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Exploring the ethical tensions surrounding antimicrobial stewardship in UK companion animal practice

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Abstract

Antimicrobial resistance (AMR) is increasingly recognised as a critical problem in human and veterinary medicine. One of the key strategies to combat AMR is to promote responsible antimicrobial stewardship and ensure prescribers use an appropriate antimicrobial for a clinical condition, at a correct dose and frequency, and only if absolutely indicated. While multiple studies have focused on the ethical tensions surrounding antimicrobial stewardship in human medicine, equivalent work has seldom been carried out in the veterinary sector, particularly relating to companion animal medicine. In addition, limited empirical ethics work has been carried out which uses qualitative approaches.

This work examines the ethical tensions surrounding antimicrobial prescription in companion animal practice through veterinarians' experience of the ethical issues raised. The perspectives of twenty-five companion animal veterinarians in the UK were explored through in-depth qualitative interviews. A descriptive ethical approach was used to examine veterinarians' characterisation of responsibility to the patients, the influence of the veterinarian-client relationship, the role of experience and evidence in clinical decision-making, and society's perceived expectations of companion animal veterinarians. This empirical work identifies that, when applying antimicrobial stewardship principles, veterinarians are surrounded by complex and intertwined ethical tensions. Veterinarians experience a near set of tensions that result from dilemmas that emerge from the veterinarian-client-animal triad. Like any treatment decision in veterinary practice, antimicrobial prescription requires the veterinarian to promote and protect the health and welfare of their patients, while respecting the client's beliefs, circumstances and means. A 'far' set of tensions, which to date have not been explored as widely, relate to societal pressures on, and expectations of, the veterinary profession in relation to AM prescribing.

The duties of practicing evidence-based veterinary medicine alongside applying precautionary antimicrobial stewardship guidelines to protect human public health, create unique ethical dilemmas. These responsibilities compete with each other in a complex web that veterinarians described as a daily navigation. In particular, the tensions represented as near and far ethical challenges resonate with the concept of 'moral distance,' which relates to the human tendency to care for those who are close to us physically and emotionally above those further removed from our life and experiences. Antimicrobial stewardship requires weighing the interests of an immediate individual patient whose health and welfare are the foundations of the clinician's work against the interests of a nebulous population that cannot be directly visualised or interacted with. Consequently, 'moral distance,' when considered alongside the aforementioned ethical tensions, is relevant to any discussion of antimicrobial stewardship.

Antimicrobial stewardship needs to be better curated based on this understanding of veterinarians' experience and ensure the promotion of effective antimicrobial stewardship in companion animal practice, with a clear message regarding the clinical or precautionary components of various guidelines, and while addressing the question of patients' safety. Communication with veterinary professionals should also be improved by taking into account the nature and complexity of the ethical challenges they face when prescribing antimicrobials, including the impact stress and moral distress can have on the profession.

List of published papers

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Contents

Chapter 1 —Antimicrobial Resistance and Companion Animal Medicine: a Gordian knot of ethical tensions?	13
1.1. Introduction	13
1.2. Introduction and Background: Antimicrobial Resistance and Stewardship	15
1.2.1. <i>Antimicrobial Resistance: Definition, Origin and Importance</i>	15
1.2.2. <i>Antimicrobial Resistance and Public Health: Current and Projected Impact</i>	16
1.2.3. <i>Antimicrobial Resistance: suggested solutions and beyond</i>	17
1.3. The Ethical Challenge of Antimicrobial Stewardship: Knowledge and Gaps	18
1.3.1. <i>Antimicrobial stewardship: definition, guidelines and policies</i>	19
1.3.2. <i>Antimicrobial stewardship in veterinary medicine: the One Health approach</i>	20
1.3.3. <i>Antimicrobial stewardship: limitations and challenges</i>	21
1.4. Study Focus: Antimicrobial Resistance, Pets and Veterinary Ethics	22
1.4.1. <i>Antimicrobial use in companion animals</i>	23
1.4.2. <i>Companion animal medicine as an ethically unique and complex occupation</i>	23
1.4.3. <i>Antimicrobial resistance and stewardship in companion animal practice</i>	24
1.5. Research Approach, Design and Aims	25
1.5.1. <i>Scope of the Study: Defining the Veterinary Ethics Approach</i>	26
1.5.2. <i>Research aim: questions raised by the synthesis of multiple literatures</i>	27
1.5.3. <i>Formulation of research questions and conceptual framework</i>	27
1.5.4. <i>Methodology and thesis structure</i>	28
1.6. Conclusion	29
Chapter 2 —Companion animal practice and antimicrobial stewardship: ethical questions and challenges arising within the walls of the practice	30
2.1. Introduction	30
2.2. Ethical challenges in companion animal practice: within the clinic	31
2.2.1. <i>The veterinarian, pet owner, and animal patient dynamic</i>	31
2.2.2. <i>Other responsibilities within the practice</i>	32

2.2.3.	<i>Antimicrobial usage and resistance in companion animal practice: a brief overview</i>	34
2.3.	Ethical challenges in GP practices and hospitals: relevant lessons and insights	36
2.3.1.	<i>Doctors, patients and the ethical challenge of handling limited resources</i>	36
2.3.2.	<i>Antimicrobial in medical practice and the exploration of doctors' prescription behaviours</i>	37
2.3.3.	<i>Antimicrobial stewardship in medical practice: lessons, questions and challenges</i>	38
2.4.	Medical use of antimicrobials: guidelines and limitations in both human and veterinary medicine	39
2.4.1.	<i>Companion animal practice and practical antimicrobial stewardship</i>	39
2.4.2.	<i>Antimicrobial stewardship in veterinary and medical practice: similar, yet different</i>	40
2.4.3.	<i>Antimicrobial use in specific circumstances: ICU, palliative care, and others</i>	40
2.5.	Moral distance in human and veterinary medicine: ethical considerations and challenges	41
2.5.1.	<i>Moral distance: definition and relevance</i>	42
2.5.2.	<i>Medical ethics and moral distance</i>	43
2.5.3.	<i>Antimicrobial stewardship and moral distance</i>	43
2.6.	Conclusion	46
Chapter 3 —Companion animal veterinarians and AMR: ethical challenges emerging from outside the practice		47
3.1.	Introduction	47
3.2.	Ethical challenges in veterinary medicine: beyond the practice walls	47
3.2.1.	<i>Role and responsibilities according to professional organisations and legal texts</i>	47
3.2.2.	<i>Public health and day-to-day companion animal practice</i>	48
3.2.3.	<i>Relevance to antimicrobial stewardship and AMR</i>	49
3.3.	Public health in the context of AMR: ethical challenges, lessons and insights	50
3.3.1.	<i>Public health and the handling of limited resources: unique ethical questions and challenges</i>	50
3.3.2.	<i>Risk mitigation and the role of precautionary principles</i>	51
3.3.3.	<i>AMR, public health ethics and distributive justice</i>	53
3.4.	Pets in modern society as the source of evolving ethical considerations	55
3.4.1.	<i>The unique case of pet animals: sociozoological scale and more-than-human solidarity</i>	55
3.4.2.	<i>Societal expectations of modern companion animal practice</i>	56
3.4.3.	<i>Companion animals and antimicrobial stewardship principles: a unique situation</i>	57

3.5.	Evidence-based medicine: expectations and challenges in human and veterinary medicine	58
3.5.1.	<i>Evidence and medicine: a short history of a tumultuous marriage</i>	59
3.5.2.	<i>Ethical limitations of evidence-based medicine and veterinary medicine: towards a patient-centred approach</i>	59
3.5.3.	<i>Evidence-based practice: relevance to antimicrobial stewardship and AMR</i>	61
3.6.	Conclusion	62
Chapter 4 —Methods and Methodology		64
4.1.	Introduction	64
4.2.	Veterinarians and Antimicrobials: Research at an Ethical Crossroad	64
4.2.1.	<i>Methodology in Veterinary Ethics literature</i>	64
4.2.2.	<i>Methodology in Medical Ethics literature</i>	65
4.2.3.	<i>Public Health Ethics</i>	66
4.3.	Methodological Approach	67
4.3.1.	<i>Qualitative Research</i>	67
4.3.2.	<i>Choosing qualitative interviews</i>	68
4.3.3.	<i>Research questions</i>	70
4.3.4.	<i>Interview Agenda</i>	71
4.4.	Data Collection and Analysis	71
4.4.1.	<i>Data Collection as an Iterative Process</i>	71
4.4.2.	<i>Coding</i>	73
4.4.3.	<i>Thematic Analysis</i>	74
4.5.	Validity and Limitations	74
4.5.1.	<i>Sampling size and Recruitment</i>	74
4.5.2.	<i>Reliability and Validity in Qualitative Enquiry</i>	77
4.5.3.	<i>The Role of the Researcher</i>	78
4.6.	Conclusion	80
Chapter 5 —Veterinarians and their patients: vocation, care and duties		82
5.1.	Introduction	82
5.2.	Veterinarians’ identity as ‘animal doctors’	82

5.2.1.	<i>Vocation and love of animals</i>	83
5.2.2.	<i>Veterinarians and the patients' 'best interests'</i>	84
5.3.	Animal health and welfare in companion animal practice	85
5.3.1.	<i>Veterinarians as experts, guides and educators</i>	86
5.3.2.	<i>Informed consent and pets' health and welfare</i>	87
5.4.	Antimicrobial prescribing and patient's best interests	89
5.4.1.	<i>Antimicrobial prescribing as the 'safest option'</i>	89
5.4.2.	<i>A complex, individual, patient-centred approach</i>	90
5.5.	Antimicrobial resistance in every-day practice	92
5.5.1.	<i>Veterinarians' perception of resistance in practice</i>	92
5.5.2.	<i>Antimicrobial resistance and pets' health and welfare</i>	94
5.6.	Conclusion	96
Chapter 6 —The vet-client relationship: support, trust and stress		98
6.1.	Introduction	98
6.2.	Antimicrobial prescription and stewardship as an opportunity to educate and promote professional authority and prestige	99
6.2.1.	<i>The challenge of informed consent and client education</i>	99
6.2.2.	<i>Professional authority and privileges</i>	100
6.3.	Antimicrobial prescription and stewardship as influenced by clients' individual behaviours and views	102
6.3.1.	<i>Client satisfaction and antimicrobial prescription</i>	102
6.3.2.	<i>Antimicrobial prescription and veterinary clients' views and attitudes</i>	104
6.4.	Antimicrobial prescription and stewardship: the role of client's financial means in practice	108
6.4.1.	<i>The socio-economic influence of the veterinary clientele</i>	108
6.4.2.	<i>Client's finances and the value of veterinary service</i>	109
6.5.	Conclusion	111
Chapter 7 —Veterinarians and the generation of knowledge: the role of experience and evidence in clinical decision-making		113
7.1.	Introduction	113

7.2.	Expertise and experience at the core of practice	114
7.2.1.	<i>Generation of knowledge in practice: creating expertise through experience</i>	114
7.2.2.	<i>Pitfalls and strengths of relying on individual experience and expertise</i>	116
7.3.	Evidence-based medicine, veterinary science and modern practice	120
7.3.1.	<i>Evidence-based veterinary medicine, ideal, pitfalls and limitations</i>	120
7.3.2.	<i>Companion animal veterinarians and sources of knowledge</i>	124
7.4.	Antimicrobial stewardship and the modern companion animal veterinarians	127
7.4.1.	<i>Awareness and opinions of guidelines</i>	127
7.4.2.	<i>Attitudes and beliefs regarding antimicrobial stewardship</i>	129
7.5.	Antimicrobial stewardship in veterinary care: unique and specific challenges.	131
7.5.1.	<i>Doubts and desire for supportive evidence</i>	131
7.5.2.	<i>Suggested strategies for improvement</i>	133
7.6.	Conclusion	135
Chapter 8	—Veterinarians and Society: blame, responsibility and the unique case of companion animals	137
8.1.	Introduction	137
8.2.	Veterinary care and human medicine: adversaries or allies?	138
8.2.1.	<i>Companion animal veterinarians and the One Health concept</i>	138
8.2.2.	<i>Links between veterinary and medical practice</i>	140
8.3.	The veterinary profession and AMR: blame and responsibility	141
8.3.1.	<i>Companion animal veterinarians, AMR: limitations to professional responsibilities</i>	142
8.3.2.	<i>AMR and veterinarians: perceived blame and deflections</i>	144
8.4.	Companion animal practice and pets: unique responsibilities in modern society	146
8.4.1.	<i>Veterinarians, antimicrobial use, and the influence of the unique standing of pets in society</i>	147
8.4.2.	<i>Pets within human lives: public health considerations</i>	148
8.5.	AMR beliefs, predictions and strategies for the future	149
8.5.1.	<i>The future of AMR in companion animal practice: potential impact and policies</i>	149
8.5.2.	<i>Antimicrobial stewardship in companion animal practice: suggestions for the future</i>	150
8.6.	Conclusion	152

Chapter 9 —Reframing the ethical challenges created by antimicrobial stewardship in companion animal practice.....	154
9.1. Introduction	154
9.2. An ethical framework to explore the ethical tensions surrounding antimicrobial stewardship in companion animal practice	156
9.2.1. <i>Antimicrobial stewardship in companion animal practice: the importance and limitations of the vet-client-pet relationship</i>	<i>157</i>
9.2.2. <i>Antimicrobial stewardship in companion animal practice: ethical challenges and concerns centred on non-human-animals.....</i>	<i>159</i>
9.2.3. <i>Antimicrobial stewardship in companion animal practice: anthropocentric ethical challenges and concerns</i>	<i>160</i>
9.3. Antimicrobial stewardship and the triangular vet-pet-owner relationship: tensions or alliance? ..	161
9.3.1. <i>Antimicrobial stewardship and the triangular vet-pet-owner relationship: professional considerations.....</i>	<i>162</i>
9.3.2. <i>Antimicrobial stewardship and the triangular vet-pet-owner relationship: ethical considerations</i>	<i>163</i>
9.3.3. <i>Antimicrobial stewardship and the triangular vet-pet-owner relationship: policy implications ..</i>	<i>164</i>
9.4. Antimicrobial stewardship and evidence-based veterinary medicine: the challenge of applying precautionary principles	167
9.4.1. <i>Antimicrobial stewardship and evidence-based veterinary medicine: professional considerations</i>	<i>168</i>
9.4.2. <i>Antimicrobial stewardship and evidence-based veterinary medicine: ethical considerations</i>	<i>169</i>
9.4.3. <i>Antimicrobial stewardship and evidence-based veterinary medicine: policy implications.....</i>	<i>170</i>
9.5. Antimicrobial stewardship and companion animal veterinarians: public health considerations and professional standing.	172
9.5.1. <i>Antimicrobial stewardship, public health and professional standing: professional considerations</i>	<i>173</i>
9.5.2. <i>Antimicrobial stewardship, public health and professional standing: ethical considerations.....</i>	<i>173</i>
9.5.3. <i>Antimicrobial stewardship, public health and professional standing: policy implications</i>	<i>175</i>
9.6. Expanding this framework to other ethical veterinary concerns and further research.	176
9.6.1. <i>Distinction between near and far ethical tensions</i>	<i>176</i>

9.6.2.	<i>Application in other ethical contexts</i>	177
9.6.3.	<i>Further research</i>	177
Bibliography		179
Annex A		211
Annex B		212

Chapter 1—Antimicrobial Resistance and Companion Animal Medicine: a Gordian knot of ethical tensions?

1.1. Introduction

The development and spread of antimicrobial resistance (AMR) are a growing threat to the effectiveness and progress of modern medicine. It is one of the most prominent and publicised public health issues in recent years, leading the World Health Organisation (WHO) to organise a ‘world antibiotic awareness week’¹ every year since 2015, and the United Nations to call a high-level meeting dedicated to the topic in September 2016². The WHO states that antimicrobial resistance ‘is an increasingly serious threat to global public health that requires action across all government sectors and society’ (World Health Organisation, 2018, no page number) and that significant coordinated action among all antimicrobial users and providers is therefore needed. Indeed, the WHO is clear that the ‘emergence of antimicrobial resistance is a complex problem driven by many interconnected factors, in particular the use and misuse of antimicrobials’ (World Health Organisation, 2001, p.3).

Many efforts have been made to try and reduce the use of antimicrobials in human medicine (Dryden et al., 2011), with varying degrees of success (Charani et al., 2010). While this may, at first glance, appear to be a simple task of modifying prescription behaviour by applying stewardship guidelines, the reality is more complex. At the root of improving and reducing antimicrobial usage is the obligation to address the ethical challenge of balancing the risk of infection for an individual patient if antimicrobials are not prescribed, against the health risk for many if resistance continues to grow. In this context it is not only human clinicians who face these dilemmas, but also veterinarians. In this context and since they hold prescription privileges for antimicrobials, veterinarians’ handling of these drugs has come under scrutiny, in particular antimicrobial use in production animals (see for example, the final report from O’Neill’s Review on Antimicrobial Resistance’ (2016)). As a result, the European Union introduced new regulations to curb the quantities of antimicrobials used in the farming industry, most famously with a complete ban of antimicrobials as growth promoters in 2006. Of course, antimicrobials are also used in other sectors of veterinary care such as companion animal practice. There as well, concerns regarding overuse of antimicrobials and its detrimental effects on AMR were raised (Guardabassi et al., 2004; Morley et al., 2005; Umber and Bender, 2009; Pomba et al., 2017). As with human doctors, efforts have been made to improve the antimicrobial stewardship of veterinarians in all sectors, mostly through the publication of clinical guidelines (Teale and Moulin, 2012; Danish Small Animal Veterinary Association, 2013; Publications Office - European Union, 2015; British Small Animal Veterinary Association, 2018).

There are significant ethical dilemmas in human clinical medicine surrounding antimicrobial prescribing, but these challenges are transformed and amplified in companion animal practice due to its unique and ethically challenging

¹ <https://www.who.int/campaigns/world-antibiotic-awareness-week> (accessed 15/06/2021)

² <https://www.un.org/pga/71/event-latest/high-level-meeting-on-antimicrobial-resistance/> (accessed 15/06/2021)

setting (Morgan, 2009). While legislation and rules on food production restricts veterinary decisions when treating farm animals, treatment of pets is decided by owners' financial means, the limitations of modern veterinary medicine, and ethically charged concepts such as animal welfare, and both veterinarian's and owner's beliefs regarding the 'value' of non-human animal life (including quality and quantity considerations) (Rollin, 2006a). Decisions in this context often carry a heavy ethical weight as many owners consider their pet as part of their family (Crawford and Balzer, 2017), (e.g. end of life decisions and euthanasia in particular have been studied and discussed (Sanders, 1995; Batchelor and McKeegan, 2012; Morris, 2012a; Christiansen et al., 2016)).

In this challenging setting, the issue of antimicrobial prescription—and its links to AMR—presents as a complex and unique set of ethical tensions existing not in isolation but enmeshed in a complex Gordian knot that must be carefully observed and studied in order to be understood. The aim of this thesis is therefore to explore concepts of public and professional ethical responsibilities faced by veterinarians when making clinical decisions involving prescription (or withholding thereof) of antimicrobials. As literature about this topic is scarce (see chapter 2 for further discussion), this exploration is done mostly through the lens of descriptive ethics but also covers some normative ethical themes through its analysis and conclusions. In particular, this work attempts to better describe and analyse non-clinical factors, specifically the social and ethical factors that affect the decision-making process of the veterinary and therefore play a role in the handling of antimicrobials in practice. By interviewing practicing companion animal veterinarians in the UK and thematically analysing their perspectives and insights, this study attempts to describe the ethically complex landscape of antimicrobial prescription in modern veterinary practice., in the hope that it will help improve the efforts made in this field to promote antimicrobial stewardship, and subsequently to slow down AMR. Recommendations are made in chapter 9 relating to several points, such as improving communication between governing / professional bodies and veterinarians, recognising and minimising stress brought on by antimicrobial stewardship in veterinary practice, improving current guidelines by clarifying their bases and nature and enhancing their clinical content and usefulness by addressing the question of patient's safety.

This chapter introduces the different bodies of literature that cut across multi-disciplinary AMR-related literatures, veterinary ethics as well as science and technology studies to build the conceptual framework supporting this investigation into antimicrobial stewardship in companion animal practice. In the first section, the multi-factorial issue of AMR is introduced and explained. The second section then highlights why companion animal veterinarians are the focus of this study, in particular the unique nature of the ethical tensions existing around veterinary medical care for pets and the role those tensions play when veterinarians prescribe antimicrobials. The third section illustrates the ethical significance of current knowledge gap existing around the experience of companion animal veterinarians, but also, and in contrast, what published literature tells us about antimicrobial stewardship in other sectors. Finally, the fourth section uses the concepts and analysis presented so far to introduce the research hypothesis, the formulation of the research questions and, of course, the methodological choices and structure of the research presented here.

1.2. Introduction and Background: Antimicrobial Resistance and Stewardship

This first section introduces the issue of AMR, its history and importance for medicine in general (both human and veterinary). It highlights what is currently known or speculated about the consequences of AMR, but also the projections that have been made regarding the future impact of AMR on the provision of health care and the global economy. Finally, it introduces and defines the idea of antimicrobial stewardship and some of the measures that have already been taken to attempt to curb the development of AMR.

1.2.1. Antimicrobial Resistance: Definition, Origin and Importance

According to the WHO, 'antimicrobial resistance (AMR) is the ability of a microorganism (such as bacteria, viruses, and some parasites) to stop an antimicrobial (such as antibiotics, antivirals and antimalarials) from working against it. As a result, 'standard treatments become ineffective, infections persist and may spread to others' (World Health Organisation, 2018, no page number). It should be noted that in many instances—including in part of this work—AMR is understood to refer to bacterial infections and to resistance to antibiotics as it is the most significant and widespread issue currently; it is important to note, however, that other microorganisms and drugs are involved.

In 1945, only seventeen years after his accidental discovery of penicillin, Alexander Fleming already warned of the dangers of antimicrobial resistance as he was receiving the Nobel prize of medicine: 'it is not difficult to make microbes resistant to penicillin in the laboratory by exposing them to concentrations not sufficient to kill them, and the same thing has occasionally happened in the body' (p.93). Unfortunately, in the decades since this warning, the prevalence of resistance to commonly used antimicrobials in bacterial infections and the subsequent burden on health systems have increased (Fair and Tor, 2014). It is now known that while development of resistance might be accelerated by inadequate dosing regimens, it also occurs as an unavoidable consequence of any—even clinically appropriate—antimicrobial use (Davies and Davies, 2010), not only in people but in animal populations as well. Various complex mechanisms lead to the development of resistance—the details of which are beyond the scope of this work, but are linked to the evolutionary pressure antimicrobials exert on the bacterial populations exposed to them (Levy and Marshall, 2004). Some of the genes conferring resistant abilities to micro-organisms have been shown to be transferred not only to subsequent generations (i.e. vertical transfer), but also between distinct microbial species and populations (i.e. horizontal transfer) (Lyon and Skurray, 1987).

At the start of the antimicrobial era, in the few decades after the Second World War, the burden of resistance—although recognised—was circumvented by using a different antimicrobial within the same drug class, or a different antimicrobial class, as many were discovered around that time. Indeed, in 1965 for example, a roundtable on the topic recognised the development of new drugs as essential to combat the development of resistance (Finland et al., 1965). Unfortunately, over the past forty years, and despite resistant infections becoming more common, the discovery of new antimicrobial compounds by the pharmaceutical industry has slowed down markedly (Powers, 2004), and resistance to the most recently discovered classes of antimicrobials is already reported (Aiello et al., 2006). In this context, and with the rise of multi-resistant infections, the range of clinical treatment options is becoming akin to an 'emptying quiver,' as put by Weber and Courvalin (2005, p.791)

Crucially, the development of antimicrobial resistance has consequences for many facets of care within modern medicine. Of course, naturally acquired or nosocomial infections rely on effective antimicrobials for their treatment; the development of resistance to commonly used drugs is causing increasingly severe problems in the treatment of malaria, tuberculosis, pneumonia, influenza and HIV to name a few of the most significant infections (World Health Organisation, 2018). But antimicrobials are also important to manage circumstances when patients are immunosuppressed, either because of a chronic illness (e.g. diabetes) or as part of medical interventions (e.g. organ transplant, cancer chemotherapy). They are also critical in ensuring the success of many complex surgical interventions (e.g. cardiac bypass, caesarean section, hip replacement).

This reliance of modern medicine on effective antimicrobial therapy has led some authors to warn that the spread of resistance could lead to a return to the pre-antibiotic era of medicine (Appelbaum, 2012), or perhaps more accurately, considering not all medical progress depends on antimicrobials, a post-antibiotic age (Brown, 1994). In this context, the potential consequences of AMR sound very grim.

1.2.2. Antimicrobial Resistance and Public Health: Current and Projected Impact

The current morbidity and mortality directly linked with AMR globally is difficult to evaluate due in part to the wide variety of legislation that controls the sale and prescription of antimicrobials worldwide. Dispensing of antimicrobials without a doctor prescription is common in developing countries (Sakeena et al., 2018), but occurs in other parts of the world as well (e.g. Spain (Guinovart et al., 2018)). Tracing how, why and in what quantities antimicrobials are used—both in human and veterinary care—is a complex task even when auditing efforts are put in place. Nevertheless, it is indisputable that global use of antimicrobials has dramatically increased in recent years; van Boeckel et al. (2014) showed that worldwide use of antimicrobials in human health care, for example, has increased by 35% between 2000 and 2010.

Some recent studies have also given estimations of the current burden caused by resistant infections on health care systems in various parts of the world. Cassini et al. (2019), for example, using data for the year 2015, estimated that, within that year in the European Economic Area, there were over 600,000 resistant infections and over 30,000 deaths that could be directly attributed to AMR. The long-term consequences for surviving patients were also important. The authors also reported those figures to be on the rise compared to 2007.

It is likely that the figures put forward by such studies actually under-estimate the real impact of AMR as reliable reporting is difficult to put in place. Indeed, developing a resistant infection can be a significant morbidity and mortality factor, but, in many cases, it will not be the primary reason the patient is seen and therefore case outcomes might not be recorded as being linked to AMR. Burnham et al. (2018) has recently argued that deaths linked to multi-resistant infections in the USA might be up to seven times higher than current estimates.

Considering these concerns alongside the aforementioned increase in global use of antimicrobials in recent years, AMR is likely to worsen if the current handling of antimicrobials in all sectors that use them continue unchanged. In 2014, the UK government commissioned a review of the current and future impact of AMR, headed by the economist Jim O'Neill. This report predicts that—unless effective measures were taken to curb the development

of AMR—by 2050, 300 million people might die prematurely due to drug resistance and that by that date AMR would have cost the global economy up to 100 trillion dollars (Review on Antimicrobial Resistance, 2014, p.7). Uncontrolled infections could also have a very significant effect on the effectiveness of modern health care with the report echoing the concerns highlighted in the previous section and questioning whether AMR could lead to ‘a return to the dark age of medicine’ (p.11). The predictions made are so dire that Viens and Littman (2015) have discussed the potential benefits of framing AMR as a ‘slowly emerging disaster’ in terms of concept and policies. How to tackle such a complex issue continues to be hotly debated. The next section will give an overview of the various ways in which it has been suggested AMR could be curbed.

1.2.3. Antimicrobial Resistance: suggested solutions and beyond

Considering the many professional sectors influencing the global issue of AMR, the proposed solutions are often of a different nature and scope. Recently, the final report of O’Neil’s ‘*Review on Antimicrobial Resistance*’ (2016) commissioned by the UK government suggested and summarised a series of interventions as follows (taken from p.73-75):

- Increase global awareness of the issue of AMR through a global public campaign
- Improve sanitation to prevent the spread of infection
- Reduce unnecessary use of antimicrobials in agriculture and their dissemination in the environment
- Improve global surveillance of drug resistance and antimicrobial consumption in human and animals
- Promote new, rapid diagnostics to reduce unnecessary use of antimicrobials
- Promote development and use of vaccines and alternatives
- Improve the number, pay and recognition of people working in infectious disease (both in research, but also in hospitals promoting stewardship, etc)
- Increase the development of new antimicrobials effective against drug-resistant microbes through promoting innovation and research globally, as well as repurposing and improving existing compounds.

This last point is an effort to address the lack of novel antimicrobial therapy already mentioned in sub-section (1.2.1). Current research into antimicrobials is mostly run on a for-profit basis by private pharmaceutical companies that often have little incentive to invest funds in researching antimicrobial therapies for multiple reasons (Powers, 2004), some of an economic nature as antimicrobials are used on a sporadic basis only and any new treatment would be used as little as possible to preserve its effectiveness and slow the development of new resistance.

The report insists that any effort to tackle AMR must be made on a global scale and highlights that such an approach would be sound from an economic point of view. Considering the complexity of the geopolitical landscape of the modern world, the challenge might, however, go well beyond financing the aforementioned strategies. Political cultures have been shown to influence individual countries’ policy on AMR, for example in the agricultural sector (Begemann et al., 2018). Considering that access to medical resources is still unequal on a global scale, concerns have been raised that the spotlight put on antimicrobial resistance focuses too heavily on reducing overall use of antimicrobials and threatens to eclipse the fact that hundreds of thousands of people, disproportionately children,

die every year from curable illnesses due to lack of access to basic antimicrobials (Laxminarayan et al., 2016). Calls have been made to argue that current strategies for antimicrobial stewardship have too narrow a scope and should not focus on resistance alone but also on just access to antimicrobials worldwide (Das and Horton, 2016). Again, this appeal illustrates well the political nature of antimicrobial stewardship strategies, as only political will can redefine current policies to include just access of antimicrobials as a priority target alongside reducing the prevalence of resistance.

Beyond those concerns, the common thread to the first six suggestions is an effort to reduce unnecessary use of antimicrobials through education of both lay members of the public and professionals (doctors, veterinarians, farmers, etc.) and the promotion of principles to follow when handling antimicrobials—as consumer, prescriber or as the person responsible for administering the drugs to a human or animal patient—summarised as ‘antimicrobial stewardship.’ Section 2 of this chapter will give more details on this concept, its strengths and its limitations.

1.3. The Ethical Challenge of Antimicrobial Stewardship: Knowledge and Gaps

Strategies to curb the development of AMR rely on the implementation of good antimicrobial stewardship by anyone who uses antimicrobials, but especially by professionals with prescription privileges. Such an approach has both ethical underpinnings and consequences. Indeed, preserving effective antimicrobials for the patients most at risk raise questions of intragenerational justice, while efforts to preserve effective antimicrobials for the future implies that society has a moral duty towards future generations (intergenerational justice). The use of antimicrobials in veterinary medicine also leads to questions regarding our moral obligations towards various animals (e.g. farmed, pets, research subjects, etc) and how those should be weighed when human health considerations also lay in the balance (Rollin, 2001). Antimicrobials have been described as a public good and as such how to best handle and distribute them is an ethically charged question (Selgelid, 2007), in particular as it involves both human and animal populations (Robinson et al., 2016).

Those questions are complex and do not have clear or easy to reach answers, as such answers depend on an individual’s views and philosophical understanding of our moral duties towards others, both human and non-human animals and may vary depending on specific circumstances. In this context, an ethical approach to the prescription of antimicrobial in companion animal practice is the most likely to yield significant and unique insights into the reality of the veterinarian’s role in handling antimicrobials and the difficulties they face while doing so.

This section briefly summarises the most prominent ethical questions existing in the literature around antimicrobial stewardship. First, it gives a brief overview of antimicrobial stewardship, its ethical basis, and how it has been translated into guidelines and policies. In a second part, it explores antimicrobial stewardship implications for veterinary medicine, highlighting the ethical issues raised by the concept of ‘One Health’ and the focus on food-producing species. Finally, it covers the limitations and ethical challenges of antimicrobial stewardship strategies.

1.3.1. Antimicrobial stewardship: definition, guidelines and policies

AMR has been described by some authors as a ‘tragedy of commons’ (Foster and Grundmann, 2006; Littmann, 2014; Giubilini, 2019), i.e. circumstances where individual pursuit of maximum self-interest and benefits has the potential to lead to harm on a much larger scale (e.g. society, population, global) (Hardin, 1968). In this context, initiatives and policies have been put in place both by international organisations such as the WHO and by national governments to attempt to avoid such a tragedy by reducing unnecessary use of antimicrobials and limiting their appeal through public education (e.g. explaining that antibiotics do not affect viruses). Given the urgency of the problem, the ethical implications of failing to protect populations against AMR, and the established link between antimicrobial use and development of resistance, principles of ‘prudent use’ were developed under the term of ‘antimicrobial stewardship’ and promoted among all professionals using antimicrobials. Section 2 of chapter 2 discusses the nature and ethical bases of ‘precautionary principles,’ their importance and limitations in the creation of policies and guidelines.

The exact wording of the antimicrobial stewardship principles varies from sources to sources, but the main messages stay the same, both across medical (Dellit et al., 2007b) and veterinary guidelines (Teale and Moulin, 2012). They can be simply summarised as follows:

- Only prescribe antimicrobials when absolutely necessary in order to reduce global antimicrobial use
- Avoid using antimicrobials prophylactically
- Use appropriate drug (narrow rather than broad spectrum whenever possible), dose, administration route and length of treatment as advised by current published evidence and local resistance profiles
- Whenever possible, carry out laboratory cultures of infections and test their sensitivity to individual antimicrobials in order to guide antimicrobial choice
- Promote patient and public education to improve compliance with precautionary principles

Some countries launched programmes aimed at promoting prudent use such as the ‘Antibiotic Guardian’³ campaign in the UK that encourages both health professionals and lay people to pledge to actively promote prudent use of antimicrobials.

Antimicrobial use has been actively scrutinised in many sectors, but a particular focus has been put on uses in food-producing animals. The use of antimicrobials as growth promoters was progressively banned in the European Union from 1997 to the total ban in 2006⁴, progressively curtailed in the United States since 2013⁵, and is becoming increasingly controversial in other parts of the world such as China (Collignon and Voss, 2015). In contrast, the use of veterinary antimicrobials in companion animals has been seldom explored.

³ <https://antibioticguardian.com/> (accessed 15/06/2021)

⁴ http://europa.eu/rapid/press-release_IP-05-1687_en.htm (accessed 15/06/2021)

⁵ <https://www.fda.gov/animal-veterinary/antimicrobial-resistance/timeline-fda-action-antimicrobial-resistance> (accessed 15/06/2021)

The focus of this thesis will therefore be companion animal practice. The next section will highlight why this particular sector should not be ignored when attempting to address the broader issue of AMR.

1.3.2. Antimicrobial stewardship in veterinary medicine: the One Health approach

In 1985, Fox stated 'animal and human interests and rights need to be seen in a broader, ecologic framework, since what we do to the environment can have a significant impact upon animal and human health and upon the survival of animal populations and entire species' (p.212). Building on this approach, the concept of One Health was developed and has become increasingly important in recent year when addressing issues such as zoonotic diseases, AMR, conservation or emerging diseases. One Health has been defined as 'the collaborative effort of multiple disciplines – working locally, nationally, and globally – to attain optimal health for people, animals, and our environment. The mission of One Health is the establishment of closer professional interactions, collaborations, and educational opportunities across the veterinary and medical professions, together with their allied sciences, in order to improve public health and animal health' (One Health Initiative Task Force, 2008, p.33). In recent years, the veterinary profession has been involved in many projects related to One Health, such as food safety and security, climate change, the human-animal bond, and of course, AMR (Gibbs, 2014).

The One Health approach is very relevant to the issue of AMR since resistance occurs in both animals and people and the same antimicrobials are used in both, including in pets (Guardabassi et al., 2004, Lloyd, 2007, Umber and Bender, 2009). AMR has been recently described as the 'quintessential One Health issue' (Robinson et al., 2016, p.377). It differs, however, from most other Public Health issues since the short-term interests of animal and human populations might not be aligned. In the case of zoonoses, for example, reduction in morbidity and mortality in animals will benefit humans and vice versa. When it comes to AMR, reducing antimicrobial consumption and preserving antimicrobial efficacy will be beneficial to all patients – animals or humans – who might need access to those drugs in the future. When it comes to individual antimicrobial treatment, however, both human and veterinary patients are competing for a resource limited by the current concerns around AMR (but actually readily available to the practitioner if they should choose to use it). As mentioned earlier, AMR has been seen as a 'tragedy of the commons' (Giubilini, 2019), but remarkably the One Health approach highlights that overuse by individuals (whether animal or human) could have consequences on both human and animal populations, as well as whole ecosystems through environmental contamination.

Whether some antimicrobials should be reserved exclusively for human treatment is a hotly debated issue (Committee for Medicinal Products for Veterinary Use, 2015, p.3) with ethical consequences. And while it is understandable to try to preserve human health by limiting access to critical antimicrobials, the current One Health approach does raise some concerns. In particular, instead of being a tool to benefit both human and animal health, there is a risk in the case of AMR that animals will instead become a tool to benefit human health and the spirit of One Health might be obscured or forgotten. Foster and Grundmann (2006, p.179) suggest that 'agricultural studies may also provide valuable data, because a strategy that leaves animals untreated raises fewer ethical concerns than an equivalent strategy in our own society.' Whether one agrees with that assertion or not, and however few these 'ethical concerns' are, they still need to be acknowledged and fairly discussed before being dismissed and

require welfare considerations to be evaluated for groups or populations of animals which can be challenging. Indeed, as noted by Hartnack et al. when discussing culling as a method of disease control in farmed animal population (2009, p.150), ‘an unresolved question became evident: whereas the perspective of animal welfare ethics and animal protection law is focused on the individual animal (where transgressions are to be found on individuals) it remains open for discussion how this perspective could be extended to animal populations.’

Consequently, and while the One Health approach is easily understood when human and animal interests are aligned, instances when human’s and animal’s interests conflict may require cautious consideration and discussion. Rollin (2001, p.36) made a case for the continued use of antimicrobials in animals (with some restrictions):

‘What of the therapeutic use of antibiotics? I have heard that there are those who would allow no antibiotics to be used even to treat sick animals. In my view, for reasons of animal suffering, this is morally wrong and as egregious a violation of husbandry as there could be. Though we have sorely failed in keeping up our husbandry obligations to animals, we surely cannot morally or economically allow sick animals to go untreated. And if we are to fail to treat farm animals with antibiotics, we are equally bound not to treat companion animals, which also stand as a zoonotic reservoir and a potential source of antibiotic resistant pathogens, something society would never accept. But, as others have said, we can limit the use of cutting-edge antibiotics in animals.’

Although all those issues are being raised by publications focusing on production animals due to the current literature bias, they are relevant to companion animals as well as any animal population’s health and welfare would be affected by restricted or limited access to antimicrobial treatment.

1.3.3. Antimicrobial stewardship: limitations and challenges

As discussed in the introduction to this section, the principles of antimicrobial stewardship raise many ethical questions (Littman et al., 2015) with potentially serious, if not dire consequences (Viens and Littman, 2015). This is particularly true when the interests of individuals are opposed to that of society (Foster and Grundmann, 2006; Littmann, 2014; Giubilini, 2019), circumstances that arise frequently in clinical settings and therefore constitute the bulk of the work presented here and are investigated in great detail in the coming chapters. For completeness in this introduction, this subsection highlights broad ethical themes raised in the literature when antimicrobial stewardship strategies are promoted and / or implemented.

Unsurprisingly considering the paucity of veterinary literature on the topic, most of the data presented here comes from human medicine literature. The use of medical literature, and in particular of medical ethics, is discussed in section 2 of chapter 3 as well as in chapter 4. Rodrigues et al. (2013) systematically reviewed 35 qualitative studies investigating factors influencing physicians’ antibiotic prescription behaviour and concluded that physicians’ attitudes (e.g. complacency, fear) was the most influential intrinsic factor, while patient-related and health-care system related factors were the most commonly reported extrinsic ones. A qualitative study carried out among eleven veterinarians caring for food-producing animals had comparable findings (Speksnijder et al., 2015b). These

results illustrate that individual physicians or veterinarians may face varied challenges, or have different concerns when presented with the promotion and implementation of the stewardship principles.

The lack of evidence-based data supporting the stewardship approach, and its implications, are discussed in more detail in the chapter 3 but has also been mentioned as being an important barrier to improving antimicrobial use in clinical settings (Dar et al., 2016). The most successful implementation of antimicrobial stewardship programmes have been carried out in human hospitals and involved a multi-disciplinary team of experts (infectious disease specialist, pharmacist, microbiologist, etc) and ongoing communication with the health care staff regarding the programme and its goals (Carling et al., 2003; Paskovaty et al., 2005; Ashiru-Oredope et al., 2016). Other approaches have also been explored (e.g. participatory action research (Sikkens et al., 2014)). The effectiveness of various implementation strategies, however, is still not well understood (Dar et al., 2016) and evaluating their social value is difficult with current methods (Munthe et al., 2019).

Following this brief exploration of the issue of AMR and the notion of antimicrobial stewardship, the next section will highlight the focus of this thesis: the ethical dimensions created by AMR in companion animal practice.

1.4. Study Focus: Antimicrobial Resistance, Pets and Veterinary Ethics

To date, most research and interventions have focused on human medicine and farm animal veterinary medicine. Antimicrobial use in companion animal medicine, however, has come under increased scrutiny in recent years. Concerns involve both pets being a threat to human health due to their role as potential reservoirs of resistant bacteria living in close proximity with humans (Guardabassi et al., 2004; Lloyd, 2007; Weese, 2008; Committee for Medicinal Products for Veterinary Use, 2015; Pomba et al., 2017), and the development of resistance affecting veterinary care and veterinarians' ability to treat infections (Pedersen et al., 2007; Marques et al., 2018).

However, and despite these concerns, not much is known about the companion animal sector. In 2005, Heuer et al. reported that over half of the annual veterinary sales of cephalosporin antibiotics in Denmark were consumed by dogs and cats, despite their population being much smaller than that of food-producing animals and concluded:

'We do not believe that antimicrobial drugs are more generously prescribed for companion animals in Denmark than in other industrialized countries. Rather, the data presented here reflect the apparent contrast between policies of antimicrobial drug use for food animals and policies for companion animals. The use of these antimicrobial drugs is avoided or restricted in food animals to minimize spread of resistance, while in companion animals, prescription continues unimpeded. This situation may create undesirable antimicrobial drug resistance in bacteria, which may subsequently spread to humans from the previously neglected reservoir in companion animals' (Heuer et al., 2005, p.345).

This section briefly summarises what is known about prescription of antimicrobials in companion animals, focusing mostly on data from the UK as an example. It then highlights why companion animal practice is a setting like no other with unique ethical tensions that require direct exploration. Finally, it explores the relevance of antimicrobial resistance in the companion animal setting.

1.4.1. Antimicrobial use in companion animals

Tracing the quantities of antimicrobials used in companion animal practice and their purpose is currently difficult, compared to farm animal practice or human health care. The UK Veterinary Medicines Directorate recently released a report entitled '*UK One Health Report. Joint report on antibiotic use and antibiotic resistance, 2013–2017*' (2019), noting 'it should be explored what data are available on antibiotic use in companion animals and horses and whether a standardised national denominator could be established so that data from companion animals and horses could be analysed to the same level as data from food-producing animals' (p.53). Despite these difficulties, the existing literature—all recent—about antimicrobial prescription in companion animal practice can give some idea of how antimicrobials are currently being prescribed. It can be organised in two categories: (1) studies investigating veterinarians' knowledge about antimicrobials and antimicrobial stewardship and their reasoning when prescribing antimicrobials (e.g. Mateus et al., 2014; Speksnijder et al., 2015b; Currie et al., 2018; Hopman et al., 2018; Tompson et al., 2020), (2) studies using practice data to analyse and report retrospectively on antimicrobial use in practice (e.g. Radford et al., 2011; Burke et al., 2016; Singleton et al., 2017). These will be discussed in more detail alongside veterinary antimicrobial stewardship in Chapter 2, but they support the idea of veterinarians as a homogeneous population with individual opinions and attitudes towards antimicrobial prescription and stewardship. Retrospective studies of prescription in companion animal practice draw a picture of overall improving stewardship over the past few years, yet with many prescription decisions not aligning with current guidelines.

It also illustrates the complexity of factors veterinarians take into account when making clinical decisions, including in circumstances when they deviate from recommended use. While studies have identified factors beyond clinical and scientific knowledge that have an influence on antimicrobial prescription, how different factors come into play in daily practice, and how they intertwine with one another and with scientific evidence and knowledge, creating ethical tensions that the veterinarian must resolve is yet to be explored.

1.4.2. Companion animal medicine as an ethically unique and complex occupation

Veterinary ethics is a recent field of study, appearing in publications following the Second World War (Sanger, 1946; Wadsworth, 1947) and becoming more prominent since the late 1970s (Rollin, 1978). The core issue studied by veterinary ethics during that time has been summarised by one of the most important veterinary ethicists, B. E. Rollin (2006a) as follows:

'Veterinarians find themselves enmeshed in a web of moral duties and obligations that can and often do conflict. In the first place, veterinarians obviously have an obligation to their clients. Second, veterinarians have an obligation to their peers in the profession. Third, veterinarians have, in virtue of their special social role, an obligation to society in general. Fourth, as is often forgotten, veterinarians, like all human beings, have an obligation to themselves. Fifth, and most obscurely, veterinarians have an obligation to animals' (p.15).

This 'obscurely' qualification can be understood since the extent and nature of the veterinarian's 'obligation to animals' will be influenced by the wider societal views on animals. Consequently, Veterinary Ethics is subservient

to Animal Ethics, a field that has evolved immensely over the past few decades with the discussion of the concepts of 'animal rights' and 'animal welfare' (Garner, 2008), the recognition of increased obligations towards animals both at individual and societal levels (Singer, 2006), and an increased emphasis put on animals' sentience (Duncan, 2006; Broom, 2010) and their ability to feel pain (Rollin, 1998). Since the core of the veterinarian's work is to look after animal health and welfare, if obligations towards animals evolve in the societal eye, it will affect the work of the veterinarian and the ethical dimensions embedded within it.

The rapid evolution of the concepts of animal welfare and animal rights (McCausland, 2014) in recent years has challenged veterinary ethics views and has constituted the main focus of the field since – as again stated by Rollin (2006a): '[The veterinarian's obligations to animals] are far from clear, because society is only now beginning to articulate a social ethics for animals that goes beyond the very restricted issue of cruelty. Indeed, it is this very matter of "flying by the seat of one's pants" when it comes to obligations to animals that make veterinary ethics, in my view, the most interesting of all professional ethics' (p.17).

In this challenging context, it is not surprising that the bulk of the veterinary ethics literature has focused on the ethical issues arising from conflicts of interests and obligations between veterinarians' responsibilities to their clients, to their patients and to themselves (Main, 2006; Morgan and McDonald, 2007; Morgan, 2009). It should also be noted that responsibility for the patient's treatment is shared between the veterinarian and their client since consent to treat is a 'permission not a mandate' while at the same time the owner 'can refuse consent' (Yeates, 2009, p.4). Decisions regarding euthanasia in particular can frequently lead to disagreements between veterinarians and clients and have therefore been explored more specifically (Morris, 2012a).

Understandably, veterinary ethicists have focused their work on exploring the ethical challenges raised by the increased weight of animal welfare in the exercise of the profession, especially when it creates conflict in the veterinarian-client relationship. Tannenbaum (1995, p.4-5) notes 'veterinarians typically serve *both* patients and clients. (...) The fact that veterinarians are the servants of two masters can make ethical issues in veterinary practice extremely difficult. The interests of patients sometimes conflict with those of the client'.

When it comes to AMR, however, veterinarians do not serve 'two masters' but three, as the interests of society in general, under the umbrella of public health, must also be taken into account. In farm animals, the use of antimicrobials is more clearly regulated, with only a small selection of drugs allowed for use and coming with clear withdrawal periods. In companion animal practice, however, and as mentioned by Heuer in the introduction of this section, such rules do not apply and the prescription of antimicrobials may for this reason engender unique ethical tensions. Chapter 2 explores what current literature reveals of the ethical tensions existing in veterinary practice when prescribing antimicrobials. To date, however, an in-depth ethical discussion of antimicrobial prescription in veterinary practice has not yet been published.

1.4.3. Antimicrobial resistance and stewardship in companion animal practice

As mentioned earlier in this chapter, evaluating the current consequences of antimicrobial resistance on human health is fraught with difficulties, as surveillance and reporting is complex and challenging. Yet, enough data is

gathered to have an idea of the evolution, spread and impact of resistant infection profiles (Cassini et al., 2019), as well as the type and quantities of antimicrobial used in human medicine (Van Boeckel et al., 2014; Klein et al., 2018). The same level of information is not currently available for companion animal practice.

While human laboratories have to follow set reporting standards (from the Clinical and Laboratory Standards Institute (CLSI) and the European Committee on Antimicrobial Susceptibility Testing (EUCAST) in the UK), veterinary laboratories are not regulated in the same way and show wide variation in how they carry out and report their culture and sensitivity testing. Pooling and analysing their data are therefore impossible. It has been noted that wide testing of second and third line antimicrobials, as well as testing antimicrobial sensitivity on commensal flora, is likely to be confusing to clinicians and promote inappropriate antimicrobial use (Morley et al., 2005). Many extrinsic factors (e.g. client's financial situation, difficulty in collecting samples, etc) also influence veterinarians' decision to culture a suspected infection in the first place (De Briyne et al., 2013). Despite those difficulties, some recent studies have confirmed that resistant infections do occur in companion animal medicine and that their prevalence may be on the rise (Pedersen et al., 2007; Marques et al., 2016; Marques et al., 2018).

It should be noted that better reporting on antimicrobial use in veterinary practice is seen as important in combatting AMR but most initiatives and suggestions on how to achieve this have focused on uses of antimicrobials in agriculture (Ferreira, 2017). In the UK, a governmental report on AMR and antimicrobial use in both human and veterinary medicine is released every year, but veterinary data is limited to how many tons of various antimicrobials have been bought by different branches of the sector not if or how they have been used (Veterinary Medicines Directorate, 2019).

Stewardship guidelines aimed at veterinarians have been available for several years (Teale and Moulin, 2012). In the UK, a 'Protect your antimicrobials' initiative (2012) was launched by the British Veterinary Association in an effort to promote the creation of local antimicrobial guidelines in companion animal practice. In Denmark, detailed guidelines were produced as well (Danish Small Animal Veterinary Association, 2013) and widely distributed using a variety of media (e.g. leaflet, phone application, computer file, etc), with an overall positive influence on veterinarians' prescription habits (Jessen et al., 2017).

Taking into account all the information presented and discussed so far in this chapter, the importance of gaining more knowledge about antimicrobial stewardship in all sectors where antimicrobials are used should be evident. The unique and complex nature of companion animal veterinary work makes it a fascinating but challenging setting to explore. The approach taken to create the research design and the formulation of the research questions is the focus of the rest of this chapter.

1.5. Research Approach, Design and Aims

This section highlights how the information and conclusions presented in the rest of the chapter led to the research aim guiding the rest of the thesis. It briefly explores the research questions, conceptual framework, and

methodology choices of this work and introduce the structure of the rest of the thesis. Chapter 4 will detail methods and methodology further.

1.5.1. Scope of the Study: Defining the Veterinary Ethics Approach

The investigation of ethical questions in clinical practice is complex and must be multi and inter disciplinary in nature, drawing on sound ethical arguments while understanding the intricacies of clinical practice and yielding answers that are both useful and implementable in a real-life setting, such an approach is an integral part of applied bioethics (Mepham, 2008). These considerations hold true when exploring issues relating to veterinary clinical practice, and as such, this work—while mostly descriptive in nature—does rely on the multi-disciplinary approach of applied bioethics. It should be noted here that in modern literature there is significant overlap between the terms ‘medical ethics’, ‘biomedical ethics’ and ‘applied bioethics’ when investigating issues arising from clinical practice.

Bioethics is a discipline that covers many kinds of enquiries (e.g. metaethics, descriptive ethics, etc) which may be normative, based on empirical research or a mixed of the two. As previously mentioned, this thesis is based on an analysis of empirical findings and written through the lens of descriptive ethics, although relevant normative themes and concepts are also discussed. Descriptive ethics are particularly important when considering applied questions that raise ethical issues such as the investigations of AMR and antimicrobial stewardship in companion animal practice.

Many theoretical foundations can be used to anchor ethical arguments, often depending on the field of enquiry. For example, public health ethics topics have been discussed using competing theories, such as liberalism, contractualist or equalitarian theories, etc. (Petrini, 2010). Similarly, medical ethics has evolved over time through many theoretical theories, from Hippocratic principles to more modern approaches, such as the four principles of beneficence, non-maleficence, justice and autonomy coined by Beauchamp and Childress (2013).

In the case of a multi-disciplinary issue such as AMR that involve many actors, some of those theories can be broadly applied. For example, non-maleficence can be applied to individual patients or to whole communities / societies (Marcus et al., 2001a). To apply such theories, however, especially in a case so complex as AMR, understanding the lived experience and breadth of values of the actors involved is key. Rollin (2006b) explains ‘Ethics1, or morality, is the set of beliefs that society, individuals, or subgroups of society hold about good and bad, right and wrong, justice and injustice, fairness and unfairness. Ethics2, on the other hand, is the logical examination, critique, and study of Ethics1.’ Following this train of thought, the role of descriptive ethics is to draw an accurate and as detailed as is possible and relevant picture of Ethics1, in order to ensure that any Ethics2 efforts are based on information that lead to prescriptive recommendations that are useful in a real life setting.

As a result, this thesis can provide insights for the veterinary profession, especially its governing and professional bodies, in order to best tackle the issue of AMR in practice and implement stewardship strategies while maximising their efficacy and uptake by members of the profession. The data presented here is also relevant to other actors,

however, such as public health officials, government representative and any professional involved with the One Health approach of medical and veterinary care.

1.5.2. Research aim: questions raised by the synthesis of multiple literatures

As discussed in section 1, antimicrobial resistance is a complex issue of great importance to the modern world and in particular to public health. Multiple actors and settings are involved in its development and spread; some, however, have been better studied than others. The reality of antimicrobial prescription—and its contribution towards AMR—by companion animal vets has seldom been studied and the data available on the topic is scarce.

Veterinary ethics literature has emphasised for the past few decades the unique nature of companion animal practice—due in part to the status of pet animals in society and their emotional bond with their owners. As discussed in section 1.2.2, the responsibilities and ethical challenges faced by companion animal vets are often specific to their occupation. Unsurprisingly in this context, the promotion and application of antimicrobial stewardship in companion animal practices create distinctive ethical questions and issues that must be recognised and investigated; some of those are shared with other professionals, while others are specific to companion animal veterinarians. In section 3, the various beliefs and opinions about AMR and stewardship of professionals with prescription privileges in both human medicine and agriculture were shown to be an essential predictor of compliance or non-compliance with current policies and guidelines.

Bringing these facets of the issue together, the rationale for this thesis can now be stated: in order to understand how best to address AMR in companion animal veterinary medicine, there is a need to better understand the competing responsibilities that are experienced by veterinarians in practice in the UK.

This is particularly important considering the scarcity of data existing about companion animal practice. The research presented here while interested and focused on ethical questions has therefore got a descriptive nature when following the foray of AMR within the landscape of companion animal practice.

The next sub-section will present the secondary research questions that logically arise from this statement.

1.5.3. Formulation of research questions and conceptual framework

Defining the tensions related to ethical responsibilities in companion animal practice—as they pertain to AMR and antimicrobial stewardship—was helpful in formulating research questions. It required exploring and synthesising the current literature on varied topics such as: antimicrobial resistance and antimicrobial stewardship in both the wide veterinary and human medical world, the concept of responsibility in social sciences, the medical ethics views on the just and fair distribution of limited resources, the concept of expertise and evidence and how it links to the push towards strongly evidence-based medicine in both human and medical health settings, animal welfare ethics at both individual and population levels. Concerns raised by human physicians in the medical literature on AMR

were particularly helpful in suggesting themes that needed exploring in companion animal practice (see chapter 2 for more details).

The underlying conceptual framework of this work contrasts the role and duties of veterinarians in society in the context of AMR—with responsibilities inherited in large part from Public Health ethics—and their day to day experience in a clinical setting, caring for their patients' health and welfare and the expectations of their clients. This approach uses the concept of moral distance (Helm, 1978; Chatterjee, 2003; Abelson, 2005) to explore prescribing behaviour (see chapter 2, section 5 for more information) and separates veterinarians' responsibilities between near (see chapter 2) and far (see chapter 3) moral duties; consequently, this thesis will investigate how companion animal veterinarians deal with the complex ethical dilemmas surrounding AMR using this bifocal lens as a holistic tool to describe and analyse veterinarians' experiences and views.

To investigate the research aim introduced in the previous section, the following questions were formulated:

- How do UK veterinarians construct their responsibilities in relation to antimicrobial stewardship?
- How do everyday practice, regulations and social responsibilities interact and shape each other in relation to public health issues?
- What does this analysis mean for regulatory policies for AMR and the role of companion animal vets in addressing public health challenges as well as our understanding of veterinary and public health ethics?

The concept of responsibility is therefore at the core of the research questions that are the focus of this thesis. It was used to create the interview agenda (see Annex A) and was the gateway used to lead interviewees to reflect on their experience in practice. While other approaches could have been considered, this has the advantage of aligning well with discourse well known of veterinarians through ethics teaching and professional discussion and was therefore a familiar and easily understood theme for the interviews. Of course, the concept of responsibility is not necessarily devoid of emotional influence, particularly in situations eliciting strong emotions such as moral distress (Moses et al., 2018).

1.5.4. Methodology and thesis structure

As one of the main goals of this project is to investigate the range of opinions, beliefs and ethical positions existing among companion animal veterinarians around the issue of AMR and the challenge of following antimicrobial stewardship principles, qualitative methods were more appropriate to ensure that the complexity and subtlety of veterinarians' views was adequately gathered. This approach was supported by comparing the findings of various existing studies and the nature of the information that this diverse methodological approach had allowed them to access. Individual face to face semi-structured interviews were planned in order to give the participants room to elaborate on the questions asked and to cover all the themes they thought relevant to the topic at hand. More on this particular topic will be covered in chapter 4.

Self-reflection on my own experience as a companion animal veterinarian has also informed the structure of this thesis, laying out and grouping various inter-linked themes under headings that present them logically while still emphasising their complexity and relations to one another.

Following this introductory chapter, this work will be structured as follows:

- Chapter 2: This chapter reviews literature that is relevant to the veterinarian's immediate responsibilities to their patient and client in companion animal practice in the context of antimicrobial prescription. It mostly uses applied veterinary and medical ethics literature, and links with empirical data chapters 5 and 6.
- Chapter 3: This chapter reviews and synthesizes literature that is relevant to the veterinarian's responsibilities to the veterinary profession, their expertise and knowledge as well as to society as a whole. It mostly uses public health and medical ethics literature, and links with empirical data chapter 7 and 8.
- Chapter 4: This chapter describes and justifies the methodological choices made in this study, as well as the strength and weaknesses inherent to those choices.
- Chapter 5: This chapter empirically analyses the data that has been gathered during interviews on the themes of relation and responsibility between the companion animal veterinarian and their animal patient.
- Chapter 6: This chapter empirically analyses the data that has been gathered during interviews on the themes of relation and responsibility between the companion animal veterinarian and their human client (i.e. the pet owner).
- Chapter 7: This chapter empirically analyses the data that has been gathered during interviews on the themes of scientific knowledge and evidence-based medicine in the context of antimicrobial stewardship in companion animal practice.
- Chapter 8: This chapter empirically analyses the data that has been gathered during interviews on the themes of AMR as a global issue and its future consequences as well as the responsibility of veterinarians towards public health and society as a whole.
- Chapter 9: This chapter brings together the conclusions of the previous chapters and presents them in their complex interlinked context, before finally emphasising the implications of those findings for current and future antimicrobial stewardship policies and guidelines. It also introduces a new, expanded ethical framework developed using the conclusions of this thesis.

1.6. Conclusion

This chapter has highlighted the importance of AMR as a global issue and the paucity of data available when discussing the prescription of antimicrobials in companion animal practice. It has emphasised the nature of companion animal practice as a unique and ethically challenging setting needing and deserving a focused investigation.

AMR in health care settings—human or veterinary—is currently managed through the promotion of antimicrobial stewardship principles. These principles, however, raise new and complex ethical questions for practitioners that cannot be overlooked or simplified if one is to understand the challenging nature of antimicrobial stewardship

promotion in practice. The views and concerns of companion animal veterinarians, therefore, are worthy of a thorough investigation through the lens of descriptive ethics as discussed in 1.5.

This thesis produced a rich dataset of empirical work which is reported and analysed in chapters 5 to 8. Before this, however, the following two chapters help situate this empirical contribution by critically reviewing two important streams of work. The first (chapter 2) focuses on those issues that are tied to the hands-on practice of companion animal veterinary medicine within the walls of the veterinary clinic. The second stream of work (chapter 3), focuses on those linked to the role of the veterinarian in a wider context (e.g. within society, the local community, or as a representative of the veterinary profession).

Chapter 2—Companion animal practice and antimicrobial stewardship: ethical questions and challenges arising within the walls of the practice

2.1. Introduction

This chapter focuses on aspects of antimicrobial stewardship that are experienced directly while practicing medicine. Both veterinary and human medicine are discussed here. Indeed, as literature surrounding antimicrobial stewardship in companion animal practice is scarce, it is at times useful to turn to medical literature and reflect on its conclusion. As will be discussed further in chapter 3, companion animals are often seen as being part of the human family (Cohen, 2002; Crawford and Balzer, 2017; Rollin, 2018), and as such, their care is frequently more comparable to human medical care than to the care provided to farmed or working animals by other sectors of the veterinary profession.

In the first part of this chapter, a summary is given of the various responsibilities that companion animal veterinarians face on a daily basis in practice. Antimicrobial prescription cannot be isolated from other ethical challenges existing within the clinic, and it is imperative that those are understood to draw a comprehensive picture of the ethical tensions surrounding handling of antimicrobials and the application of antimicrobial stewardship principles. Similarly, beyond its ethical aspects, antimicrobial prescription is a clinical decision and to fully address the ramifications of antimicrobial treatment in practice, the clinical context pertaining to antimicrobial use and antimicrobial resistance must be taken into account and is briefly covered here. The second part of this chapter focuses on the medical ethics literature and the various arguments surrounding handling of limited resources by health care professionals. It also explores the use of antimicrobials in medical practice, and the stewardship initiatives put in place in diverse medical settings. In a third part, specific circumstances of both human and veterinary medicine are explored, as well as some particulars of current stewardship guidelines in companion animal practice. Finally, the fourth part of this chapter is dedicated to the concept of ‘moral distance’ (Glover, 1977) and will explain why it is relevant to the issue of AMR and the promotion of antimicrobial stewardship in human and veterinary medical practice.

2.2. Ethical challenges in companion animal practice: within the clinic

The modern role of the veterinarian has undergone many changes and now differs greatly from the romantic but historical vision of the paternalist and benevolent countryside vet. Challenges faced by the profession include increased business competition between practices, lower wages, and changing relationship between vets and their clients (Williams and Jordan, 2015). Dramatic progress in veterinary medical and surgical abilities and therefore options for treatment have led to a marked increase in veterinary fees that feeds competition between practices, rising pet insurance costs, and creates uncertainty for the profession (Burns, 2013). Parallel to these changes and similarly to the doctor-patient relationship in human medicine, the relationship between veterinarian and client has evolved from paternalistic to a partnership, with requirements to obtain informed consent before treating patients. The situation in veterinary medicine is complicated by the fact that the interests of the patient, client and veterinarian do not always align (Rollin, 2006a; Morgan, 2009; Morris, 2012a) leading to veterinary professionals facing complex communication challenges and ethical dilemmas on a daily basis. While this might also be the case in some areas of human medicine—such as paediatric care (Brudney and Lantos, 2014), the omnipresence of such circumstances in veterinary medicine (more so in companion animal medicine for reasons that will be explained in this chapter and the next) has led to the bulk of the ethical and philosophical work carried out around the veterinary profession to focus on the triangular relationship existing between the veterinarian, the human owner and the animal patient. In this section, the literature pertinent to this relationship is first summarised, then other known challenges and dilemmas often encountered when practicing veterinary medicine are detailed. Finally, the literature surrounding companion animal practice, antimicrobial usage and AMR will be discussed.

2.2.1. The veterinarian, pet owner, and animal patient dynamic

Veterinary Ethics studies the specific ethical problems encountered by veterinarians in the exercise of their profession. It is a relatively recent field with the term appearing in a couple of publications after the Second World War (Wadsworth, 1947; Haigler, 1949) but only becoming frequently encountered in the published literature from the 1980s onwards. This recent history makes veterinary ethics a challenging and exciting area of study with a rather small literature base compared to, for example, medical ethics.

Ethical tensions and challenges faced by veterinarians are particularly complex in companion animal practice as pets tend to be more highly regarded by all parties involved than farmed or wild animals; this situation leads to the creation of a sociozoological scale (Arluke and Sanders, 1996) that will be explored in more detail in chapter 3. The concept of 'more-than-human solidarity' (Rock and Degeling, 2015) is also particularly relevant in companion animal practice. This concept refers to the idea that 'acting in solidarity with people implies respecting their commitments to one another as to places, plants and non-human animals' (p.63). In the same manner, it can be argued that companion animal veterinarians have increased obligations to their patients due to the strong emotional interdependence between owners and their pets, with many people considering pets to be a part of their family (Crawford and Balzer, 2017).

In this rapidly evolving and challenging context, and as previously mentioned, it is not surprising that the bulk of the veterinary ethics literature has focused on the ethical issues arising from conflicts of interests and obligations

between veterinarians' responsibilities to their clients, to their patients and to themselves (Main, 2006; Morgan and McDonald, 2007; Morgan, 2009). Indeed, traditionally, veterinarians are seen as being 'animal doctors' or as the sometimes tongue-in-cheek 'other family doctor'. This last epithet reinforces the idea of that veterinarians have responsibilities and duties towards both their animal patient and their human client. They are an advocate for their patient's health and welfare (Main, 2007; Hernandez et al., 2018), but they also must carry out their clients' wishes and, as seen above, be aware and respectful of their client's emotional wellbeing, especially where it pertains to the human-animal bond they share with their pets. Many of the communication challenges faced by veterinarians aim at finding the best common grounds within the available options in term of patient welfare, finances and prognosis between themselves and their clients (Morgan and McDonald, 2007; Cleton and Meijboom, 2009; Moore, 2011; Batchelor and McKeegan, 2012). While a veterinarian's role is to inform and guide their client's decisions, client's agreement with a treatment plan is necessary for a veterinarian to proceed. This is true even if the veterinarian does not believe the client is making the best decision for the patient. Indeed, the concept of 'informed consent' has become increasingly important in veterinary medicine (following in the footsteps of human health care) (Fettman and Rollin, 2002; Main, 2006). Obtaining informed consent is a complex and well debated process (Corrigan, 2003; Wells and Kaptchuk, 2012) in the medical field, and is challenging in veterinary practice as well (Whiting et al., 2017; Ashall et al., 2018). Conversely, it should be noted that consent for treatment 'is a permission not a mandate, so the veterinarian can conscientiously refuse the owner's wishes' (Yeates, 2009).

Disagreement between veterinarians and clients often arise from different ethical and philosophical schools of thought regarding complex topics such as the intrinsic worth of the animal's life, what constitutes an acceptable quality of life, or how much consideration quantity of life deserves (Main, 2007; Moore, 2011; Morris, 2012a). In essence, if veterinarians and clients' core values regarding animal life and animal welfare are different, disagreement or at least challenging communication might ensue. Morris (2012, p.171) remarks:

'In fact, decisions around end-of-life care and euthanasia are among the biggest ethical concerns for interns, residents, and experienced veterinarians alike as they are memorable, complex, and contain deep and unresolved tensions inherent in human-animal relationships.'

Interestingly, and through a series of individual examples, the book illustrates that those core values are also different among individual veterinarians as well, leading them to having different professional opinions regarding clinical decision making and client communication. This finding has also been demonstrated by other studies in both companion animal and farm animal veterinarians (De Graaf, 2005; Morgan, 2009). In particular, how veterinarians construct and balance the amount of responsibility they have towards their patient versus their client varies. Beyond this triangular relationship, however, the veterinarian also deals with further responsibilities within the practice.

2.2.2. Other responsibilities within the practice

Effective provision of healthcare requires a team-based approach including in modern veterinary practice to both reduce the risk of errors being made (Kinnison et al., 2015a), but also to increase job satisfaction and reduce burnout (Moore et al., 2014). Teamwork has become increasingly important over the last few decades as

veterinary practices got bigger, employed more people and saw more clients (Kinnison et al., 2015c). Of course, while good teamwork is important to ensure patient's safety and so relates to having to provide a professional service to both patients and clients, direct relationships with other veterinarians or related professions (veterinary nurses or technicians, receptionists, but also behaviourists, animal physiotherapists, etc.) are also a source of responsibility on the part of the veterinarian to demonstrate professional and inter-professional skills. Within the clinic having a close-knit team and colleagues who are team-players is important for overall moral and job satisfaction (Clarke et al., 2019). As such it can be argued that individual veterinarians have a responsibility to promote a collaborative and respectful working environment and good communication with colleagues; this is especially important since individuals can have a significant impact on the overall effectiveness of the veterinary team (Kinnison et al., 2015b) and since as discussed above not all opinions, views and attitudes will be shared between individual professionals. This evolution of the inner workings of the modern veterinary practice has been reflected in modern veterinary curricula that emphasise both professionalism (Mossop and Cobb, 2013; Gray, 2014) and interprofessionalism (Kinnison et al., 2014; Estrada et al., 2016) as essential to the modern veterinarian. It should be noted that beyond interactions with other professionals relating to individual patients (either within the clinic or through direct referral), interprofessional skills are also seen as essential to improve and promote the practice of One Health principles across medically-inclined professions; in particular relationships between veterinarians and physicians have been discussed (Courtenay et al., 2014; Wilkes et al., 2019). Consequently, and considering how AMR and AMR policies are consistently linked to the One Health approach, interprofessional skills or lack thereof might have a bearing on individual veterinarians' view of the issue.

As discussed in the first section, veterinarians have responsibilities towards both patient and client. It is important to emphasise here, however, that these responsibilities extend to all patients under their care and respective clients. This can prove particularly important when veterinarians have to decide how to allocate limited resources such as their own professional time since time pressure is well recognised as a common source of stress in veterinary practice (Batchelor and McKeegan, 2012; Vandeweerd et al., 2012c). Furthermore, having to take into account professional responsibilities to other animal patients (present and / or future) echoes the concepts of inter and intragenerational justice relevant to the distribution of limited resources among human populations (again present and / or future) (Page, 1999), particularly in the context of AMR (Millar, 2011; Littmann, 2014). This topic will be discussed more thoroughly in Chapter 3.

There is one more set of responsibilities that must be mentioned here. In his analysis of veterinary ethical conflicts, Yeates (2009) notes that 'a veterinarian, as with any autonomous agent, has certain agent-specific, object-specific responsibilities to him or herself' (p.5). He mentions charging for professional services, developing professional abilities and ensuring personal safety in the face of an aggressive patient as some examples of such responsibilities. Morris (2012a) in her work about euthanasia in veterinary practice remarks 'veterinary work causes distress for practitioners because it requires people who care strongly about animals to kill them' (p.136). It has also be argued that the practice of euthanasia, and being faced by frequent ethical decisions leading to concrete life or death choices, create a kind of stress unique to veterinarians (and some other professions such as shelter workers) that Rollin termed 'moral stress' (Rollin, 1987). Moral stress arises in professions whose purpose is to care for animals

and promote their health and welfare, yet who are often involved in the active killing of these same animals (Rollin, 2011). It should be noted, however, that the practice of euthanasia is only one of many sources of stress and potentially emotionally damaging tasks veterinarians have to cope with on a daily basis. Other issues that are well recognised in other health care professions such as compassion fatigue (Cohen, 2007) and burnout (Moses et al., 2018) also affect veterinarians. In this context, it is regrettable but perhaps unsurprising that stress-related disorders, depression and suicide rates have been demonstrated to be higher in the veterinary profession than in the general public (Bartram and Baldwin, 2010; Dawson and Thompson, 2017). Reviewing those figures is beyond the scope of this thesis, but it should be noted that this trend has been demonstrated in multiple countries and is therefore not an exclusive product of cultural background or specific working conditions.

In this context, it is both surprising and concerning that responsibility to protect oneself from physical and emotional harm is not emphasised more often when discussing veterinary ethical issues. Although ethical teaching at undergraduate level has become more widespread in recent years (Magalhães-Sant'Ana et al., 2010; Magalhaes-Sant'Ana et al., 2014), it is still unknown whether this is an effective method for improving veterinarians' ability to deal with ethically challenging situations and in turn to reduce the amount of stress generated by the practice of veterinary medicine.

Nevertheless, the stressful nature of common situations (Batchelor and McKeegan, 2012) such as working with a client with limited financial means, or a request for treatment to be pursued beyond what the veterinarian believes reasonable, should be kept in mind as it may affect veterinarians' decision-making when faced with dilemmas likely to add to the amount of stress they are already coping with. In summary then, there are issues beyond the standard vet-client-animal triad. As this section has highlighted, vets also have responsibilities towards other colleagues, and to themselves. As discussed in the introduction, the next section moves on to summarising what is known about antimicrobial use in practice in order to illustrate why stewardship is needed and important and provide the ethical challenges discussed here with a background rooted in current prescription practices. Antimicrobial resistance is briefly touched upon as well.

2.2.3. Antimicrobial usage and resistance in companion animal practice: a brief overview

Literature relating to antimicrobial usage and resistance in companion animal practice is limited compared to what is available in regard to human medicine; it has, however, expanded in recent years with growing interest in this research topic probably stemming in part from the increased focus surrounding all issues related to AMR.

Several retrospective studies of practice records in the UK using established surveillance networks (SAVSNET and Vet Compass) have helped give an idea of antimicrobial prescription habits in companion animal practice. For example, in 2011, a study showed that in over 22,000 consultations that took place in sixteen different practices, 35% of consultation with dogs and 48% of consultations with cats involved the prescription of antimicrobials (Radford et al., 2011). More recently another study of over 1.5 million consultations from 374 different practices showed that 25% of dogs and 21% of cats received an antimicrobial (Buckland et al., 2016). Finally, an even more recent study by Singleton et al. (2017) analysing over 1.2 million consultations from 216 different practices showed a prescription rate of antimicrobials of 18.8% for dog consultations and 17.5% for cat consultations. While this

progress is encouraging, those studies only encompass a subset of practices that may not be representative of the average UK practice. Being part of a research surveillance network may affect how veterinarians practice as well. Regardless of those limitations, some specific results are still cause for concern. For example, cefovecin—a third generation cephalosporin, a drug class of importance for human health that should not be used as a first line antimicrobial—has been shown to be very frequently prescribed by veterinarians, especially in cats (Burke et al., 2016; Singleton et al., 2017). Other studies have also suggested that antimicrobial prescription in circumstances when they would be deemed inappropriate by prudent use principles also happen in practice. For example, in a questionnaire sent to over 2,900 mixed and companion animal practice by Knights et al. (2012), vets reported administering prophylactic antimicrobials to 30% of clean surgical procedures (i.e. uncontaminated by infectious material such as elective surgical procedures). 79.9% of veterinarians also agreed that if unsure if needed or not they will give antimicrobial prophylaxis. Prudent use guidelines state that antimicrobial prophylaxis should usually be avoided (Publications Office - European Union, 2015). Similarly, Hughes et al. (2013) sent a questionnaire to 900 veterinarians and responses showed that 23% of dogs with uncomplicated GI disease would receive antimicrobials, a condition for which they are not recommended.

Another section of literature existing around antimicrobial prescription in companion animal practice looks not directly at prescription of antimicrobials, but at veterinarians themselves and how they make the decision to prescribe antimicrobials. In 2013, one large European study based on voluntary questionnaires sent to veterinarians in all clinical fields was published on the topic of antimicrobial prescription and stewardship (De Briyne et al., 2013). The paper covered a wide range of topics and attitudes and showed an overall good awareness and knowledge of the prudent principles of antimicrobial prescription on the part of veterinarians. While this is a positive finding, the answers to this questionnaire contrast with the ones obtained with more open ended methods such as qualitative interviews; leading one to wonder whether the answers are motivated by a drive to provide the 'right response,' often easily recognisable in a questionnaire. Mateus and al. (2014) interviewed twenty-one veterinarians from seven different practices in the UK using semi-structured interviews and showed that factors beyond clinical evidence and knowledge, such as social norms, previous experience, animal and client characteristics, etc, play a role in clinicians' decision to prescribe antimicrobials. A comparable study was carried out in the Netherlands interviewing 18 companion animal veterinarians and had similar findings (Hopman et al., 2018). An even more recent study by Tompson et al. (2020) used mix-methods to examine the prescription of antimicrobial critically important to human health in companion animal veterinary practice. One of the most interesting conclusions of this study was that significant variations in prescription behaviours existed among veterinarians, even among those who worked in the same close environment.

In conclusion, the current literature investigating antimicrobial prescription in companion animal veterinary practice, although scarce, confirms that classes of antimicrobials regarded as important or even critical for human health—such as third generations cephalosporins—are regularly used in companion animal practice. It also suggests that prescription behaviours vary between individual veterinarians and that the various and complex factors driving those behaviours are still under investigations.

Relatively little is known about the prevalence of AMR in veterinary medicine, especially in companion animal practice. This is due in part to the absence of national and international surveillance networks in veterinary medicine and the lack of standardised testing and reporting by veterinary laboratories (Morley et al., 2005). A handful of studies on specific conditions have shown that resistance in companion animal practice may be worsening (Marques et al., 2016; Marques et al., 2018). Resistant pathogens causing clinical disease in humans have also been isolated from healthy pets (Committee for Medicinal Products for Veterinary Use, 2015; Iseppi et al., 2015).

None of the studies published so far focused on veterinarians' understanding and views of antimicrobial stewardship and of the role the veterinary profession should play in this context. Our current understanding of how professionals handle antimicrobials and experience their role and responsibilities while doing so comes mostly from literature focused on human medicine. Consequently, this is the focus of the next section of this chapter.

2.3. Ethical challenges in GP practices and hospitals: relevant lessons and insights

The literature surrounding the issue of antimicrobial stewardship in human medicine is vast and would be impossible to fully review here. Instead, the first subsection aims at giving an overview of various viewpoints and arguments existing in the medical ethics literature when considering handling of limited resources by physicians. The second subsection briefly discusses what is known of antimicrobial use and of the rise of resistance in medical practice. Finally, the last subsection focuses on the idea of antimicrobial stewardship in medical practice, the challenges surrounding the implementations of stewardship principles, as well as the lessons learnt from various stewardship initiatives. The aim of exploring this literature is to identify how it can inform our understanding of the ethical tensions facing veterinarians in terms of their relationships in the clinic.

2.3.1. Doctors, patients and the ethical challenge of handling limited resources

As discussed in section 2 of the introduction chapter, antimicrobial stewardship principles advise clinicians to only prescribe antimicrobials when absolutely necessary and to endeavour to reduce their overall use. Those goals transform antimicrobials into a commodity which use should be carefully planned and limited; in effect, it asks clinicians to handle antimicrobials as a limited resource that must be protected and preserved. Tilburt (2014a) explores the ethical conflicts doctors face when deciding on treatment options for patients while also having to safeguard the health care system resources to benefit as many other patients as possible. He notes that these conflicts have not been satisfactorily resolved by the current bioethics and medical ethics theories, and suggests that one possible way forward is to use the idea of 'role morality' (Applbaum, 1999) by 'defining different roles and spheres where the different expectations of professionalism are more or less operative. (...) Each of these roles entails a distinct set of obligations specific to that role within those respective spheres. Role morality manages competing obligations by delineating in which settings those obligations apply' (Tilburt, 2014a, p.34).

This approach is very similar to the traditional veterinary ethics approach described above as it relies on analysing competing obligations existing within the professional life of a single individual, in this case a doctor. But

interestingly, instead of looking at conflicts between different duties inherent to one professional role, it recognises the existence of two roles for the doctor: one as a patient care provider (p.34) – a view aligned with traditional medical ethics, and one as the handler of ‘resource constraint issues’ (p.35).

This distinction is important as the role of looking after limited societal resources is not traditionally the focus of physicians—or veterinarians. Such roles, whether related to financial resources or antimicrobial stewardship, are also in conflict with the historical duties and traditional professional ethics of these professions, the spirit of which is still very much alive and proudly patient-centred. For example, over 80% of USA medical schools’ graduation oaths include a statement promising that ‘the health and life of my patient will be my first consideration’ (Kao and Parsi, 2004, p.884).

Instead of analysing competing responsibilities occurring within one professional role, i.e. providing a health care service to an individual patient within a given set of circumstances, the existence of two separate roles with conflicting obligations raises complex issues as – while both roles are important – their respective weight in the daily life of the professional is not balanced. Tilburt (2014, p.35) notes that ‘practically due to the nature of physician work and health care financing, most days, most of the time, this role morality strategy would functionally insulate physicians from the responsibility of advocating for just structures of care because 99% of the time, most doctors are wearing their patient care hat (so to speak)’. In the same way, thinking about good antimicrobial stewardship and preservation of antimicrobials for societal good as a separate role from that of a clinician will do little in changing prescribing habits as in ‘patient care mode’, consideration for the patient will easily take precedence over AMR concerns (Broom et al., 2014). Or, as again put by Tilburt (2014, p.35): ‘instead of having a conflict between two professional principles, with role morality, one trades a direct conflict in principles for a conflict in roles with no way of reconciling how those roles should be prioritized. (...) Role morality if worked out more completely or combined with some version of specification at least acknowledges that one can really only wear one hat at a time, and when one is wearing “x” hat, one’s main job is “y”.’

From the above, the limitations of using competing obligations to address public health challenges in clinical practice should become apparent. The helpfulness of traditional veterinary ethics in tackling the problem of antimicrobial stewardship in practice is therefore likely to be limited and the issue might require a different approach. In most studied veterinary ethical dilemmas, the different parties involved have a concrete presence in the veterinarian’s professional life: patients, clients, other veterinary professionals, even the profession as a whole through its representative bodies. Antimicrobial stewardship and Public Health, in comparison, are vague entities with little weight in daily practice which leads to the creation of a ‘moral distance’ between the veterinarian and their obligations to good stewardship. This will be explored further in part 4 of this chapter.

2.3.2. Antimicrobial in medical practice and the exploration of doctors’ prescription behaviours

Antimicrobials are used in different settings in human medicine, from hospitals, to end-of-life care facilities, to general practitioners (GPs) offices, etc. Rodrigues et al. (2013) reviewed qualitative studies that focused on physicians’ perception of the factors that influence prescription behaviour of antimicrobials in practice. They found that the most important extrinsic factors were patient-related (e.g. symptoms) or health care system-related (e.g.

time pressure, existence of guidelines, etc). When it came to intrinsic factors, physicians' attitudes (e.g. complacency, fear, etc.) towards antimicrobial prescription were rated as most influential. Finally, this review emphasised the complexity of the antimicrobial prescription process as it depends on multiple factors affecting all the actors involved in this process, and these various factors are mutually dependent from one another.

Many studies have focused on prescription behaviour in human medicine with a wide range of findings. For example, some have shown that physicians may downplay the severity of AMR or feel that the situation is worse in other practices / hospitals (Stach et al., 2012; Wood et al., 2012; McIntosh and Dean, 2015). How individual physicians define and understand their social responsibilities has also been shown to influence antimicrobial stewardship behaviour (Wood et al., 2007). Assumptions were also made by some physicians who believed that their patients desired antimicrobial treatments despite patients' demands and expectations not being clearly discussed (Altiner, 2004); these assumptions likely led physicians to experience increased pressure to prescribe antimicrobials. Similarly, antimicrobial prescriptions may sometimes be used as a placebo to provide patients with the reassurance of a therapeutic approach even in self-limiting disease (Byrne et al., 2012). Other—sometimes contradictory—factors have been shown to influence antimicrobial prescription; for example, some physicians have been shown to be more likely to prescribe antimicrobials to patients belonging to lower social classes (Walker et al., 2010), while others were more likely to prescribe them to paying patients compared to those eligible for free care (Murphy et al., 2011). Finally, Broom et al. (2014) concluded that sub-optimal antimicrobial prescribing can be understood as a logical choice in a hospital setting; they point out that 'the rules of the game within *the field* are heavily weighted in favour of the management of immediate clinical risks, reputation and concordance with peer practice vis-à-vis longer-term population consequences. Antimicrobial resistance is thus a principal of limited significance in the hospital' (p.81).

These studies illustrate the complexity of antimicrobial prescription behaviour and the wide range of factors coming into play in practice. Another part of the medical literature has focused on specific antimicrobial stewardship initiatives and their successes and limitations.

2.3.3. Antimicrobial stewardship in medical practice: lessons, questions and challenges

As discussed in chapter 1, guidelines on antimicrobial stewardship follow prudent use principles, aiming at reducing the frequency of antimicrobial prescription, with a particular focus put on limiting the use of classes of antimicrobials considered critical to human health. However, the efficacy and benefits of such guidelines are still being investigated with studies reporting mixed results following implementation of antimicrobial stewardship initiatives; some show good results (White et al., 1997), other no improvement (Cook et al., 2004). A recent review warned that the efficacy of control policies to limit AMR was undermined by a lack of evidence (Dar et al., 2016). In contrast, the risk to the patient if they develop an infection is well known to the physician and the benefits of preventing this from happening are concrete and foreseeable in the short term (Littmann, 2014). While reducing antimicrobial use might prevent the development of further resistance, it does not reliably reverse the prevalence of existing resistance mechanisms in bacterial populations (Levy and Barbosa, 2000).

Doctors have also been shown to be more likely to use guidelines if they are based on strong evidence and make allowance for the individuality of the patient when managing a case (Limbert and Lamb, 2002); this study also showed the attitude of individual physicians as being the most important factor when predicting their willingness to follow antimicrobial guidelines. In general, guidelines (not just antimicrobial guidelines, but clinical guidelines as well), are poorly followed by clinicians unless a multifaceted approach (i.e. relying on opinion leader, further professional education about the guidelines, individualised auditing and feedback, etc) is implemented (Timmermans and Mauck, 2005). Of course, this means an increased burden on the health care system and more resources being made available to support guidelines in order to ensure that they are followed.

Various approaches have been put forward to improve antimicrobial stewardship in medical practice. The importance of colleagues' opinion and peer support has been demonstrated, in particular those who have microbiology training (Skodvin et al., 2015). Furthermore, access to an infectious disease specialist when treating cases in a critical care setting has also been shown to improve appropriateness of antimicrobial use and adherence to guidelines (Raineri et al., 2008); similarly access to pharmacists with expert knowledge of antimicrobials has been shown to improve antimicrobial stewardship in both primary and secondary care (Ashiru-Oredope et al., 2016). Involving physicians in participatory action research focused on antimicrobial use has also been suggested (Sikkens et al., 2014). However, it should be noted that, when reviewed, the quality of the evaluations of various interventions aimed at improving antimicrobial stewardship has been questioned (Ramsay, 2003). Following this foray into the prescription behaviour of physicians, the next section investigates antimicrobial stewardship guidelines and their limitations in both the human and veterinary sectors.

2.4. Medical use of antimicrobials: guidelines and limitations in both human and veterinary medicine

To fully understand the challenges faced by veterinarians in the clinic, the nature and practical content of antimicrobial stewardship guidelines, as well as how their contents are communicated to veterinarians, must be investigated and is summarised here. In a second part, some key differences between veterinary and human antimicrobial stewardship approaches are highlighted. Finally, specific circumstances that may be difficult to reconcile with prudent use principles, or may align with some aspects but not all of the stewardship goals, are discussed. Indeed, not all antimicrobial prescription circumstances are similar and, as will become clear here, other considerations can affect the decision-making process.

2.4.1. Companion animal practice and practical antimicrobial stewardship

Several antimicrobial guidelines aimed at veterinarians exist (Teale and Moulin, 2012; Publications Office - European Union, 2015). The ones most relevant to this thesis, both prominent in the veterinary world and aimed specifically at companion animal veterinarians, are discussed here. The Protect Your Antimicrobial poster from the British Small Animal Veterinary Association (BSAVA) reminds clinicians of the essence of the principles of antimicrobial stewardship and let them pick their preferred first and second line prescription options for specific clinical situations (British Small Animal Veterinary Association, 2012); it therefore requires active participation from

veterinarians who have to display and fill the poster in the practice for it to be useful. The poster is part of a larger campaign that includes some supporting materials available online or as an e-book (British Small Animal Veterinary Association, 2018). Despite its publication and distribution being just shy of a decade, its impact on antimicrobial prescription behaviour of veterinarians is currently unknown. In contrast, the Danish Small Animal Veterinary Association published more detailed and prescriptive information, again related to specific clinical situations (Danish Small Animal Veterinary Association, 2013); it was provided to veterinarians in various formats, e.g. printed, phone application, website, etc. A recent publication suggests it has led to better antimicrobial stewardship by veterinarians (Jessen et al., 2017).

Not much is known at the moment of veterinarians' views on antimicrobial stewardship principles and their application in practice. This will, however, be an essential part of the data analysis in the later chapters of this thesis (chapters 5 to 8) and will therefore be discussed in much more depth there.

2.4.2. Antimicrobial stewardship in veterinary and medical practice: similar, yet different

Human and companion animal veterinary care both aim at improving their patients' health, welfare and quality of life. There are, however, stark differences between the two that will have a significant impact on how antimicrobial stewardship principles are applied and understood.

For example, euthanasia—although a decision often fraught with ethical tensions—is a common and widely accepted option in veterinary care (Morris, 2012a); human euthanasia on the other hand is either illegal or rare and very highly regulated. Consequently, in veterinary medicine, euthanasia could potentially be the outcome in cases that are difficult or expensive to treat, including when it comes to infectious presentations. Ensuring good compliance is also likely to play a more important role in veterinary medicine when deciding what antimicrobials to prescribe and how to administer it, as administering a pill to a cat, for example, can be very challenging (Umber and Bender, 2009). This latter paper suggests that such considerations may lead to increased selective pressure in veterinary medicine; retrospective studies have certainly showed that long acting injections of antimicrobials are favoured by veterinarians in cats (Burke et al., 2016; Singleton et al., 2017), even if the specific drug used would not be considered as a first line antibiotic according to current stewardship guidelines.

Financial limitations may also affect how veterinarians handle antimicrobial prescription. Indeed, successfully managing patients belonging to clients with limited financials means is a challenge often encountered in veterinary practice (Klingborg and Klingborg, 2007; Batchelor and McKeegan, 2012). Such circumstances affect work-up of cases, for example, by promoting an empirical approach to treatment of bacterial infections instead of carrying out culture and sensitivity testing (Bourely et al., 2018).

2.4.3. Antimicrobial use in specific circumstances: ICU, palliative care, and others

Antimicrobial stewardship guidelines have been discussed as problematic in specific circumstances. For example, pros and cons of restricting the use of antimicrobials in critical care has been debated (George and Morris, 2010). This is important as inadequate treatment of infections poses a severe risk to the life and health of critically ill patients (Kollef et al., 1999). And although it can be argued that such a decision is ethically sound, antimicrobial

stewardship can be characterised as a form of bedside rationing of a medical resource (Oczkowski, 2017). It is understandable therefore that some physicians fear that withholding antimicrobials may put their patients at risk (see for example Broom et al., 2014). Antimicrobial restrictions can have serious impacts that must be carefully and ethically managed, although the best way forward to achieve this goal is often unclear (Garau, 2006). Similarly, if antimicrobial stewardship leads to global rationing of antimicrobials, it may adversely affect deprived human populations who struggle to access medical care, including much needed antimicrobial treatment (Laxminarayan et al., 2016).

One of the tenets of prudent prescribing states that antimicrobials should only be used when absolutely necessary. Yet, in practice, antimicrobials are often used in palliative care, not with the aim to treat an infection, but to improve the comfort and quality of life of patients in end-of-life care situations. While such usage may not adhere to the spirit of prudent prescribing, both physicians and family members wish for prescription of antimicrobials in such circumstances (Marcus et al., 2001b). Veterinary patients—particularly companion animals—often require interventions similar to human critical or palliative care; findings from medical literature should therefore be kept in mind as the veterinary side of antimicrobial stewardship is explored, as similarities and differences between human and veterinary health care may come to light (for more on this topic, see the data analysis in chapters 5 and 6).

This chapter has so far explored some the ethical challenges faced by veterinarians in companion animal practice on a daily basis, in particular those that originate from within the walls of the clinic. Specific aspects of antimicrobial stewardship both in veterinary and human medicine were also covered. By drawing all those themes together, this chapter has demonstrated the complexity of the role of the vet, and their role in managing a wide variety of ethical as well as practical tensions. However, in order to stand back from the detail and to help frame the wider issues discussed in the next chapter, a ‘higher level’ concept is needed. It is proposed that the concept of ‘moral distance’ can fulfil this function. The remainder of the chapter will therefore introduce this concept

2.5. Moral distance in human and veterinary medicine: ethical considerations and challenges

As discussed in this chapter, clinical decision-making in both veterinary and human medicine come with complex challenges and competing responsibilities. The previous chapter concluded by highlighting the research questions that framed the research presented here; and in particular emphasised how questions of responsibilities were key in investigating AMR in companion animal practice. In this chapter, however, an investigation of the medical literature highlighted that not all responsibilities are experienced in the same way in clinical practice. Indeed, the handling of limited resources in a clinical setting creates unique dilemmas and duties; in particular, individual patient care can be seen as being in direct competition with the need to ensure that a limited resource is fairly distributed to maximise societal benefit. To balance such imperatives, the clinician has to wear different ‘hats’, depending on their focus, i.e. the individual patient or the just distribution of medical resources. When faced with numerous ethical challenges that may impair or benefit various parties, the concept of ‘moral distance’ becomes relevant to how clinicians decide on a course of action. In this section, the concept will first be introduced; in a second part, its relevance to modern medicine (and by extension veterinary medicine as well) will be explained;

finally the role ‘moral distance’ might play when clinicians deal with AMR will be discussed. This aspect of veterinary care is important to highlight in order to ensure that veterinarians can successfully conceptualise, self-reflect, and improve their decision-making process in practice. It can also help non-veterinarians understand better the ethical tensions antimicrobial stewardship policies create in veterinary practice.

2.5.1. Moral distance: definition and relevance

Coined by Glover (1977, p.286-297), the concept of ‘moral distance’ refers to the ‘undoubted fact that physical distance alone makes a difference to our moral behaviour’ (Helm, 1978, p.13). Moral distance is not only physical, however, but can also be relational. Existing emotional bonds, for example, may be argued to lead to an increase in moral duty. As put by Chatterjee (2003, p.327):

‘One important issue debated among ethicists is the relevance of distance in determining moral boundaries. It may seem intuitively obvious that distance, both physical and relational, makes a significant difference in our obligations to help others. Intuition seems to tell us that we should help someone in need nearby, all else being the same, over someone similarly situated in a far-away place. Likewise, it may seem intuitively correct to hold that we have a greater obligation to help those with whom we have relational or affective ties than to help strangers. Distance seems to set moral boundaries, and distant strangers are accorded minimal moral concern.’

In other words, physical or relational proximity might influence moral standings in favour of recipients that can be interacted with more directly. Whether this is acceptable from an ethical standpoint is very much debated. For Utilitarians, moral distance is an ethical failing that cannot be justified as we have a moral obligation to help as many others as possible if we are able to in order to maximise the benefits of our actions and the greater good. Consequently, from such an ethical standpoint, the physical distance between us and the beneficiaries of our help should be irrelevant when deciding a course of action (Glover, 1977; Singer, 1993). Other ethicists, however, have a more nuanced approach and argue that moral distance can – in some circumstances – be ethically justifiable (Helm, 1978; Abelson, 2005), especially as the consequences of our actions on distant or far removed (in time, space or relations) parties may be of ill-defined nature and impact. The identity and characteristics of those distant parties may also be rather nebulous. In comparison, the consequences of our actions on parties that are close to us and can be directly interacted with are usually more predictable and measurable.

Relationships or connections can also be seen as engendering or reinforcing moral obligations (Reader, 2014), and therefore the implementation of moral distancing might be seen as a simple consequence of increased obligations. Put in the context of the ethical duties doctors have towards their individual patients (see section 3 of this chapter), this last idea may prove very relevant when considering ethical challenges arising from the practice of both human and veterinary medicine and how clinicians construct their responsibilities and obligations when practicing.

It should be noted here that the goal of this thesis is to describe the complexity of the clinical decisions—and their ethical ramifications—made by companion animal veterinarians when prescribing antimicrobials. In this context, the concept of ‘moral distance’ is being used as a descriptive tool as the medical literature shows that it is a source

of moral conflict for physicians when having to balance their role at the bedside of the patient with their role as a gatekeeper of limited resources. (Hunter, 2007; Tilburt, 2014). Of course, and as discussed above, from a philosophical point of view, giving in to the pull of 'moral distance' and prioritising those close to us, whether in a geographical or relational sense, may be seen as justified or as a moral failing and this thesis does not pretend to give an answer. However, as will become clear in the data analysis chapter, moral distance is experienced by veterinarians as well and is therefore an essential idea to understand if one is to explain professionals' attitudes towards AMR and stewardship.

2.5.2. Medical ethics and moral distance

In a medical context, e.g. organ donation, moral distance has been discussed as the source of 'an excessive focus on the physically close or immediate, leading to a lack of attention paid to the wider consequences of one's actions (or inactions). These consequences could include harming or contributing to the deaths of patients who are separated from the clinician by space and time, but are no less affected by the clinician's decision' (Shaw and Gardiner, 2015, p.10). Of course, the authors chose to qualify a particular amount of focus on the physically close as 'excessive' while others might argue that it is appropriate. As seen in section 2 of this chapter, many clinicians struggle to reconcile their role caring for individual patient with that of a gatekeeper of limited resources and an agent of public health guarding society's interests (Hunter, 2007). Others go further and condemn the current circumstances clinicians find themselves in as untenable and call on responsibility for gate-keeping of limited resources to be more widely shared: 'it is ethically untenable to expect doctors to face this trade-off during each patient encounter; the physician cannot be expected to compromise the wellbeing of the patient in the office in favour of anonymous patients elsewhere. Hence, as in other domains of public policy where individual and collective interests conflict, some form of collective solution is required' (Weinstein, 2001, p.268).

Yet, and despite these concerns, current antimicrobial stewardship policies and guidelines squarely place the burden of antimicrobial gatekeeping in a clinical setting on the shoulders of doctors and veterinarians. In this context, and considering all that has been discussed in this chapter so far, the next subsection raises the question of whether the concept of moral distance might help explain how prescribers construct their responsibilities towards the AMR crisis.

2.5.3. Antimicrobial stewardship and moral distance

As discussed previously, in a systematic review of qualitative studies examining antibiotic prescribing behaviour in human physicians, 'attitudes emerge as being the most important factor affecting antibiotic prescription, a finding that could be of great importance when it comes to designing interventions to improve rational antibiotic prescribing' (Rodrigues et al., 2013, p.209). Similarly, a study carried out among farm veterinarians suggest that they too are a varied population and that their attitudes and opinions on AMR and antimicrobial stewardship might impact their prescription decisions (Speksnijder et al., 2015b). Literature on other topics such as how veterinarians view their responsibilities to the animal patient and to their owner reinforces the fact that veterinarians are not a homogeneous population when it comes to their beliefs, attitudes, and moral and ethical judgements (De Graaf,

2005). Consequently, exploring and understanding clinicians' (both in human and veterinary care) range of attitudes and beliefs regarding AMR and antimicrobial stewardship is essential to understand what strategies should be put in place to promote effective stewardship.

As seen in the previous sections, clinicians are likely to feel increased responsibility towards their individual patient compared with parties further removed from their direct practice that may also be affected by their prescription of antimicrobials (e.g. other hypothetical patients, the community at large, even future generations). This can now be characterised as an application of moral distancing, reinforced by the patient-focused principles of traditional medical ethics.

This concept might be particularly important in the context of AMR. Abelson (2005) identifies several factors that might arguably mitigate one's obligation to erase moral distance when making decisions: uncertainty of benefits, indefiniteness of beneficiaries, statistical triviality of benefits. Each of these factors can be applied to the issue of AMR to illustrate how they might influence prescription providers.

For example, and as discussed in section 4 of this chapter, one can argue that current antimicrobial guidelines and policies have unproven and uncertain benefits (Dar et al., 2016). In contrast, the risk to the patient if they develop an infection is well known to the physician and the benefits of preventing this from happening are concrete and foreseeable in the short term (Littmann, 2014). In this respect, antimicrobial stewardship can be considered to have uncertain benefits as per Abelson's definition and therefore it can be argued that acting according to a moral distance approach is ethical.

Similarly, in veterinary medicine, an argument was made that the ban of antimicrobials as growth promoters will force producers to offer better husbandry conditions to their livestock, leading to an overall increased in animal welfare (Rollin, 2001). Others, however, have questioned this argument and argued that the ban on antimicrobials in the EU led to poorer overall animal welfare; and while it did lead to a reduction in overall quantities of antimicrobials used, it also increased the amount of antimicrobials regarded as critical for human health used by veterinarians in food producing animals (Casewell et al., 2003). In this case again, the benefits gained are arguably uncertain.

The beneficiaries of current antimicrobial stewardship policies are also ill-defined and support Abelson's view of acting on a moral distance basis as an ethically defensible course of action. As discussed in the previous sub-section, the emotional bond between doctor and patient (or vet and patient / client), together with the notion of duty of care, gives the patient a special status in the eyes of the clinician (Broom et al., 2014). Abelson (2005, p. 36) argues that 'those emotionally close to us have a prior moral claim on our assistance'. On the other hand, and while the number of potential patients that might benefit from better antimicrobial stewardship is vast, they are but a hypothesised faceless crowd to which the physician's duty of care is rather abstract. By comparison, the moral obligation to treat the patient with as little risk as possible might seem much greater (Lachmann, 1998).

Finally, one can argue that the importance of a doctor's (or veterinarian's) prescription decisions is trivial and statistically irrelevant when considering the scope and complexity of the AMR issue. A single doctor changing their prescription behaviour will have little effect on the progression of AMR. Besides, even if the whole health sector

followed the prudent use guidelines, it will not fully resolve the issue since the continued use of antimicrobials – even if done appropriately – will keep on selecting for resistance albeit at a slower pace (Lachmann, 1998; Laxminarayan et al., 2013). Better antimicrobial stewardship will also not affect major other components of the AMR problem such as the contamination of the environment with antimicrobials (Gothwal and Shashidhar, 2015) or the still widespread use of the drugs as growth promoters in agriculture in some parts of the world (Collignon and Voss, 2015). The balance of risks versus benefits of following prudent use principles might therefore be difficult to appraise at clinical level. Statistical triviality of benefits is the third and last of Abelson’s factors that can be considered as supportive of a moral distance approach.

Other arguments can also tip the balance in favour of antimicrobial prescribing such as the feeling of benevolence physicians gain from doing their utmost for an individual patient (Broom et al., 2014) or the reassurance that might be associated with defensive prescribing (Mol et al., 2006). Considering all of the above, the decision to prioritise the care of an individual patient over the prudent use guidelines can be understood, particularly in a professional setting giving increasing consideration to patient-centred ethics (Parker, 2001; Vliet Vlieland, 2002). Again, this thesis is not arguing in favour of moral distance as an ethical justification for prioritising individual patient care over societal needs, it is simply establishing that ignoring the importance of the concept when investigating prescription behaviour would prevent one from understanding the weight of the ethical dilemmas faced by health care providers. Clinical decisions are not always made using purely rational and carefully weighed out arguments (Croskerry and Norman, 2008), and the impact of the doctor-patient relation on prescription decisions, as well as on how clinicians view and experience their own responsibilities, in a busy healthcare setting should be recognised.

Perhaps unsurprisingly considering these concerns, work in human medicine suggests local guidelines are an essential step to improve the implementation and uptake of any guidelines by physicians (Timmermans and Mauck, 2005). Indeed, creating local—as opposed to broader and more removed guidelines, such as national or international ones—guidelines is likely to help breach the ‘moral distance’ divide by emphasising the benefits of good stewardship not on a nebulous and ill-defined population of patients, but on the patient population doctors care for on a daily basis. Again, this idea is explored further in the data analysis chapters and the conclusion of this work.

In summarising the literature, this section has revealed that much more is known about moral distancing by human physicians compared to veterinarians. Having to contend with such feelings of moral distanciation impacts how physicians experience their responsibilities to individual patients and to society, but here again views and attitudes differ among individuals. It is clear, however, that having to balance various and separate interests when prescribing antimicrobials is complex and creates conflicts that some may experience as being irreconcilable, at least from an individual point of view. Consequently it is suggested that, ‘moral distance’ is an important concept to keep in mind while analysing veterinarians’ responses and constructions of responsibilities that are presented in later chapters.

2.6. Conclusion

This chapter brought to light the complexity of antimicrobial prescription by clinicians, both in the medical and veterinary fields. It gave a brief overview of the many conflicting interests and ethical tensions surrounding veterinarians in the consult room and how they can affect antimicrobial prescription decisions. Such tensions will be revisited later, in particular in chapters 5 and 6, and illustrated by analysed interview data. A summary of current debates surrounding restriction of medical resources, including antimicrobials, in the medical setting was also introduced. The ethical tensions generated by the handling of limited resources while caring for individual patients was highlighted, including the fact that some health care providers consider such a position untenable. The complexity and diversity of the attitudes and beliefs of physicians that can influence prescription decisions in practice were discussed, including some that were not clinical in nature such as consideration of the patient's social status. Part 2 also described how antimicrobial stewardship guidelines—although they can be considered rational and ethical (Oczkowski, 2017)—are difficult to implement successfully in practice and may require a multifaceted approach and the involvement of microbiology experts. In part 3, specific veterinary and medical circumstances were highlighted that may prove impossible to reconcile with the tenets of prudent use of antimicrobials. Finally, the concept of moral distance was proposed and discussed at length. The concept was shown to be useful as a kind of organising principle for multiple streams of work, helping to highlight why it may feel difficult, if not impossible, for clinicians to prioritise removed and nebulous future goals when faced with patients in practice. Of course, this chapter focused on ethical challenges born within the walls of the veterinary practice. The public health argument of the AMR debate should be examined as well and will be the focus of the next chapter.

Chapter 3—Companion animal veterinarians and AMR: ethical challenges emerging from outside the practice

3.1. Introduction

As discussed in previous chapters, veterinarians are enmeshed in a web of responsibilities. Not all, however, are the product of direct interactions in the consult room. First, this chapter explores further ethical challenges affecting companion animal veterinarians, but focuses here on ethical tensions that emerge from outside the practice. A key part of such tensions, especially when considering the prescription of antimicrobials, is the requirement to take into account public health while practicing veterinary medicine. In a second part, public health is characterised and explained, specifically its implications for managing AMR as a global issue are investigated and arguments supporting the promotion of prudent use of antimicrobials in both medical and veterinary practice are discussed. Notions of justice and fairness as essential to the management of limited resources in society are also introduced.

In a third part, the special status of companion animals in society, and how this status affects the veterinary professionals in charge of their care, is described. The relevance of such ideas to the application of antimicrobial stewardship principles in practice is also made clear.

Finally, the chapter discusses the concept of evidence-based medicine, its importance in modern medical and veterinary practice, as well as its limitations and evolution over the past few decades. The tensions existing between EBM and the prudent use of antimicrobials are highlighted.

3.2. Ethical challenges in veterinary medicine: beyond the practice walls

Public health is an integral part of modern veterinary education curricula (Smulders et al., 2012) and is relevant to various aspects of veterinary work such as safety in the human food-chain, management and prevention of zoonotic diseases, development of antimicrobial resistance, etc. This section explores what role veterinarians are expected to play in public health in the UK by law and their professional code of conduct, then focuses on public health as it pertains exclusively to companion animal practice, and finally discusses the specific case of AMR and antimicrobial stewardship as a public health issue in companion animal practice.

3.2.1. Role and responsibilities according to professional organisations and legal texts

Many laws are relevant to veterinary work in areas such as regulations of medicines affecting prescription privileges, imports of animals (including rabies vaccination or worming to avoid the spread of zoonotic diseases non-endemic to the UK), slaughter and meat processing regulations, etc.

The Code of Professional Conduct for Veterinary Surgeons, published by the Royal College of Veterinary Surgeons (RCVS), explains and summarises the duties and responsibilities of veterinary surgeons. Public health is frequently mentioned in this text (Royal College of Veterinary Surgeons, 2012).

For example, it states that ‘veterinary surgeons must seek to ensure the protection of public health and animal health and welfare, and must consider the impact of their actions on the environment’ (p.21). And the section about prescription of medicines points out that ‘the responsible use of veterinary medicines for therapeutic and prophylactic purposes is one of the major skills of a veterinary surgeon and crucial to animal welfare and the maintenance of public health’ (p.42). Interestingly, the Code also singles out the responsible use of antimicrobials as being of particular importance:

‘The development and spread of antimicrobial resistance is a global public health problem that is affected by use of these medicinal products in both humans and animals. Veterinary surgeons must be seen to ensure that when using antimicrobials they do so responsibly, and be accountable for the choices made in such use’ (p.45).

It is clear from those examples that public health is a recurrent theme when discussing how veterinarians should approach their work. It says little, however, about how veterinary work is affected by these expectation on a day to day basis, in particular in companion animal practice.

3.2.2. Public health and day-to-day companion animal practice

Modern veterinarians—although they have the qualifications to do so in the UK—rarely practice in more than one branch of veterinary medicine (e.g. farm animal / equine / companion animal practice). Consequently, their involvement with public health depends on the type of work they carry out. Farm animal vets have to take into account the legislation, guidelines and controls that surround food produced for human consumption on a daily basis. Companion animal vets, on the other hand, are only involved in a few instances of work relevant to public health (e.g. vaccination against rabies, legislation surrounding notifiable diseases) that are an integral part of patient and client care, or as put by Wohl and Nusbaum (2007), ‘the public health activities of small animal veterinary practitioners are typically embedded in the day-to-day operations of small animal care and client service rather than a set of practices specifically designed to advance public health’ (p.495). These authors also note that since an increasing number of veterinarians work in companion animal practice, the population of veterinarians actively involved with public health issues has markedly reduced in size. Following the same train of thought, Trevejo (2009) suggests that companion animal veterinarians should be required to have a more active role in public health, fulfilling duties such as ‘(1) disease detection and reporting, (2) disease surveillance, (3) response, (4) health education and disease prevention, (5) program evaluation, and (6) research’ (p.216). Interestingly, AMR is also mentioned in this paper as a potential topic of research veterinarians could help investigate but not as an ethical issue integrated into the practice of veterinary medicine.

Society and societal concerns are sometimes mentioned in veterinary ethics texts. When it comes to ethical challenges faced by veterinarians in practice, they are usually used as an arbitrator or a helpful guide that can help

the veterinarian stuck in an ethical conundrum reach a decision. For example, society's evolving views on particular issues such as medication use in food animals are often translated into laws or mandatory guidelines (see for example the ban of antimicrobials as growth promoters by the European Union in 1999) that might help a veterinarian decide what they should do when faced with a client who does not respect those rules (Rollin, 2006a, case 4, p.111-2). Society's views on animal welfare—as well as its expectations for veterinarians to be the champions of animal welfare (Rollin, 2000; Morton, 2010)—can also help guide the veterinarian towards the best course of action in cases of suspected animal cruelty (Rollin, 2006a, case 41, p.187-8) or to decide what treatment options are ethically acceptable in specific circumstances (Rollin, 2006a, case 23, p.151-3). In the same way, professional ethics are in part a reflection of society's expectations of a particular profession and can be helpful when deciding, for example, to report a colleague for malpractice (Rollin, 2006a, case 59, p. 223-4).

As illustrated in the next section, the public health interests embedded into the notion of antimicrobial stewardship, however, are the source of ethical challenges rather than their resolution.

3.2.3. Relevance to antimicrobial stewardship and AMR

Companion animals have a unique place in human society (see 3.4.) and as they live in close proximity to human beings, micro-organisms are likely to be able to pass back and forth between pets and their owners, which is particularly worrying when it can lead to the transmission and / or persistence of antimicrobial resistance. Indeed, clinical reports exist discussing transmission of bacteria such as the infamous MRSA (methicillin-resistant staphylococcus aureus) from people to pets (Seguin et al., 1999), but also the role pet animals might play as reservoirs of resistant microorganisms (Guardabassi et al., 2004; Lloyd, 2007; Goni et al., 2018) that may in turn affect human populations.

Despite those concerns, companion animals have been mostly ignored when discussing a One Health approach to curbing AMR (Kahn, 2017). This is exemplified by the conclusion of the O'Neill report on antimicrobial resistance commissioned by the UK government (Review on Antimicrobial Resistance, 2016) that does not mention 'pets' or 'companion animals' at all, despite promoting a One Health approach to the AMR problem and dedicating a whole section to the need to 'reduce unnecessary use of antimicrobials in agriculture and their dissemination in the environment' (p.24). The next section (p.32) is titled 'improve global surveillance of drug resistance and antimicrobial consumption in humans and animals' and therefore might include companion animals in this goal, but this is never made explicit. Yet, if pet animals play a role as reservoir for resistant microorganisms as mentioned above, then it is reasonable to assume that veterinarians should take into consideration the potential impact of their prescription decisions on public health when handling antimicrobials. This is reinforced by the antimicrobial stewardship guidelines aimed at companion animal veterinarians that have been published in recent years (British Small Animal Veterinary Association, 2012; Danish Small Animal Veterinary Association, 2013). To fully understand the nature of the competing responsibilities that emerge from considering the consequences of antimicrobial prescription on public health, however, one must dive further into various topics that will compose the rest of this chapter: first, how AMR and public health relate to one another and what ethical tensions handling limited resources such as antimicrobials generate for clinicians; second, why companion animals are a unique case

different from, for example, farm animals, and what does this mean for the AMR debate; third, the role evidence plays when society takes a precautionary approach to larger problems, such as the case of medical resources, and antimicrobial use in particular.

3.3. Public health in the context of AMR: ethical challenges, lessons and insights

In his Dictionary of Public Health, Last (2007, dictionary entry accessed online)⁶ defines Public Health as:

‘An organized activity of society to promote, protect, improve, and, when necessary, restore the health of individuals, specified groups, or the entire population. It is a combination of sciences, skills, and values that function through collective societal activities and involve programs, services, and institutions aimed at protecting and improving the health of all the people. The term “public health” can describe a concept, a social institution, a set of scientific and professional disciplines and technologies, and a form of practice. It encompasses a wide range of services, institutions, professional groups, trades, and unskilled occupations.’

Consequently, the focus of Public Health Ethics is to discuss and define how Public Health can accomplish its goals in a morally acceptable way. It should be noted that Public Health Ethics is a growing field and encompasses many definitions and ethical theories (Petrini, 2010; Lee, 2012) and as a consequence no one unified framework is universally accepted when dealing with ethical issues within the field of Public Health. In particular, ‘conflict between the *priorities of public health* and the emphasis of medical ethics on *the duty of the doctor to the individual patient* is of long standing and has never been satisfactorily resolved’ (Lachmann, 1998, p.297, emphasis in the original). Here again, this idea echoes the concept of moral distance being embedded in the ethical conflicts surrounding the dual role of physicians as protectors of both individual patients’ health and public health as a whole. It also reinforces the need for an empirical approach to this ethical exploration of the issue of AMR in practice, as veterinarians are in a similarly conflicting situation, and the lack of resolution described here is likely to apply to them as well. However, further enquiry in the specific circumstances of companion animal practice is needed to gain more knowledge on these issues.

Keeping the definition of public health that introduced this section in mind, I now discuss the handling of limited resources from a public health standpoint, as well as the idea of risk mitigation using a precautionary approach, and finally the idea of justice and fairness as it pertains to AMR.

3.3.1. Public health and the handling of limited resources: unique ethical questions and challenges

In the context of AMR, public health is the main driver behind the prudent use principles that aim at reducing the overall amount of antimicrobials used in clinical settings by stopping inappropriate use and guiding clinicians towards prescription choices (drug, length of treatment, route of administration, etc) maximising effectiveness of treatment but also preserving more effective antimicrobials for difficult cases that absolutely need them

⁶ <http://www.oxfordreference.com/view/10.1093/acref/9780195160901.001.0001/acref-9780195160901-e-3712?rskey=W1ZO3V&result=3712> (accessed 15/06/2021)

(MacDougall and Polk, 2005; Dellit et al., 2007a). By respecting those principles, it is hoped that the rate of development of AMR can be reduced and the effectiveness of individual antimicrobials can be prolonged. However, and as detailed in the previous section, this can lead to conflict between the clinician's duty to their patient and their duties as a public health practitioner, but also to a conflict between the patient's autonomy and right to informed consent and the societal good (Garau, 2006). The aim of modern Public Health is to find a 'balance of, as opposed to a struggle between, individual freedom and community well-being' (Lee, 2012, p.86).

To what extent Public Health interests can or should supersede an individual's autonomy and rights has been the focus of much debate in Public Health Ethics, on topics such as vaccination (Lachmann, 1998; Hobson-West, 2004; Rozier, 2016) or what restrictions can be imposed on infectious patients and / or asymptomatic individuals who have been exposed to a known infectious disease (Lachmann, 1998; Barbisch et al., 2015). Literature has been published to help address those issues and reach a balance between individual rights and public health (Dawson and Verweij, 2007), but as mentioned previously, the absence of a consensus on the foundations and theories of Public Health Ethics prevents a wide agreement across the field on those issues.

3.3.2. Risk mitigation and the role of precautionary principles

When society is faced with a complex problem, policies and guidelines are published in response that are supposed to reflect the best course of action for the greater good while integrating current scientific findings. This ideal situation represents a 'linear model of science-policy interplay' (Lovbrand and Oberg, 2005, p.195) that adheres to the following steps: identifying an issue, analysing the core questions associated with it, relying on science to gather more information and find answers, and finally coming up with guidelines on how best to handle that issue.

While this approach may seem very rational, it has two important flaws (Sarewitz, 2004) that can be summarised as follows:

- It assumes that science can reliably explain, study and model complex problems and that those scientific findings can accurately reflect the reality associated with the problem studied.
- It also assumes that science and scientific findings are impartial and hold a general truth, exempt of context and political influence.

Which questions are examined and how they are formulated will often be influenced by which of the potential answers the current political spheres would find most helpful. Different scientific disciplines will also approach the same issue differently, often reflecting varied values and goals that can conflict with one another. This is not to say that science is partisan. Objectivity and integrity are values at the core of scientific inquiry and are upheld to the best of their abilities by the vast majority of the scientific community. Yet, findings and evidence can also be subject to diverse interpretations by experts (Oreskes, 2004). Nevertheless, issues of large scope, such as climate change, pollution, extreme poverty or antimicrobial resistance, are too complex to model and explain in their entirety and any scientific enquiry in these fields realistically must focus on a given aspect of the problem, in turn leading to unavoidable assumptions, simplifications and limitations that will colour findings and conclusions (Sarewitz, 2000).

Naturally, this does not mean that scientific research should not be carried out, simply that each set of results will provide insights but not hold all the answers nor should it be expected to. Ethical and political debate have a role to play in defining goals and guidelines when dealing with major issues. As Sarewitz (2000, p.95) puts it, major issues should be approached in a way that 'honours the reality of democratic politics and complex natural phenomena, and places science not outside this reality, but squarely within it.' Interestingly, the bulk of the work that has been carried out regarding the role of science in the elaboration of policies has looked at environmental challenges such as climate change. The same breadth of literature is not yet available regarding antimicrobial resistance.

Environmental policies rely on the concept of the 'precautionary principle.' In 1992, the United Nations Conference on Environment and Development released the 'Rio Declaration,' a series of principles all participating states agreed to adhere to when facing environmental and developmental challenges. Principle 15 reads as follows:

'In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.'⁷

Many other declarations centred around climate change and environmental protection have contained similar statements, emphasising the need for the approach to be economically sound (Ricci et al., 2004). Beyond these economic concerns, however, 'the term precautionary principle has the advantage that it provides an overarching framework that links environmental sciences and public health' (Kriebel et al., 2001, p.871), raising many ethical questions around environmental policies (Simon, 2010), as well as how risks and uncertainty should be evaluated and handled (Ricci et al., 2003; Roser, 2017).

Where public health is concerned and if an issue might lead to catastrophic consequences, it can be argued that the cost-effectiveness of a precautionary approach is likely to become less relevant (Fischer and Ghelardi, 2016). The severity of the problem does not, however, lessen the ethical concerns that some authors have raised regarding the reliance of modern policy on the precautionary approach. For example, Pieterman and Hanekamp (2002) note:

'The ideal now is a harm free society where all can live secure in perfect health and reasonable wealth. In this sense precautionary culture involves a radicalisation of the ideas of prediction and control that were first developed by risk culture. However, there is a contradiction here. On the one hand precautionary culture puts enormous trust in what science can do, but on the other hand it shows all the signs of late modern scepticism in science' (p.47).

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https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CON_F.151_26_Vol.I_Declaration.pdf (accessed 15/06/2021)

Beyond those fundamental concerns, Kottow (2012) points out:

‘Whenever public health challenges are shrouded in uncertainty and prevention cannot be knowingly applied, it is replaced by a precautionary approach which is ethically less reliable because subject to the negotiations of vested interests’ (p.71).

As discussed with the mention of AMR as a tragedy of commons in the first chapter, this notion of competing interests is at the core of the AMR debate, not only between individuals and society, but between present and future, as well as between non-human and human animals. It is unsurprising, therefore that concepts of fairness and justice are prevalent in the ethics literature examining AMR. The next section will discuss these specific ethical tensions in more details.

3.3.3. AMR, public health ethics and distributive justice

‘Justice’ is another important concept in Public Health Ethics. Often called ‘social’ or ‘distributive’ justice, it refers to the just access to health care and health care resources among individuals regardless of gender, class or ethnicity. This is a key issue in the fight against AMR as one must not forget that currently many more people are dying from treatable infections due to lack of access to antimicrobials in low-income countries than do from complications from AMR (Littmann et al., 2015; Laxminarayan et al., 2016). Focusing on reducing the use of antimicrobials in Western health care systems could potentially shadow and endanger the efforts made to provide just access to antimicrobials worldwide, with potentially devastating consequences for the poorest communities (Das and Horton, 2016). Of course, the concept of justice also demands that overuse of antimicrobials – that can be linked to rise in AMR – is curtailed in order to preserve drug efficacy for the greater number. It should be noted that the points listed so far only addresses intragenerational justice. However, and as put by Millar (2011, p.156), ‘compliance with accepted criteria for the use of antibiotics could be seen as just in an intragenerational context, but may still be unsustainable for succeeding generations. (...) If current patterns of antibiotic use cannot be sustained for future generations then can we describe those patterns as just.’ This question while pertinent remains unanswered as no consensus on the nature and extent of our duties to further generations has been reached and ‘different normative approaches come to vastly different conclusions’ (Littmann et al., 2015, p.361).

Some have argued that antimicrobials should be recognised as ‘public goods’ (Aiello et al., 2006; Selgelid, 2007) necessitating government involvement in their handling, funding and distribution. Aiello et al. (2006, p.1913) in particular argue that antimicrobials ‘production and consumption should be governed solely by public interest’. This statement raises many questions, particularly regarding usage in veterinary medicine, that those authors do not answer. However, and even if one agrees that ‘public interest’ correlates with the application of prudent use principles by clinicians, when it comes to therapeutic usage, ‘the physician consultation is still the only point at which a meaningful risk assessment can be made and attempts to control this decision outside of the consultation are at best inflexible and often, in fact, flawed’ (Garau, 2006, p.22). The ethical tensions existing between the roles of the physician as a gatekeeper of Public Health and their role as the guardian of patient health and the challenges it poses will be discussed in the section 2 of this chapter. However, even if a clinician could be impartial in their decision-making and truly balance patient and society’s interests during each consultation, reality is more complex

than sometimes pictured. For example, using antimicrobials for viral infections is often depicted as an irresponsible and unnecessary use of antimicrobials that need to be quenched (Selgelid, 2007). This argument overlooks the fact that differentiating between bacterial and viral infections is still very challenging at a clinical level (Garau, 2006) or that secondary bacterial infections can be a serious threat to some of the most vulnerable patients.

In other words, even if one wants to follow guidelines to the letter, a certain amount of risk to the patient (and possibly to the clinician's reputation and career) is unavoidable. As put by Littmann (2015, p.361), 'prescribers may find themselves in a conflict of interest between the interests of the patient and the public's health. What is not made explicit in current proposals for antibiotic policy is whether and how such a trade-off should be made and what risks to the individual would be acceptable, should antibiotic prescribing be restricted.' The lack of clear consensus on the level and nature of acceptable risks to the patient is likely to be one of the reasons why current guidelines do not help resolve the ethical dilemmas faced by clinicians. Indeed, George and Morris (2010) point out that 'neither the published guidelines nor the important stewardship articles identify safety as an endpoint' (p.207), leaving the physician as the arbitrator of how much risk it is fair to expose individual patients to. As discussed in the previous chapter, current literature shows that this is a position that many physicians find difficult. Moral distance might come into play in those cases as described previously, reinforced by the prevalence of patient-focused ethics in the medical profession. After all, doctors still swear an oath that states – in the vast majority of cases – that the patient's health and welfare will be their primary consideration (Kao and Parsi, 2004). The concept of 'above all do no harm' is an essential part of traditional medical ethics and might oppose clinical decisions involving an ill-defined risk to patient health. Garau (2006, p.22) proposes as a possibly way forward to change the first ethical responsibility of doctors from the negative assertion 'do no harm' to the more positive ambition suggested by Burck (2002) of 'above all, treat on the basis of knowledge'. Marcus et al. (2001a), on the other hand, using the ethical principles of Beauchamp and Childress (2013) argues that the principle of nonmaleficence should be applied by physicians 'not only to individual patients, but to the community at large'. While those approaches are helpful to frame the dilemmas faced by prescribers, they do not solve the weight moral distance creates when considering individual patients compared to the community nor do they establish what level of risk should be deemed acceptable when withholding or prescribing antimicrobials. More knowledge regarding use of antimicrobials and what constitutes good antimicrobial stewardship is needed (Garau, 2006; Dar et al., 2016) for medical professionals to make accurate risk assessments regarding individual and community use of antimicrobials. Focusing on reducing uncertainty regarding the need for antimicrobials, such as developing bedside diagnostic techniques, is also likely to be useful.

That is not to say that this view is universal. Lachmann (1998) criticises the utilitarian approach to Public Health issues based on risk and cost-benefit ratios and notes 'some *mantras of bioethics* – beneficence, absence of maleficence, autonomy, justice, human dignity and the "partimonie humaine," however, are not necessarily congruent with the greatest benefit to the greatest number' (p.302, emphasis in the original). Weinstein (2001, p.268) also suggests that making clinicians the gatekeepers of scarce medical resources might be problematic in itself and that 'solutions will be politically and ethically sustainable only if patients as citizens of the larger population accept the need for rationing of limited resources in health care.' As discussed in the previous chapter,

family members and individual patients, as well as physicians, usually prefer an antimicrobial to be administered, even in palliative situations (Marcus et al., 2001b) demonstrating that the rationing of medical resources is difficult to accept on an individual basis.

In conclusion, most public health practitioners and ethicists agree that there is an urgent need to reconcile medical bioethics and public health ethics but how to do this, particularly in a way that will allow for better and just handling of scarce resources while maintaining trust between doctor and patient, is still under much debate.

This section, however, focused mostly on evidence surrounding physicians and public health as a counterbalance to individuals in society, and keeping all discussed here in mind, the next section turns its focus back on companion animals and the unique place they have in modern human society. This is necessary in order to fully understand the wider social context which impacts on the ethical dilemmas discussed in the previous chapter.

3.4. Pets in modern society as the source of evolving ethical considerations

This section focuses on companion animals and how they differ from other types of animals that society relies on. It first explains key concepts that play a crucial role in the special status of companion animals such as the sociozoological scale and more-than-human solidarity. The second subsection explores how the special status of companion animals in society impacts the role of the companion animal veterinarian. Finally, the third subsection will discuss why these considerations are crucial to understanding the ethical tensions stemming from the application of antimicrobial stewardship principles in veterinary practice.

3.4.1. The unique case of pet animals: sociozoological scale and more-than-human solidarity

Many animals have been indispensable to human survival throughout history, providing food, labour and companionship to human beings for millennia. This dependence of our species on animals still exists in the modern world, but this does not mean that animals are regarded as equals. Indeed, a sociozoological scale (Arлуke and Sanders, 1996) exists within every society reflecting the varied moral status, worth and rights of different animal species depending on the regard or disdain they are awarded within a given sociocultural context. Moreover, as anthropomorphism promotes advocacy for animal welfare (Butterfield et al., 2012), and since pets are more likely to be anthropomorphised due their close bonds with humans and tameness, their welfare is widely held to higher standards compared to that of other species. In turn, an essential part of achieving good animal welfare relates to ensuring animals' health through good husbandry and the provision of knowledgeable veterinary care. As a result, animals kept as pets are usually more highly regarded and valued than wild or farmed animals, which in turn will affect how their care is handled and how veterinary medicine is practiced. As discussed in 2.2.1, the concept of 'more-than-human solidarity' (Rock and Degeling, 2015) is also particularly relevant in companion animal practice. The authors also state that 'accountability follows from privilege. Amongst researchers, policymakers, and practitioners in public health, accountability extends to consideration for non-human animals, plants, and ecosystems, and to respect for other people's emotional, social, and physical interdependence with non-human entities' (p.63). Consequently, high regard for companion animals will engender high expectations of the veterinarians in charge of their care.

Degeling et al. (2013) also argues that some health problems such as obesity are the product of similar and shared lifestyle issues in both companion animals and people and would therefore gain from being addressed together at a communal rather than individual level: 'the emergence of socially mediated population-level health problems that translates across species barriers poses a challenge to how we understand and negotiate connections between the health of humans and their pets' (p.92). This remark is reminiscent of the One Health approach discussed in chapter 1 and links public health concerns to similar issues in pet populations. Little is known, however, about veterinarians' views on those suggestions and how they would fit within their own understanding of their responsibilities and professional role.

3.4.2. Societal expectations of modern companion animal practice

Societies and their cultural expectations evolve over time. A good way of exploring those expectations, however, is to focus on publications by professional regulatory bodies such as the Code of Professional Conduct for Veterinary Surgeons published by the RCVS (Royal College of Veterinary Surgeons, 2012). Other materials such as the contents of veterinary schools' curricula, as well as literature published on the topic may help to characterise what is expected of the veterinary profession in 21st century UK.

The current oath (put in place with this wording on the 1st of April 2012) taken by veterinary surgeons upon graduation states (Royal College of Veterinary Surgeons, 2012, p.17, emphasis from source):

'I PROMISE AND SOLEMNLY DECLARE that I will pursue the work of my profession with integrity and accept my responsibilities to the public, my clients, the profession and the Royal College of Veterinary Surgeons, and that, ABOVE ALL, my constant endeavour will be to ensure the health and welfare of animals committed to my care.'

This declaration emphasises the various agents veterinarians have responsibility towards, and also underlines that the profession should focus not only on animal health, but also on animal welfare. It echoes the patient-centred oaths taken by human physicians and mentioned in section 3 of chapter 2. Calls for veterinarians to address and improve the welfare of animals are not new (Rollin, 1978), yet are still being echoed today (British Veterinary Association, 2016; Hernandez et al., 2018) suggesting that the profession has not yet managed to define and fulfil its role adequately in that respect. This may partly due to the fact that current veterinary curricula poorly equip vets to address issues of behaviour and welfare (Fraser, 2008a). But other considerations are also likely to come into play, such as the difficulty to understand what is meant by animal happiness (Webb et al., 2019) or by good welfare, even in the academic literature (Fraser, 2008b). Good welfare is often equated to giving the animal the opportunity to behave in a natural way or express natural behaviour, as seen in the famous five freedom principles (and as discussed by McCulloch, 2013). These principles were built on to advocate for animals deserving a 'life worth living' (Mellor, 2016) or argue that such welfare principles were in fact animal rights (McCausland, 2014). Yet, the concept of naturalness is as poorly defined as welfare is (Yeates, 2018), especially in the case of domesticated animals. Addressing welfare and health issues that originate from domestication itself, such as

detrimental breed standards in dogs can be an especially challenging endeavour (Rollin, 2018). While trying to improve welfare of pet animals, professionals (vets, pet welfare charities, etc) often rely on educating pet owners on topics such as welfare and behaviour. Yet, how successful and worthwhile such interventions are is largely unknown (Philpotts et al., 2019).

Another important aspect of companion animals in UK society is that although laws have been passed protecting their welfare (e.g. Animal Welfare Act in 2006 in the UK), they are still considered property and therefore their owners are allowed to make nearly all choices for them within the limitations imposed by legislation. In contrast to this materialistic view of pets, owners often consider their pet as being part of their family (Cohen, 2002; Crawford and Balzer, 2017; Rollin, 2018), and have therefore heightened expectations of their veterinarians including around end-of-life care (Heuberger et al., 2016) and euthanasia (Morris, 2012a). Consequently, companion animals live older and with more serious diseases than farmed or working animals usually do, and as such their veterinary care differs in ways that affect the implementation of antimicrobial stewardship principles in practice, for example with the provision of geriatric and palliative care or chemotherapy and radiation treatment against cancer.

3.4.3. Companion animals and antimicrobial stewardship principles: a unique situation

In the previous chapter, the use of antimicrobials in companion animal practice and the guidelines associated with veterinary antimicrobial stewardship were discussed. It is important to recognise this usage can also be influenced by the unique place of companion animals in society, particularly when they are considered part of the family unit by their owners (see previous sections). In such circumstances, not only do the interests of the patient may be considered more highly than those of other animal species, but ensuring the best treatment possible for the animal is important to prevent distress and grief for the human family; this echoes the concept of more-than-human solidarity (Rock and Degeling, 2015) discussed previously that emphasises that pets have value beyond their intrinsic worth as living being due to the emotional attachment other human beings experience towards them. Section 4.2 in chapter 2 discussed the use of antimicrobials in human medicine in specific circumstances such as ICUs or as palliative treatment as part of end-of-life care. As seen in the previous section, similar situations are likely to arise when caring for companion animals much more frequently than in other sectors of veterinary care. For example, some pet owners may request palliative care for their animals (Moore, 2011; Heuberger et al., 2016), leading to antimicrobial prescription dilemmas for the veterinarians similar to the ones described for physicians (Marcus et al., 2001b).

Moreover, the current veterinary ethics literature does not explore circumstances when society's interests might be opposed to the patient's (and to a certain extent, the client's) interests. This is particularly relevant when thinking about antimicrobial use. Most antimicrobials are overall safe drugs and clinicians are often inclined to give them to cases that may have or develop an infection even if its existence has not been demonstrated. In a companion animal practice survey in the UK, 79.9% of veterinarians agree with the statement: 'if I am not sure if antibiotic prophylaxis is needed, I tend to give it' (Knights et al., 2012, p.6). Similarly, in human medicine, physicians recognise that clinical uncertainty leads to conservative treatment decisions, i.e. overtreatment with

antimicrobials (Broom et al., 2014). These examples illustrate the fact that in many clinical cases, giving antimicrobials to a patient just in case they are needed is seen as a prudent and potentially beneficial course of action for this individual. This is in contradiction with the prudent use principles that require antimicrobial use to be ‘justified by a veterinary diagnosis’ and state that ‘routine prophylaxis should be avoided’ (Teale and Moulin, 2012; Publications Office - European Union, 2015, p.11). Similar recommendations exist in human medicine (Dellit et al., 2007a). While other circumstances exist when society’s and patient’s interests conflict – for example in the case of a zoonosis outbreak resulting in herd culling or deciding which drugs can or cannot be used in food animals, those cases are usually legislated or a decision is made for the veterinarian regarding the course of action they have to take by the relevant authorities.

Conflicts between society’s and patients’ interests occur more commonly in human medicine, particularly in countries where the health service is at least partially funded by the State. In this case, financial resources—and consequently all resources—are limited and must be justly distributed among the patient population in order to obtain the greater benefits for the greater number (see 3.2.1 earlier in this chapter for more on this topic). This should make clear why this thesis relies on a significant amount of literature based around human medical care rather than veterinary care when investigating such issues.

Finally, companion animals’ interactions with public health can be influenced by their owners. Indeed, owners’ attitudes, beliefs and lifestyles can also influence the veterinary care of their animal. For example, canine obesity has been characterised as a by-product of human sedentary lifestyles (Degeling et al., 2013). Pets have been discussed as potential sentinels for human health issues as they share the same environment (Schmidt, 2009). Although limited studies on the topics have been published at time of writing, it is also likely that health decisions people make for their family, such as vaccinations or beliefs regarding antimicrobial use, influence similar decisions that they make for their pets (Hobson-West and Jutel, 2020).

As highlighted in chapter 2, antimicrobial prescription is a clinical decision and as such must also be seen under the lens of medical and scientific knowledge. The next section highlights how, beyond the precautionary approach of prudent principles of antimicrobial use, notions of evidence and patient-centred care come into play when considering treatment with antimicrobials.

3.5. Evidence-based medicine: expectations and challenges in human and veterinary medicine

As well as being influenced by relations in the clinic with patients, clients, and colleagues, and by pressures from outside the clinic including responsibilities for human health, veterinarians are also scientists. As such, veterinary medicine is influenced by other concepts, such as the idea of evidence-based medicine. Evidence-based medicine (EBM) plays an essential role in the practice of modern medicine (Evidence-Based Medicine Working Group, 1992) and veterinary medicine (Doig, 2003). This concept is heavily emphasised in medical and veterinary curricula, and continuous professional development training in both professions, and as such plays an important role in every clinical decision made in practice, including antimicrobial prescription. In this section, EBM is first defined and explained, its limitations and critics are then summarised. Finally, its relevance to AMR and antimicrobial stewardship will be discussed.

3.5.1. Evidence and medicine: a short history of a tumultuous marriage

Sackett et al (1996. p.71) defined evidence-based medicine in a widely quoted definition as ‘the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients.’

While this might seem a straightforward statement and an obvious way to practice medicine, the implications of simple words such as ‘best evidence’ is in fact fraught with challenges. Indeed, not all published evidence is created equal, and both physicians and veterinarians need to appraise such evidence before deciding on its worthiness and whether or not they are confident enough in the data to use it in their clinical practice. Sackett (2000) has described a hierarchy of evidence that reflects the scientific rigour of different kinds of studies and research methods. The more highly regarded study designs are supposed to reduce biases and random errors. For example, a randomised controlled trial is seen as higher evidence than a cohort study which is better than a case report, which in turn is better than non-peer reviewed evidence such as an expert opinion.

While this approach has been widely spread as a useful tool to evaluate medical and veterinary literature, recent years have nuanced it. It has been recognised that depending on the type of evidence that is sought, some study designs might be more appropriate than others. For example, RCTs might be the better option to evaluate the effectiveness of a treatment, but a retrospective cohort study might be more appropriate to assess the risks associated with it (see for example (Vandeweerd et al., 2012b, p.29, table 1)).

But knowing the hierarchy of evidence and the more appropriate study design for the researched question is not enough. A clinician must also be able to notice design flaws or biases. To assess the validity of a RCT for example, the trial settings, the selection of patients including a statistically calculated sample size, the chosen outcome measures, the reporting of adverse effects and many other characteristics must be evaluated (Rothwell, 2010). Systematic literature reviews and meta-analyses can be helpful, but they can include design biases and flaws as well. Others have also questioned whether the accepted hierarchy of evidence reflects how useful evidence is for clinicians in practice (Cartwright, 2011).

Another challenge faced by clinicians is both how to find time to assess the quantity of evidence that is constantly being published and accessing such evidence. When physicians increasingly struggle with the amount of evidence at their disposal (Greenhalgh et al., 2014), veterinary medicine on the other end suffers from a paucity of available data (Vandeweerd et al., 2012b); yet, both can struggle with accessing current publications.

Beyond those practical limitations, other criticisms of EBM have also been discussed, as will now be summarised.

3.5.2. Ethical limitations of evidence-based medicine and veterinary medicine: towards a patient-centred approach

Since its introduction as a concept in the 1990s, EBM has quickly become a pillar of modern medical practice, but has also faced a number of criticisms. Lambert (2006) summarised the most common ones found in the literature into six groups as follows (p.2634):

- Incommensurate nature of population evidence and individual patient profiles

- Bias towards individualised interventions
- Exclusion of clinical skills from medical practice
- Production of formulaic guidelines
- Failure to consider patient views and narratives
- Difficulties in disseminating and implementing evidence into practice

She also notes that the shift of the health professions towards EBM exists ‘within a contemporaneous political and economic climate of declining trust and growing accountability’ (p.2633). In response to these criticisms, the definition of EBM has progressively evolved to include a larger focus on the doctor-patient relationship and the involvement of patients into their own care (Lambert, 2006). Evidence-based patient care has been devised as an effort to bring together EBM and patient-centred care (Edwards and Elwyn, 2001), i.e. a way to use the best medical knowledge available to offer patients treatment options while respecting their choices and agency.

Indeed, individual patients have personal circumstances—including beliefs and values, comorbidities and complicating factors that differ from those of a population selected for a study. Regardless of the quality of the published evidence, results cannot be directly translated from research into practice without careful consideration (Pearce et al., 2015) and informed consent from the patient.

In veterinary medicine, a similar effort is made to ensure clients make informed decisions for their pet (Hernandez et al., 2018) which should include the various treatment options based on the best evidence possible. However, veterinary clients’ decisions regarding the appropriate treatment for their pet may also be widely different from those they would make for themselves. Non-evidence-based yet important opinions concerning animal welfare, quantity vs quality of life as well as the place and worth of animals in society and within the family unit will come into play and influence the decisions made (Rollin, 20062006a).

Clients may have set views on topics such as chemotherapy in animals or what level of arthritis truly impairs quality of life (Main, 2007). While the veterinarian’s role is to offer all treatment options possible, in many cases the most important decisions will only be partially informed by EBVM or experiential knowledge. The ability of the owner to medicate their animals (i.e. to inject insulin twice a day at set times, or to pill a non-cooperative cat daily) can influence the treatment decisions made for the patient (Umber and Bender, 2009). Euthanasia of patients with treatable conditions might in some cases be regarded as perfectly reasonable (Morris, 2012a).

Evidence also exists that veterinary medicine publications are on average more flawed than their human counterparts. This might be due to a lack of knowledge, resources, or looser publication criteria in the veterinary world. A recent study by Di Girolamo and Reynders (2016) illustrate this by comparing ‘effectiveness of intervention’ studies published by five leading veterinary journals compared to five leading medical journals in 2013. Without summarising here all their findings a few key points are of interest, for example, human journals were between 6 and 15 times more likely to publish RCTs than veterinary journal. The median number of patients in veterinary RCTs was 26 compare to 465 in human trials, those were also less likely to be real patients raising

questions regarding the clinical usefulness of such trials. Finally, when evaluating the presence of RCT quality markers (reported power calculations, primary outcomes, random sequence generation, allocation concealment and estimation methods), only 2% of veterinary RCTs included all of those compared to 77% of human trials. Other authors have raised similar concerns (Lund et al., 1998; Giuffrida, 2014; Mathie and Clausen, 2015).

Considering the multitude of species under veterinary care, interpreting and applying evidence can be difficult. Domesticated species in particular have been bred across centuries to achieve remarkable variations between individuals. On a wider scale, some species are studied more than others and the clinician has to decide whether transferring research conclusions across species – particularly when it comes to species with very little clinical data – is the right thing to do or not. Discussing the ethical challenges that may arise in such circumstances is beyond the scope of this thesis but is a reality faced by veterinarians daily.

When it comes to antimicrobial stewardship, it is important to remember that antimicrobial prescription is a clinical decision and will therefore be influenced by EBM both in human and veterinary medicine.

3.5.3. Evidence-based practice: relevance to antimicrobial stewardship and AMR

One approach to help clinicians with the amount of evidence at their disposal is the creation of clinical guidelines. The Institute of Medicine in the US defines clinical guidelines as ‘systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances’ (Institute of Medicine Committee to Advise the Public Health Service on Clinical Practice Guidelines, 1990). Consequently, clinical guidelines have multiplied in an effort to summarise the existing evidence on specific topics and to disseminate the findings relevant to clinical practice. Their quality, numbers and provenance, however, are problematic. ‘So many parties have jumped on the EBM bandwagon and so many clinical practice guidelines are churned out by individuals, professional organisations, insurers, and others that the benefits of uniformity may disappear in the cacophony of overlapping, conflicting, and poorly constructed guidelines. With more than 1,000 guidelines created annually, calls for “guidelines for clinical guidelines” have been issued.’ (Timmermans and Mauck, 2005, p.19). Some authors have also argued that current medicine could now be considered guideline-based medicine and that the original spirit of EBM has been lost (Tebala, 2018). Clinical guidelines also exist in veterinary medicine; for example, the IRIS guidelines give veterinarians a working framework to diagnose and treat renal disease in small animals⁸. As highlighted here, one important aspect of clinical guidelines is the underlying assumption that they are a compilation of findings from literature in an easier to learn and apply format, and are therefore evidence-based. For example, in the UK, clinical use of antimicrobials by physicians is addressed in the evidence-based NICE guidelines that are freely available online and regularly updated⁹. While those guidelines incorporate precautionary principles, they are at their core dedicated to clinical management of common illnesses / presentations.

⁸ <http://www.iris-kidney.com/guidelines/> (accessed 15/06/2021)

⁹ <https://www.nice.org.uk/> (accessed 15/06/2021)

Dedicated antimicrobial stewardship guidelines, however, are of a different nature. They are based on the precautionary principle of prudent use of antimicrobials and aim at curbing the development of AMR; in brief, their effectiveness has not been demonstrated and is not yet fully understood (Dar et al., 2016). The consequences and effectiveness of some antimicrobial policies have been challenged, for example the ban of growth promoters by the European Union (Casewell et al., 2003).

The difference between clinical guidelines and antimicrobial stewardship guidelines in practice may be confusing and should be kept in mind when considering how they are applied and understood by clinicians. More on this topic is covered in the data analysis presented in chapter 7.

3.6. Conclusion

The aim of this chapter was to stand back from the vet-patient-client triad discussed in the previous chapter, to consider the wider pressures on the veterinarian that impact antimicrobial prescribing. The chapter began by highlighting public health as a source of ethical tensions in small animal practice, particularly in the case of antimicrobial prescription. Indeed, and as has been described in medical literature, the interests of the individual patient may be seen as being opposed to the interests of society, creating a moral conundrum for the veterinarian who must evaluate the balance of risk versus benefit for both the patient and the societal good and decide the best course of treatment. Public health ethics literature, however, justifies the prudent use of antimicrobials in an effort to maximise the greater good and promote notions of fairness and justice intra and inter-generationally in society. The nature of the precautionary principle, however, is based on risk mitigation rather than guaranteed outcomes and as such is not without its critics.

To understand the nature of the tensions existing in companion animal practice, it is also essential to understand the special status of pets in modern society. Companion animals are commonly seen as having an increased intrinsic worth compared to other species not kept as pets, but also have an added extrinsic worth due to the bond they share with their owners. The high status of companion animals translates into heightened expectations put on their veterinarians, which in turns affect treatment options and decision-making in practice, including when antimicrobial prescription is considered.

Given the role of veterinarians as scientists, with an interest in scientific evidence, the last section of this chapter focused on the concept of EBM in both medical and veterinary settings. Beyond the notion of evidence, it also explained the concept of patient-centred care and the need for an individualised approach to medical treatment to ensure that the best outcome for each patient is found. Put in the context of the triangular relationship between the vet, client and pet (see first section of chapter 2), one can now easily imagine the complexity of such an endeavour in veterinary medicine where treatment must be individualised not only for the animal patient, but for the human client as well depending on their goals, means and expectations. The tension added to this picture by the prudent use of antimicrobials can now be summarised clearly as two-fold. First, it asks the clinician to balance the interests of society against the immediate interests of the patient, an endeavour likely to be affected by the notion of moral distance as discussed in section 5 of chapter 2. Secondly, it promotes a precautionary approach to treatment options instead of an evidence-based one. Consequently, the research presented in this thesis focuses

on how clinicians experience and manage the tensions summarised here. The complexity of the themes presented in chapter 2 and 3 and their various interactions, as well as the scarcity of the veterinary ethics literature on the topic of AMR in companion animal practice, supports the use of an empirical ethics approach anchored into a descriptive effort aiming at exploring and finding the boundaries of the questions discussed in this work. Research approach and methodology is discussed and justified in the next chapter.

Chapter 4—Methods and Methodology

4.1. Introduction

As highlighted in previous chapters (see in particular chapter 2), the lack of certainty when making clinical decisions and the critical importance of antimicrobials when practising any kind of medicine (human or veterinary) create inescapable ethical challenges when trying to tackle the problem of AMR. The number and the different nature of the parties involved situate this research project at an ethical crossroad between veterinary, medical and public health ethics.

This chapter's aim is to clarify and justify the methodological choices made regarding the study design and the approach to the analysis in order to answer my research questions. In a first part, I highlight what methods have been used across the different literatures relevant to this project and how they have informed and supported the methodological approach I followed for this study. In a second part, specific methodological choices and considerations are explored and justified. Thirdly, specific and practical elements of data collection and analysis are explored. Finally, I discuss the validity and limitations of this study, focusing particularly on sampling and recruitment of participants and my dual role as a veterinarian and a researcher.

4.2. Veterinarians and Antimicrobials: Research at an Ethical Crossroad

As many research methods are available to the researcher wishing to investigate a topic as wide as AMR or veterinary ethics, this section briefly reviews the methodologies used in existing literature in the fields of veterinary, medical and public health ethics—in particular as they relate to AMR, and discusses how they have informed this study's design and method choice.

⇒ Various ethical approaches seen in investigating veterinary literature

4.2.1. Methodology in Veterinary Ethics literature

The traditional focus of veterinary ethics has been on the triangular relationship between veterinarian, client and patient and the ethical tensions and competing responsibilities associated with it. Much of the veterinary ethics literature is normative in nature; ethicists and philosophers—most often without a veterinary background—examine and discuss the ethical conflicts encountered by the veterinarians in the exercise of their profession (Tannenbaum, 1985; Tannenbaum, 1995; Rollin, 2006a; Yeates, 2009; Grimm et al., 2018). Their conclusions are usually informed by existing theories in other bodies of work such as animal and medical ethics, and seek to provide veterinarians with normative frameworks that can be used as guides when faced with ethical challenges and competing responsibilities. Empirical studies in the field of veterinary ethics have also been carried out over the past few decades and have mostly relied on methods derived from ethnography to investigate the ethical tensions existing in the practice of the veterinary profession. For example, Sanders used a combination of direct observation and participation in the daily life of veterinary hospitals alongside individual interviews with clinicians to describe veterinarians' views and attitudes regarding difficult clients (1994a), problematic or aggressive patients (1994b) or

euthanasia (1995). More recently Morris (2012a; 2012b) has also tackled the complex relationship veterinarians have to the euthanasia process using similar methods, as has Morgan to study the range of views and attitudes of veterinarians regarding animal welfare and ethical dilemmas (Morgan and McDonald, 2007; Morgan, 2009). Similar to the work presented in this thesis, some of these studies (e.g. Morgan, 2009) focus on ethical dimensions of veterinary practice and use an empirical approach to highlight and describe the diverse values and opinions existing among veterinarians. By doing so knowledge and understanding is gained of the challenges faced by veterinarians that would be inaccessible through a normative or theoretical approach.

De Graaf (2005) investigated farm animal veterinarians' views on professional responsibility—particularly when client and animal's interests conflict—by using a series of individual interviews to create a questionnaire based on Q-methodology (participants have to rank statements taken from the interviews' transcripts based on their own views of the issue debated).

Quantitative questionnaires have also been used to gather information on veterinarians' views, for example, on ethical issues (Rutgers and Baarda, 1994). Studies focused on antimicrobial prescription by veterinarians in practice are scarce but several use quantitative questionnaires (Knights et al., 2012; De Briyne et al., 2013), or a retrospective analysis of practice records (Radford et al., 2011; Singleton et al., 2017). When this PhD was being planned, one study had used semi-structured qualitative interviews to investigate 'factors associated with antimicrobial usage' in companion animal practice in the UK (Mateus et al., 2014); it also used hypothetical clinical scenarios presented to the participants to assess their knowledge and attitude regarding antimicrobial appropriateness. More recently, another study using similar methods has been used to investigate antimicrobial prescription in companion animal veterinarians in the Netherlands (Hopman et al., 2018), and another UK-based research group used a Delphi study to research the same topic (Currie et al., 2018).

While these studies provide valuable data on the topic of antimicrobial prescription and stewardship in practice, none have for their main focus the ethical tensions it engenders; the breadth of attitudes, beliefs and opinions existing among individual veterinarians and the way they in turn influence their clinical decision-making while handling antimicrobials are still mostly unknown.

4.2.2. Methodology in Medical Ethics literature

Due to the larger number of studies published in human medicine, the literature selection presented here is narrower and looks specifically at how published studies have investigated the ethical issues associated with antimicrobial prescription.

For example, a systematic review of qualitative studies aimed at understanding physicians' prescription behaviour by Rodrigues et al. (2013) reports the results of thirty-five different papers. Methods used included interviews, focus groups and questionnaires. Others have also evaluated physicians' behaviour—particularly compliance with official guidelines—using quantitative questionnaires (Cortooos et al., 2012).

It should also be noted that many studies (often quantitative in nature) have been published evaluating the effectiveness of interventions to improve prescribing without focusing exclusively on the ethical dimension of

antimicrobial prescription (Ramsay, 2003; Davey et al., 2006). While results in human medicine are often conflicting, literature regarding the effectiveness of interventions to promote stewardship in the veterinary field is still extremely scarce (Weese, 2006; Jessen et al., 2017).

Finally, and as with veterinary ethics work, an important section of medical ethics literature is non-empirical in nature and relies on philosophical and ethical discussions of challenges encountered in medical practice. Unsurprisingly, a wealth of topics is addressed in this way, many that are relevant to the ethical issues raised by the promotion of antimicrobial stewardship principles. For example, Weinstein (2001) discusses if physicians should be gatekeepers of limited resources, Garau (2006) explores the consequences of antimicrobial restriction policies in the healthcare setting, and George and Morris (2010) question the implementation of antimicrobial stewardship programs in critical care settings.

4.2.3. Public Health Ethics

The specific goals of public health ethics (see section 3 of chapter 3 for definitions and discussion) cannot be investigated by simply relying on traditional bioethical and clinical theories of ethics (Lee, 2012). The bulk of the published literature on public health ethics consists of non-empirical work reflecting on the role and place of public health in modern society and modern medicine and proposing public health ethical frameworks (Lee, 2012, p.89). Some empirical studies have been grappling with those issues as well and will be highlighted below.

As mentioned previously (see 3.3.3.), public health and the ethical challenges it presents are an essential part of the AMR debate. The philosophical notions of inter and intra-generational distributive justice are at the core of the ethical questions posed by AMR (Millar, 2011; Littmann, 2014; Littmann et al., 2015). In human medicine, this is of particular relevance in countries having a complete or partial public funding of their health care system (e.g. the UK) which forces physicians to deal with limited resources when making decisions for their patients. This creates unique conflicts of interest between individual patient's care and using those resources in order to maximise societal good, i.e. between medical and public health ethics. Those conflicts – as well as how to best handle and resolve them—have been recently explored by Tilburt (2014a) and a series of follow-up articles (Bamford, 2014; Banja, 2014; Huddle, 2014; Riggs and DeCamp, 2014; Ross and Bernabeo, 2014; Tilburt, 2014b; Ubel, 2014; Wasserman and Wertheimer, 2014) (see section 2 of chapter 3 for further discussion).

Despite the One Health approach (see section 2 of chapter 1 for definition and further explanation) promoted by the WHO of major public health issues, ethicists have focused almost exclusively on the physician relationship to the competing needs of their patient and of public health (Lachmann, 1998; Lee, 2012), and little attention has been given to veterinarians. Littmann (2014, Littmann et al., 2015) focuses on AMR and distributive justice in the medical world, but also mentions overuse of antibiotics in farm animals and the possibility of negative repercussion on animal welfare if veterinary use of antimicrobials should become restricted (Littmann et al., 2015, p.360).

Due to the permeation of medical practice by public health issues, studies aiming at understanding how physicians deal with professional challenges have integrated questions exploring the ethical challenges they raise. Those

studies have used qualitative methods to understand physicians' views and attitudes regarding ethical conflicts created by the interaction between traditional medical responsibilities and public health responsibilities. For example, Sabbatini et al. (2014) used focus groups composed of physicians to explore how they deal with the dual responsibility of looking after their patient's best interests while using health care resources wisely.

Ginsburg et al. (2012; 2014) created challenging scenarios (some of which were relevant to public health, e.g. patients requesting antibiotics or diagnostic tests that were not indicated) and again used focus groups of medical interns to gather their views on the different issues raised. In contrast, while veterinary studies might acknowledge the existence of public health and Society's interest as an interested party in the ethical challenges encountered by veterinarians, they have focused almost exclusively on the triangular relationship between animal, client and veterinarian. De Graaf (2005), for example, notes:

'To make matters even more complex, next to the interests of animal patients and human clients, veterinarians have to consider many more interests, such as their own interests (commercial; the veterinarian needs to make a living), the interests of the animal population (absence of animal diseases) and the interests of society at large (veterinary hygiene and public health)' (p.558).

Yet, this dimension of the veterinarian's work is forgotten during the survey and discussion to focus exclusively on the veterinarian's competing duties to patient and client. It should also be noted that the veterinarian's own interests go beyond pecuniary considerations. Protecting one's professional identity can also be important particularly when faced with responsibilities conflicting with this self-image. For example, the existence of ethical tensions between the traditional role of a doctor and the gatekeeping of finite resources for the good of society is well recognised (Hunter, 2007).

Reviewing the methods used in the various literatures investigated while designing this study was useful as it provided a wide overview of the type of data obtained in each case, the strengths and limitations of various methods, and as will now be discussed informed my methodology choices in order to ensure that they would fit well with my inquiry.

4.3. Methodological Approach

This section highlights the reasons why a qualitative research method was deemed best for this project. In a second part, it explains how the method and study design were chosen and how they evolved over time.

4.3.1. Qualitative Research

This thesis focuses on learning more about veterinarians' views and attitudes regarding their responsibilities in practice, how those compete and interact with each other, and more particularly how they come into play during the prescription and use of antimicrobials. This research project is therefore shaped as an effort to gather meaning and understanding from participants and to reach through analytical efforts holistic and intuitive conclusions. For

this endeavour to succeed, empirical methods that investigate the reality of companion animal veterinarians' professional lives are needed. Following this first step, further non-empirical discussion might prove useful when considering how best to translate the findings into information helpful to promote effective antimicrobial stewardship in practice. The implication is that each participant's experience is unique and provides a version of the challenges encountered in practice. The goal is not to reach a universal truth but to understand better how different veterinarians see their responsibilities and cope with them in the real world of practice, echoing the descriptive ethics focus of the research. Qualitative methods are best suited to such an endeavour (Braun and Clarke, 2013, p.6).

An alternative would have been to use a quantitative or semi-quantitative survey to gather information about veterinarians' views, as done by De Briyne (2013). However, while this approach might answer simple questions it would give little insight into how veterinarians reach their conclusions. This is particularly important since clinicians might agree on ethical issues but for different reasons (Morgan, 2009).

It can be argued that while considering a topic like AMR that focuses on promoting good antimicrobial stewardship, and therefore seeks to improve clinicians' decision-making and awareness of the issues surrounding the prescription of antimicrobials, understanding the reasons behind their views on the ethical challenges associated with those issues is essential. Qualitative methods are uniquely suited to this endeavour as they will not only allow the researcher to gather clinicians' opinions on a range of topics, but they will be able to investigate these opinions further to draw out at least part of the meaning they contain.

In contrast, a quantitative survey would offer a pre-defined set of answers, giving the participants no leeway to co-construct the data with the researcher the way they would, for example, in an interview. This co-construction and elicitation of meaning allow an exploration of the topic at hand with more details and scope as well as less assumptions. That is not to say that qualitative methods do not come with their own limitations and weaknesses that must be addressed and reflected upon (see section 5 below).

It was therefore decided early on that data would be gathered using qualitative methods. The exact study design, however, was not as straightforward. The first step was to frame the research questions in a way that would inform my approach.

4.3.2. Choosing qualitative interviews

Having decided to use qualitative methods, a vast array of possibilities on how to proceed was still available. Qualitative methods include diverse approaches such as ethnographical observation, interviews, focus groups, action research, etc.

Some of the limits put on the scope of this study were logistical in nature. For example, it was decided that the research would involve only veterinarians working in the UK due to time and financial limitations. While it might have been interesting to conduct the research in the different sectors of veterinary practice (companion animal, equine and farm), it was unrealistic to hope to accomplish this in the available time. The focus on companion

animal veterinarians was decided in part due to my own professional experience (I have only worked in companion animal practice and therefore it was the area where my practical knowledge would be the most useful), but also because (see Chapter 2) it is a section of the veterinary profession that has been seldom studied in the context of AMR despite the large amounts of antimicrobials it handles.

Since the focus of this project was on ethical issues and constructions of responsibilities, allowing for a conversation with professionals to take place was essential. Although pure observational methods might have provided interesting insight into *how* prescription of antimicrobials happens in practice and what communication with clients on the topic entails, they would have been unlikely to fully answer the research questions, unless paired with individual interviews as done in some other studies (Morgan, 2009; Morris, 2012a).

Again, considering the time frame of this research, including the extensive exploration of the literature that was required at the beginning, as well as my lack of experience as a researcher, carrying out a combination of ethnographic study and interviews would almost certainly have proven too ambitious (for example, the studies cited above had a minimum of 18 months to collect their data).

Using focus groups as a research method was considered but abandoned for several reasons. Firstly, focus groups 'may be used as a main method in studies centrally concerned with norms and meanings (as opposed to the documentation of behaviour, to which they are ill-adapted)' (Bloor et al., 2002, p.18). The data obtained would have therefore been an interesting but limited insight into the social norms existing among veterinarians and that may be implicated in the prescription of antimicrobials; however, it might not have provided the breadth of answers hoped for regarding individual beliefs and opinions among veterinarians. Secondly, while focus groups could still have been useful, alongside individual interviews, the logistics of recruiting participants and organising the focus groups were another difficult point to overcome. Without significant incentives, gathering busy professionals from different practices in a single location at a single time would have been a challenge and risked a high attrition rate. Using pre-existing groups (e.g. veterinarians working in one large single practice) was a possibility (Bloor et al., 2002, p.24), but the risk that existing hierarchical relationships would influence the discussion and results was problematic (p.8).

Individual interviews were deemed the most appropriate and feasible method to use to investigate the research questions with the time and resources available. I decided to focus on face-to-face individual semi-structured interviews with an agenda informed by the critical review of the literature I had already carried out (see earlier chapters).

This approach fitted well with the project as 'the semi-structured interview is used when the researcher knows most of the questions to ask but cannot predict the answers. It is useful because this technique ensures that the researcher will obtain all information required (without forgetting a question), while at the same time it gives the participant freedom to respond and illustrate concepts' (Morse and Field, 1996, p.94). Or as put by Braun and Clarke (2013, p.81), 'interviews are ideally suited to experience-type research questions. (...) Interviews can also be useful for exploring understanding and perception—and construction-type research questions.'

Interviews also leave room to explore themes around and beyond the questions that are being asked. Edwards and Holland (2013, p.17) note: ‘as human interaction and negotiation is seen as the basis for the creation and understanding of social life in interpretive approaches, it is the interaction of the participants in the interview situation—the researcher and the researched—that creates knowledge. The data in the form of talk that comprises the interview is regarded as a co-construction.’

This co-construction or co-production is essential to the inductive qualitative method as it allows for a more thorough exploration of the participant’s experience. It creates understanding guided by, but also going beyond, the researcher’s own knowledge and assumptions. One important aspect of the data co-production in this study is my own background as a veterinarian with real-life experience of antimicrobial prescription in companion animal practice in the UK. The benefits and pitfalls associated with my role as both a veterinarian and a researcher on this topic will be explored in section 4.5.3 of this chapter. It should be noted, however, that while interviews should be recognised as shared encounters and the influence of such circumstances on the data obtained kept in mind, the analysis itself does not pretend to be constructivist in nature (see 4.4.3 for more information on the nature of the analysis carried out).

In conclusion, by gathering information on the challenges of antimicrobial prescription in small animal practice and how they are experienced by professionals, this project was designed to generate and analyse data valuable in finding the best ways to promote good antimicrobial stewardship; for example, by informing the creation of improved policies and guidelines, continuous education and professional development, etc. The impact value of the data obtained in relation to current policy and guidelines is investigated and highlighted in Chapter 9.

4.3.3. Research questions

How to frame a qualitative research question is in part dependant on the methodology that is being used. Based on published literature on similar topics (see 4.1) and to allow for more flexibility in the treatment of the data, I decided to carry out semi-structured interviews and to use a thematic analysis method (see 4.4.3 for more details). One of the advantages of this approach is to allow for further analysis if appropriate by using other social science theories without having to commit to a particular theoretical framework from the start (Braun and Clarke, 2013, chapter 8).

The questions were therefore informed by the review of the existing literature outlined in the previous chapters but have not been formulated to fit with a specific qualitative methodology.

The conclusion to the different problematics highlighted so far in this thesis is that to understand how best to address AMR in companion animal veterinary medicine, there is a need to better understand the competing responsibilities faced by veterinarians in the UK.

The following questions, as discussed in section (5) of chapter 1, are particularly relevant:

- How do UK veterinarians construct their responsibilities in relation to antimicrobial stewardship?
- How do everyday practice, regulations and social responsibilities interact and shape each other in relation to public health issues?

- What does this analysis mean for regulatory policies for AMR and the role of companion animal vets in addressing public health challenges as well as our understanding of veterinary and public health ethics?

4.3.4. Interview Agenda

As covered in 4.3.2. of this section, a semi-structured interview agenda was created to explore the research questions. It was composed of open-ended questions followed by a series of prompts to be used only if the answer to the main question failed to cover the breadth of information sought (see annex A for a copy of agenda). The agenda included some introductory questions to help build rapport with the participant and allow them to feel more at ease; for example, the first questions investigated the participant's professional background and unique clinical interests, as well as their decision to become a veterinarian.

The interview agenda went through a series of feedback and discussion sessions within the research team. It was also piloted out with three of my professional acquaintances to ensure that the questions lead to answers of the expected scope. It was then reviewed and modified as necessary. For example, some of the pilot interviews showed that participants were sometimes confused when 'antimicrobial' and 'antibiotic' were used interchangeably; the questions were therefore reworded to ensure consistency throughout (antimicrobial was used since it has a wider meaning and an active association with the concepts of stewardship and resistance). Interviewees themselves tended to use both 'antimicrobial' and 'antibiotic' as interchangeable terms when giving their answers.

Participants were also provided with an information sheet giving background information on the study and its aims, as well as answering questions on participants' rights, and data anonymisation and storage (see Annex B for a copy).

A definite number of interviews was not decided upon at the start of the study, although a tentative suggestion of twenty-five to thirty was made based on other studies in the field. Interviews were arranged by sending emails to veterinary practices inviting them to participate, but also by using my own professional contacts in veterinary practice to put me in touch with willing and interested participants. In the end, twenty-five individual interviews were carried out in diverse parts of the UK. The sampling and recruitment of this study as it relates to its validity and rigour will be further discussed in the next section of this chapter.

4.4. Data Collection and Analysis

This section gives an account of how data collection and analysis were carried out. In doing so, this section highlights the nature of data collection as a reflective and critical process, influencing and adjusting both study design and analysis as it happens. Specifics about the coding and analysis process are also explained.

4.4.1. Data Collection as an Iterative Process

One of the strengths of qualitative research is the depth and complexity of information that can be obtained regarding the topic studied. Particular care must be taken, therefore, to allow for coverage of the full breadth of themes raised by the research enquiry while keeping the data as relevant as possible. Semi-structured interviews

are particularly useful for this purpose as they use open questions that leaves room for the interviewee to explain their views and perspectives on a particular topic and raise unforeseen themes and problematics (Braun and Clarke, 2013, chapter 4); more specific prompts can be used if a particular point does not get organically raised during the course of the interview.

Empirical data is, therefore, co-constructed in the process between the researcher's—or research team's—interview agenda and how the interviewee expands and adds to it. It should be noted, however, that this is not the only way co-construction between the researcher and the participant happens in the research process (see 4.5.1). Despite familiarity with the topic at hand and pilot interviews, it is unavoidable that some relevant avenues of enquiry and themes will appear during the research process as participants share their views and experiences. Indeed, identifying unexpected themes is one of the main reasons for conducting an open, only partially structured, enquiry. In turn, it is essential to recognise those new themes as they appear in order to add them to the ongoing data collection and ensure that they are explored further. This iterative process between design and implementation, between questions and data analysis is a quintessential part of good qualitative enquiry (Morse et al., 2002); done well it allows the analysis itself to become 'self-correcting' (p.17).

Ideally, interviews should be transcribed and coded as data is gathered. In the case of this project, this was only done fully for seven interviews, due to time and health limitations. Eighteen of the interviews were completely transcribed only after all interviews had been conducted. This is unlikely to have had a major impact on the validity of the study as qualitative methodological literature suggests that in most cases the vast majority (Hennink et al., 2017) of and most important themes should be found after only six interviews (Guest et al., 2006). Moreover, this limitation does not mean that the research process ceased to be iterative when full transcription was not shortly obtained. Indeed, notes were taken during the interviews to flag up any new and interesting theme raised, and time was set aside afterwards to review the audio file with the same aim and, if necessary, to modify the interview agenda from there on. If prompts had to be used frequently to cover a topic a more open-ended way to raise this theme was also sought.

Collecting data as an iterative process was also useful in evaluating the degree of saturation of the data obtained. Indeed, reaching saturation of data is often presented as the goal of qualitative studies (Morse, 1995), although this is a hard to predict and ill-defined notion (Guest et al., 2006). Saturation being a concept inherited from grounded theory, Glaser and Strauss defines it as follows (1967): 'the criterion for judging when to stop sampling the different groups pertinent to a category is the category's *theoretical saturation*. *Saturation* means that no additional data are being found whereby the sociologist can develop properties of the category. As he sees similar instances over and over again, the researcher becomes empirically confident that a category is saturated' (p.61, emphasis and use of male pronoun from the original). Outside of grounded theory, the concept has evolved and is often called 'data saturation' (Saunders et al., 2018), a term that is not without its own ambiguity (Hennink et al., 2017). The central idea remains the same, however, saturation is an empirical judgement made by the researcher that further sampling is not yielding any more information on the topic studied. This is challenging, if only because most research projects have to be completed within a pre-defined timeframe and therefore a nebulous end to data collection is neither practical nor realistic. An alternative is to turn towards other studies that share similarities

with the project being designed and use their experience to inform the likely number of interviews needing to be planned. However, as previously mentioned, the literature suggests that a small number—around six, although this is likely to vary between projects—of interviews are necessary to identify the main overarching themes of the topic at hand (Guest et al., 2006), although such a small number will not explore each of these main themes fully (Hennink et al., 2017). In the rest of this section, I describe the choices made during the recruitment phase and why twenty-five individual interviews were deemed suitable for this project. The concept of saturation will be discussed further in 4) b).

4.4.2. Coding

Open coding was carried out on all interview transcripts using the NVivo 11 software identifying fifty-eight individual themes raised by interviewees linked to over two thousand individual interview fragments.

One interesting aspect of the data collected that became obvious during the coding phase was the prevalence of anecdotes being used to illustrate the interviewees' views. In many cases, the theoretical answer to a question was brief and the veterinarian moved quickly onto an example illustrating their point. This use of anecdotes has not been explored in veterinary medicine at the time of writing; it is, however, a well-recognised communication tendency of human physicians. Hunter (1986) wrote:

'Despite the opprobrium associated with subjective narration and the justified cautions about the use of the anecdote, stories are central to medicine as an intellectual discipline that has as its task the understanding of and response to human variety' (p.689).

In the context of veterinary medicine, where patients' narratives are difficult if not impossible to access and where human understanding and response still play an essential role, it seems likely this remark would hold true.

As mentioned above, the increase focus on evidence has led to a dismissal of the importance of anecdotes by some (Ratzan, 2002; Lyden et al., 2010). Yet, others have pointed out that much anecdotal knowledge has shown to be valuable with the advent of EBM (Balasubramanyam, 2005; Bowe et al., 2014). Nunn (2011) argued that all evidence is narrative in some way and that even research studies and reviews emerge from and as stories. Interestingly, as medicine started to move away from a strictly positivist, objective and evidence-based approach towards a more patient-centred one (Parker, 2001), an argument could be made that subjective narration and evidence-based data could indeed be complementary (Kosko et al., 2006), and case reports—that are essentially published anecdotes—add unique and valuable information to published literature (Bradley, 1992; Bignall and Horton, 1995; Kang, 2010). Enkin and Jadad (1998) emphasised that 'ignoring or under-estimating the role of anecdotal information in health care decisions is likely to hinder communication among decision makers, and to retard their uptake of research evidence' (p.963) and pointed out that if no evidence if available, anecdotes might be adequate—as well as the only available—guidance. This is particularly important in veterinary medicine where the body of available evidence is still small and of often poor quality (Mills, 2015; Di Girolamo and Reynders, 2016).

While exploring in more details the role of anecdotes in communication in veterinary medicine is beyond the scope of this thesis, it is an important point to note as it might inform the conclusions of this work. During interviews, veterinarians showed a preference for sources of information that were practical and often using case reports to convey knowledge such as the *Veterinary Times* or *In Practice*, rather than peer-reviewed, academic journals such as the *Vet Record*. This is perhaps unsurprising as the power of stories to transfer information and knowledge and more importantly to have it understood and remembered is well documented, including in a clinical setting (Patel et al., 2015) and to communicate scientific and medical knowledge to lay people (Mutonyi, 2016).

4.4.3. Thematic Analysis

In a process reminiscent of axial coding in grounded theory (Corbin and Strauss, 2015), themes obtained through open coding were then grouped and connected in order to identify patterns that could be analysed and interpreted (Braun and Clarke, 2013, chapter 10). This was a particularly challenging step as all data is interconnected and while seeking and identifying patterns across themes and data is necessary to analyse and explain findings in a deep yet communicable manner, it is essential not to lose data richness and complexity in the process. Further analysis also happened during the writing of the thesis' empirical data chapters, as the process of organising and crafting each chapter brought new insights into the connections made within the data and between data and literature.

As mentioned previous, one of the advantages of thematic analysis is to allow for further analysis if appropriate—even at a later date—by using other social science theories or theories of practice without having to commit to a particular theoretical framework from the start (Braun and Clarke, 2013, chapter 8). While this was not feasible within the timeframe of this project, it is an exciting potential for the future.

4.5. Validity and Limitations

In this last section, the concepts of validity and reliability in the realm of qualitative enquiry are reflected upon and applied to this project. First, I highlight choices made during the sampling and recruitment of the participants; then I explore the strength and weaknesses of this research as informed by current methodological literature; finally, I examine my personal role as both a researcher and a clinician and discuss how it influenced and informed data collection and analysis.

4.5.1. Sampling size and Recruitment

Deciding on an appropriate number of interviews for a qualitative study is a complex process that involves many factors (Morse, 2000). This section justifies the decision to stop collecting data after 25 and compares the data presented here with other studies with similar approaches.

Firstly, and most practically, veterinarians are busy professionals and can be hard to reach as participants, especially without providing financial compensation as has been done by other studies (Hopman et al., 2018), an

approach that is not without raising obvious ethical issues. Sampling was, therefore, minimally purposive to maximise the odds of finding willing participants; the only criteria given when recruiting interviewees were for ‘veterinary surgeons who have worked full-time in the UK for a least a year (or part-time equivalent) with a workload constituted of at least 50% companion animals (dogs, cats, rabbits, small rodents)’. Despite the open recruitment approach, the resulting non-probabilistic sample was made of twenty-five reasonably varied individuals:

- Eighteen female vets and seven male vets (reflecting the feminisation of the veterinary profession in the recent decades, especially in companion animal practice (Irvine and Vermilya, 2010))
- Several graduates from all six of the current UK veterinary schools, and two veterinarians who had graduated abroad
- Graduation years ranging from 1986 to 2016
- Twenty-one vets working in thirteen private practices, two working in charity practice, and two who were employed as locums by various practices.

Secondly, stopping at twenty-five as the final number of interviews was also dictated in part by the time and funding available, a well-recognised limitation of recruitment in modern research (Green and Thorogood, 2018). Importantly, it can also be argued that generating more data than can be reasonably analysed by the researcher or research team within the boundaries of the project is unethical, wasting participants’ time and research funds (Francis et al., 2010; O’Reilly and Parker, 2013). The interviews in this study allowed for an in-depth discussion of the topics at hand with the vast majority lasting well over forty-five minutes, providing a quantity and richness of data adequate to achieve the aims of this study.

The following table details the aforementioned interview data:

Graduation Year	Veterinary School	Gender	Duration of interview (in minutes)
1993	Bristol	M	76
2007	Cambridge	M	72
2011	Nottingham	F	69
2001	Bristol	F	68
2007	Liverpool	F	66
1986	Royal Veterinary College	M	62
2004	Royal Veterinary College	F	58
2011	Cambridge	F	58
2014	Nottingham	F	57

2016	Nottingham	F	57
2010	Edinburgh	M	56
2004	Royal Veterinary College	F	55
2006	Liverpool	F	55
1999	Missouri	F	54
2016	Royal Veterinary College	F	52
2005	Royal Veterinary College	F	51
1991	Cambridge	F	47
2002	Royal Veterinary College	M	47
2015	Liverpool	M	46
2005	Kosice, Slovakia	F	43
1983	Bristol	F	42
1999	Cambridge	F	42
1998	Edinburgh	F	40
2011	Glasgow	F	38
1987	Glasgow	M	30

Thirdly, the total number of interviews aligned with similar studies that have demonstrated a rich dataset following comparable or smaller number of semi-structured qualitative interviews. At the time of planning the research, a qualitative study looking at antibiotic prescription by farm animal veterinarians in the Netherlands had interviewed eleven participants (Speksnijder et al., 2015b), and another investigating antimicrobial prescription by small animal vets in the UK had interviewed twenty one (Mateus et al., 2014). More recently, another study focusing on companion animal vets—this time in the Netherlands—had eighteen participants (Hopman et al., 2018).

Unsurprisingly perhaps, considering the larger resources—and consequently scope—of the research in human medicine, the studies interviewing medical doctors often have thirty (Broom et al., 2014) to forty (Wood et al., 2007) participants. Even in those studies, however, numbers have varied a lot depending on the exact focus of the research and methodology used; in a review of thirty-five qualitative studies examining antimicrobial prescription in human medicine (Rodrigues et al., 2013), the number of participants varied between eight and 633.

Fourthly, as mentioned previously in section 4 of chapter 1, little has been published in the literature about companion animal veterinarians and antimicrobial issues, particularly using both a qualitative approach and an ethics focus. This research is, therefore, exploratory and descriptive in nature and since qualitative research is not

focused on generalisation or statistical representation, the exact number of interviews is less important than the richness of meaning contained in the data they will provide, as well as the amount and richness of the data generated by each individual interview (Malterud et al., 2015).

Of course, as will now be highlighted, this fact does not exempt the research from having to address rigorous questions of reliability and validity regarding its design, implementation and results.

4.5.2. Reliability and Validity in Qualitative Enquiry

How to evaluate the quality and trustworthiness of qualitative studies is a hotly debated topic and one that is yet to be fully resolved (Morse et al., 2002). As mentioned in 4.4.1, reaching saturation is the most commonly mentioned quality criteria when it comes to qualitative studies, despite the fact that it is an ill-defined term (Saunders et al., 2018). An illustration of the different meanings saturation can take—relevant in the context of thematic analysis—is, for example, ‘code saturation’ being different from ‘meaning saturation’ (Hennink et al., 2017). ‘Code saturation’ referring to wide, overarching themes will be reached long before ‘meaning saturation’ since meanings can be depending on individual views, narrow, and numerous. Yet, it is difficult to claim a topic has being fully explored unless meaning saturation has been reached.

Some authors have endeavoured to operationalise the process of reaching ‘data saturation,’ defined—rather vaguely—as meaning ‘that no new themes, findings, concepts or problems were evident in the data’ (Francis et al., 2010, p.1230). This paper suggested that ‘after 10 interviews, when three further interviews have been conducted with no new themes emerging, we will define this as the point of data saturation’ (p.1234) and use such a point as the stopping criterion indicating that saturation has been reached and no further interviews were needed. This criterion should be assessed after each interview, from interview thirteen onwards, which once again highlights the importance of qualitative research as an iterative process (Morse et al., 2002). Yet, the result of such an approach depends on what exactly is being considered as ‘new data,’ e.g. a new theme or a new opinion by an interviewee on a previously recorded theme. It is likely to be adequate to reach ‘code saturation’ since literature suggest this is often reached after a relatively small number—between eight and sixteen—of interviews (Namey et al., 2016); three interviews without no new meaning might be unworkable, however, to claim that ‘meaning saturation’ has been reached, as the number of interviews needed might be enormous. In the one paper published that actively differentiated between the two, code saturation was reached after nine interviews, while the authors failed to reach meaning saturation for all codes after twenty-four interviews (Hennink et al., 2017). The authors also concluded after investigating concrete versus conceptual codes that ‘a smaller sample is needed to capture explicit, concrete issues in our data, and a much larger sample is needed to capture subtle or conceptual issues’ (p.607); therefore the focus and depth of understanding sought by the research can help guide the study design and stopping criteria.

Delving much further into the methodological conundrum that surrounds the concept of saturation is beyond the scope of this thesis; the above should, however, highlight why claiming saturation has been reached is an endeavour fraught with ambiguity. Using the language referenced above, all main overarching themes were identified within the scope of seven interviews, and all themes after fourteen. According to the stopping criterion

defined by Francis (2010), and considering twenty-five interviews were carried out in total, code saturation has been reached in this study. Meaning saturation, however, is trickier and when it has been reached for some codes such as *'uncertainty when making clinical decisions'* or *'time pressure,'* it is unlikely that others, such as *'professional self-regulation'* or *'practice reputation'* have been fully explored. One of the challenges of the topic studied here is the vast number of facets of veterinary practice it involves; even with long, in-depth interviews and appropriate prompting, individuals chose to focus on different aspects of the issue and a more directed and constraining approach or much longer interviews (unrealistic given the timeframe available to most interviewees within their workday) would have been needed to fully explore some topics.

It should also be noted that other authors have argued that saturation should not apply to all qualitative enquiries and that its ubiquitous presence as a quality criterion in qualitative research is problematic (O'Reilly and Parker, 2013). Moreover, it is important to highlight that not reaching saturation does not render the data obtained invalid, it only implies that the topic at hand has yet to be fully explored (Morse, 1995).

As mentioned at the start of this section, saturation is the most common quality criteria mentioned in literature but not the only one. Self-reflection and continuous back and forth between study design, data collection and analysis is another (Morse et al., 2002); this aspect of this study has been highlighted in 4.4.1. Authors also recommend to have several researchers carrying out the coding of the same interviews to validate the findings of the analysis (Francis et al., 2010); while obviously a worthwhile idea, the time, financial and logistical constraints of a research PhD made it desirable but unachievable and constitutes one of the weaknesses of the findings and analysis.

Finally, as will now be examined, qualitative enquiry also depends on the expertise and talent of the researcher or research team, as they influence the reliability and validity of all its facets, from data collection, to coding and analysis and ultimately results and the ideas and recommendations they generate.

4.5.3. The Role of the Researcher

Morse et al. (2002) state 'research is only as good as the investigator. It is the researcher's creativity, sensitivity, flexibility and skill in using the verification strategies that determines the reliability and validity of the evolving study' (p.17). While it could be argued that this statement is true in all spheres of research work, it is particularly essential in qualitative research where the verification strategies are embedded within the research process, in some respects require empirical judgements on the part of the researcher, and are not easily demonstrable and repeatable by an independent third party.

In this context, and considering this was the first qualitative study I have personally undertaken, it should be recognised that my inexperience as a researcher constitutes another weakness of this project, somewhat offset, however, by the support of my supervisory team, university training and extensive reading on the topic. My professional experience as a veterinarian also proved useful in interviews, as I have received formal training as an undergraduate in communication techniques meant to gather information in an open manner—in particular the

Calgary-Cambridge model of consultation (Silverman et al., 1998)—that I have had years since to put into use on a daily basis and to turn into natural communication skills. The usefulness of skills developed in a clinical setting and subsequently applied to research has been recognised by others as well (Sidebotham, 2003). In contrast, I also had to be careful to not fall into the role of the educator that is often natural to veterinary surgeons (Dolby and Litster, 2015) and provide information that might influence the interviewees' answers. To avoid this pitfall, I critically listened and reflected onto all early interviews and made conscious effort to improve my interview technique as the study went on.

Another question raised among the research team was if and how my own experience as a veterinarian should be disclosed to the participants. It was quickly agreed that my role as a veterinarian had to be acknowledged; firstly, because not doing so would be deceptive and unethical since withholding this information would not benefit the research in any way; secondly, because the profession is a small community and I was likely to encounter people I knew of or who knew of me during the duration of the project.

Besides those points, there are some advantages in sharing similarities with the participants. Braun and Clarke (2013, p.88) notes 'some researchers argue that some participants feel more comfortable disclosing (sensitive) information to someone who is broadly similar to them, meaning that for an effective interview, it is important to "match" the major social characteristics of the participant and the interviewer'. Being of the same age, gender or profession of the participants might therefore help build trust and rapport and lead to more depth and meaning being present in the data gathered. However, complete matching of interviewer and interviewee is difficult since people are inherently different and some disparities are unavoidable.

On the other hand, while interviewing professionals about their work, there is a risk that the participant will resort to jargon or figures of speech and images inherited from a shared professional culture. In this case, I believe that knowing the researcher had enough knowledge to understand jargon and veterinary references allowed participants to follow their train of thoughts unhindered, without needing to fall back in the role of educator mentioned previously. In other settings, sharing common language, role and ability to quickly build trust with participants enhanced the quality of the interviews (Quinney et al., 2016). However, it is also possible that interviewees could feel a peer pressure to conform to certain norms that are expected of profession members. In my experience as a vet, this is an attitude that is more likely to be found when veterinarians interact with outsiders while interactions with other members of the profession tend to be honest and confiding—sometimes spilling into expressing cynicism and disillusion regarding the profession.

Another advantage of my position as a veterinary surgeon was access to participants. This is a recognised advantage to being an 'insider' to the population studied (Asselin, 2003). As mentioned previously, recruitment was achieved by contacting practices directly and by using professional acquaintances to put me in touch with interested parties; this resulted into two somewhat different kinds of interviewees: the first was a group of interviewees who usually had an active interest in antimicrobial stewardship and the problem of AMR who answered positively to being contacted directly; the second was veterinarians accepting to participate in the interviews on the recommendation of a common acquaintance, most of them did not have a particular interest in

AMR or antimicrobial stewardship. Based on the coding and analysis of the interviews, I believe that such a recruitment strategy allowed me to access a wider range of views and a less skewed population of veterinarians than I would have relying on direct—non-introduced by a third party—contact alone. I also believe that the data obtained is coloured by the fact that the participants knew they were talking to someone with clinical and personal experience of the issues they were mentioning. This does not mean that the data is superior to what would have been obtained by an outsider. One must be mindful to not allow the researcher positioning as an insider to distort the knowledge gathered (Taylor, 2011). However, it is now well recognised that qualitative enquiry—as a result and product of human experience—cannot be free of biases, but instead that those must be identified and reflected upon; as an insider researcher, biases can lead to misinterpretations or insights depending on how they are handled (Greene, 2014). In this context, the data and results of this study are not strengthened by having been collected by a veterinarian, but their exact nature has, in part, been shaped by that fact.

It should also be noted that the debate regarding positioning of the researcher as an insider or outsider inherited from ethnographic studies is still evolving. Recent work suggests that the division might not be so clear; most researchers with insider knowledge will occupy ‘the space between’ (Dwyer and Buckle, 2009), and fluidly draw on both their insider traits and their researcher identity to produce their research work (Burns et al., 2012; West et al., 2013). One little examined aspect to insider research is also the emotional impact it can have on the participants, but also on the researcher (Ross, 2017). I certainly have to recognise that part of my motivations in conducting this study, beyond the academic achievement and the professionalism of being a researcher, is to faithfully portray and examine the difficulties veterinarians find themselves in and to hopefully communicate them in a sensitive and thoughtful manner.

Based on my experience and self-reflections, my identity as a veterinary surgeon was overall positive for the research; it should, however, be recognised that it influenced the data collected, as well as the analysis. Self-reflection was invaluable in identifying my own views and biases and making sure that they did not unduly influence the analysis, although here again my identity as a veterinarian comes into play, particularly regarding policy and guidelines implications. For example, and as mentioned by one of the participants during an interview, supplementary team meetings to discuss issues within the practice are a common suggestion made by outsiders to solve a multitude of problems; yet, and despite the positive and proactive associations with such an initiative, for logistical and time pressure reasons, this is most of the time unrealistic and unworkable in the real world and therefore unhelpful. Having a deep understanding of the running logistics of an average first opinion veterinary practice—as contrasted with a referral hospital where most research is usually carried out—is definitely useful when exploring ways to promote stewardship, discussing where the burden of responsibility should lie, etc. (see chapter 9 for more discussion on this topic).

4.6. Conclusion

In this chapter, the methodological choices made to investigate the varied views of veterinarians in UK companion animal practice on antimicrobial stewardship and AMR, and more specifically the research questions raised by a

wide breadth of literature—explored in details in the introductory chapters, have been highlighted and justified. Specific aspects of the collection and analysis of data from modern veterinary practice have been described, offering insights into the challenges inherent to this project and how they were tackled. Finally, the thorny issue of validity in qualitative enquiry was debated; the reliability and validity of this study's findings, obtained through a constant iterative process throughout the work, were discussed, focusing in particular on the recruitment of participants and the influence of my background as a veterinarian.

The next four data chapters report on the data analysis, focusing on different aspects of the ethical tensions faced by veterinarians. The next chapter explores the key relationship between the veterinarian and their animal patient.

Chapter 5—Veterinarians and their patients: vocation, care and duties.

5.1. Introduction

To understand the ethical tensions influencing antimicrobial prescribing in companion animal practice, it is essential to reflect on how veterinarians construct their professional role and how they regard the different relationships that come into play while practicing. This chapter focuses on the relationship with the animal patient and the veterinarian's responsibilities towards said patient. Indeed, while deciding whether to prescribe antimicrobials to a patient, a veterinarian has to weigh the perceived benefit of the drug to this particular patient against the risk of overusing antimicrobials and promoting resistance that might affect both humans and animals. Veterinarians' values and their understanding of their professional roles and relationships have been shown to form an integral part of the veterinarians' decision-making process in various works pertaining to veterinary ethics, in particular regarding euthanasia (Sanders, 1995; Moore, 2011; Morris, 2012a; Morris, 2012b; Christiansen et al., 2016; Hartnack et al., 2016), but also other ethically challenging circumstances regularly encountered in modern practice (Main, 2006; Morgan and McDonald, 2007; Batchelor and McKeegan, 2012).

In this chapter, I present an empirical analysis of the interview data relating to the relationship of veterinarians with animals in general and their patients in particular. I compare and contrast my interviews' findings to existing literature about veterinarians in clinical practice, but also about human doctors, their professional responsibilities to—and relationship with—their patients in the context of antimicrobial prescription and while working with other restricted resources.

In the first section, the significance of animals in both the choice and the practice of the profession by veterinarians is highlighted and compared to the relationship between doctors and human patients. The next section explores how pets' welfare and health are conceptualised and promoted by veterinarians through client education, and while navigating the conundrum of pet status as both patients and property. It also touches on the nature of informed consent in veterinary practice and how this affects the decision-making process. The last two sections focus on antimicrobial prescription and antimicrobial resistance specifically. Firstly, the prescription of antimicrobials is shown to be perceived by veterinarians to be in most cases beneficial for the patient; but also to be a complex and multi-factorial decision in each individual case, fitting poorly with rather vague and non-specific clinical guidelines. Finally, I discuss the perceived prevalence of antimicrobial resistance in companion animal practice and its current influence on pets' health and welfare.

5.2. Veterinarians' identity as 'animal doctors'

As mentioned in the introduction to this chapter, it is essential to explore how veterinarians see their professional role and construct their responsibilities towards animals in general, and in particular their patients, in order to understand how they weigh the conflicting interests of various parties while making clinical decisions. The veterinary identity is complex, evolving and still not fully understood (Armitage-Chan et al., 2016); this thesis therefore focuses on the different professional facets and relationships of the veterinarian in turn, in an effort to

analyse how they affect the issue of antimicrobial prescription and stewardship in practice. Indeed, antimicrobial prescription is an especially challenging area for modern veterinarians (Morley et al., 2005), as pressures and considerations external to the usual triangular relationship between the vet, their patient and client must be taken into account (Teale and Moulin, 2012; Pomba et al., 2017).

In this first section, the identity of the veterinarian as an animal doctor is investigated by exploring how it is rooted in a love of animals and a perceived duty of care that encourages the veterinarian to pursue what they judge to be the patient's best interests.

5.2.1. Vocation and love of animals

One of the initial questions asked of interviewees in this research project was if they remembered why they wanted to become veterinarians. In other studies, many members of the veterinary profession and veterinary students describe their career choice as having a strong vocational component, often made early in childhood. For example, in a survey of first-year French veterinary students, nearly 40% indicated that 'vocation' was the leading factor in their career choice (Sans et al., 2011). A 'deep-rooted vocation' was also one of the main reported factors for becoming a veterinarian in a qualitative study involving UK veterinary students (Cardwell and Lewis, 2017).

Veterinarians, in the data analysed here, gave overall similar answers. Out of the twenty-three who were asked the question, eighteen had wanted to be a veterinarian from a young age, often noting that this wish had stemmed from a love of animals and a desire to work with them. For example:

A love of animal I think, I just... from about the age of about four or five I wanted to be a vet and, yeah... I just love being with animals and... (Veterinary Surgeon 21)

Two veterinarians said they didn't remember the reason behind their professional choice, and two had more atypical backgrounds and emphasised that fact.

I always loved animals; I've always worked with animals. I used to work at a zoo as a keeper. And it was just something I had an interest in. [...] So it wasn't something ever since I've been a little girl I've always wanted to be a vet, it wasn't one of those stories. (Veterinary Surgeon 14)

Interestingly, and although the two quotes presented here differ on the vocational aspect of the veterinarians' studies, they both agree that loving animals was a key component of their profession choice, echoing other published findings (Cornish et al., 2016).

Some of the interviewees took this notion a step further and actively pointed out working with animals rather than humans as an essential factor in their decision to become veterinarians.

I've always preferred animals to humans. I've always identified more with animals than humans. I find it much easier to understand – people are complicated. (Veterinary Surgeon 19)

I always wanted to be a vet, but I really just, I liked medicine, erm, kind of doctory stuff, but I really don't like humans, so... (laughter) Just animals. (Veterinary Surgeon 24)

Of course, and as will be emphasised in chapter 6, effective communication is an essential component of modern veterinary practice (Cornell and Kopcha, 2007), but the prevalence of the love for animals in the discourse of veterinarians interviewed here is telling and can help us understand how they regard their animal patients and their responsibilities towards them. Unsurprisingly, given the above, interviewees were keen to present the veterinarian as an advocate for the patient's interests.

5.2.2. Veterinarians and the patients' 'best interests'

As discussed in the introductory chapters, several parties' interests are involved in veterinary practice when making decisions: the pet's, the client's, the vet's, the veterinary profession's and the wider human society's (Rollin, 2006a, p.15); it is the veterinarian's role to weigh and balance them, and how to achieve this balance has been the focus of much of the modern veterinary ethics literature.

Beyond these ethical considerations, however, understanding the veterinarian's identity in practice and how they define their primary duty and responsibility is important in the context of AMR. Indeed, in medical ethics literature, how doctors are meant to look after the best interests of their individual patients while at the same time ensuring that limited resources are being used to maximise benefit to society as a whole has been a topic of fierce discussion (Adams, 2014; Bamford, 2014; Huddle, 2014; Riggs and DeCamp, 2014; Ross and Bernabeo, 2014; Tilburt, 2014a; Tilburt, 2014b; Ubel, 2014; Wasserman and Wertheimer, 2014). The obligation to look after both the patient's and society's best interests, has been termed 'dual agency,' and Weinstein (2001, p.268) has argued that it is 'ethically untenable to expect doctors to face this trade-off during each patient encounter; the physician cannot be expected to compromise the wellbeing of the patient in the office in favour of anonymous patients elsewhere.'

More specifically, Oczkowski (2017) has defined antimicrobial stewardship programmes as a form of bedside rationing. While this paper concludes such programmes to be ethically sound, reconciling them with ethical principles of beneficence, non-maleficence, autonomy and justice can be challenging (Marcus et al., 2001b). Some authors have even argued that in the context of antimicrobial resistance, society might in some circumstances need to go against individual patient's best interests (Foster and Grundmann, 2006). Despite these discussions, the Hippocratic principles of helping and not harming individual patients, expanded through the aforementioned fundamental ethical concepts, are still at the core of modern medical ethics and relevant to the contemporary identity and values of human physicians (Askitopoulou and Vgontzas, 2018). Perhaps unsurprisingly, reconciling fidelity to such patient-centred ideals and good antimicrobial stewardship has been recognised as challenging (Sabin, 1998), if not downright impossible (Ellis, 1999). Physicians have been shown to struggle with the tensions existing between medical ethics and the prioritisation of resources in health care (Hunter, 2007), including in the case of antimicrobial prescription (Metlay et al., 2002b).

Similarly, to understand the tensions existing in companion animal practice around the question of antimicrobial stewardship, a closer look at the contemporary identity of veterinarians is needed. As highlighted in the previous

section, the love of animal was a key aspect of interviewed veterinarians' personalities. More specifically, some interviewees expanded on the responsibility they felt towards their patients.

We really as the vets try to act on behalf of the pets who can't speak for themselves. (Veterinary Surgeon 12)

I think I would always make sure that the patient, and its best interest came first. (Veterinary Surgeon 4)

This patient-centred vision of the veterinarian's role is reminiscent of the Hippocratic principles mentioned above, and indeed echoes the oath veterinarians swear in the UK (as an example): 'above all, my constant endeavour will be to ensure the health and welfare of animals committed to my care' (Royal College of Veterinary Surgeons, 2012, p.13).

In accordance with this declaration, the desire to pursue the patient's best interest was explicitly not limited to health considerations, but also pertained to welfare and to the bond the animal had with their human family, echoing recent calls to recognise and increase veterinarians' responsibilities towards animal welfare (Morgan, 2009; British Veterinary Association, 2016; Hernandez et al., 2018).

I'm quite interested in [...] just preventive care, so, hm... very much... hm... just making sure, just sort of pet/animal bond and, making sure pets are taking care of and also that all their welfare needs are met. (Veterinary Surgeon 12)

In summary, in an effort to understand the tensions existing in companion animal practice in the context of antimicrobial stewardship, it is essential to develop an understanding of the modern veterinary identity and the vision, values and beliefs they associate with their professional role. For the vast majority of interviewed vets here, the love of animals was a key component of their personal and professional identities and consequently they often expressed a responsibility to promote and pursue their patients' best interests. This is comparable to human medical practice where the traditionally patient-centred focus of doctors have made it difficult for them to play the role of gatekeepers of limited resources, even while they are doing so to promote societal good (Weinstein, 2001; Hunter, 2007; Tilburt, 2014a).

Of course, in companion animal practice, clients also play a critical role in clinical decision-making. While chapter 6 will deal with the client's role in specific detail, the next section delves into how they influence veterinarians' efforts to improve the pet patient's health and welfare.

5.3. Animal health and welfare in companion animal practice

Beyond the veterinarian's professional judgement regarding the patient's best interests, their decisions and abilities to improve an animal's health and welfare is usually not independent, but—especially in companion animal practice—relies on reaching an agreement with the animal's owner regarding a certain course of action. Consequently, the veterinarian has to communicate and guide owners effectively, and must also respect the legal

status of pet animal ownership and the rights it grants pet owners through the concept of informed consent, which as will be discussed relates but is not equivalent to the same principle in human medicine.

5.3.1. Veterinarians as experts, guides and educators

Veterinary ethics works have historically focused mostly on the triangular relationship between the vet, the patient and its owner (Sanders, 1994a; Jackson and Gray, 2004; De Graaf, 2005; Main, 2006; Morris, 2012a; Christiansen et al., 2016). The importance of the client as an actor in the practice of veterinary medicine was recognised and emphasised by interviewees.

I think above all our responsibility has to be for the pet, but we can't get away from the fact that we have responsibility for the owner as well. (Veterinary Surgeon 7)

What constitutes the 'best interests' of the patient was presented by the interviewees as being part of the veterinarian's knowledge and expertise, also emphasising that an integral part of their job was to guide and educate owners regarding their pets' interests.

I think part of being a good clinician is to help guide owners into what... what is best for their pet and what they should do. (Veterinary Surgeon 12)

It's your job to educate [clients] on what is best for their animal because you are the one that is, you know, you have done your degree at the end of the day and is qualified to do so. (Veterinary Surgeon 4)

The importance of the veterinarian role as an educator has been increasingly recognised in recent years (Main, 2007; Christiansen et al., 2016), and concerns about lack of training in that area in veterinary curricula raised (Dolby and Litster, 2015).

The veterinary patient presents some unique challenges as well; some species exhibit behaviours that can be difficult to interpret from an anthropomorphic point of view. For example, pain or discomfort might present in ways that are difficult for owners to recognise and consequently empathise with. Pain scoring in animals is notoriously difficult (Bateson, 1991; Rutherford, 2002), and although pain recognition and management have improved in veterinary care over time, improvements still need to be made (Bell et al., 2014; Hunt et al., 2015). In Bell et al. (2014) study, veterinarians identified owner's compliance as the most significant barrier to treatment of chronic pain in dogs (more on compliance in chapter 6). Here, a veterinarian highlights the importance of educating owners about pain and discomfort that they might not recognise:

A lot of these conditions that we deal with, you know, the owners aren't actually aware of the discomfort. I think we have to sort of guide them as to what, you know, what is, what is uncomfortable and stuff and I think that has a bearing on how much, what decision they make I think. (Veterinary Surgeon 1)

Once again, educating owners is seen as a way to promote the animal's best interests. While prioritising animal health and welfare may be the most attractive option for the veterinarian (Rollin, 1978), and in the UK seems to be in accordance with the aforementioned oath taken by veterinary surgeons (see 5.2.2), the legal status of domestic animals interferes with the patient's best interests being the uncontested priority of the veterinarian.

Pets, indeed, are considered property in the legal system and their owners are entitled the right to make decisions regarding their health, as well as life and death, within the broad frame of animal welfare laws. A veterinarian concerned about a patient's welfare has therefore little recourse at their disposal, except in the face of glaring animal cruelty. As argued by Schnobel (2014), 'the law has played a significant role in forwarding a framework which restricts the development of a more care-based model and rather supports an instrumental view of the veterinarian's role' (no page number). The existence of this tension between the veterinarian's opinion about a patient welfare and the owner's was recognised by interviewees as challenging.

I think that's probably the most difficult one where it's their pet, but you might not agree with, they might not agree with your clinical judgement on how that pet is and how that pet's quality of life is. (Veterinary surgeon 7)

Recent literature has also argued that client autonomy in veterinary medicine should be limited by animal welfare considerations (Gray et al., 2018). In human medicine, the notion of 'informed consent' aims at protecting the patient's rights to make decisions (following appropriate information being given by the physician) regarding their own health and welfare. The concept of 'informed consent' in veterinary medicine, however, is different and has implications for animal welfare.

5.3.2. Informed consent and pets' health and welfare

The relationship between veterinarians and pet owners is one of the most important in companion veterinary practice; and beyond their duty to care for animals' health and welfare, veterinarians are also service providers for their clients. The exchange of service and expertise for financial compensation creates its own set of responsibilities, both professionally and legally.

Vets can view their responsibility towards the client compared to the one they have towards the patient differently. In contrast to the previous quotes where the interviewees stated that the patient's best interests were their main concern, one veterinary surgeon explained:

Well, the client is paying for it. They can decide whatever they want. The animal is their property, you know, they come to me for my opinion on what's wrong with it and how to fix it. [...] But it's up to them to make the call. (Veterinary Surgeon 19)

This pragmatic statement, as mentioned above, reflects the legal boundaries surrounding the practice of veterinary medicine in companion animal practice, emphasising that while the veterinarian offers options, the ultimate decision regarding treatment legally rests in the hands of pet owners. It also highlights the varied opinions existing among vets regarding the prioritisation of their duty of care and how they prefer to weigh the interests of the patient against those of the owner. Other studies have also revealed the heterogeneity of attitudes and beliefs existing among vets regarding their professional responsibilities (De Graaf, 2005; Morgan, 2009; Morris, 2012a).

Hernandez et al. (2018) notes that offering a 'vending-machine approach' (p.8), where all options are presented as equal, ensures client autonomy, but that it also allows the veterinarian to avoid the professional responsibilities they have towards the patient. Heuberger et al. (2016) have also shown that while quality of life and pain management of senior patients are very important to pet owners, they 'lacked knowledge and had unrealistic attitudes and beliefs about treatment options, costs, and long-term feasibility' (p.152). Echoing this quote, other interviewees, while recognising the owner's power of decision regarding treatment, highlighted again the importance of client education in this context as well as the value of the veterinarian's expertise.

The owner is really the person who has ownership of the pet and should be making those decisions, but they don't have a veterinary degree, so they can't make informed decisions without our support. (Veterinary Surgeon 12)

The interviewee here emphasises that any decision made by an owner must be 'informed,' referring to the concept of 'informed consent' that has gained in importance in human medicine in the past few decades. Modern medicine asks physicians to gain 'informed consent' from their patients before treatments and diagnostics can be carried out (del Carmen and Joffe, 2005); in essence, informed consent implies that the patient has been made aware of the various treatment and diagnostic options available to them, including an explanation of the risks and prognosis associated with each. The concept has subsequently crossed over into veterinary medicine with the RCVS code of conduct mentioning in several places that veterinarians should seek 'informed consent' from their clients (Royal College of Veterinary Surgeons, 2012). It also states 'veterinary surgeons must accept that their own preference for a certain course of action cannot override the client's specific wishes other than on exceptional welfare grounds.' What would qualify as 'exceptional welfare grounds,' however, is left to the judgement of the individual veterinarian (p.52). Taking into consideration the need for informed consent and the legal status of pets, a veterinarian may be hard-pressed to be an effective advocate for the animal's welfare in an ethically challenging situation. Indeed, the obligation to obtain informed consent in veterinary practice exists to ensure that the owner's rights, the integrity of their property and their power of decision over it are respected. Informed consent in that context does not pertain to the rights or welfare of the patient as it would in human medicine. As a consequence, informed consent between the veterinarian and their client does not imply protection of the animal patient, which, in turn, can create difficult ethical challenges for the veterinarian if they believe a patient's health or welfare is compromised by an owner's decision regarding treatment or lack thereof (Ashall et al., 2018).

To be advocate for their patients' health and welfare, veterinarians must therefore be effective communicators with individual clients. Here, the veterinarian is confident they know the best course of action for the patient and see their role as convincing the owner to agree with them.

I have a slightly old-fashioned view in that, I believe, I know best. I'm quite prepared to talk to people and I'm quite prepared to persuade them round to my way of thinking. (Veterinary Surgeon 6)

The different strategies veterinarians employ to communicate and persuade clients, as well as how it compares to decision-making for non-autonomous patients in human medicine are explored in chapter 6. The ethics of influencing clients are also discussed there.

The rest of this chapter focuses on the issue of AMR and antimicrobial stewardship in the context of animal welfare, in particular the veterinarians' desire to pursue their patient's best interests which—as we have seen—is an important, but fraught with challenges, part of their professional identity. In the next section, antimicrobial prescription and some of the challenges it presents will be investigated in more detail.

5.4. Antimicrobial prescribing and patient's best interests

Prescribing antimicrobials is a unique type of clinical decision-making, due in part to the public health concerns associated with it. Examined in the narrow context of an individual patient's care, however, it is most often perceived by clinician as being a potentially beneficial and low risk course of action. The breadth of clinical cases for which antimicrobials may be considered appropriate, as well as the varied factors that can influence a clinician judgement in an individual case, make each prescription decision unique and involves considerations beyond the contents of stewardship guidelines.

5.4.1. Antimicrobial prescribing as the 'safest option'

All drugs used clinically are associated with varied safety margins and risks of side effects for the patient. During the interviews, veterinarians overall presented commonly used antibiotics as drugs that can often be beneficial to the patient and carry low risks of adverse effects.

I imagine that vets, and I can see it, I can understand it myself, if antibiotic resistance didn't exist then I probably would shove it at a lot of things because it's generally safe and there's a lot of cases that you can't really rule out infection[...], so I can understand using it because it's safe and it might help, and if it doesn't it's unlikely to, to that individual animal to cause it any problems, it's more of a general population issue. (Veterinary Surgeon 2)

Unsurprisingly considering what has been discussed in this chapter so far, the role of the veterinarian as the patient's advocate was reiterated when it came to antimicrobials and the animal's health was seen as the priority compared to stewardship considerations.

I am aware that I need to be responsible with giving my antibiotics, but if I felt generally that that patient needed it, then you know, I would prioritise making sure that you know, its best interest was my priority really. (Veterinary Surgeon 4)

This quote echoes results from other studies. For example, Knights et al. (2012) showed that 79.9% of companion animal veterinarians they surveyed agree with the statement: 'if I am not sure if antibiotic prophylaxis is needed, I tend to give it' (p.6). Clinical uncertainty has been shown to lead to conservative treatment decisions in human medicine as well (Metlay et al., 2002b; Broom et al., 2014), and, as mentioned previously, to ethical tensions for physicians having to balance patients' welfare and a role as gatekeepers of limited resources (Garau, 2006). Use of antimicrobials when the need is uncertain is, however, in contradiction with the prudent use principles described

in both human and veterinary guidelines (see chapter 3, also (Publications Office - European Union, 2015), (Teale and Moulin, 2012), (Dellit et al., 2007b)).

Most interviewees were keen on pointing out how carefully they used second or third-line antimicrobials such as fluoroquinolones. First-line antimicrobials, however, often seemed to be used more liberally.

One of the things I quite often say, nothing ever died of amoxicillin poisoning but when we're looking for a safe antibiotic, you know, amoxicillin would be the safest general most effective thing if you've got a wound. So I tell people not to hold back. (Veterinary Surgeon 6)

The safe nature of amoxicillin has also been highlighted in human studies where it has been found to be sometimes used as a placebo (Byrne et al., 2012). The influence of such treatment, however, can last for months and select for resistance mechanisms in the gut microbiota (Kirchner et al., 2014). Although similar data is not available at time of writing for veterinary patients, it is likely that findings would be similar as the mechanism of action of those drugs is the same across species.

Varied attitudes regarding antimicrobial use existed among interviewed veterinarians:

But for the most part, animals don't need them because animals do have an immune system, they do have their own defences and for the most part they're otherwise healthy. (Veterinary Surgeon 24)

I just do sort of fling antibiotic at it the moment it starts up because of the consequences of development of infection. (Veterinary Surgeon 2)

Other veterinarians emphasised that withholding antimicrobials could be difficult and feel like taking a risk.

You need to have the confidence to back off, but I have found there have been times I've thought 'I'm not going to give them, I'm not going to give them' and get to the stage where I go 'damn it I'm going to give them' and sorted. (Veterinary Surgeon 17)

The veterinarian here acknowledges that not giving antimicrobials requires some degree of confidence. Beyond the best interests of the patients, the process described here reflects self-doubt and some degree of stress. Uncertainty when making clinical decisions may therefore lead to over-prescription of antimicrobials, not only because these drugs are perceived as presenting little risk to the patient, but also because it might feel safer for the veterinarian themselves and prevent adding stressors to an already stressful and difficult job (Bartram and Baldwin, 2010; Batchelor and McKeegan, 2012).

Another aspect of antimicrobial prescription emphasised by all interviewees was the individual nature of the decision-making process, relying on case-specific factors.

5.4.2. A complex, individual, patient-centred approach

Individual animals' circumstances and the risks associated with them were taken into account when considering antimicrobial prescription. The general health of the patient was also reported to play a role in the willingness of the veterinarian to withhold or not antibiotic treatment.

You know, if it's a one year old dog, I'm much more relaxed in saying 'don't need it,' if it's a fourteen-year-old decrepit, you know, multiple problems dog then... it's much harder that 'no, it definitely doesn't need it at this point.' I think it has to be done on a case by case basis. (Veterinary Surgeon 8)

Medical ethics literature has also showed that clinicians emphasise the individual nature of ethically challenging cases (Ginsburg et al., 2012), and more specifically of antimicrobial prescription decisions (Broom et al., 2014). Similarly, when asked what factors drive their antimicrobial prescription decisions, an interviewee noted:

That's a hard question to answer because unless you have the case in front of you it depends on what the case is presenting. (Veterinary Surgeon 14)

Guidelines and their implementation will be discussed in chapter 7, but it can be noted here that the importance of case-specific factors in clinician's decision-making might make it difficult to use general guidelines to inform prescription decisions. Indeed, in human medicine, general guidelines alone (not specific to the practice / hospital) have been shown to fail to improve antimicrobial stewardship (Timmermans and Mauck, 2005). Overall, interviewees found it difficult to explain how and why they decided to give a patient antimicrobials. For example, the veterinarian here talks about a 'gut feeling':

It's a gut feeling but, sort of, signs of an infection would make me think about and the length of time it's been going on would make me push towards it, so any sort of raised temperature or you know any sort of swellings or anything like that would push me more towards...[...] So if it's not a sky high temperature, if it's only a little bit and things like that, but it's a gut feeling for me. I can't put my finger on it, it's hard. (Veterinary Surgeon 19)

The severity of the illness was also a major factor in veterinarians' prescription decisions, and again risk to an already ill patient was considered unacceptable, even in the face of specialist recommendations.

I think it depends how... how long the animal's been ill and how ill it is on presentation perhaps, that... I think that's built into the decision definitely. (Veterinary Surgeon 21)

I think certainly for one of my certificates¹⁰ I got completely slated, I had a case of salmonella and I gave it some antibiotics and got slated for doing it, it was one of my first essays and I spoke to [another vet] about it and you know, the dog was very, very sick and she had exactly the same opinion as me at the end of the day, you know, you had a very sick dog, if you hadn't given it and it had died then you'd have regretted it. (Veterinary Surgeon 13)

The language used here is significant; the veterinarian talks about regret, an emotional response, as associated with treatment failure and a sad outcome showing an obvious personal investment in the fate of the patient.

¹⁰ a 'certificate' is a clinical postgraduate qualification focusing on a particular area of interest a veterinarian can study toward while working in practice. It does not grant specialist status.

Similarly, physicians – and in particular generalists – have been shown to be influenced by the severity of an illness (Metlay et al., 2002a; Wood et al., 2007), for example by using antimicrobials considered to be more potent in sicker patients. The ethics of antimicrobial restriction in intensive care units have also been debated (George and Morris, 2010). An important point raised by this last paper and that might explain clinicians’ reticence to follow published guidelines is that ‘neither the published guidelines nor the important stewardship articles identify safety as an endpoint’ (p.207). This is discussed further in chapter 7 in the context of evidence and guidelines, but should be emphasised here as it could explain why in many cases, and with their patient’s best interests foremost in their mind, veterinarians may think antimicrobial administration to be the most careful course of action.

Inseparable from antimicrobial prescription is of course the problem of antimicrobial resistance and how it influences the veterinarian’s clinical decisions.

5.5. Antimicrobial resistance in every-day practice

Antimicrobial resistance prevalence and severity in companion animals is not well studied (Weese, 2008), despite its potential significance for human health (Guardabassi et al., 2004; Umber and Bender, 2009; Committee for Medicinal Products for Veterinary Use, 2015). Reporting and surveillance of resistance cases is difficult, in part due to the lack of standardisation of veterinary laboratories (Morley et al., 2005). A study in Denmark demonstrated low level of resistant organisms in samples from dogs sent to veterinary laboratories, but showed that most antimicrobials used in practice had a very broad spectrum of action (Pedersen et al., 2007). Use of broad-spectrum antimicrobials is also widespread in UK companion animal practice (Radford et al., 2011; Mateus et al., 2014; Singleton et al., 2017). Prudent use guidelines recommend use of narrow spectrum antimicrobials whenever possible (Teale and Moulin, 2012), although the usefulness of such a classification has been debated (Acar, 1997).

Considering the above, the varied experience of veterinarians in daily practice is likely to influence their views, attitudes and beliefs regarding AMR and its relevance to their profession. When resistance is identified, however, its impact on patients’ health and welfare would be an inescapable complication for the veterinarians.

5.5.1. Veterinarians’ perception of resistance in practice

Perhaps unsurprisingly considering the lack of data about AMR in companion animal practice, interviewees showed different opinions regarding the importance of resistance in this context. Some considered it rare and others common.

I’m not sure because I mean like through vet school, they did say that there has been, resistance has developed in certain classes and for certain conditions. From my colleagues here I don’t feel like necessarily they have kind of maybe come across much resistance. (Veterinary Surgeon 10)

Particularly with ear infections. We see it, that’s one of the most common things we see... is Pseudomonas infections in ears that are resistance to pretty much every antibiotic that exist or one that we don’t have. (Veterinary Surgeon 16)

Similarly, opinions about resistance and its relevance to medical practice vary among human physicians (Wood et al., 2012). This is particularly important since beliefs and attitudes regarding AMR have been shown to be the most important factor leading to prudent antimicrobial prescribing in human doctors (Limbert and Lamb, 2002; Rodrigues et al., 2013). Belief and attitudes regarding AMR, although not as widely studied, are also important in veterinary practice (Busani et al., 2004; Mateus et al., 2014; Speksnijder et al., 2015b).

And indeed, when interviewed, veterinarians' personal experience with resistance in practice was at the core of their opinions on the problem of AMR in companion animals:

So the evidence in my eyes is that infections still respond to good old-fashioned antibiotics, which have been knocking around a long time. So, although, there is resistance out there we are told it doesn't seem to have any real bearing in my clinical practice. (Veterinary Surgeon 6)

[Resistance] is there, and I know it's there, it's at the back of my mind. Erm... but it's not... I suppose 'cause it's not caused me a great issue to date (laugh), then I'm not too alarmed about it. (Veterinary Surgeon 12)

All interviewed veterinarians mentioned seeing resistant ear infections caused by *Pseudomonas* bacteria, although how common this was varied.

*We also have a lot of *Pseudomonas* otitis cases that are multi-resistant that we struggle with, because they are pretty much resistant to everything. (Veterinary Surgeon 19)*

*The big one where I tend to see most resistance issues is actually *Pseudomonas* in ears. [...] But it's not actually a massive issue, I found in our practice. (Veterinary Surgeon 3)*

The problem of multi-resistant ear infections caused by *Pseudomonas* is also recognised by the veterinary literature (Wildermuth et al., 2007; Barnard and Foster, 2018). How resistant ear disease affects veterinary patients' welfare will be explored in the next section. Of note is the fact that the same organism causing otitis, urinary and wound infections in dogs (*Pseudomonas aeruginosa*) also causes important problems in human medicine due to its common resistance to fluoroquinolones and many other antimicrobials (Deplano et al., 2005; Falagas and Kopterides, 2006; Cook et al., 2008).

Some interviewees questioned whether a failure to recognise resistance might also exist in veterinary practice.

I think it's a problem that people sometimes don't recognise that this drug is not working and continue to prescribe more without investigating further. (Veterinary Surgeon 23)

This veterinarian related the story of a cat that was being kept on the same antimicrobial for six weeks for a chest infection despite failing to show improvement. When eventually investigated, the infection showed resistance to the antimicrobial used. Switching therapy to an appropriate antimicrobial agent led to immediate improvement of the patient's clinical signs and health.

In contrast, when asked about the trend of resistant cases in practice, other interviewees wondered if resistance had increased in recent years, or if they only felt it had, due to carrying out an increasing number of culture and sensitivity tests.

It's amazing how many you see when you actually look for [resistant cases]. [...] I think again it's difficult to know how much I'm seeing more and how much is that I'm looking for them, and I'm not sure. (Veterinary Surgeon 7)

I think that's a slightly hard question to answer because I don't think I used to do as many culture and sensitivity. So therefore am I doing more so therefore I'm seeing more resistance? I'm looking for it more now than maybe I was ten years ago. (Veterinary Surgeon 14)

Considering the lack of data about the evolution of resistance in companion animals over time, their question is currently impossible to answer.

Many veterinarians reported that they would carry out cytology themselves when faced with an ear infection and send out a culture if suspecting *Pseudomonas* infection. In other cases, culture and sensitivity usually followed a failure of the initial treatment.

Often it's when something has not responded as well to whatever you've... you've used as your first line, rather than just pick another one. Then we would culture. (Veterinary Surgeon 21)

This approach is similar to what other companion animal veterinarians have reported (De Briyne et al., 2013). In veterinary practice, culture and sensitivity testing must be financed by the owner of the animal and this will therefore be explored further in chapter 6.

The next section focuses on the health and welfare implications of antimicrobial prescription and resistance in companion animals, an important and recurrent theme during the interviews.

5.5.2. Antimicrobial resistance and pets' health and welfare

Beyond therapeutic difficulties and financial costs, resistance has an impact on the individual patient as it often leads to prolonged illness, morbidity, and a compromise in welfare. This aspect of resistance in companion animal practice has seldom been explored in the current literature. Despite considering antimicrobials safe for the patient in uncertain cases, interviewees also emphasised that antimicrobials should not be used as readily as some other drug classes.

There aren't any other classes of drug [besides antimicrobials] that I don't use because I want to minimise my use of them. (Veterinary Surgeon 2)

You need to be quite careful with [antimicrobials]. 'Cause you could. Well, say... say you have an animal that you're not sure if it's painful or not, and you give it pain relief, it's not gonna do any harm, well apart it might upset its stomach or something, but it's not going to... If it's not painful, it doesn't matter. Whereas

if you give an antibiotic to an animal that's not got an infection, you have potential to cause a... so like for a resistant infection, or maybe the antibiotics stop working over time, so you do need to use them when there's a reason to use them. (Veterinary Surgeon 16)

These quotes show awareness of antimicrobial stewardship ideals and principals of prudent antimicrobial use (Teale and Moulin, 2012; Danish Small Animal Veterinary Association, 2013).

As mentioned in the previous section, cases of multi-resistant ear infections were common in practice and could be problematic to manage, leading to significantly impaired welfare for the patient and ongoing financial costs for the owners.

The ones that are a problem, so the ones that we do see as a clinical case, I suppose most often it's going to be ears. [...] And that is a problem. It's a... it's a real problem. For the pet. Erhm... they're either going to have bilateral TECA¹¹ operations done, or they're just going to have nasty ears for the rest of their life. We never really get on top of it. (Veterinary Surgeon 22)

I've put animals to sleep because the owners couldn't afford any treatment. Usually, you can sort of manage the [ear] infection you've got, you can't cure it, you can manage the clinical symptoms. [...] You never clear the infection, the dog is stuck with it for the rest of its life. But you can usually get a reasonable quality of life with it. Erhm... it's just always a little bit miserable. (Veterinary Surgeon 8)

Veterinary surgeons were therefore aware of the potentially harsh consequences of AMR on patients' welfare and quality of life in those cases. With the exception of a couple of anecdotal reports of wounds struggling to heal due to resistant infections, however, these concerns were limited to ear infections.

In contrast, in other cases, the palliative use of antimicrobials was sometimes seen as essential to the patient's quality of life. Unsurprisingly considering what has been discussed earlier regarding the importance of the patient's best interests for veterinarians (see section 2 of this chapter), prescribing antimicrobials for welfare reasons was deemed reasonable despite the risk of resistance developing. To give just one example:

I do use antibiotics long term, typically more for my palliative care patients. You know, the really old timers that have horrible, horrible mouths, have liver problems. You know, have antibiotics for a couple of weeks and their mouth clears up. You have them off and it gets worse. Put them back on and they're fine. [...] We may end up with resistance down the road but we'll cross that bridge when we get to it. I've had some dogs on [penicillins] probably for about a year / year and a half. But it's helped that dog maintain a good quality of life. (Veterinary Surgeon 14)

Palliative use of antimicrobials is a contentious issue in the context of AMR, since efforts are being made to reduce overall use of antimicrobials. Similar problems have been discussed in human medicine (Marcus et al., 2001b). In

¹¹ TECA: Total Ear Canal Ablation, a major operation carried out in cases of chronic ear infection unresponsive to medical treatment during which the ear canal is completely removed.

those cases, both the patient and patient's family were in favour of continued antimicrobial use even in case of terminal illness or advanced dementia. As with the veterinarian quoted above, the physicians in charge were also reluctant to withhold antimicrobial therapy.

5.6. Conclusion

This chapter explored the identity of veterinarians as animal doctors, drawing parallels between Hippocratic principles in human medicine and the duty and responsibility of veterinarians towards their patients' health, but also welfare. Drawing on medical ethics literature, the challenges faced by clinicians having to look after individual patient's best interests while at the same time being the gatekeepers of finite resources for the societal good were highlighted. In this context – including the rationing of antimicrobials through prudent use principles (Oczkowski, 2017), many views exist. Practicing physicians, however, often admit to struggle with the decisions they are asked to make. The ethical dilemmas doctors face have been described as 'untenable' (Weinstein, 2001, p.268) and most will prioritise their patient's welfare, in accordance with the principles promoted by modern medical ethics. Or as put by Ellis (1999, p.940), 'both fidelity (caring for patients) and stewardship (rationing resources) are ethically incompatible when attempted by the same individual.' This chapter has shown veterinarians to have similar attitudes towards their patient's best interests, most describing promoting them as their primary responsibility. This comparison with medical doctors demonstrated some shared views on professional responsibility towards patients as well as the same preference towards prioritising patients' treatment in uncertain or severely ill cases.

Veterinary medicine is, however, complicated by the involvement of the patient's owner who is legally entitled to make decisions for the treatment and life of their property. Reminiscent of the arguments brought forward by Schnobel (2014), interviewed veterinarians were aware that this situation creates a unique set of ethical challenges that vets have to negotiate when attempting to preserve their patients' health and welfare, before taking into consideration any notion of stewardship. Although the relationship between veterinarians and client is explored in more details in the next chapter, it is important to recognise here that communication with clients is an essential part of promoting patient's health and welfare in companion animal practice, not only as a professional responsibility but also to ensure the best outcome for the patient whose welfare is not protected by the concept of informed consent in veterinary medicine (Ashall et al., 2018).

Veterinarians were overall confident that they knew the best course of action for the animal, affirming it as a reflection of their knowledge and expertise. These themes will be explored further in chapter 7. When discussing antimicrobial prescription, however, it became clear that some clinical decisions bring with them a degree of uncertainty or risk, and that this was dependent on the individual circumstances of the patient. If in doubt, veterinarians reported that they erred towards conservative prescription decisions regarding antimicrobial, considering them safe and of little risk to the patient. Again, this reflected similar clinical choices made by human physicians (Broom et al., 2014).

Attitudes and beliefs regarding the prevalence and importance of AMR to companion animal practice varied between veterinary surgeons. However, multi-resistant ear infections were commonly mentioned and had a non-negligible impact on patients' quality of life, a clinical presentation well recognised in the literature (Falagas and Kopterides, 2006; Wildermuth et al., 2007; Barnard and Foster, 2018).

Palliative use of antimicrobials was also discussed and recognised as essential to some patients' welfare, despite such use being controversial. As in human medicine (Marcus et al., 2001b), interviewed veterinarians regarded palliative use of antibiotics as often necessary, despite opposing prudent use principles.

The parallels between human and veterinary practice are significant as much more academic work has been carried out in medical than in veterinary settings, and some of the conclusions and ways forward described in the medical literature could be considered to help improve stewardship in veterinary practice. There are also, however, key differences between the two as well, notably legal aspects that must be recognised and managed.

In the next chapter, the next part of the relationship puzzle of companion animal practice will be sketched out, that of the veterinarian and the client / pet owner.

Chapter 6—The vet-client relationship: support, trust and stress

6.1. Introduction

While the focus of the last chapter was on the relationship between the vet and the animal under their care, the analysis has already started to highlight that an important part of the veterinarian's role involves communicating with the clients about treatment options (Jackson and Gray, 2004) and their pet's welfare, and gaining informed consent for treatment before it is administered. The emphasis put on antimicrobial stewardship by professional and governmental organisations (Royal College of Veterinary Surgeons, 2012; Committee for Medicinal Products for Veterinary Use, 2015), however, has changed the nature of antimicrobial prescribing compared to other drugs regularly used in veterinary practice. Prescribing antimicrobials comes with responsibility beyond the health and welfare of the patients and the informed consent of the client; the development of resistance and its public health implications, as well as pressure from professional bodies (British Small Animal Veterinary Association, 2012), bring forth new responsibilities for veterinarians and consequently new tensions that may affect their relationship with their clients.

In this chapter, I first explore how interviewees showed reluctance to leave decisions regarding antimicrobial use in the hands of their clients, emphasising that professional expertise was essential when prescribing these drugs, particularly in the current context of AMR. This need for expertise when making clinical decisions was also used as a way to reinforce the veterinarian's authority and prestige in their relationship with the client.

By contrast, the second theme explored is the need for good veterinarian-client communication, especially around antimicrobial prescription. While veterinarians do not think clients should be allowed to make antimicrobial prescription decisions, they also want to avoid direct confrontation and convince them of what they see as the right course of action; this is also a way of emphasising the shared responsibility all members of society have to protect public health. Consequently, communication with clients is deemed an essential part of prescribing antimicrobials, both to ensure client satisfaction—which was presented as being good for business and reducing veterinarians' stress by limiting opportunities for conflicts with clients (Batchelor and McKeegan, 2012)—and to fulfil the veterinarians' role as educators (Dolby and Litster, 2015).

Finally, veterinarians also recognised that clients' means have a direct influence on their decision-making process while prescribing antimicrobials. Interviewees explained that following best practice and guidelines was often difficult, if not impossible, due to the client's inability to pay for gold standard of care diagnostics and treatments.

Focusing on the relationship between veterinarians and their clients exemplifies why handling antimicrobials in a veterinary practice is such a complex endeavour. Although it is only a small part of the whole picture, it is one of the main tenets of veterinary work and, as discussed above, brings to the fore tensions of a linked yet varied nature.

6.2. Antimicrobial prescription and stewardship as an opportunity to educate and promote professional authority and prestige

As highlighted in the previous chapter, an intrinsic part of deciding on treatment options in veterinary practice involves communication with the client. Of course, this applies to all clinical decisions, including antimicrobial prescription. Moving forward with a treatment plan therefore involves gaining the approval of the client. This section describes how veterinarians seek to educate to gain informed consent from their clients, while recognising the difficulty and limitations associated with such an endeavour. They also use their professional expertise, authority and prestige to weigh in favour of certain clinical decisions, such as antimicrobial prescription.

6.2.1. The challenge of informed consent and client education

The requirement to gain informed consent means that options must be presented and explained to the client, including their advantages and risks (Royal College of Veterinary Surgeons, 2012). This is also an essential part of fulfilling veterinarians' responsibility to ensure the health and welfare of their patients (Hernandez et al., 2018). As is the case in human medicine (Turner and Williams, 2002; Corrigan, 2003), gaining true informed consent can be challenging:

I think that yeah, you do get increasingly tied up with the informed consent, but informed consent is a minefield really because what is informed consent? And how...because informed consent involves that they have to have understood what you've said to them, well they could have seemed to understand what you said to them, but they actually might not have a clue, if they nod at you and smile at you then they seem to have understood what you say, and you don't want to seem rude by sort of going back and saying 'do you understand?' (Veterinary Surgeon 7)

The concept of informed consent requires understanding of the options offered (Shahvisi, 2016) on the part of the patient / client. It should be noted here that being able to repeat information given through fact sheets or discussion does not equal comprehension (Wirshing et al., 1998). Patients often struggle to retain the information they are given, particularly in the long term (Turner and Williams, 2002). Veterinarians were keen to emphasise that their professional role went beyond offering a simple list of options to their clients:

I think the more qualified you are the more comfortable you feel with saying [to clients] which you feel would be the best option for them. And I think they do expect that, I think clients like that. They don't just want to be given three options, x, y and z and no opinion on it, because how on earth do they... do they weigh that up? They can't, can they? (Veterinary Surgeon 12)

This quote emphasises the role of the veterinarian as an educator. Yet, and despite the inclusion of non-technical competences in modern veterinary education (Coe et al., 2011; Mossop and Cobb, 2013; Magalhaes-Sant'Ana, 2014), developing the pedagogical abilities of the veterinarian has rarely been given the importance it deserves (Dolby and Litster, 2015).

There is also an increasing amount of evidence showing that the process of consent can be influenced by a person's emotional state (Supady et al., 2011), as well as socioeconomic and clinical factors (Corrigan, 2003). This was

highlighted by some of the interviewees. For example, one veterinarian working in a charity practice providing care for animals belonging to people receiving welfare support stated:

Our clients generally—this can sound a bit rude—quite often aren't as well educated as some in private practice. So sometimes they just don't know what... what it wants... and they just take what you say as gospel, lot of the time they do. Which does make it a bit easier (laughs). (Veterinary Surgeon 16)

Here, the veterinarian recognises that not having to convince people or explain options in a lot of details makes their job easier. It does raise the question of whether true informed consent can be obtained in those circumstances. The remark, however, is not surprising as clients with a lot of knowledge are often seen as more difficult to communicate with by veterinarians (Chitty, 2006). It should be noted as well that charity practices are limited in the options that they can offer clients as they pay for—or heavily subsidise—the treatments provided. As discussed in medical ethics literature and in chapter 5, having clinicians being both responsible for their patient's health and welfare and gatekeepers of finite resources (for example, financial ones) can be difficult to reconcile and raise ethical concerns (Graber and Tansey, 2005; Tilburt, 2014a).

Interestingly, and despite recognising the necessity to gain informed consent, interviewed veterinarians were keen to point out that in most cases they did not believe the decision to give or not antimicrobials to a patient fell into the remit of the client. Professional authority, expertise and prestige were, as discussed in the next sub-section, seen as important as well when practicing antimicrobial stewardship.

6.2.2. Professional authority and privileges

Veterinarians saw antimicrobial prescription as a decision that requires their professional expertise and emphasised that this was the reason why veterinarians hold prescription privileges.

I don't think a client should be able to come into me and say 'I want antibiotics for my animal' and I give them antibiotics. I don't think that's... that's the whole point of it being a prescription, isn't it? (Veterinary Surgeon 21)

The Royal College of Veterinary Surgeon (RCVS) supports this view, stating in their Guide of Professional Conduct (Royal College of Veterinary Surgeons, 2012, p.35): 'Veterinary surgeons must be seen to ensure that when using antimicrobials they do so responsibly, and be accountable for the choices made in such use.' Although the code does not define what it considers 'responsible,' it gives a list of references to guidelines such as the BSAVA Protect initiative¹², and the European Union's action plans on antimicrobial resistance¹³.

The tensions created by asking medical professionals to fulfil both the traditional role of a doctor and being gatekeepers of finite resources have been discussed in the medical ethics literature (Tilburt, 2014a), with some authors arguing that such demands are 'ethically untenable' (Weinstein, 2001, p.268) and should not be placed on

¹² <https://www.bsava.com/Resources/Veterinary-resources/PROTECT-ME> (accessed 14/06/2021)

¹³ http://europa.eu/rapid/press-release_IP-11-1359_en.htm (accessed 14/06/2021)

the shoulders of individual clinicians. It has been suggested that asking patients to sign a written declaration stating they understand the societal consequences of their treatment decisions –when they diverge from public health guidelines— could be a way forward (Graber and Tansey, 2005). On a wider scale, public health concerns can create complex situations, sometimes even conflicting with individuals’ human rights; consequently and as public health issues evolve laws should be reviewed appropriately (Harris and Martin, 2004). More on this topic is discussed in chapter 8.

Beyond the question of antimicrobial stewardship, many interviewees mentioned their professional authority and expertise to explain what decisions clients should –in their opinion— be allowed to make.

I think that [clients] definitely need to be able to make an informed choice, but they shouldn't actually be able to do your job for you. It's your job to educate them what is best for their animal because you are the one that is, you know, you have done your degree at the end of the day and are qualified to do so. (Veterinary Surgeon 4)

Interestingly, veterinarians also expressed frustration with some clients at the perceived lack of respect for their professional expertise (more on this concept in Chapter 7). A number of professions have experienced a loss of prestige in the public eye over the past few decades (Hargreaves, 2009), often concurrent to and possibly in part due to a feminisation of their ranks, including in veterinary medicine (Irvine and Vermilya, 2010). Professional prestige of veterinarians is a complex feature of their role both within the clinic (Hamilton, 2013) and within society as a whole (more on this in Chapter 8). Some interviewees explained that the current societal standing of the profession made communication with clients more challenging.

I think there's a lot of uneducated clients that think they know best out there, there's a lot of breeders that you know, the clients come in and want what the breeders have said rather than what the vets have said, so I think generally the profession as a whole needs to be promoted I think. (Veterinary Surgeon 13)

Some veterinarians contrasted this perceived loss of prestige with a past when veterinarians were more highly regarded and trusted. Easy access to unfiltered and potentially inaccurate information thanks to modern technology was also mentioned as making veterinarians’ job more difficult.

I mean I loved the days where vets were upon a pedestal and everyone believed exactly what we said and there was no internet, and they'd come in and you'd go 'pills' and they'd go home and give the pills, but yeah that doesn't exist anymore thanks to Google. (Veterinary Surgeon 2)

Easy access to the internet has changed the dynamic of communication between clinicians and their patients (Hesse et al., 2005) (or clients in the case of veterinarians), making information about medical topics more readily available and the first point of call for many people. The quality of the information available is, however, varied and in many cases poor, misleading or even unsafe (Eysenbach et al., 2002). Many sources will also use jargon and complex language beyond what has been recommended to communicate with lay members of the public, leading to potential misunderstandings (Hutchinson et al., 2016). The use of internet resources and how they influence communication and relationship between clients and veterinarians is well recognised (Hobson-West and Jutel,

2020). Unsurprisingly, this has led to new challenges for veterinarians with clients attempting to diagnose their pets' issues and making assumptions regarding treatment, particularly when it comes to antimicrobials.

There's quite a lot of people that come in and they say, they've been reading on the internet and diagnosed it and come in and say 'I need some antibiotics for it.' (Veterinary Surgeon 15)

People look on the internet and they know what's wrong and they know what the animal needs, and again you amaze them by actually saying 'no it's not'. (laughs) (Veterinary Surgeon 13)

These quotes mirror findings from the human medical literature that modern access to online information should be accompanied by enhanced communication between clinicians and their patients / clients, as well as directing them towards trustworthy, easy to access resources (Silver, 2015).

Based on analysis of the quotes highlighted above, veterinarians seem to base their decision-making process regarding antimicrobial prescription on their professional judgement, and many emphasise their expertise and authority in order to justify keeping decisions about antimicrobials out of the client's hands. This reported lack of client involvement in decision-making of antimicrobial prescribing might be seen as problematic, however, as medical literature suggests that patient engagement with stewardship programmes may be important in improving antimicrobial use (Heid et al., 2016; Rawson et al., 2016). That is not to say, of course, that veterinary clients do not play an active –although less well-defined role—in antimicrobial prescription decisions in practice. As will now be discussed in detail, ensuring client satisfaction is an essential part of good veterinary practice and influences how veterinarians fulfil their role.

6.3. Antimicrobial prescription and stewardship as influenced by clients' individual behaviours and views

As discussed in Chapter 5, clients are an omnipresent part of companion animal practice work. Importantly, the majority of the ethical dilemmas encountered by veterinarians in practice (e.g. human killing of healthy animals, financial limitations, extended treatment in grave prognosis cases, etc) stem from client's demands or circumstances (Morgan and McDonald, 2007). In turn, these are a major source of stress for vets (Bartram and Baldwin, 2010; Batchelor and McKeegan, 2012). Antimicrobial prescription can be a particularly challenging process, potentially bringing into conflict, not only public health and individual patient's interests, but also client's wishes. This section focuses on the importance of client satisfaction in veterinary practice, but also the heterogeneous and individual nature of veterinary clients and how this influences how veterinarians' practice, especially when prescribing antimicrobials.

6.3.1. Client satisfaction and antimicrobial prescription

Veterinary practices are businesses that must provide a good service to their clients in order to be successful. As discussed previously, conflicts with clients are also a major source of stress for veterinarians in practice (Batchelor and McKeegan, 2012). As such, it is unsurprising that in some cases, interviewees recognised that they might be influenced by clients when prescribing antimicrobials.

I think generally, there's a subset of vets who are very client-pleasing, and like to have happy clients, and don't like clients to be upset, and feel like sometimes drug choices are more designed for client happiness than... clinical appropriateness. That's a way to put it. (Veterinary Surgeon 8)

If they really push [for antibiotics], it depends what kind of clients they are. If they're half decent, I probably push back and say 'you know, no. I'm the vet. I make the decisions.' If they really litigious and horrible, then probably give in to them, just to keep the peace. (Veterinary Surgeon 24)

It is interesting to note that here the veterinarian points out that some clients may be more problematic to deal with than others. Although not directly asked during the research interviews, other studies define problematic clients as being 'annoyingly ignorant, inattentive, demanding and apparently neglectful of their pets' physical condition' and 'clients who are seen as emotionally over-involved with their animals, or display an overriding concern for the financial aspects of the service encounter as opposed to their animals' medical welfare' (Sanders, 1994a, p.160). Aggressive clients can also be a source of conflict and stress in companion animal practice (Barbonis and Endenburg, 2007). Interestingly, as referred to above, knowledgeable owners are also seen as being challenging clients (Chitty, 2006).

The notion of prescribing antimicrobials to try and avoid confrontation with clients and consequent stress—'keeping the peace' as the previous interviewee put it—and added work for the veterinarian was raised in other interviews as well. Here the veterinarian recognises that their own emotional state may play a role in whether they would agree to prescribe antimicrobials or not.

If [clients]'re going to be aggressive about it, or really want to cause me a problem, or write a complaint to which I'm going to have to start writing statements and this and that and the other. Or if I'm tired, or there're several other things going on, there is unfortunately a point where I might cave and just go 'oh well, it's not going to do... on a small scale, this antibiotic shot is probably not going to help this dog, but it's not going to harm it either, so I'm just going to give it for a quiet life.' I'd like to think that I wouldn't do that, but if the client was going to become so difficult that it was going to cause a real issue and a complaint, then potentially I might. (Veterinary Surgeon 23)

Interestingly, here the veterinarian recognises that giving in and prescribing antibiotics to please the client is the 'wrong' course of action, but actively minimises the importance of a single antibiotic injection. This correlation between antimicrobial prescription and stress avoidance is noteworthy as it adds to the well-recognised sources of stress mentioned earlier. Indeed, it has been suggested that contemporary veterinary practice increasingly presents new challenges veterinarians may be ill-equipped to face (Armitage-Chan et al., 2016).

They don't demand. They say 'oh I think it needs an antibiotic'. And then it's up to the vet to have the strength and the courage to say to them 'I don't think it does. And I think you should do this...' (Veterinary Surgeon 24)

They've had the problem before and antibiotics have helped, the breeder has told them that that's what they need, a friend has told them that's what they need, the internet has told them that's what they need,

so you've got to stand your ground and I think you've got to believe that you're the professional and you've got to back your judgement rather than being swayed by what they say, it's not always easy, it's sometimes very difficult. (Veterinary Surgeon 11)

As illustrated by these quotes, the language used by veterinarians while talking about refusing clients' requests (explicit or not) for antimicrobials reinforces the idea of direct or indirect conflict with clients' wishes as being stressful, e.g. 'courage,' 'very difficult,' etc. This echoes the findings of another study among farm veterinarians in the Netherlands who also recognised that refusing farmers' demands for antimicrobial prescription was difficult and uncomfortable (Speksnijder et al., 2015b). Maintaining good relationships with patients has also been shown to influence antimicrobial prescribing in human medicine (Butler et al., 1998).

6.3.2. Antimicrobial prescription and veterinary clients' views and attitudes

Although the interviewees had a wide range of opinions regarding clients' propensity for explicitly requesting antimicrobials, they overall agreed that clients were usually satisfied when their pet was prescribed antimicrobials. Similarly, a tendency to overestimate the usefulness of antimicrobials has also been demonstrated among parents in human medicine (Coxeter et al., 2017). Clients' positive opinion of antimicrobials came up several times during interviews.

I still think that most owners... like most people who go to the doctor with the flu... think that the antibiotics are the be all and end all and that it will cure the animal (Veterinary Surgeon 24)

I also tend to find that when you say you're going to give something antibiotics there's no argument, they're fine with that, I don't think I've ever had somebody say to me 'I don't want antibiotics' when you say you're going to give them, so I'd say it's far easier to convince them to have them than it is to convince them not to have them. (Veterinary Surgeon 7)

This perception of antimicrobial prescription being well received by clients is an important point. Indeed, although similar work has not yet been carried out in the veterinary setting, human doctors have been shown to overestimate their patients' desire for antimicrobials (Altiner, 2004), and in turn this perception has an influence on the likelihood of antimicrobials being prescribed (Coenen et al., 2006). In the study by Altiner, most patients were keener on improved communication and reassurance from their doctor. The conclusion was that 'the (over) prescription of antibiotics might not be a question of knowledge but a lack of patient centredness' (p.500). Interestingly, this was echoed in the veterinarians' interviews as a feature of busy practice rather than an unwillingness to communicate with the clients on the veterinarian's part.

Lots of vets I meet complain about not being able to do their job effectively, because you've got a list of clients going out the door, you've got ten minutes appointments backed up. Erhm... it's difficult to explain to someone why you're using this and what's an appropriate thing to do and what the next step would be, when you've got ten minutes to diagnose the problem, come up with a treatment solution and go onto the next person. Erhm... so yes, it is a bit of a culture issue in the profession, I think. (Veterinary surgeon 8)

It should be noted that explanations other than lack of patient centredness have been put forward when considering antimicrobial prescription (or over-prescription) by GPs; for example, that it is a way for the physician to prioritise their patients' immediate needs (Cope et al., 2015), an argument reminiscent of the themes discussed in chapter 5 and the concept of 'moral distance' (see section 5 of chapter 2).

Beyond, clients simply being seen as 'difficult,' interviewees explained that older clients and / or clients whose pets had been readily given antimicrobials before were more likely to ask for them again.

I think you've got a generational difference with clients because I don't ever seem to have an issue with younger clients wanting antibiotics. They always just do with or without depending on what I say. Whereas the older ones who are probably used to being able to get a jab whenever they wanted would be more keen to just, you know, last time I got a jab and it worked. Why can't I have that this time? (Veterinary Surgeon 19)

But then the clients would come in and say that [...] 'in the olden days we would have just had some antibiotics and that would have been that', and it's like 'yeah but I can't do that anymore' you know, that's not how it works because we're more educated, but it doesn't always ring true with clients, that's the trouble (Veterinary Surgeon 13)

Some veterinarians explained that they tried to side-step the issue by not explicitly stating to the client that they were not using an antimicrobial. While such an omission can be an understandable attempt at avoiding conflict and client's dissatisfaction, it raises ethical issues regarding trust between the clinician and the client and the vet's responsibility to obtain informed consent (Fettman and Rollin, 2002).

If [clients] know that it's not an antibiotic, they will be like they are not happy and want to see someone else. So, if you say this will resolve the diarrhoea, I think you get a lot better reception.

Interviewer: So it's almost like you're not hiding from them, but you try not to insist.

No, I won't say it's not an antibiotic because immediately they say 'come on.' I say this will help bind them and I think that works quite nicely. (Veterinary Surgeon 9)

Doctors have also been shown to worry that their patients might be dissatisfied or would want to find a new physician if their prescription expectations were not met, although this assumption was not supported by studies involving patients (Himmel et al., 1997).

Another complicating factor veterinarians have to consider while trying to ensure that clients are satisfied by the service they provide is that their wishes and expectations for information vary greatly.

Sometimes I find that [clients] aren't that interested in understanding what's going on, and sometimes people just say to me 'what do you think we should do? Do that', whereas then other clients will be wanting to know absolutely everything so I think it depends partly on the client's inclination and how interested they are to be informed, and maybe partly on how able the client is to try and understand what's going

on, and I try and explain things as simply or in as much detail as is needed or it seems the client wants.
(Veterinary Surgeon 10)

Again this echoes current literature that questions whether the ideal of informed consent and shared decision-making (Fettman and Rollin, 2002; del Carmen and Joffe, 2005) is truly achievable – or even desirable – in clinical practice. In both human and veterinary medicine, patients and clients have been shown to not fully understand the consent process, and in some cases, to find it frightening (Akkad et al., 2006; Whiting et al., 2017). Excessive information being provided can lead to difficulties making decisions (Levy, 2014) or even an increased incidence of side effects (Wells and Kaptchuk, 2012). Veterinary ethics literature also recognises that it is neither realistic nor desirable to present all possible treatment options to clients (Main, 2006). There are many aspects to informed consent to consider in modern veterinary practice (Fettman and Rollin, 2002), but it is important to recognise that clients' expectations and desire for information may vary (Christiansen et al., 2016), as highlighted in the quote above, and may not necessarily conform to what the veterinarian expects (Milani, 2008). This has also been demonstrated to be the case with human patients (Degerliyurt et al., 2010).

Despite those difficulties, client education was presented by interviewees as having an important role in improving antimicrobial stewardship. Here, the veterinarian equates informed consent with explaining the intricacies of treating different diarrhoea cases:

I think some places you don't get good informed consent, sort of people don't explain why they're using what they're using.

Interviewer: You mean vets, yeah?

Hm (positive hum). So people don't understand... You know, sort of using antibiotics for diarrhoea where you've got massive amounts of blood, a poorly dog and a temperature. If you don't explain why antibiotics are appropriate in that case, and not appropriate to the small intestinal diarrhoea in a well dog with no temperature who's bouncing all over the room perfectly happy, they don't understand. They just know that last time they got antibiotics for the diarrhoea when the dog was really sick, and now the dog's got diarrhoea again so clearly it needs antibiotics to stop it being really sick. (Veterinary Surgeon 8)

Explaining complex and sensitive issues to a varied population of clients is a recognised challenge in veterinary practice (Jackson and Gray, 2004), and vets have been shown to use a range of communication techniques and various types of partnerships with clients, based on individual preferences and circumstances (Cornell and Kopcha, 2007). Communication tools such as visual aids have also been suggested as helpful (Kishimoto et al., 2009).

All interviewees agreed that clients had heard about antimicrobial resistance if the topic came up, although how much they understood about it was debatable. Despite this awareness, veterinarians reported that most clients readily seem to accept antimicrobial prescriptions without concern.

The majority nod at you as if they've heard of [antimicrobial resistance] and sort of look convincing, whether they quite understand the degree of the problem and that it really is a serious thing I'm not entirely sure. (Veterinary Surgeon 7)

A few anecdotes of clients questioning why antimicrobials were given came out of the interviews, but such instances were rare.

The practice next door has just closed down and I saw a cat with diarrhoea which they treated with some amoxiclav and the lady said 'the cat is no better, why did they give it antibiotics?', and I looked through the notes and I was not able to explain why, and she was furious because she said 'I wouldn't take antibiotics myself if I didn't need it so why have they given the cat antibiotics?' (Veterinary Surgeon 11)

Interviewees also emphasised the need to give some kind of treatment to their patient for the benefit of the client even if they felt the problem would self-resolve without it.

My first boss told me 'you've got to say something, do something and give something', so my giving is often a Vitamin B injection because it makes them feel that they've had something, something that's not going to do any harm. [...] So I think sort of the probiotics, even though I'm not convinced, there's not much evidence to say if they work or not, it is something that they can have and they feel like they've got something, so I tend to go down that route a lot. (Veterinary Surgeon 13)

This willingness to prescribe or administer a treatment to an animal in order to ensure client satisfaction may seem surprising, but it echoes once again medical studies. A survey of GPs in the UK showed that 97% had prescribed a placebo treatment or intervention (Howick et al., 2013). The use of 'impure' placebos (treatment effective for certain conditions but whose efficacy is unknown when used as a placebo) is very relevant to the fight against antimicrobial resistance (Fassler et al., 2010), as antibiotics are still often used for infections that are likely to be viral in origin (Steinman et al., 2003).

In summary, veterinarians pointed out that they dealt with a wide range of clients with different levels of knowledge and backgrounds and that this influenced their treatment and prescription decisions. Overall, however, there was a perception that even if clients did not explicitly ask for antibiotic treatment, they were most often happy for their pet to receive it. Client satisfaction is important in practice to ensure the continued business relationship between vet and client (Hobson-West and Jutel, 2020), but also as a way to minimise stressful situations for the veterinarians themselves. These considerations were acknowledged as being part—in some circumstances—of the complex decision-making process while prescribing antimicrobials. Individual variations in personality and values both in vets and in clients affected this process as well, emphasising that neither veterinarians themselves, nor veterinary clients are homogeneous populations with similar values, attitudes and beliefs.

Beyond consent and communication, client's influence on treatment decisions in private companion animal practice has also a major financial component as will now be discussed.

6.4. Antimicrobial prescription and stewardship: the role of client's financial means in practice

Clients' ability to pay veterinary costs is an unescapable feature of practice that dictates the treatment options available to the patient. Unsurprisingly, being unable to pursue the course of action veterinarians deem best for the animal can be frustrating and stressful and create conflict with the clients (Morgan, 2009; Batchelor and McKeegan, 2012; Morris, 2012a). In a first part, this section explores the influence of the various socio-economic context veterinary practices exist in. In a second part, it focuses on individual clients' circumstances and how they may affect specific clinical decisions.

6.4.1. The socio-economic influence of the veterinary clientele

Interviewees frequently mentioned clients' financial situation as playing an important role in treatment decisions. In particular, they recognised that different veterinary practices existed in varied socio-economic contexts. Affluent areas were seen as easier to work in. Talking to clients about money is often seen as one of the most awkward parts of the job (Klingborg and Klingborg, 2007), and this was reflected in the interviewees' statements:

We've got the luxury of being in quite a nice well-off area and people will spend, whereas some people you know, it's a struggle to get the client in, let alone... (Veterinary surgeon 13)

By contrast, another veterinarian—reflecting on a previous job—recognised that financial concerns had important consequences on how difficult their work was and what treatment options they were able to provide their patient with.

It wasn't a very affluent area but people expected a lot. They expected you to do everything for their pet but they didn't really feel they should pay for it, so you were constantly in difficult positions with clients where you were having to have conflicts about well, if you want this, you have to pay for it or else we can do this as an alternative, but they didn't want the lesser alternative. I found that, that was my hardest time. (Veterinary surgeon 5)

What the best and most ethical course of action when faced with treatment limited by client's financial means is a hotly debated question in the veterinary ethics literature (Tannenbaum, 1995; Main, 2006; Morris, 2012a). Perhaps unsurprisingly, an interviewed veterinarian working for a charity practice explained that clients not having to pay for veterinary care made treatment and diagnostic decisions easier:

*I think the slight advantage we've got here is that people on the whole don't pay for the treatment. Because I think that's often a big factor in private [...] Whereas often here we'll do treatments and diagnostics that **we** (emphasis) think are appropriate, because we can do really, to an extent, really what we want. We've got some constraints on the budget and the way round we do things, but we tend to... Often we'll give them the options but we've really got an idea of what we think is the most sensible... I find if you portray it as the best thing for the animal, normally they'll agree with you. (Veterinary Surgeon 16)*

When it came to antimicrobial prescription, this difference between private and charity practice was also relevant, although in a different way. A vet who had worked in a charity practice in the past but was now working in a private clinic pointed out:

What's interesting is that we had initially amoxicillin on the shelf, erm... but we don't have that anymore. Our first-line now tends to be amoxy-clav which interestingly, that's something that again, is different from charitable practice where we use a lot of amoxicillin. And you do wonder... We started with it on the shelf but I think because, in your head, there's this pressure that, you know, people paying, we want to make them better. Oh we'll just give it amoxy-clav instead of amoxicillin 'cause it's got that slightly broader cover. (Veterinary Surgeon 12)

Antimicrobial stewardship guidelines encourage clinicians to use narrow-spectrum antibiotics rather than broad-spectrum ones. Therefore amoxicillin-clavulanate would be considered a less appropriate first-line antibiotic than amoxicillin on its own; yet, the veterinarian here recognises feeling pressured by the fact that clients are paying for their services and therefore will reach out for the broader antibiotic cover that will be effective—and therefore also promote resistance—in more numerous bacterial populations. In a similar way, GPs have been shown to be more likely to dispense antimicrobials if patients were paying for their care (Murphy et al., 2011). All interviewees reported using amoxicillin-clavulanate as their first line antibiotic, echoing published literature (Radford et al., 2011; Mateus et al., 2014; Singleton et al., 2017). Penicillins as a whole are classed by the World Health Organisation as 'critically important' mostly due to their ubiquitous use in human medicine and the fact that in some geographical settings, penicillins may be the only or one of the few therapies available (World Health Organisation, 2016, p.16). Alongside the global efforts to curb overuse of antimicrobials, it should be remembered that access to life-saving antibiotic treatment is still suboptimal in some parts of the world (Littmann et al., 2015; Laxminarayan et al., 2016).

This sub-section highlighted how different practices were affected by the socio-economic background of their clients. Unsurprisingly, individual clients' means and circumstances also play an essential role during the provision of veterinary services.

6.4.2. Client's finances and the value of veterinary service

Competition between veterinary practices based on prices was perceived by some of the interviewed vets as having become fiercer in recent years, in part due to the increased ease with which clients could compare prices and opinions thanks to the internet and social media.

I think we're deluding ourselves if we say money isn't a factor nowadays. [...] I think people were always worried about money but I think where you have to be careful nowadays as before people really couldn't check and compare, but now we have this social media and the internet; [...] it's much, much more important, you have to be seen to be providing value for money. (Veterinary Surgeon 25)

Interestingly, however, veterinarians saw financial considerations very differently when it came to impeding or helping them carrying out investigations. For example, this interviewee emphasised why the gold standard of carrying culture and sensitivity testing of infections was often difficult to go for, at least in first instance:

I mean not everybody can afford gold standard. [...] 'Let's do some bloods today and some swabs, and this, that and the other' and 'how much is it going to be?' 'oh three hundred quid,' 'oh I can't afford that, and can we not try something?' And... empirical use, we do kind of use antibiotics empirically as well at times, as well. [...] There's not always a harm in doing it, because you know you're ultimately going to do that anyway. (Veterinary Surgeon 18)

As is obvious from this quote, the veterinarian did not believe that culture and sensitivity was likely to change the antimicrobial choice in most cases and therefore felt empirical use and choice of antimicrobials was appropriate. Clients' financial means prohibiting diagnostic tests and encouraging empirical antimicrobial use have been shown to be a barrier to improving antimicrobial stewardship in all sectors of veterinary medicine: companion animals (Mateus et al., 2014), equine practice (Hughes et al., 2013) and farm animals (Speksnijder et al., 2015b). Diagnostic testing was not always seen as being a financial burden, however. In contrast with the previous quote, in a case not responding to treatment, another veterinarian described using the financial dimension of different options to convince the client not to choose to simply repeat antibiotic administration:

You know a lot of times you'll see a cat bite abscess which has been given some [cefovecin] and it hasn't got any better, and you've got a choice; do you repeat the [cefovecin] injection, do you try with some tablets or a syrup, or do you actually think perhaps the best thing to do would be to get the cat in, sedate it, flush the abscess out, open it all up and let it drain a bit better, because that's often better than giving any antibiotics at all, and then you can explain to the client 'look I can either do that which will be £200.00, or I can give you another [cefovecin] injection which is probably going to work out to be £30.00 anyway but it might not work, you might as well maybe just have the £200.00 and get it all sorted'. (Veterinary Surgeon 11)

In conclusion, it is impossible to argue that clients' finances are not an important factor in clinical decision-making in practice, including when it comes to antimicrobial prescription. Veterinarians can be both sympathetic to and frustrated by the limitations this creates when caring for their patients. The role of finances is complex in the case of antimicrobial prescription in that investigations and prescription can both be presented as money-saving or costly, especially in complex clinical cases. This also depends on how the veterinarian approaches the case and presents the facts to their client; individual veterinarians may therefore have different experiences and come to different conclusions when treating similar cases. How veterinarians should handle cases where owners have very limited financial means, however, is unclear beyond the obligation to relieve pain and suffering (sometimes by carrying out euthanasia) (Royal College of Veterinary Surgeons, 2012, p.23).

6.5. Conclusion

This chapter has highlighted the complex dynamics that make up the essential relationship between veterinarians and their clients. Unsurprisingly, depending on personal and professional circumstances, this relationship can be both a source of stress (Batchelor and McKeegan, 2012) and a rewarding part of the veterinarian's role. Decision-making regarding antimicrobial prescription was seen as being the remit of the veterinary surgeon and used to emphasise their authority and expertise. This is important as it can be argued that this authority has been threatened in recent years by factors such as the feminisation of the veterinary profession—particularly notable in companion animal practice (Irvine and Vermilya, 2010). Others have also argued 'vets often turn [...] unrealistic ideals of expertise back in on themselves, thus generating doubt and insecurity for any failure in their practices' (Clarke and Knights, 2018, p.1395). This might explain why, as will be discussed further in the next chapter, professional experiences, especially if a case has a bad or difficult outcome, may have a strong influence on individual veterinarian's decision-making process. Armitage-Chan et al. (2016) showed that despite the 'identity of the veterinary surgeon as an infallible expert' (p.322), veterinarians were critical of mistakes and errors and demonstrated poor ability to cope with them.

In the context of antimicrobial stewardship, gaining informed consent from owners was seen as difficult, as veterinarians overall did not believe that clients should decide whether antimicrobial prescription was appropriate or not. As such, withholding antimicrobial treatment was seen as a potential source of conflict that veterinarians often wished to avoid or bypass.

Veterinarians also recognised that the need to ensure client satisfaction with their services—both for the success of the business and to reduce stress and conflict—was an important consideration when prescribing antibiotics. To which degree and in what respect depended on the individual circumstances and relationship between vet and client, once again emphasising the breadth of values, attitudes and beliefs existing in modern companion animal practice, reflecting literature focusing on other sectors of veterinary work (De Graaf, 2005; Speksnijder et al., 2015b). The perceived pressure experienced from clients to prescribe antimicrobials varied widely between veterinarians. Some recognised that time-pressure or mood could affect their decisions as well. This is important as, for example, time pressure has been recognised in human medicine as leading to a lack of communication between GPs and their patients and an over-estimation of the patients' desire for antimicrobial prescription (Altiner, 2004).

Finally, the financial means of the client (or in some cases of charity funding) had to be considered when making treatment decisions, including antimicrobial prescription. In some cases, financial limitations meant that gold standard diagnostics could not be carried out, supporting existing literature (Hobson-West and Jutel, 2020), and / or prudent use guidelines could not be followed. In some cases, the fact that clients paid for veterinary services was also more likely to lead to antimicrobial prescription as a whole, or to prescription of antimicrobials with a wider spectrum, echoing findings from the human medical literature (Murphy et al., 2011). How to best minimise deviance from guidelines in this context while preserving the patient's health and welfare, as well as providing the client with the professional guidance they are seeking is unclear. This chapter highlighted that the ethical tension

existing between 'fidelity (caring for patients) and stewardship (rationing resources)' (Ellis, 1999, p.940) in human medicine, as discussed in the previous chapter, is complicated further in veterinary medicine by the fundamental triangular relationship between the veterinarian, their animal patient and their human client. Indeed, fidelity in this context is a source of ethical conflicts by itself, as the veterinarian has a duty not only to their patient but to their client as well (Rollin, 2006a).

Chapter 7 investigates further the notion of veterinary expertise as well as the role of evidence-based medicine in modern companion animal practice. Client and animal compliance are other important aspects of antimicrobial stewardship that are examined in this next chapter as well.

Chapter 7—Veterinarians and the generation of knowledge: the role of experience and evidence in clinical decision-making

7.1. Introduction

As explored in the previous empirical chapters, clinical decision-making in practice is a complex process that must take into account and combine the weight of many factors including patient's welfare and client's beliefs and financial means (De Graaf, 2005). It is not the prerogative of the veterinarian alone but a shared decision-making process with the client (Cornell and Kopcha, 2007; Christiansen et al., 2016), relying on the concept of informed consent (see Chapter 6 for more details). The range of treatment options deemed appropriate and discussed during a consultation, however, requires clinical knowledge and judgement on the part of the veterinarian and is at the core of the expertise made available by veterinary practices. As put by Cockcroft (2007, p.499), 'optimal decision making requires veterinarians to identify all possible strategies, accurately predict the probability of future events, and balance the risks and benefits of each possible action in consultation with the client'. This holds true when considering the appropriateness of antimicrobial prescription and the promotion of good antimicrobial stewardship. Indeed, chapter 5 has highlighted how veterinarians often admitted being reluctant to withhold antimicrobial treatment if they believe it could lead to a worsening of a patient's condition; a finding reminiscent to existing literature investigating similar views among human physicians (Broom et al., 2014). By highlighting the uncertainty and complexity inherent to many a clinical decision, such findings also contrast with some of the published literature focused on companion animal vets that simplify antimicrobial prescription behaviour into binary 'appropriate' versus 'inappropriate' categories (King et al., 2018). Veterinarians' knowledge and clinical judgement is therefore at the core of their handling of antimicrobials. Consequently, this chapter analyses interview data to explore the role of veterinarians not only as expert holders of specialised knowledge, but also their roles in constructing and generating veterinary medical knowledge, as well as their relationship to published evidence and to the concept of evidence-based veterinary medicine (EBVM).

It should be noted that this chapter does not focus on the topic of expertise versus lay knowledge. This is touched upon in chapter 8 that explores the role of veterinarian in society, and its implications regarding public health.

In the first part of this chapter, professional experience as an essential part of modern veterinary expertise—including when prescribing antimicrobials—is highlighted, as are the pitfalls and strengths of relying on individual experience while making expert clinical decisions. Secondly, EBVM is shown as being a desirable and longed for professional ideal in veterinary medicine; yet, in turn, the reality of EBVM, especially while compared to the quality and quantity of resources available in human evidence-based medicine (EBM), constrains those wishes. Practical aspects of using EBVM in companion animal practice are discussed, particularly the sources of knowledge sought by veterinarians as well as how the evidence they gathered is used clinically, notably when prescribing antimicrobials. This is also contrasted with similar published research data from human physicians to help highlight the specific issues that arise in companion animal veterinary practice when implementing and promoting good antimicrobial stewardship.

The last two parts of the chapter focus more closely on the clinical aspects of AMR and antimicrobial stewardship that are uniquely challenging. First, veterinarians' knowledge and opinions of stewardship guidelines, as well as more generally of antimicrobials, antimicrobial stewardship and resistance are detailed. Finally, the nature of stewardship as promoting 'prudent use' and being based on precautionary principles is explored, in particular how this approach might influence veterinarians' beliefs and willingness to follow recommendations.

As in previous analyses, this chapter uses a breadth of medical and veterinary literature from various fields, to explore the complex aspects of the appropriateness of antimicrobial prescription as a clinical judgement based on professional expertise and experience.

7.2. Expertise and experience at the core of practice

Promoting antimicrobial stewardship in practice requires clinicians to review and modify the way they practice veterinary medicine (Currie et al., 2018). As highlighted in chapter 5 and 6, relational tensions between the veterinarian and both the patient and the client can be one barrier to implementing changes in antimicrobial prescription if the clinician believes such changes to be a risk to the patient or to potentially lead to client dissatisfaction. While these aspects of antimicrobial prescription are important and must be taken into account, drug prescription is by its very nature a clinical decision and it is therefore essential to understand how veterinarians' clinical judgement is formed and potentially influenced. This first section explores the role that the veterinarian's experience plays in generating knowledge in modern companion animal practice, but also the potential strength and pitfalls associated with relying on clinical experience and what influences it might have on antimicrobial prescription and stewardship.

7.2.1. Generation of knowledge in practice: creating expertise through experience

As outlined in chapter 5, interviewed veterinarians emphasised that many factors have to be taken into account while making clinical decisions and as a consequence every case and patient have unique aspects to them that influence the clinician's decisions. This remark echoes similar findings in medical literature (Ginsburg et al., 2012). Medical care has been described as the 'art of making decisions without adequate information' (Sox et al., 1988, p.17), a sentiment that was echoed in interviews.

*You are acting a lot of the time on incomplete information. Our job acts on incomplete information.
(Veterinary Surgeon 1)*

Information is especially lacking in veterinary medical care; the amount of research and evidence available to clinicians is small compared to human medical literature (Vandeweerd et al., 2012b), and often of poor quality (Di Girolamo and Reynders, 2016). Considering these limitations, it is unsurprising that experience alongside scientific knowledge was described by veterinarians as an essential part of veterinary medical practice.

That's why they call it the art rather than the science, isn't it? It's because it's partly based on science and partly based on intuition and what's worked before. [...] So it's one of those ones where I think experience makes a lot of difference. (Veterinary Surgeon 8)

And perhaps unsurprisingly as well, lack of experience—for example in the case of recent graduates—was seen as leading to defensive prescribing, particularly where antimicrobials were concerned, echoing the fact that in doubt most interviewees felt antimicrobials are unlikely to do harm and might benefit the patient as highlighted in chapter 5.

I mean I think as a new grad, I remember, pretty much everything had a non-steroidal and an antibiotic and that's just how it was. [...] I think new graduates are a bit scared of things not going right, and they will just reach for the antibiotics. (Veterinary Surgeon 13)

While it is likely that differences exist between individual new graduates, clinical reasoning and decision-making has been shown to be one of the main challenges faced by the inexperienced veterinarian (Dixon et al., 2017). Young veterinarians have also been shown to suffer on average from higher levels of occupational stress (Dawson and Thompson, 2017). Considering the concerns raised by veterinarians—some with many years of experience—in chapter 5 about the perceived risks of withholding antimicrobial prescription from a patient, it is likely that the principles of antimicrobial stewardship are regarded differently by individual veterinarians, depending on their experience and self-confidence. In human medicine, clinical experience has been shown to make physicians more likely to adopt a restrictive approach to antimicrobial prescription, but also to lessen the perceived relevance of national guidelines (Skodvin et al., 2015). It should be noted, however, that antimicrobial guidelines in human medicine are usually much more detailed and prescriptive than those available to veterinarians.

Interestingly, experience was not described by interviewees as a linear process expanding over time. It required the veterinarian to be reflective and learn judiciously from case outcomes.

So it's again, kind of having more discussion with regards to, could we have changed anything? How can we learn from that experience? And it's a case as well of, just because it's happened once it doesn't necessarily mean we have to change every single rule in the rulebook. (Veterinary Surgeon 14)

This reflects the RCVS guidance on 'Clinical Governance,' a concept taken from human medicine and in particular the modern National Health Service in the UK (Scally and Donaldson, 1998), and defined in the Professional Code of Conduct for Veterinary Surgeons as 'a continuing process of reflection, analysis and improvement in professional practice for the benefit of the animal patient and the client owner' (Royal College of Veterinary Surgeons, 2012, p.50). The Code then details many aspects of Clinical Governance including continuous professional development (CPD) and the duty to stay up to date with new developments relevant to the individual veterinarian's work, but also the need to be reflective of the veterinarian's own performance and of unexpected events and outcomes, and to change professional behaviours and decisions accordingly.

As seen in the quote above (Veterinary Surgeon 14), interviewed veterinary surgeons often emphasised the need to reflect and learn from cases. This process, however, was perceived as stressful, especially when the veterinarian had to change their clinical habits in an effort to improve practice. For example here, an interviewee remembers their worry when they first complied with recommendations and stopped giving prophylactic antibiotics to routine neutering cases:

*You know, the first time I thought... 'oh *deep breath* I didn't give antibiotics to this dog... dear god... don't get a post-op infection,' that kind of thing. But actually, as soon as the first couple came back and they were fine, I felt a bit more empowered to say 'No. This is right.'* (Veterinary Surgeon 23)

This quote illustrates how reflecting on a small number of cases at one defined point in time in the veterinary surgeon's career can influence their opinion of a particular clinical path. It also shows the emotional and stressful dimension of taking a course of action the veterinarian is unsure about (Clarke and Knights, 2018). This is of particular relevance when considering prescription of antimicrobials as treatment is usually considered safe and of little risk to the patient (see chapter 5).

Considering the importance of individual experience and expertise highlighted in this section, a few questions are now raised. What are the downsides of frequently relying on individual experience? How do veterinarians handle situations where they judge their own experience and expertise to be inadequate? And, of course, what influence do the answers to these two questions have on antimicrobial prescription and stewardship?

7.2.2. Pitfalls and strengths of relying on individual experience and expertise

Despite reflectiveness being an important part of Clinical Governance according to the RCVS, the process of building experience and clinical judgement through reflection has seldom been studied in practice. There are only a few papers about the concept of Clinical Governance in veterinary practice; at the time of writing, they are mostly concerned with ways of improving clinical work inspired by human medicine, such as the use of checklists (Oxtoby and Mossop, 2016) or clinical audit (Viner, 2010), or the use of evidence in practice (Yeates et al., 2013). Yet, as highlighted in the previous section, clinical experience is an essential building block of clinical decision-making and judgement in companion animal practice. Interviewees were keen on emphasising the value of years of experience and of treating many cases during their career. However, and as will now be explored, they also recognised that relying on personal experience might make them reluctant to change the way they practice veterinary medicine.

It's a case of yeah, progress is great. But what I've been doing for the past fifteen years if it ain't broke don't fix it. You know I've been using this and not had a problem. I've not had any concerns. (Veterinary Surgeon 14)

This approach can be problematic as unnecessary treatment might keep on being given if it is not perceived as having negative consequences for the patient. This is particularly relevant in the case of antimicrobial prescription, both in human medicine with for example the prescription of antimicrobials to treat the common cold (Steinman et al., 2003), or in veterinary medicine with the administration of antimicrobials to dogs with uncomplicated diarrhoea (Maddison and Watson, 2001). On the other hand, other interviewees did recognise the potential issues with clinical habits and saw them as a likely barrier to improving practice.

Some [vets] would be probably more likely to go 'well, this is what I've always done.' [...] I mean if you always seek your own council, then, then... you know... You may not progress. (Veterinary Surgeon 18)

Indeed, in human medicine, some studies have shown that without targeted intervention, prescribing habits were a more accurate predictor of antimicrobial prescription than specific clinical factors (De Sutter et al., 2001), and

relied mostly on training and perception of what was considered a common treatment (Kuehlein et al., 2011). Currie et al. (2018) argued that veterinarians' antibiotic prescription behaviours is one of the most influential factors related to antimicrobial stewardship in practice. Of course, while habits can be problematic, experience is essential to a good clinician: the Evidence-based Medicine Working Group stated that 'clinical experience and the development of clinical instincts (particularly with respect to diagnosis) are a crucial and necessary part of becoming a competent physician' (1992, p.2421). Here, when discussing what factors they used to decide whether to prescribe antimicrobial or not, one veterinarian again emphasised the importance of previous experience with similar cases.

What symptoms is it presenting with, you know. Is it... is this a problem that antibiotics would historically solve? (laugh) [...] Well, I suppose pattern recognition. (Veterinary Surgeon 18)

Pattern recognition has been shown to be an important and useful tool in diagnostic reasoning in human primary care (Heneghan et al., 2009) and veterinary care (Cockcroft, 1998; Cockcroft, 2007). Reliance on pattern recognition while useful can also be problematic, particularly in atypical clinical presentations, leading to potential errors in diagnosis (Goyder et al., 2015). This reliance on pattern recognition was also recognised by interviewees. For example, one veterinarian pointed out that it could lead to making decisions almost on 'autopilot.'

I suppose as a vet, generally speaking you start to do things from experience or almost go on auto-pilot and there are certain cases you feel that it's appropriate to use antibiotics and certain ones that you don't, and I think I just follow that little plan that I have in my head. (Veterinary Surgeon 5)

While this approach may come with obvious pitfalls, decisions in clinical practice cannot all rely on reflective, analytical and abstract reasoning, due to how time consuming and cognitively demanding such an approach is (May, 2013). As demonstrated in analyses of both questionnaires and semi-structured interviews, clinicians will often rely on a more intuitive form of judgement involving the concept of 'pattern recognition' both in veterinary and human medicine (Cockcroft, 1998; Thomson et al., 2014). While both approaches are used by all, the experienced and competent clinician is the one who will be able to adapt their reasoning to the particulars and circumstances of each clinical case. Indeed, a combination of intuitive and reflective approaches is linked to fewer clinical mistakes than either individual strategy (Croskerry and Norman, 2008). This might also explain why excellent and experienced clinicians often struggle to articulate their decision-making process (Epstein, 1999).

Interestingly, and in contrast with the previous quote, interviewees also recognised that the idea of pattern recognition could be helpful when trying to improve how they practice veterinary medicine, allowing them to shape their decision-making process anew to include many cases if needed rather than individual ones.

I think the advantage is that you know, the majority of cases you see in this country, they tend to fit a pattern. I mean, 9 times out of 10, we see cases of you know, that you have seen before. It's just how you, it's what path you go on having seen them again where you go, you know, what direction do you take and I think that's probably the way one needs to alter things. (Veterinary Surgeon 1)

This is an interesting remark as a recent survey about the influence of national antimicrobial stewardship guidelines in Danish companion animal practice has shown that confidence in traditional prescribing practice was one of the main barriers towards implementation of new therapeutic guidelines (Jessen et al., 2017); the study also showed that positive experience with empirical treatment was one of the main barriers to the increased use of culture and sensitivity testing. As stated by the veterinarian in the quote above, in some cases, changing the veterinarian's perception of what the standard treatment for a given pattern should be could have a cascading effect affecting many cases.

Although going into more details about the cognitive theories of clinical decision-making is beyond the scope of this thesis, it should be noted that this is a complex and dynamic process that—particularly in busy environments—can be influenced by environmental and distracting factors (Franklin et al., 2011).

In contrast to learning from and reflecting on the outcomes of—even a small number of—clinically significant cases (see previous section), veterinarians also recognised that the development or outcome of one single case might subsequently influence their clinical decision-making in many other cases, and that while this did not fit well with the idea of EBVM, it was difficult to avoid.

There's always that tendency to use a particular drug because you used it that one time and it did well, which is more of a failing of evidence-based medicine isn't it, but you always are going to think about that case when that happened. (Veterinary Surgeon 2)

This remark is supported by medical studies showing that anecdotal cases can be very influential and memorable (Patel et al., 2015). It should be noted that the same veterinarian quoted above (Veterinary Surgeon 2) also pointed out that changing decision-making or prescribing practice based on a single case—while understandable—could be a pitfall of using experience as a guide, particularly if it conflicted with current scientific evidence.

I can understand people, if they've had a bad experience, then that changes what they do for a hundred patients. But it's just trying to actually stop that from happening, unless there's a reason why you know, if that one case you legitimately did do something wrong and that's supported by the science then yeah great, change what you do, but if it's just a one off... (Veterinary Surgeon 2)

The danger of using anecdotes to make clinical decisions is well recognised; for example, Ratzan (2002) published an editorial entitled 'the plural of anecdotes is not evidence.' Individual case reports—although usually peer-reviewed—rank low in the pyramid of evidence (Vandeweerd et al., 2012b, p.29). As mentioned in the Methods chapter (see chapter 4) however, stories and anecdotes are an important part of how clinicians learn and communicate (Parmley, 1996; Nunn, 2011; Patel et al., 2015). Their value as a source of evidence or a guide to clinical practice is debated, but some authors argue that anecdotes should not be seen as contrasting with evidence-based medicine but instead as complementing it (Kosko et al., 2006). Veterinary literature on the topic is scarce, but human medical literature provides insight into the reality of complementing or guiding EB(V)M by using individual case outcomes (Enkin and Jadad, 1998; Kang, 2010; Lyden et al., 2010). This theme will re-emerge

in the next section examining how EBVM fits into modern companion animal practice and how veterinarians handle and access current knowledge.

In this context, and antimicrobial prescription being a clinical decision, antimicrobial handling and stewardship in companion animal practice is bound to be influenced by all the complex arguments discussed in this section. One key conclusion is that considering how common antimicrobial prescription currently is in companion animal practice (Radford et al., 2011; Singleton et al., 2017), a pattern of prescribing behaviour by individual veterinarians is likely to emerge for common conditions. It is important to recognise that clinical decision-making is not always based on slow, analytical reasoning and that this must be taken into account when formulating antimicrobial stewardship advice. In turn, this might explain the importance of producing local clinical guidelines providing clinicians with empirical first and second line antimicrobial choices for frequent clinical presentations, slotting neatly within a more intuitive approach of those cases (Pulcini and Gyssens, 2013). Indeed, in human medicine, compliance with national or international guidelines, that are usually less well defined in their injunctions compared to local guidelines, has been showed to be generally poor (MacDougall and Polk, 2005). In sections 3 and 4 of this chapter, the nature and specificity of current or wished-for guidelines will be explored further. In conclusion, considering the complexity and general speed of the decision making process in practice, it is likely that clear and prescriptive instructions (e.g. do not use fluoroquinolones without justification from a culture and sensitivity test) will be more easily integrated in veterinarians' prescription patterns than vaguer recommendations (e.g. only use antimicrobials when strictly necessary). This is supported by the data presented here where 20 out of 25 interviewed veterinarians spontaneously mentioned trying not to use fluoroquinolones often in practice. As put by one of them:

It seems to have filtered through that fluoroquinolones should not be used unless, you know, there is a clear indication or a culture or a life-threatening situation. (Veterinary Surgeon 23)

Simple and specific injunctions are therefore important when communicating with veterinarians (and likely with clinicians in general), and more likely to lead to stewardship principles 'filtering through' to the profession. Of course, antimicrobial stewardship guidelines can never be specific enough to apply to all clinical cases or take into account all potential co-morbidities and circumstances (Brown, 2002). It is also important to recognise that veterinarians constantly use their clinical experience (and as we will see in the next section that of their colleagues) when making clinical decisions in practice. Unsurprisingly, teaching and encouraging the development of reflective skills is seen as an essential part of clinical governance that veterinarians are asked to develop throughout their career (Royal College of Veterinary Surgeons, 2012, p.54). Reflection on cases must be judiciously critical, however, to accurately judge what weight should be given to the outcomes of each case.

In complex or unusual cases, clinicians have to rely more extensively on an analytical, rather than intuitive, approach as well as on finding sources of information and knowledge beyond their own experience (May, 2013). The strategies they employ in those circumstances and how they come into play when prescribing antimicrobials will be explored in the next section.

7.3. Evidence-based medicine, veterinary science and modern practice

As discussed in chapter 3, evidence-based medicine (EBM) was defined by Sackett et al. (1996) in a pivotal paper as ‘the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients’ (p.71). This full definition is important as it emphasises the need for the clinician to use their own clinical judgement to decide if and how to apply evidence when considering individual cases. Following in the footsteps of the medical profession, veterinary literature in recent years has promoted the practice of evidence-based veterinary medicine (EBVM) (Doig, 2003; O'Neill, 2016) as a pillar of good, modern veterinary practice. Consequently, the principles of EBVM, including the critical appraisal of published literature, have made their way into the veterinary curriculum (Arlt and Heuwieser, 2011; Steele et al., 2013; Shurtz et al., 2017). An international EBVM network was created in 2014 (Anonymous, 2014) and the RCVS Knowledge group has organised EBVM skills days (Anonymous, 2015), as well as launching a freely accessible EBVM toolkit online¹⁴ aimed at veterinarians working in practice. Some veterinary schools have also set up centres dedicated to EBVM and advertise training to veterinarians on the topic (Anonymous, 2016).

Yet, despite this recent focus on developing EBVM, little is known about its implementation in general practice or about the views and beliefs of individual veterinarians. Most of the documentation available—as will become obvious in this chapter—is letters by individual clinicians published in the veterinary press. This section will use interview data to provide insights into the participants’ views on evidence and veterinary science, including the sources of information they favour. As mentioned earlier, this is an important component of the antimicrobial stewardship puzzle in practice, as antimicrobial prescriptions are by definition a clinical decision that rely on the veterinarian’s knowledge and judgement.

7.3.1. Evidence-based veterinary medicine, ideal, pitfalls and limitations

Practicing EBVM was seen as a worthy goal by interviewees as they recognised that the evidence at their disposal was rapidly growing and changing.

I think things are changing all the time, aren't they? So, even in the three years I have graduated, I probably should use evidence-based medicine. (Veterinary Surgeon 9)

The struggle to stay up to date with an ever evolving and growing body of published evidence while working in a busy practice is well recognised in human medicine (Davidoff et al., 1995), and has been discussed in veterinary literature as well (Vandeweerd et al., 2012b). Time pressure was seen as one of the main obstacles encountered when trying to use evidence appropriately in practice (Vandeweerd et al., 2012c). This is not surprising considering that long hours and a busy work life are well recognised as a source of stress for veterinarians (Gardner and Hini, 2006; Bartram and Baldwin, 2010; Batchelor and McKeegan, 2012).

¹⁴ <https://knowledge.rcvs.org.uk/evidence-based-veterinary-medicine/ebvm-toolkit/> (accessed on 15/06/2021)

So I think I'm reasonably good at interpreting data if I have the time to sit and read it. And we're all time poor. (Veterinary Surgeon 6)

I don't have the time; if I'm going off something that I've seen on a study it's going to have to be something that's from a decent peer-reviewed journal so that I can know that someone has kind of done that, and that I can look and say 'okay well this study has found this', and I must admit I kind of tend to have to take it as gospel truth. (Veterinary Surgeon 2)

This approach of taking study results as 'gospel truth' can be problematic as an integral part of practicing EBVM includes a critical evaluation of the evidence presented (Doig, 2003; Vandeweerd et al., 2012a). It should be noted that the interviewee did point out that they would be using a peer-reviewed journal and regard this as a proof of quality. It is, however, well recognised that the overall quality of evidence in veterinary medicine is a lot poorer than that available in human medicine (Lund et al., 1994; Lund et al., 1998; Mathie et al., 2012; Di Girolamo and Reynders, 2016), enhancing the importance of a critical evaluation of any findings. Indeed, interviewed veterinarians often noted that they were dissatisfied with the quality of the evidence the literature provided, demonstrating an awareness of the need to be critical of published studies.

Sometimes they have just not looked at enough animals, so you will be like this is an amazing study, and then they have tested four animals. (Veterinary Surgeon 9)

I think there's a lot of good studies out there, and there's a lot of really crap ones that are useless. But there's been some that have... six patients or something and they've treated them for two days, and you know, it doesn't mean anything. (Veterinary surgeon 16)

Veterinary medicine only represents a small portion of the pharmaceutical market, and in turn the scope of veterinary studies is often limited by the funding available to undertake them (Vandeweerd et al., 2012b; Colville et al., 2016). Consequently, some authors have emphasised that EBVM should not try to emulate EBM and the ambition of relying on the EBM pyramid of evidence quality (promoting large scale, well designed random controlled trials (RCT) as ideal), but should instead question how to produce the best quality evidence possible with the means available to the veterinary world (Keene, 2000). As put by Vandeweerd et al. (2012a), 'it might be better to aim to conduct a good retrospective study rather than attempt a difficult RCT that ends up being poorly conducted' (p.8).

As discussed above, interviewed veterinarians recognised the need to critically appraise literature, although they pointed out that the ability to do so might vary between clinicians.

[Vets] are sort of rope-learners, we are bad at assessing evidence and doing all of that, but if someone tells us something, we're pretty good at remembering and erm... doing it. (laugh) (Veterinary Surgeon 12)

If you've done neither [a certificate nor a PhD], then you probably don't have the confidence, you probably have the ability but maybe not the confidence to do it. So I think, it depends where the vet is in their career path. (Veterinary Surgeon 22)

The level of continuous education and / or how much emphasis was put on critical appraisal of evidence in the undergraduate curriculum of each individual veterinarian is likely to play a role in their ability and confidence when appraising evidence. Interviewees recognised that scientific methods could evolve quickly as well, and that this could be a barrier preventing them from critically appraising evidence:

I think as long as you understand how they're getting to the point of making a conclusion, that's okay to appraise, but when they're using technologies that you just don't understand I think perhaps that's when it gets a bit hazy. (Veterinary Surgeon 11)

Some authors have indeed pointed out that it is unrealistic to expect all veterinarians to competently appraise complex statistics (Holmes, 2009), or as noted by this interviewee laboratory techniques they are not familiar with.

Other veterinarians pointed out that some of the veterinary literature was not relevant to clinical practice, demonstrating a perceived gap between published evidence and clinical needs.

It depends on the article and whether it is an article that's been written or whether it's a research paper and who wrote it and whether the conclusions are supposed to be helpful in a clinical setting or whether it's just actually more pure research that's designed not to show things that are particularly helpful to clinicians at the time. (Veterinary Surgeon 6)

This is an interesting remark as recent medical literature has emphasised the need for clinicians to work as and with scientists to guide research towards the areas more relevant to modern medical practice (Hunt, 2018). While literature has explored the role of the physician-scientists (Kennedy, 2015) and their contributions to the field of EBM (Sears, 2018), the bridge between veterinary practice and veterinary medical research is only starting to be explored. Interestingly, Vandeweerd et al. (2012a), when considering use of evidence by veterinarians in practice, echoed this previous quote stating that 'for the moment, we may still have the impression of two separate worlds, the academic research on one side and the reality of practice on the other side' (p.9).

Similarly, another interviewee noted that the lack of evidence in many areas was frustrating and that current EBVM was in some respects lacking.

It feels like [EBVM]'s very much kind of developing, I think it's got still quite a way to go yet [...] They'll be like 'oh so we investigated this question and this is the result of it', but often the result is just there wasn't enough evidence there to say one way or the other. (Veterinary Surgeon 10)

This quote fits with letters, published in the veterinary press, from clinicians expressing dissatisfaction at the paucity of evidence available to them when they attempt to follow EBVM recommendations (Williams, 2016). This situation has led to some debate about the current ethics of practicing EBVM (Mills, 2015; Turner and Royle, 2015; Whitehead, 2015), with some veterinarians worrying about the consequences of this approach, particularly the focus on patients of referral hospitals and the lack of regard for, and preservation of, the experiential knowledge gathered by clinicians in first-opinion practice (Alkoff, 2015). Others recognised the current limitations of EBVM but emphasised that some evidence was better than none (Dean and Brennan, 2016), or as put by Williams (2010)

'absence of evidence is not an excuse for therapeutic nihilism' (p.2) and lower levels of evidence (such as expert opinions) should be considered if no high quality trials are available.

However, interviewees also pointed out that even when published evidence exists, the complexity of real-life cases made applying study findings challenging.

Most research is quite... erhm... sort of... involves one factor, erhm... which is quite a sort of basis for science, otherwise, you cannot figure anything out. Whereas everything in practice is multifactorial, so... Very rarely will you have an animal just with one disease, there's usually co-morbidities. (Veterinary Surgeon 22)

This remark is particularly important when considering antimicrobial prescription as—as highlighted in chapter 5—the patient's specific circumstances (signalment, co-morbidities, etc) play an important role in the veterinarian's clinical judgement. The complex nature of individual cases as a barrier to simple prescription recommendations is also recognised by the medical literature on antimicrobial stewardship (Brown, 2002).

In summary, EBVM has been playing an increasingly important role in veterinary medicine in recent years, emulating the example set by human medicine. The veterinary profession, however, is still divided on the best approach to EBVM considering the often limited means at their disposal, and some are arguing that copying EBM might be a laudable but unrealistic goal (Mills, 2015). Discussions on which version of EBVM would be the most beneficial to the profession and its patients are ongoing (Williams, 2010; Alkoff, 2015; Turner and Royle, 2015; Whitehead, 2015). However, the contribution of this study is to reveal that interviewed veterinarians recognised the pursuit of EBVM as a worthy goal, although a considerable and varied numbers of barriers such as lack of time, paucity of data, poor quality of studies, and difficulty applying findings to real life cases, frustrate them in their endeavours. Professional bodies such as the RCVS in the UK have been promoting EBVM as paving the way towards higher standards of clinical practice (Anonymous, 2015); this approach was reflected in the interviews, with veterinarians questioning the implementation and quality of available evidence rather than the principle itself.

Antimicrobial prescription is a multifactorial and complex clinical decision. As seen in chapter 5, antimicrobials are generally considered safe for the patient and prescription often regarded as less risky than withholding the drug. This section took a general approach of the place of EBVM in modern practice rather than focusing exclusively on antimicrobial prescription; however, the influence of the promotion of the EBVM principles as a professional culture will come into play in section 3 and 4, when antimicrobial stewardship guidelines and their implementation in practice will be discussed.

Finally, and besides the lack of time, interviewees pointed out one other barrier to using evidence in practice. Accessing published data was often difficult and prevented them from practicing EBVM as recommended.

We don't get access to all of the journals, you have to pay for all of them so you can't be subscribing to Veterinary Dentistry and Veterinary Dermatology and reading every article, you'd have no time. (Veterinary Surgeon 11)

Limited access to publications also made veterinarians wary of their ability to critically appraise evidence.

The other thing I found particularly difficult is, if you're looking up for a particular issue, ideally you don't just want to look at one paper you want to look at multiple. So if you can't access all of those papers then you can't really make a proper informed judgment. (Veterinary Surgeon 3)

From these quotes, another question arose, if access to published data is time-consuming and limited, where do veterinarians turn to supplement their knowledge and gather information about those cases that necessitate a reflective and analytical approach?

7.3.2. Companion animal veterinarians and sources of knowledge

Relatively little is known about the information resources veterinarians use in practice. Some studies have focused on veterinary students' information seeking behaviour and database search literacy (Dodd, 2007; Weiner et al., 2011). This tells us little, however, about how veterinarians go about finding information once in the stressful and time-challenged environment of clinical practice (Batchelor and McKeegan, 2012; Dixon et al., 2017; Clarke and Knights, 2018; Moses et al., 2018).

Further studies will be needed to fully explore all the themes discussed in this section, but parallels between human and veterinary medicine can be drawn. However, and considering how fraught with uncertainty and ethical tensions (see chapter 5 and 6) antimicrobial prescription has been revealed to be so far in companion animal practice, understanding where veterinarians turn to when seeking advice and information about their decision-making is key to a more effective promotion of antimicrobial stewardship. Besides the aforementioned difficulties accessing published data, the sources of knowledge used by veterinarians, when faced by a clinical problem they required further information about, were varied. Many interviewees reported relying on discussion and the knowledge and experience of their colleagues.

If I really need an answer, sometimes I will just ring somebody like at [specialist veterinary practice] or somewhere... and chat it through with somebody... who I regard as having erh... you know, a medicine speciality or something. (Veterinary Surgeon 21)

This approach also held true when considering antimicrobial choice.

Probably more so from what colleagues use and then just general first line things. (Veterinary Surgeon 15)

Interestingly, colleagues' opinion and advice on antimicrobial prescription has been showed to be very influential in human medicine—particularly if coming from someone more experienced (De Souza et al., 2006; Mattick et al., 2014). On the other hand, prescription decisions made by colleagues who had not actively sought advice were rarely challenged (Livorsi et al., 2015)

In the interviews, some participants also explained that they relied on more recently graduated colleagues as vectors of knowledge.

I would probably, you know, talk to the other members of the staff; can they remember anything, have they read anything in the Vet Record which... That's probably a typical old guy thing, you just let the young ones do the work and you pick their brains. (Veterinary Surgeon 25)

It's also using our new grads as well, because they come out of vet school with a lot of new information that, us dinosaurs, as we call it, you know aren't aware of or, you know, we don't have our heads in published papers all the time. (Veterinary Surgeon 14)

These quotes reinforce the need to promote good stewardship during veterinary training and show that transfer of knowledge within the veterinary profession does not always happen according to experience, but that the knowledge gained from recent training is recognised and valued. This is particularly important as medical literature as shown that compliance with antimicrobial guidelines tend to decrease with clinical experience (Skodvin et al., 2015).

Not all interviewees were as receptive to ideas brought forward by their colleagues, however. Echoing the reliance of some clinicians on their own experience and habits that they might be reluctant to change mentioned in the first part of this chapter, this interviewee was wary of new ideas on principle.

My approach generally is to be sceptical so I have to be very much convinced by people, but I wouldn't necessarily go to the extent of researching it further. I might just discount what they say because I don't like it. (Veterinary Surgeon 5)

As has been mentioned before, this quote emphasises the fact that veterinarians are not a homogeneous population and that no single strategy is likely to successfully promote antimicrobial stewardship and information about AMR to the whole profession.

Beyond a straightforward transfer of knowledge, younger vets were also seen as important in introducing new modern ways of accessing knowledge and training material. For example, a veterinarian who graduated in the 1980s pointed out:

Occasionally I'll do some of these webinars online, it's a new experience for me, they scared the hell out of me to start with, but just recently I've been, you know some of the young ones here have been pushing me onto going on them so I've tried some of them. (Veterinary Surgeon 25)

In contrast to this, however, the same interviewee was still using books they had acquired while at vet school over two decades ago.

I occasionally go back to some of my old textbooks that I have from college. (Veterinary Surgeon 25)

This reliance on both material obtained during vet school years and on books was echoed in other interviews.

So the main source would be, obviously, what I was taught at college. (Veterinary Surgeon 12)

I use a lot of BSAVA manuals, the In Practice papers, like my own lecture notes as well. (Veterinary Surgeon 10)

More often than not I'll just go to a book, if it's something that's fairly standard then that's my initial go to. (Veterinary Surgeon 2)

Reliance on potentially insufficient sources of information (colleagues, textbooks, printed journals) has also been reported in human medicine (Dawes and Sampson, 2003; Oliveri et al., 2004). Indeed, books or lecture materials, can quickly become outdated, even when published and updated online (Jeffery et al., 2012); a fact that was highlighted by some interviewees who had a different approach and would rather rely on internet searches, although they also pointed out the need to be discriminatory when considering the information they obtained.

Google. Google and read abstracts, usually, is the... my main way of finding things out. Erhm... because the problem is like... textbooks, a lot of the time the practices have textbooks but... there'll be a few editions out of date, so, they're using a textbook that's four, five, six years old and often the data is not actually correct yet... correct now, compared to what it was four, five years ago. (Veterinary Surgeon 8)

While using general internet searches to find relevant clinical information might be frowned upon as too pedestrian for a medical professional, some have suggested that it could be a useful tool in the clinician's arsenal (Schattner et al., 2013).

Material obtained from drug manufacturers was also regarded as helpful, but again the interviewee here insisted on the need to consider it critically.

Drug company produced information is quite useful. [...] You have to be careful to engage the filter to know when you're being educated and when you're being marketed to. But we're all intelligent people, we're all capable of doing that and most of us are cleverer than most of the marketing department. (Veterinary Surgeon 6)

Concerns regarding the influence of marketing by pharmaceutical companies on clinicians are well recognised in human medicine (Wall and Brown, 2002; Smith, 2003; Piper et al., 2018). What role those companies play in veterinary medicine, if and how they actually influence veterinarians are questions that deserve exploring (Hobson-West and Jutel, 2020) but cannot be answered by this thesis. It is interesting to note, however, that veterinarians are aware that information from pharmaceutical companies needs to be critically evaluated.

Despite the vast swath of sources veterinarians pulled knowledge from, they were keen on emphasising again that making clinical decisions required bringing together knowledge and clinical experience.

I don't go examining through published material probably as much as I should. But I do tend to sort of use advice sheets quite a lot and I use my clinical...I'm trying to think of the right way to put it...sort of the clinical experience, in a way. And clinical understanding of pharmacology. [...] So I think it is partly sort of clinical experience and known pharmacological particulars are quite often what I base my decisions on. (Veterinary Surgeon 3)

This section's quotes illustrate the variety of strategies individual vets choose to gather knowledge when needed, based on personal preferences as well as logistical considerations such as ease of access and familiarity with the

material. It makes it clear that communicating new information to most veterinarians is likely to require more than a single-track approach. It is also clear from the quotes above that veterinarians are critical of the information they are given, regardless of its origin, and are aware of the potential pitfalls associated with the various sources of information they have to rely on.

The next two sections explore in more detail how these conclusions regarding experience and evidence fit within the promotion of antimicrobial stewardship and the issue of AMR as a whole in companion animal practice.

7.4. Antimicrobial stewardship and the modern companion animal veterinarians

This section details the interviewees' awareness and knowledge of current antimicrobial guidelines as well as their individual beliefs regarding stewardship in practice. As mentioned previously, personal beliefs have been shown to be a key predictor of prescription behaviour in human medicine (Rodrigues et al., 2013). And studies both on antimicrobial use (Speksnijder et al., 2015b) and on other topics (De Graaf, 2005) have already demonstrated that veterinarians are far from a homogeneous professional population. If we are to understand how to best promote antimicrobial stewardship in practice, it is therefore essential to explore the range of beliefs and opinions held by veterinarians.

7.4.1. Awareness and opinions of guidelines

Several different guidelines regarding the prudent use of antimicrobials in veterinary practice are available (Teale and Moulin, 2012), some are general (Publications Office - European Union, 2015; World Animal Health Organisation, 2015) and some are specific to companion animal practice (British Small Animal Veterinary Association, 2012; Danish Small Animal Veterinary Association, 2013) (see chapter 2, section 3 for more details).

When asked if they were aware of any of these guidelines, a few interviewees did not know any and in one occasion conflated them with legally enforceable rules such as the prescription cascade (Royal College of Veterinary Surgeons, 2012, p.40).

Only vaguely, I mean I know there's the cascade system and people you know, prefer you not to use certain types of fluoroquinolone because they want to reserve it for humans but I must admit I don't spend a lot of time reading them. (Veterinary Surgeon 25)

Most interviewees were only aware of the British Small Animal Veterinary Association Protect poster¹⁵ although they did not always know who published it (British Small Animal Veterinary Association, 2018) or the specific advice it contained.

Everybody seems to have a Protect poster. Erhm... but no, nobody seems to have really guidelines as to what... what they want us to use. A lot of places now seem to have their own drugs, so their own brand of drugs and they want you to use those ones obviously (laugh). (Veterinary Surgeon 24)

¹⁵ https://www.bsava.com/Portals/0/resources/documents/Protect%20poster_2017.pdf (accessed 15/06/2021)

We had some. It was like a flowchart on which one to use and when not to use. I think that was an antimicrobial guideline. But nothing springs to mind. (Veterinary Surgeon 19)

This particular poster summarises the mainstay of current antimicrobial stewardship and suggests various antimicrobial choices for common clinical presentations. It is, however, incomplete and parts of it require filling by the clinicians in order to explicit each practice policy regarding empirical prescribing. This approach is understandable as studies in human medicine have showed that local guidelines—in addition to general overarching ones—are essential when attempting to change clinicians' behaviour (Timmermans and Mauck, 2005). This holds true when it comes to antimicrobial stewardship where local leadership and guidelines have been shown to be important in the success of antimicrobial stewardship programs (MacDougall and Polk, 2005). Local antimicrobial guidelines do not exist in most veterinary practices (Hughes et al., 2012; Hardefeldt et al., 2017). Even when practices had the Protect poster, some interviewees explained that the blanks had not always been filled, skipping the step that would transform it into a set of local guidelines.

We have a chart which we started trying to fill in, we sort of agreed which drugs we would tend to use in which situations, so we tend to be fairly similar in that but we haven't actually got as far, or had the time to actually finish filling it in and get it sorted. (Veterinary Surgeon 17)

So I ordered the Protect poster and we've been trying to fill it out as a practice, we've got about a quarter of the way through, we've not like, we just haven't had time to finish it so I'm aware of it but yeah... (Veterinary Surgeon 10)

Other interviewed veterinary surgeons had a more hostile attitude towards the idea of practice-based clinical protocols in general, concerned that they might lead to a 'cookbook approach' of medicine, a well-recognised worry associated with the implementation of EBM in the human field (Costantini et al., 1999; Timmermans and Mauck, 2005).

I think as soon as you put a protocol in place people feel like they're being told what to do, and I think it's important that, I mean every case is different, and I think it's important that people use their own clinical judgement, because otherwise I think you start to just rely on the protocol [...] So no, I don't think, I don't like protocols and I'm not sure that we'd want to put that in place. (Veterinary Surgeon 11)

Most of the interviewees agreed that there was more awareness of antimicrobial stewardship among companion animal vets in recent years; yet, there was still a lot of variation between individual clinicians depending on their professional circumstances. Here again, the influence of colleagues on a veterinarian's approach and knowledge is emphasised.

I think it depends on where they worked and who they've worked with as to what their influences may have been, [...] and if there's not necessarily that proactive approach then I think maybe the knowledge is not necessarily there, so I think there is more awareness as a whole, but I think the amount that it's stuck to varies between individuals, potentially quite considerably I think. (Veterinary Surgeon 7)

Effective dissemination of guidelines is difficult and has been noted as one of the main barriers to promoting stewardship among physicians (Brown, 2002). This issue might be even more relevant to veterinary medicine where the structures promoting knowledge transfer are not as sturdy or developed (Toews, 2011). Overall, with the exception of the Protect poster (British Small Animal Veterinary Association, 2012), there was little awareness of specific guidelines among interviewees. This second subsection focuses on veterinarians' attitudes and beliefs about antimicrobial stewardship.

7.4.2. Attitudes and beliefs regarding antimicrobial stewardship

If and how a veterinarian attempts to follow antimicrobial guidelines is likely to be influenced by their own views and beliefs on various topics such as antimicrobial resistance, their own prescription habits, and the importance of companion animal practice in the development of resistance. Indeed, in one systematic review of qualitative studies investigating the factors influencing antimicrobial prescribing by human physicians, clinicians' attitudes (e.g. fear, complacency, etc) were showed to be one of the most significant (Rodrigues et al., 2013). Both this thesis and the current literature seem to suggest that this may be true in veterinary practice as well. For example, two different practices whose employees were interviewed in this study were still using perioperative antimicrobials even for clean surgeries such as neutering (a clinical decision in stark disagreement with current guidelines (Morley et al., 2005)), reflecting the various opinions found among veterinarians regarding the administration of perioperative antibiotics (Knights et al., 2012). In both cases, veterinarians were aware that this policy went against antimicrobial stewardship recommendations (British Small Animal Veterinary Association, 2012). In one case, the veterinarian believed that not administering perioperative antimicrobials would lead to much higher complication rates. Here again, as was previously highlighted in chapter 5, the fear was that individual patients would be adversely affected by a change in prescription pattern.

I still believe in using routine antimicrobial cover after a surgery; I know that's frowned on now. [...] As soon as you stop using post-op cover for antibiotic, you don't guarantee that you're going to get an infected wound but certainly the percentage of animals returning with infections and complications is much, much higher. (Veterinary Surgeon 25)

In the other practice, veterinarians were worried that the sterility they could achieve in their surgical theatre was limited by their environment as they were using a converted residential building rather than a purpose-built one (a common occurrence in small animal practice in the UK). Here as well, the concern was that patients might develop infections post-operatively if antimicrobial cover was not provided. The decision to administer antimicrobials, however, was presented as regrettable, but outside the veterinarians' control considering the limitations they had to work within.

I know it's not the right thing to do, but we will give them an injection of antibiotic when they have a surgery as a one off injection and we have talked about withdrawing that and obviously making sure that our aseptic technique is absolutely spot on but I am still nervous that we can't actually fully achieve that with confidence in this building. (Veterinary Surgeon 4)

This same veterinarian (4), however, was very keen on improving antimicrobial stewardship in other areas. For example, they also told an anecdote of trying to change treatment of urinary infections in dogs to a shorter three day course of antimicrobials, based on recommendations by pharmaceutical representatives and the protocols currently being recommended to GPs in human medicine¹⁶. In the end, the results were disappointing with infection flaring up once antimicrobials were discontinued and the veterinarian went back to their previous treatment approach.

That is always going to be a challenge, because you try to do what is right and then if the patient doesn't respond, you have to default back to what you did before. (Veterinary Surgeon 4)

Some veterinarians pointed out that having access to a small number of antimicrobials could help clinicians follow guidelines, although it would not solve the problem completely.

It does really help that we have limited antibiotics in the clinic. Erhm... I think that reels people in for what they can or can't use. But yeah, we do have some guidelines and as I said, whenever a new vet join, we kind of talk to them about what we have and when we use it. Erhm... but they are just guidelines, people ultimately do whatever they want. (Veterinary Surgeon 24)

Limited access to antimicrobials, however, can also lead to misuse as if a second or third line antimicrobial is being ordered in for a particular case, economic pressure might drive its administration to other patients (most opened bottles of injectable drugs must be discarded after 28 days).

There are a few cases where we've ordered [cefovecin] in, but you know, if you start having that in. Then you probably have to use it in 28 days, you can then imagine the boss saying to the... erm... the assistants 'this needs using.' 'Cause it's fair enough, you open a bottle, you want to get your money's worth from it. That's where it all becomes skewed, erm... but you know, the drug companies make it quite difficult as well. (Veterinary Surgeon 12)

Cefovecin is a third-generation cephalosporin, an antimicrobial not considered to be a first-line drug but that is often used in veterinary patients that are difficult to medicate as a single injection lasts for fourteen days. Recent literature has showed it to be frequently used especially in feline patients since they are often fractious when given tablets (Burke et al., 2016; Singleton et al., 2017). It is unclear in those cases, however, whether the veterinarians are in breach of the guidelines. Indeed, is it better to guarantee that a full course is administered at the appropriate dose or to focus on antimicrobial choice?

Concerns were also expressed that trying to follow a clinical protocol to practice better stewardship may lead the veterinarian to fail to adapt their decision-making process to individual owner's circumstances.

I think some vets, probably if you're a very new vet and you want to know what you should be doing, what the practice expects, having a protocol there is good, but then I think you end up relying on that protocol

¹⁶ <https://www.nice.org.uk/guidance/ng109> (assessed on 15/06/2021)

you know, [...] if you do that I think you are in danger of not listening to what the client says, and if they say 'I can't afford this.' (Veterinary Surgeon 11)

Again, this quote echoes known concerns of human physicians as guidelines do not take into account patients' preferences and choices (Brown, 2002), an essential facet of good clinical practice in modern medicine that endeavours to be more patient-centred and less authoritative and dogmatic (Parker, 2001).

Finally, some veterinarians worried that a local protocol may actually lead to more resistance in the long run.

The practice protocol would pinpoint the use of one type of antimicrobial, which means everyone's using it, which means everything is resistant to it. If different vets have different antibiotics they prefer to use as a first line then you're less likely to get resistance than if everyone uses the same one. So I don't think that would help. (Veterinary 19)

This quote illustrates this importance of beliefs in clinicians; their understanding of how resistance develops and spreads will influence their compliance with recommendations and guidelines. Perhaps unsurprisingly, communication, training and explanations of clinical guidelines are important for them to be implemented successfully (Timmermans and Mauck, 2005).

The interviewed group of veterinarians in this study demonstrated widely varied views about antimicrobial stewardship, as well as if and how they embraced it. They also reported various challenges veterinarians faced when trying to follow good practice depending on the stage of their career, the practice they work at, etc.

In the last section of this chapter, the specific aspects of antimicrobial stewardship in veterinary medicine that differ from human medicine and how they influence and interfere with veterinarians' decisions are explored.

7.5. Antimicrobial stewardship in veterinary care: unique and specific challenges.

As discussed in the first two sections of this chapter, scientific evidence plays an important—although complex role—in companion animal veterinary practice. This section explores how the concept of evidence-based practice intertwines with veterinarians' views of antimicrobial stewardship, and their suggestions for improving the promotion of stewardship in practice.

7.5.1. Doubts and desire for supportive evidence

Overall, interviewed veterinarians felt they knew little about antimicrobial resistance and felt they would benefit from more information, in particular feedback regarding the efficacy and results achieved by current stewardship efforts.

No, again I'd like to know the facts and figures. 'Cause we all get... it's all about resistance is a problem, resistance is a problem, erm... this is what it's about. I would like to know where we are at... You know, resistance was a problem? Is it more of a problem now? Is it less of a problem? Are we getting onto things here? (Veterinary Surgeon 12)

Perhaps we need a little bit more detailed information rather than there's a resistance. We need to... yeah. Perhaps that would be helpful actually. Erhm... and it might encourage a lot of... you know... again we have more evidence to base what we're doing on, haven't we? So yeah, that would be useful. (Veterinary Surgeon 21)

A recently graduated veterinarian also explained that while they were taught about resistance during their vet school years, they had not been struggling with resistance in practice and neither had their colleagues.

I mean like through vet school they did say that there has been, resistance has developed in certain classes and for certain conditions. From my colleagues here I don't feel like necessarily they have kind of maybe come across much resistance. (Veterinary Surgeon 10)

An increased emphasis on antimicrobial stewardship was also perceived as a potential source of stress.

I think there's enough stress in the job as it is without then somebody thinking 'oh god I'm now going against protocol so now I'm going to have that issue to deal with'. (Veterinary Surgeon 7)

This remark can be easily understood in the light of the conclusions drawn from chapter 5 and 6; antimicrobial stewardship can often be seen as opposed to the immediate interests of the patient or the client, and as an added source of stress and uncertainty for the veterinarian. Other aspects of the reality of day to day practice—e.g. the time and economical cost of promoting stewardship to a clinical team—were also seen as barriers to improving veterinarians' knowledge and decision-making.

Maybe we aren't as proactive as we potentially could be. [...] It's finding the time, getting everyone together, closing the surgeries, decreasing your client intake because you've closed for the afternoon. So I would like to say that we're getting better but I think we could do more. (Veterinary Surgeon 14)

Clinicians also expressed a desire for more evidence to base their decisions on.

Rather than just the Protect poster, erm... you know... [...] if we've got something evidence-based, we can say to the owners, you know, 'no, 90% of cases will get better without this' and that gives us far more... more... clarity. (Veterinary Surgeon 12)

Human physicians possessed different sets of guidelines, precautionary ones based on general antimicrobial stewardship principles, and evidence-based ones—such as the NICE guidelines in the UK—regularly updated by expert panels who review all current evidence. As we have seen in section 2 of this chapter, the quantity and quality of good veterinary studies is often lacking, and many a clinical decision is empirical, based on the veterinarian's experience, that of his/her colleagues or of veterinary specialists in a particular field. Precautionary guidelines do not have 'safety as an endpoint' (George and Morris, 2010, p.207) and therefore do not address the risks and uncertainty that withholding or prescribing antimicrobials may cause. Even detailed veterinary antimicrobial guidelines, such as the ones from the Danish Veterinary Association (Danish Small Animal Veterinary Association, 2013), state 'during development of these guidelines it became clear that there is a lack of controlled clinical studies regarding treatment of infections in companion animals. This guide is based on resistance reports

from the diagnostic laboratory at the Department of Veterinary Disease Biology and current knowledge in the fields of infectious diseases, antibiotic therapy, pharmacology and internal medicine' (p.ii). The frustration of the interviewee quoted above (Veterinary surgeon 12) is therefore understandable, especially considering, as highlighted in chapter 5, that changing prescription behaviour can be seen by the veterinarian as posing a risk to their patient.

While a prudent use approach to antimicrobial use is rational and should be adopted considering the potential impact of AMR currently (Burnham et al., 2018) and in the next decades (Review on Antimicrobial Resistance, 2014), the sparse evidence available to support the clinical component of antimicrobial prescription in companion animal practice is likely to promote defensive prescribing as illustrated by the quote above (Veterinary surgeon 12).

7.5.2. Suggested strategies for improvement

Varied answers were given when interviewees were asked for suggestions on improving stewardship in practice. Auditing individual clinicians' prescription patterns—especially after implementing a change in practice recommendations—was suggested.

So when the [BSAVA Protect] posters went on the walls, everyone was sent a message with them written on as well, an electronic copy, [...] these are our first line antibiotics that we should be using unless there's a clinical indication to use anything else. And we haven't, there's been no follow up, we haven't looked at whether people are actually doing that, we just kind of tell them to do it and assume that they are. (Veterinary Surgeon 2)

The need to have access to more helpful references was also highlighted. Resources focused on individual drugs provided veterinarians with clinical information regarding their spectrum and effectiveness, but were lacking when it came to making stewardship-friendly decisions.

I don't think there is a good handy reference book. Obviously, data sheets and BSAVA compendia are quite useful for the specific drugs. But not necessarily if you're starting from, what shall I treat this infection with? They only answer the question of, is this drug useful for this infection? Which isn't always the way round you want it. (Veterinary Surgeon 6)

Interviewees were also aware that AMR is an evolving problem and that protocols and recommendations cannot be effective if they are not reviewed and updated.

Veterinary laboratories were seen as having a useful role to play in creating prescription recommendations as they were thought to have access to and be able to collate and analyse much more information than an individual practice would.

At the end of the day, the people that we send our samples off to the lab, they hopefully can create a pattern and that may be more beneficial. You know, if they are seeing a trend or a change in drugs that

are resistant to x, y, z or sensitive to x, y and z that may be, you know, they have the database. I think, we actually here see a very small selection to the whole country. (Veterinary Surgeon 9)

This comment echoes work done in human medicine where national and international surveillance of AMR is seen as a key component of the efforts to curb it (Review on Antimicrobial Resistance, 2016); this includes both auditing of clinicians' prescription patterns and collation of data from laboratories to identify the emergence and spread of resistance profiles. In the UK, limited surveillance of clinical prescription by veterinarians in companion practice is available through retrospective analysis of clinical records in volunteering practices (Radford et al., 2011; Committee for Medicinal Products for Veterinary Use, 2015; Singleton et al., 2017). While human laboratories have to follow set standards (from the Clinical and Laboratory Standards Institute (CLSI) and the European Committee on Antimicrobial Susceptibility Testing (EUCAST)), veterinary laboratories are not regulated in the same way and do not use similarly standardised testing and reporting methods that would allow for collation and comparison of data (Morley et al., 2005). In human medicine, pharmacists who specialise in antimicrobials have also been shown to be effective leaders when implementing stewardship initiatives (Hand, 2007); their increased presence in hospitals and trusts may in part explain why stewardship initiatives tend to be more successful in secondary rather than primary care (Ashiru-Oredope et al., 2016).

Feeding back up-to-date information to first opinion veterinarians was seen as challenging; but interestingly many of the interviewees emphasised the importance of using a clinically-focused and short format in an easily accessible medium.

This is a really important topic, so it would be useful to have for example, the kind of thing that I am talking about in say, I don't know, Veterinary Times¹⁷ or you know, something that is much more mainstream. [...] You are not wanting to know huge amounts of background details [...] You know, you want to know how it's practically going to apply to your job really. (Veterinary Surgeon 1)

The need for information to be evaluated critically in order to be trustworthy was not forgotten; however, several veterinarians agreed it was unrealistic to expect the individual clinician to carry out this work.

I think most first opinion full time vets need to kind of be spoon fed it a little bit, someone else has to do that work and say 'look this is the facts, use it', and I suppose that's the issue with evidence-based medicine is it's got to be, there's got to be someone doing a lot of hard work in the background to get that evidence down to the first opinion vets I suppose. (Veterinary Surgeon 2)

In agreement with this quote, authors in the current veterinary literature have indeed promoted an approach called Critically Appraised Topics (CATs) (Vandeweerd et al., 2012a), which already exists in human medicine. The RCVS Knowledge group has also recently launched such an initiative called in-Focus¹⁸ that reviews new scientific veterinary literature and email summaries to clinicians. While the current weaknesses of EBVM still need to be

¹⁷ Non-peer-reviewed weekly veterinary journal in the UK

¹⁸ <https://knowledge.rcvs.org.uk/library-and-information-services/infocus/> (assessed 15/06/2021)

addressed, such projects could greatly increase transfer of knowledge through the profession. Their dissemination and impact, however, are still to be evaluated.

Some interviewees were critical of the current stewardship promotion strategies, in particular the lack of auditing and feedback on practice and individual performance.

The Protect poster is a really good start. But who's looking at the results of what it says on the Protect poster? [...] And then what if someone writes a completely nonsensical on there, erm... there's no one checking it. (Veterinary Surgeon 12)

Finally, some interviewees were keen on pointing out specific areas of current antimicrobial use that they believed were often unnecessary. There was, however, no consensus between clinicians, with some making diametrically opposed statements.

Dentals is another one, I think there is a lot of antibiotics that are being used in dentals, and... I'm not hugely knowledgeable on dentals compared to some people, erhm... but I've been very comfortable not using any. [...] When I graduated there was the current thought of 'yes, we should use antibiotics for dentals,' but that seems to have gone out of fashion now, and we certainly don't see any problems. (Veterinary Surgeon 22)

You hear about dentals going wrong. I haven't had any myself. I would often prescribe a short course of antibiotics, particularly in nasty... (laugh) nasty dentals. Erh... but I've seen pictures from colleagues, where it's just gone all horrible, just relying on a single injection on the op day. (Veterinary Surgeon 18)

Once again, these two quotes highlights differences in veterinarians' views and prescription behaviours on given topics, especially those where prescription decisions are not based on evidence. It should be noted that most of the concerns expressed here are not challenging the need for antimicrobial stewardship or asking for more supportive evidence to justify a prudent use approach, instead evidence is requested to support best clinical practice and is likely to be a desire that expands far beyond the prescription of antimicrobials.

7.6. Conclusion

This chapter discussed the knowledge and evidential aspects of clinical decision-making in veterinary practice. It also highlighted the fact that veterinarians are a heterogeneous professional population with various views and beliefs regarding the role experience and evidence should play in modern practice, in particular how EBVM should be developed and integrated to daily practice. This is unsurprising both in view of the literature presented in this chapter about EBVM (Williams, 2010; Mills, 2015), and the fact that individual views have been shown to exist in the veterinary profession around relationships with clients and patients (De Graaf, 2005) or antimicrobial prescription (Speksnijder et al., 2015b; Hopman et al., 2018; Schneider et al., 2018; Tompson et al., 2020). Veterinarians access varied sources of information and are critical of their trustworthiness. They often rely on

books and colleagues (as often do doctors (Skodvin et al., 2015)) as they fit easily within the bustling world of a busy practice.

Various barriers exist to improving clinical practice: the quality and quantity of evidence available to veterinarians—due mostly to lack of funding for veterinary research, as well as the transfer of knowledge among the profession, all play a role. Veterinarians in this study shared a number of concerns with human physicians regarding clinical guidelines, particularly regarding the preservation of clinical freedom and the respect of the client / patient's choices and preferences. Parallels between the findings of this thesis and medical literature can be made in certain areas.

When it came to AMR, veterinarians' awareness and knowledge of guidelines was limited. The BSAVA Protect poster was the only one mentioned (and not always having been looked at, displayed or completed). They also showed various beliefs and attitudes regarding current stewardship efforts. The lack of clinical evidence to support prescription decisions was seen as problematic; most interviewees, however, did not dispute the need for a prudent approach when handling antimicrobials.

In summary, veterinarians share many concerns with human physicians when considering antimicrobial prescription in the context of modern stewardship. The structures and evidence in place to support them, however, are much less sturdy in comparison to the medical world and having to rely on experience and empirical antimicrobial choice is likely to lead to defensive antimicrobial prescribing. In view of the individual differences between veterinarians highlighted in this chapter, various strategies are likely to be needed to promote antimicrobial stewardship effectively to the whole of the profession – the implications of this analysis for policy and practice will be discussed in chapter 9. The next chapter explores how veterinarians understand the issue of AMR in a global context and how they perceive the role and place of their profession within a society challenged by the growing prevalence of antimicrobial resistance.

Chapter 8—Veterinarians and Society: blame, responsibility and the unique case of companion animals

8.1. Introduction

As highlighted in the introduction chapter, AMR is a complex issue that involves many professional sectors and affects not only human society as a whole, but also animal populations and more generally environments and ecosystems. To tackle the issue effectively, identifying all areas of human activity that promote the development of antimicrobial resistance as well as how they inter-connect and influence each other is essential (Review on Antimicrobial Resistance, 2014). AMR has been described as the ‘quintessential One Health issue’ (Robinson et al., 2016, p.377), as it links human, animal and environmental concerns. As discussed in the introduction, definitions of One Health vary and usually reflect the particular focus of the organisations that attempt to define it (Gibbs, 2014). More relevant than a definition perhaps is the One Health’s mission statement as stated on the One Health Initiative website:

‘Recognizing that human health (including mental health via the human-animal bond phenomenon), animal health, and ecosystem health are inextricably linked, One Health seeks to promote, improve, and defend the health and well-being of all species by enhancing cooperation and collaboration between physicians, veterinarians, other scientific health and environmental professionals and by promoting strengths in leadership and management to achieve these goals.’¹⁹

According to the above citation, collaboration and cooperation between physicians and veterinarians would seem to constitute an important piece of the AMR jigsaw. Little is known, however, of veterinarians’—in particular of companion animal veterinarians’—opinions of One Health and how they make sense of the concept and its significance.

This thesis has until now focused mainly on the aspects of antimicrobial stewardship and AMR that pertain to the veterinary work in practice, one cannot forget that individual veterinarians are part of and work within a wider societal context. This chapter therefore investigates how the interviewed veterinarians perceive their role in society but also their impressions of society’s views and expectations of the veterinary profession around the issue of AMR. In the first part, the relationship between veterinarians and physicians—stemming from their shared clinical roles—is explored, with a particular focus on the concept of One Health. The second section focuses on veterinarians’ perception of how blame and responsibility are assigned in a societal context and on the role played by the veterinary profession around AMR. In a third part, the unique status of companion animals within society and how it may affect veterinary practice and policies to curb AMR as well as public opinion are highlighted. Finally, the last section seeks to understand how interviewed veterinarians expected AMR to influence companion animal

¹⁹ <https://onehealthinitiative.com/mission-statement/> (accessed on 15/06/2021)

practice in the future, as well as their views on the role veterinarians should fulfil while tackling the issue going forward.

8.2. Veterinary care and human medicine: adversaries or allies?

As discussed in the introduction of this chapter and in chapter 1 of this thesis, attempts to curb AMR are intimately linked to One Health principles and aim at protecting public health both currently and in the future. How veterinarians view the One Health concept may therefore influence how they see and receive antimicrobial stewardship efforts and is investigated in the following sub-section. One Health also promotes the idea of considering human and animal health as linked and influencing each other; the second subsection explores the existence of links between the medical and veterinary professions and the roles those may play in practice.

8.2.1. Companion animal veterinarians and the One Health concept

One Health was directly mentioned by several of the interviewed veterinarians, showing an awareness and knowledge of the concept. Others discussed it less directly by exploring the relationship and shared knowledge—or lack thereof—between veterinarians and physicians.

Some of the veterinarians expressed doubts about the usefulness of One Health as an idea:

I think [One Health] is an interesting notion. I'm not sure it stands deep scrutiny. I think it's more of a medico-political idea than a true, sort of, philosophical concept. A nice thing to bat around. (Veterinary Surgeon 6)

These reserves are interesting as there is little in the literature regarding the views of either veterinarians or physicians working in first opinion practice on the One Health concept. While the concept is promoted both in the veterinary (Gibbs, 2014) and medical (Rabinowitz et al., 2018) press, its impacts or limitations in practice has been seldom explored. This is particularly important since reservations regarding the application of the One Health approach to real life issues have been raised, especially around the concept of 'justice' (Lysaght et al., 2017). It echoes concerns from the veterinary ethics literature; for example regarding culling of large numbers of arguably healthy animals as an accepted method for disease control (Hartnack et al., 2009). The concept of justice, in particular distributive justice, is of particular significance while tackling the issue of AMR (Littmann, 2014) as the increase prevalence of resistant infections has transformed antimicrobials into a limited resource that needs to be managed and used in a way that should be—if at all achievable—justly prioritised (Millar, 2011).

Other interviewees, nevertheless, were more positive about the benefits of the One Health approach, recognising that improving communication between doctors and veterinarians and learning about their respective situations would be helpful.

This brings us back to the One Health thing, doesn't it? I think it would help if doctors were aware a bit of the situation that we were in rather than just blaming us, because I think that annoys people, but also yeah if we were sort of more informed as to exactly what sort of state we were in really. (Veterinary Surgeon 7)

There's a big emphasis on One Health and working together in like a whole variety of spheres, not just antimicrobial resistance, [...]...having experience of each other's environments and kind of being aware of the different challenges that a human GP, a human doctor or a veterinarian are kind of facing, and a better appreciation of that across each other, I think would be helpful. (Veterinary Surgeon 10)

As is made obvious by these quotes, however, a closer relationship with human physicians was desired, but not currently experienced. It is significant, as well, that veterinarians' conceptualisation of the One Health principle involved closer relationships and dialogues between various professions. Some efforts have been made to bridge the gap between the two professions; for example, the British Medical Journal and the Veterinary Record have collaborated to publish articles aimed at creating positive links between physicians and veterinarians (Alder and Easton, 2005; Anonymous, 2005). Nevertheless, as seen above, veterinarians do not appear to have experienced a rapprochement between medical and veterinary practice in their daily work.

Interestingly, at least one veterinarian had explicit reservations about working closer with human doctors, believing both professions would always struggle to get along.

There's always going to be vets arguing with doctors because we believe we're smarter than them and they believe they're more important. (Veterinary Surgeon 19)

While this may seem little more than a tongue-in-cheek remark on the part of the interviewee, the boundaries of the identities of both physicians and veterinarians, as well as their collaborations and rivalries is an essential part of how the ideas behind the One Health concept came into being (Woods and Bresalier, 2014) and are still relevant today. This shared history between the two professions questions the frequent characterisation of One Health as an emerging concept (Atlas, 2013; Gibbs, 2014). Instead, well documented precedents redefine One Health as one of various historical attempts by physicians and veterinarians to collaborate in positive ways, often meeting similar challenges along the way (Bresalier et al., 2015). Consequently, One Health approach proponents would do well to study and learn from historical precedents, in particular when it comes to promoting a closer relationship and enhanced collaboration between the veterinary and medical professions.

One Health has also been integrated to modern curricula in veterinary schools, often as part of the veterinary ethics teaching (Magalhães-Sant'Ana, 2015). Some authors even suggest inter-professional training on the topic for medical and veterinary students (Wilkes et al., 2019). Despite this approach, however, some interviewees were critical of the teaching they had received.

I think [One Health] is important but I think one of the problems personally that I had with it, was when we got taught about it, it was made to be a very boring topic, so it was just someone standing there talking at you about all of this stuff that you think 'oh well that's not really relevant because that's about people and that's not directly relevant to me', it's not made to seem to be urgent and I think that's how it's conveyed across by different individuals as to how it's portrayed and how urgent you think it is. [...] That's always the optional sort of one that people think 'oh I won't go to that'. (Veterinary Surgeon 15)

This particular veterinarian had only been qualified for a couple of years at the time of the interview. The importance of the role veterinarians have to play for One Health to be a successful approach is well recognised (Gibbs and Gibbs, 2013). Yet, the lack of involvement of many veterinarians—and in particular companion animal veterinarians—in public health has been noted and deplored by some authors (Wohl and Nusbaum, 2007; Trevejo, 2009). This last quote (Veterinary Surgeon 15) suggests that educational strategies regarding One Health and public health in veterinary schools as engaging and rewarding topics can still be improved upon (McConnell, 2014). This is particularly important when it comes to the issue of AMR where communication and trust between the various stakeholders can help navigate the complex challenges surrounding antimicrobial use, in particular those arising from the various degrees of knowledge and understanding of the parties involved (Schneider et al., 2018).

Beyond the concept of One Health, interviewed veterinarians also acknowledged the existence of links between veterinary and medical practice.

8.2.2. Links between veterinary and medical practice

Antimicrobial stewardship—including prudent antimicrobial use—has become an increasingly important topic in medical practice over the past few decades. Many factors can influence physicians' decisions to prescribe antimicrobials (Wood et al., 2007; Walker et al., 2010; Byrne et al., 2012); in particular the personal views, habits and beliefs of the individual doctor play an important role in their handling of antimicrobials (De Sutter et al., 2001; Rodrigues et al., 2013). Awareness of the inappropriate use of antimicrobials and its potential consequences on AMR has been promoted in recent years by various initiatives such as the WHO's 'world antibiotic awareness week'²⁰ aimed at the general public, and Public Health England's 'antibiotic guardian pledges' that—although accessible to everyone—mostly influenced clinicians or individuals with prior knowledge of the issue (Newitt et al., 2019). A whole-system concerted approach to antimicrobial stewardship has also been suggested as the most effective approach to improving prescription behaviour (Charani et al., 2010).

Following the increased importance of AMR in medical practice, concerns over antimicrobial use and stewardship in veterinary practice have also developed (Morley et al., 2005; Lloyd and Page, 2018), as noted by some interviewees who recognised that the emphasis on good antimicrobial stewardship in human medicine helped their own communication with their clients.

I think it's feeding through in that 'well I won't get it from my GP so perhaps I shouldn't expect to get it from the vet', I think that does definitely come through, but whether that is coming through as quickly as it is in the human field I don't think so. (Veterinary Surgeon 11)

So many people [...] would be like, I want some antibiotics for a bad throat and I think the NHS has obviously really clamped down on that and that education has come through to the clients. So, when we are reinforcing that from their pet's point of view, it's not quite as challenging as it was before. (Veterinary Surgeon 4)

² <https://www.who.int/campaigns/world-antibiotic-awareness-week> (accessed 15/06/2021)

These remarks suggest that a concerted effort to provide members of the public with consistent and shared messages between physicians and veterinarians could be more effective than from one profession alone.

Veterinarians' perceptions of the consequences of AMR in human practice varied. Some saw human physicians as bearing the brunt of the problem and expressed sympathy and the desire to learn from one another.

I think there's a lot more responsibility and pressure on doctors than there is on vets. But I think we definitely... should try to learn from each other, 'cause antibiotics and bacteria are still the same.
(Veterinary Surgeon 16)

Many initiatives focused on antimicrobial prescribing exist in human medicine (Ashiru-Oredope et al., 2016; Owens et al., 2017), and while they could be a source of pressure on the physician, they are also supportive as they allow for providing clinicians with individual feedback and guidance, proving invaluable in improving antimicrobial stewardship and handling (McNulty and Francis, 2010). In contrast, other veterinarians in this study did not believe that human doctors' responsibilities regarding antimicrobial stewardship were accurately reflected in the coverage of AMR.

It just seems in the media that the human practice doesn't seem to get blamed very much, I know we shouldn't have a blame culture, but... erhm... it would be nice to have a slightly more balanced view.
(Veterinary Surgeon 22)

As discussed in the introduction chapter, this quote hints at the complex mesh of professional responsibilities that are linked to AMR and the varied opinions and beliefs regarding the weight of responsibility that each actor connected to the issue bears. Interestingly, when studied side by side, different professions recognise that they have a role to play in tackling AMR, yet they all tend to minimise their own responsibility in the larger picture while emphasising that of other professionals (Zhuo et al., 2018). The next section expands on this theme and illustrates how companion animal veterinarians view not only their own responsibility towards AMR but also that of other professionals.

8.3. The veterinary profession and AMR: blame and responsibility

The complex aetiology of AMR means that no single antimicrobial use can be regarded as the source of the issue. Instead, any individual who prescribes, handles or uses antimicrobials should be encouraged to follow good stewardship practice. In reality, however, patients have been reporting feeling disempowered by their lack of involvement in decisions surrounding antimicrobial treatment (Rawson et al., 2016), and the AMR crisis has historically been blamed by various parties on either human medical use of antimicrobials or on the use of these drugs in agriculture (Kahn, 2017). Companion animal use of antimicrobials had been mostly ignored in this debate, although it has come under increased scrutiny in recent years (Committee for Medicinal Products for Veterinary Use, 2015; Tompson et al., 2020).

In this context, exploring veterinarians' framing of their own responsibilities regarding AMR may provide insight into how best to promote good stewardship, as well as into the limitations of current strategies. Their perception of other parties' (general public, pet owners, other professions, etc.) responsibilities can also help shape their understanding of the AMR issue as a whole.

8.3.1. Companion animal veterinarians, AMR: limitations to professional responsibilities

Chapter 5 and 7 have demonstrated that interviewees believe AMR to be an important problem that need to be addressed in practice and accepted that they have a responsibility to do so. However, many were also keen on pointing out that other responsible parties are involved in the AMR conundrum, reflecting findings from other studies (Zhuo et al., 2018). For example, they pointed out that owners themselves can be responsible for spreading resistant infections to their pets:

Yeah, looking at the two together, and how much risk... antibiotic resistance in animals is to humans. Because certainly with MRSA (multi-resistant staphylococcus aureus), it's MRSA that comes from the owner, isn't it? Not from the... not from the dog. So actually, the owner is a bigger risk to our pets (laugh). (Veterinary Surgeon 12)

Indeed, many cases of MRSA in pets have been shown to be associated with contact with human hospitals (Umber and Bender, 2009), either because members of the households are healthcare professionals or because they visited hospitals for health reasons. Animal to human transmission of MRSA has also been recorded (Pomba et al., 2017).

In addition to this concern of human to pet transmission of resistant organisms, some interviewees expressed doubts that companion animal practice truly played a role in the spread of AMR:

I'm not sure if it's the small animal vets that are contributing to this problem, or whether it's the farm side that's, not our vets... but the antibiotics are used widely in poultry and lots of them in poultry... and pig, pig production, I think. (Veterinary Surgeon 18)

This comment is interesting as none of the interviewees mentioned knowing about issues such as the prevalence of resistant Enterobacteriaceae in healthy dogs (Weese, 2008; Committee for Medicinal Products for Veterinary Use, 2015). Recent research has also raised the possibility that one of the currently most worrying resistant pathogens in human medicine—vancomycin-resistant enterobacteria (VRE)—might have evolutionary links with ampicillin-resistant bacteria found in dogs (Kahn, 2017). Despite being relevant to the topics discussed, none of the interviewed veterinarians brought up the association between current resistance in human medicine and pets, or seemed aware that this is a topic already discussed and a source of concern in the literature.

In contrast with the previous quote, some veterinarians believe that blaming practitioners treating farm animals could be seen as deflecting responsibility.

In large animal medicine, often farmers are trusted to diagnose and treat problems, so farmers are given antibiotics [...], so I think small animal vets sit on their high horse and say 'well, it's not our prob... It's not

our fault, it's over there, look, look what they've done. It's production animal medicine that's the problem, and don't necessarily take responsibility for small animal issues (Veterinary Surgeon 8)

This statement shows awareness of the tendency for 'other-blaming' which has been demonstrated around AMR; for example, between farmers and their veterinarians (Golding et al., 2019). Veterinarians' views of other professions will be explored in the next section, but it is important to note here that interviewees demonstrated reflective and critical skills when it came to their responsibility and the position of companion animal veterinarians within the wider landscape of the AMR issue.

Besides the risk of human to animal transmission, veterinarians also pointed out that ensuring good antimicrobial stewardship went beyond decisions by prescribers. Human patients and pet owners had to be willing or capable of following stewardship rules:

I think [antimicrobials] are still overprescribed, they're still overused, but I think it's not just the over-prescribing, I think it's then the inappropriate use of them as well once they're in people's homes. (Veterinary Surgeon 7)

As demonstrated in chapter 6, most interviewees agreed that educating owners regarding good stewardship principles was the veterinarian's responsibility. As highlighted here, however, the veterinarian does not truly have control over the handling and administration of antimicrobials in the client's home; similarly to a physician having to rely on patients following instructions and completing courses of drugs as dispensed. Veterinary patients have the added issue of often being fractious or unwilling to take medication. Compliance with doctors' or veterinarians' prescriptions and recommendations has been shown to be suboptimal in both human (Martin et al., 2005) and veterinary medicine (American Animal Hospital, 2003). This is particularly important since—as stated by the WHO (Sabateb and World Health Organisation, 2003)—'increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments' (p. XIII). While this quote primarily relates to the treatment of chronic diseases, the statement is relevant to AMR since administering antimicrobials at the right dose and for a complete course is one of the tenets of stewardship guidelines (Dryden et al., 2011).

Finally, the role of public opinion in the context of AMR was also emphasised in interviews. Promoting and practicing good antimicrobial stewardship was seen as protecting the profession against potential negative consequences (see section 4). In this case the veterinarian believed that the veterinary profession had reacted to the AMR problem more strongly than was required but that being seen as responsible was an advantageous position.

I think some of the conscience that we've had instilled in us about antimicrobial resistance it's partly PR. I think we need to be seen to be responsible. I think we probably have reacted more than we need to. I think we probably overreacted to the antimicrobial resistance pressure that's been exerted. But I'm not sure that's a bad thing, you know, we can hold our hands up and say, actually it's not our fault. We are responsible about using antibiotics – get your own house in order. (Veterinary Surgeon 6)

This positive view of current stewardship in veterinary practice is noteworthy, as recent studies have shown that although improving over the past few years, antimicrobial use in companion animal practice is still facing serious challenges (Burke et al., 2016; Singleton et al., 2017). The mention of ‘public relations’ and the need to be ‘seen to be responsible’ is also interesting as it demonstrates that the pressure of public opinion around AMR is being felt by veterinary professionals, and might echo the tendency of media publics to present AMR experts and lay people in opposition to one another feeding a culture of blame across society (Davis et al., 2018).

Perhaps unsurprisingly, many interviewees—in contrast with the previous quote—were concerned about veterinarians being unfairly or excessively blamed for the rise of AMR.

8.3.2. AMR and veterinarians: perceived blame and deflections

A frequent concern expressed by the interviewees was that the veterinary profession as a whole was assigned excessive blame and responsibility in the development and spread of AMR.

The farming practice does seem to get a lot of blame. [...] I know small animal practice can still make a difference, I'm sure. Farm animal practice can as well. But I'm sure the human... human prescribing habits can make a difference as well. But yeah, it'll be lovely to have a little bit more of a balance view on who plays what role. Because I always feel a little bit that the vets get the... the thumbs down on it, that, you know, it's all our fault. (Veterinary Surgeon 22)

The sentiment expressed in this last quote reflects the well-recognised blame culture existing around AMR (Davis et al., 2018). Recently, the BVA urged veterinarians to move away from the need to assign blame to the issue (Clark, 2019). Other interviewees agreed with the above quote, also mentioning that antimicrobial use in farm practice was at the source of veterinarians being held responsible in the development of AMR, but presenting this idea as one more relevant to the past than to current times.

It felt like, just being on the outside of it, like there was a degree of victimisation of vets as being a cause of antimicrobial resistance, well that's how I think people felt [...] back when there was a lot more overuse, especially on the farm side and the growth promoting antibiotics and food and all that kind of nonsense, I can kind of see that being a big issue. (Veterinary Surgeon 2)

The ban of antimicrobials as growth promoters for farmed animals in the EU is presented here as a step towards reducing blame assigned to the veterinary profession in the eye of the public. Of note is the fact that while the ban of antimicrobials as growth promoters has reduced the overall amount of antimicrobial used in agriculture, it has increased the quantities of critically important antimicrobials used in this sector with consequences that are still little understood (Casewell et al., 2003). As put by Phillips et al. (2004), ‘the application of the “precautionary principle” is a non-scientific approach that assumes that risk assessments will be carried out’ (p.28) and consequently, the efficacy of many AMR policies is still debated. Yet, despite this state of affairs, the veterinarian interviewed here focuses on ‘how people felt’ as essential when considering the issue of AMR. This preoccupation reflects the complex sociological debates surrounding the topic (Brown and Nettleton, 2017). Other interviewees

also talked about blame being assigned to the veterinary profession as a political move aimed at deflecting attention and responsibility away from human practice.

You can't escape the fact that antimicrobial resistance has been a political hot topic battered around by a lot of quite ill-informed people, scaremongering. The BMA [British Medical Association] has quite often thrown arrows in the veterinary profession's direction as a source of antimicrobial resistance in medicine, which I feel is a diversionary tactic. I don't think it's got anything to do with it at all. A very, very tenuous link. You know, human hospital infections are generated in human hospitals – nothing to do with us. (Veterinary Surgeon 6)

While this take on AMR might seem flippant at first, evidence exists that official guidelines and policies about antimicrobials are influenced by the political climate in which they are generated (Begemann et al., 2018). The influence of the societal context on the handling of the AMR crisis and the promotion of stewardship should not be underestimated; for example, recent work has demonstrated that regions with high levels of corruption in Europe were associated with higher use of antimicrobials (Rönnerstrand and Lapuente, 2017).

Poor antimicrobial stewardship and inappropriate use in human practice was mentioned by many interviewees.

I think what we have to be careful of is that veterinarians don't get blamed, because I think antibiotic use in humans is pretty shoddy. (Veterinary Surgeon 12)

Some also pointed out that the problem of AMR had been recognised and tackled earlier in human than in veterinary medicine and that this should be taken into account when considering each profession's responsibility towards good stewardship.

I don't think we're the only people to blame there, I think this has been a widespread misuse for years and I think doctors are just as guilty as we are, I think they just possibly recognised it a little bit earlier than we did, so I think we're just behind. (Veterinary Surgeon 7)

Once again, these quotes reflect the need to assign blame that has historically been inherent to the AMR debate. The tendency to blame human medicine and a perceived lack of good stewardship by human doctors has also been demonstrated in the case of farm veterinarians and farmers (Golding et al., 2019).

The importance of healthy animals and of good veterinary treatment to a thriving human society was also emphasised.

I think that's probably what it comes down to – their valuing humans over animals, which, you know, I can understand. But at the same time if we're not allowed to use a certain class of antibiotics and an infection spreads that is only sensitive to those class of antibiotics and we can't use them and we lose thousands of animals and the farming goes down the pan in this country and everyone starts starving. You see, your worst-case scenario is, it's all well and good not being ill but if there is no food because everything is dying and we can't treat it. There are better ways of tackling it than just saying, don't use that one. (Veterinary Surgeon 19)

This quote highlights the fact that—although increasingly removed from the average person’s life—agriculture is still the foundation of human civilisation (Kahn, 2017) and the reliance of humans on non-human animals should not be overlooked when policy decisions are considered.

Not every interviewee had a negative view of antimicrobial usage in human medicine, however.

I know in the human field they’re really quite careful, aren’t they? With antibiotics. I think they have to culture like everything, and they have protocols and everything. We don’t have that in the veterinary world. And I think it’s very easy just to give something antibiotics (Veterinary Surgeon 16)

This positive view of human medicine illustrates the wide range of beliefs and perceptions existing among companion animal veterinarians. This is particularly interesting since—and as mentioned previously—AMR has historically been presented as a shared responsibility, or a shifting blame depending on the context, between agriculture and human medicine (Kahn, 2017). While companion animal veterinarians might be drawn to supporting their colleagues in the farm sector due to their shared background, the modern approach to pet health—focusing on animal welfare and the human-animal bond rather than productivity—would identify more closely with the goals of modern medical ethics, such as patient-centred choices (Vliet Vlieland, 2002); and as seen in the quote above, may lead to a more positive—yet seemingly wistful—view of medical health care.

Finally, some veterinarians believed that the lack of research into AMR and in particular into the production of antimicrobials was a larger issue than the clinical use of antimicrobials.

I don’t think the problem is because we have been using them, I think the problem is because there has not been enough research, I mean the amount of money that the food producing industries and the medicine industries have got, I think really they should have had a strategy years ago thinking ‘well we’re only going to get 10 years out of this, we need a second or third or fourth generation’, but they’re not doing that, they’re just rebranding things, they’re sending things out as generics, which is reusing and reusing. (Veterinary Surgeon 25)

Indeed, the lack of funding for serious research into new antimicrobials is one of the barriers to finding working solutions to the AMR issue (Aiello et al., 2006); and while repurposing older drugs might provide clinicians with therapeutic options in the short term, it is not a viable long-term approach (Weber and Courvalin, 2005).

The first two sections of this chapter mostly focused on veterinarians’ views of AMR as a global issue and the responsibility various professions held in its spread. The rest of the chapter focuses on companion animal practice and how this area of veterinary medicine, by caring for animals whose relationship with humans involve complex and emotional ties, is in a unique position when facing the challenges originating from the issue of AMR.

8.4. Companion animal practice and pets: unique responsibilities in modern society

Arluke and Sanders (1996) have described the existence of a sociozoological scale existing within every society and reflecting the different moral status, worth and rights of different animal species, depending on how they are viewed in this particular sociocultural context (see chapter 3, section 3). For example, pets are often more highly

regarded than farmed or wild animals due to their close bond and physical proximity with humans as well as their tameness. In turn, this leads to a more anthropomorphic vision of companion animals and their needs, consequently creating increased concerns and advocacy for their welfare (Butterfield et al., 2012).

Ban or restrictions on some classes of antimicrobials in veterinary care has been considered as a policy to curb AMR (Committee for Medicinal Products for Veterinary Use, 2015), and have been put in place in farm practice in the Netherlands for a number of years (Speksnijder et al., 2015a). While veterinarians' opinions around the issue was sought in interviews, the societal status of pet animals was brought forth by many as a factor that should be acknowledged and handled with caution by policymakers.

8.4.1. Veterinarians, antimicrobial use, and the influence of the unique standing of pets in society

Interviewed veterinarians referred to the difference in status between pets and other animals, in particular their association with family units giving them a privileged place within human society. Speaking about potential restrictions or bans being put on antimicrobials in veterinary practice, one interviewee noted:

Culturally, I think small animals it would probably be less of an issue, because I think the general public perception of not having the drugs to treat their dogs and cats would be a political nightmare. [...] they think of dogs and cats more like family, so they're less pressured about it, they don't care about antimicrobial resistance so much if it's going to save Fluffy. (Veterinary Surgeon 8)

Research has shown that patients and their families wish to receive antimicrobial treatment even if terminally ill (Marcus et al., 2001b). This same study also showed that health care providers were reluctant to withhold antimicrobial treatment even in circumstances where the drugs would be palliative at best and despite the public health consequences. As pets are seen by their owners as being part of the family (Cohen, 2002; Crawford and Balzer, 2017; Rollin, 2018), it is likely that similar responses would be found in the veterinary context. More research around owners' perception and beliefs of antimicrobial use in their pets is needed, however. Chapter 5 has illustrated cases where palliative, prolonged use of antimicrobials was deemed reasonable by both the veterinarian and the pet owner; such use would strictly be in breach of stewardship guidelines (Teale and Moulin, 2012), although ethical welfare considerations would likely support it.

Following a similar train of thought, the attachment of the owner to their pet was also mentioned as an important consideration when treating companion animals.

I think if somewhere it said in the paper 'dogs not to be treated with antibiotics anymore because of risk to human health,' people would be up in arms. But what I do think is we have to be careful not to be sort of bullied into submission, because erm... we are still trying to do an important job. Erm... yeah, they're not humans, but they are animals and to some people they'll be more important than the humans we're trying to treat. (Veterinary Surgeon 12)

This quote reflects the fact that companion animals gain value beyond their own intrinsic worth due to their importance to their owner as a fellow human being. Coined 'more-than-human solidarity' by Rock and Degeling (2015), this concept is of particular relevance to companion animal practice. Defined as the idea that 'acting in

solidarity with people implies respecting their commitments to one another as to places, plants and non-human animals' (p.63), more-than-human solidarity implies that veterinarians have a responsibility to care for their patients, not only to ensure the animal's health and welfare, but also to protect the human-animal bond shared between owner and pet, leading to an increase in their accountability to their clients. The authors also state that 'accountability extends to consideration for non-human animals, plants, and ecosystems, and to respect for other people's emotional, social, and physical interdependence with non-human entities' (p.63).

Besides, this emotional relationship, most pets live in close quarters with their owners, a situation that set them apart from other animals as well and creates its own problems.

You can't have pets with bacterial diseases, you know, that would be such a huge welfare issue. I don't think we can ever... I don't think we're ever going to be stopped from treating those, and also surely that's not in the human interest either, you know you've got some dogs with some disgusting, smelling thing walking around the house, I mean I think that's just... a health hazard for the owners. (Veterinary Surgeon 22)

This quote agrees with the view expressed by one of the most prominent veterinary ethicists; indeed, Rollin (2001) argued that withholding all antimicrobial treatment from animals would have welfare consequences severe enough to be an untenable ethical position. The potential for companion animals to act as reservoirs of resistant organisms (Guardabassi et al., 2004; Lloyd, 2007; Iseppi et al., 2015) also presents a public health conundrum that cannot be underestimated and as pointed out by the interviewee here, restricting treatment of animals would have public health consequences.

This is not to say that interviewed veterinarians see the lives of companion animals and human beings as equivalent. As will now be discussed, the value of human health and human lives is an important factor influencing veterinarian's opinions regarding antimicrobial stewardship and AMR.

8.4.2. Pets within human lives: public health considerations

Despite the recognised higher status and worth of pets in society compared to other animals, interviewees agreed that human life should take precedence if needed.

And any newer antibiotics that are produced now, perhaps we really... we shouldn't be... we shouldn't be using them. I mean you know it's nice to be able to save someone's dog but you have to be able to save somebody's baby as well, don't you? (nervous laugh) And you know, I think perhaps a line has to be drawn somewhere. (Veterinary Surgeon 21)

Despite veterinarians' commitment to ensuring their patient's welfare discussed in chapter 5, and the increasing focus in the literature on making sure that animals lead a 'life worth living' (Mellor, 2016), none of the interviewees questioned the precedence of human over animal lives. Whether this was because they shared that belief or because an 'animal rights' position is likely to be seen as currently unrealistic (Garner, 2008) was not explored.

In summary, veterinarians believed that the societal status of pets would and should protect them from restrictive antimicrobial policies, not only to ensure their welfare, but also in order to preserve the human-animal bond existing between pets and their families. Public health was recognised as important as well, with all veterinarians agreeing that, if necessary, human lives should take precedent over animal ones; however, as pets usually live in close proximity with their owners, preserving companion animals' health—and especially controlling infections—was seen as benefiting human health.

Interviews usually ended by exploring veterinarians' predictions regarding the future of AMR as well as their suggestions for improving and promoting antimicrobial stewardship in practice from now on.

8.5. AMR beliefs, predictions and strategies for the future

As discussed in chapter 1 of this work, a worsening of the AMR crisis is predicted to happen over the next few decades with potentially dreadful consequences for both human and animal lives (Review on Antimicrobial Resistance, 2016), if antimicrobial use and handling are not drastically improved.

Many initiatives and stewardship programs have been launched in several sectors, based on precautionary principles, a rational societal approach to managing risks (Ricci et al., 2004). Nevertheless, the effectiveness and impact of current policies and guidelines are difficult to assess (Dar et al., 2016). In this uncertain context, the views of veterinarians on the future of both AMR and antimicrobial stewardship are important to explore.

8.5.1. The future of AMR in companion animal practice: potential impact and policies

When asked whether the prevalence and impact of resistance on companion animal practice was going to worsen over the coming years, most veterinarians in this study agreed that it likely would. Similarly, in the agricultural sector, worsening of the prevalence of AMR in the future is mostly anticipated by veterinarians, although opinions between individual clinicians vary (Helliwell et al., 2019). Here again, interviewees acknowledge links between veterinary work and human medicine.

Drawing parallels from what's happening in human medicine, where I think they're always a few years ahead of what we see, and they're obviously seeing much more of it at the moment, so I think that will pass over to us, but we'll see. (Veterinary Surgeon 11)

Veterinarians were also concerned that their prescription privileges for antimicrobials would be challenged as the consequences of AMR on a global scale became more severe.

I think it's a big threat that they'll take away our dispensing rights. So yes, I think... I think it will change. It's already happened, hasn't it? In like... farm and stuff. Erm... so, you know, with our use of antibiotics, it's something, I think we do have to be really careful and erm, use wisely, otherwise we'll get our privilege taken away from us. (Veterinary Surgeon 12)

Restricting the prescription privileges of veterinarians has, indeed, been considered by governing bodies (Committee for Medicinal Products for Veterinary Use, 2015). Other approaches, however, such as the Netherlands' national guidelines made available to practitioners free of charge and in various formats (paper booklet, downloadable PDF, phone or tablet application) have had positive results (Jessen et al., 2017).

It should be noted here that while fear of losing access to some antimicrobials was shared by several interviewees, some admitted that the reasoning behind a potential antimicrobial restriction or ban was not clear to them.

I think they'll start limiting what we have in our cupboards, in our stocks, because they don't want resistance. So they'll stop letting us have it for some reason. Not quite sure why. But they seem to be doing that so... yeah... (Veterinary Surgeon 24)

This statement may seem surprising, but other studies have shown that veterinarians' understanding of resistance mechanisms and how prescription decisions might influence AMR varied between individuals (Mateus et al., 2014; Speksnijder et al., 2015b; Hopman et al., 2018). As seen earlier in the chapter, veterinarians' beliefs regarding how much their own profession or sector of the profession contributes to AMR may also influence their opinion of policy decisions and restrictions. Finally, some interviewees emphasised the need for self-regulation within the profession and the influence this could have on future policies.

I know in some other countries there are more restrictions as to what you are allowed to prescribe or not, so I'm not sure to what extent, I think it depends as to how well we manage to kind of regulate ourselves and how the medical industry as well kind of, how resistance is developing in human medicine, but yeah I think it will definitely change things. (Veterinary Surgeon 10)

Recognising the need for the veterinary profession to self-regulate—and to demonstrate its sense of responsibility by doing so—shows an awareness of the relative lack of state oversight over veterinarians in the UK compared with other professions (Hobson-West and Timmons, 2016).

The last section of this chapter will in turn investigate how veterinarians propose to tackle the AMR issue in practice and their suggestions to improve stewardship.

8.5.2. Antimicrobial stewardship in companion animal practice: suggestions for the future

Echoing the discussion about One Health at the beginning of this chapter, some of the interviewed veterinarians were keen on tackling AMR through closer ties with medical professionals.

I think that there could be some joint CPD some of the time, [...], you could maybe invite some GPs along or you know, the GPs could lead it but they invite the vets, and there's cross culture of our ideas and so that you know, you would have maybe commissioning groups from the NHS sending out invitations to local veterinary practices to come and get involved and understand what's going on in that situation when there's antibiotic usage or those sorts of things being discussed, because I think that would be useful, you'd then start to understand each other's reason for doing things. (Veterinary Surgeon 11)

Overall, interviewees agreed that veterinarians had a responsibility to promote prudent antimicrobial use, especially among their clients.

It's at least in part up to vets. Erhm... vets should do that, we should have campaigns, posters, you know... We should have, perhaps an antibiotic awareness week, or... or something. Erhm... I think it's our responsibility. (Veterinary Surgeon 21)

As was highlighted in chapter 6, interviewed veterinarians embraced their roles as educators (Dolby and Litster, 2015) and agreed that promoting awareness and stewardship among their clients was part of their professional role. The suggestions presented here as noteworthy as they show an awareness of global initiatives such as the WHO's awareness week on antimicrobial resistance. They also indicate that the interviewee recognised the need for a concerted professional effort beyond the consultation room.

Indeed, other interviewees agreed that education at practice-level was important but also hoped to see larger initiatives with the potential to reach more people.

We should definitely do [antimicrobial stewardship education] at practice level to help immediately ourselves but I do think the nation could probably benefit from knowing. There are a lot of pet owners out there. And I think the RCVS could certainly help on that front. They don't do an awful lot. It's about time they did something. We pay them a lot of money. (Veterinary Surgeon 19)

As mentioned previously, the veterinary profession in the UK is tasked with regulating itself (Hobson-West and Timmons, 2016) and a lack of trust into its leadership as expressed here may be problematic when attempting to tackle an issue as encompassing and complex as AMR. Little is known of veterinarians' opinions of their governing body and professional associations, although engagement with for example the RCVS elections is generally low with only a quarter or less of veterinary surgeons choosing to exercise their right to vote²¹.

Interestingly, the importance for the profession to communicate one shared message was also emphasised as an essential part of improving awareness of the issues associated with AMR.

I think as long as we are all a united profession, saying the same message, then that client education will go through. I think the worst thing would be one vet doing their best kind of, kind of saying to the client that we are not going to give antibiotics because I don't think it's a bacterial infection and they end up going to a practice down the road [...] and then that vet then just undermines you, gives it antibiotics and then you have lost your client [...] That is my only thing. Sometimes I think, the whole profession needs to be united. (Veterinary Surgeon 4)

In a recent study examining the relationship of farm vets and farmers around the issue of AMR (Golding et al., 2019), the authors stated 'other-blaming could be reduced using a social identity approach; a common ingroup

²¹ <https://www.rcvs.org.uk/news-and-views/news/record-turnout-for-2019-rcvs-council-election/> (accessed 15/06/2021)

identity could be created by encouraging vets and farmers to focus on their common goal, namely a shared desire to promote animal welfare through optimal antimicrobial stewardship' (p.2). In a similar fashion, this last quote could suggest the need to create closer ties between companion animal veterinarians themselves in order to present a coherent and united guidance to clients and members of the public when promoting good stewardship. Unity within this branch of the profession is likely needed as a first step before rapprochement with other veterinary sectors, and ultimately human doctors, can be considered. The awareness demonstrated by this interviewee is encouraging but how to practically move forward is still an unanswered challenge.

8.6. Conclusion

This chapter illustrated the place of the veterinary profession beyond the walls of the practice and within modern society. Once again, veterinarians are dealing with competing and complex responsibilities. Section one highlighted how the modern socio-political context promoting One Health worldwide attributes responsibilities to veterinarians that may be difficult to reconcile with their daily experience in practice. Links between human and veterinary medicine are tenuous at best, especially in companion animals where public health considerations are rarely brought forth (Wohl and Nusbaum, 2007; Trevejo, 2009). Veterinarians' views on the One Health approach vary widely between individuals.

Section two revealed how AMR has been seeped in a blame culture that has opposed veterinarians and physicians in recent years (Zhuo et al., 2018). Companion animal veterinarians worry about unfair blame being assigned to them or to the veterinary profession as a whole, while most still recognise their role as prescribers in promoting good stewardship. 'Blame culture' has been discussed as a barrier to tackling AMR (Clark, 2019). The tension existing between clinical considerations in practice and the fear to be blamed by public opinion is likely a source of stress for professionals and should be explored further in future studies.

Section 3 argued that companion animal practice faces unique challenges due to the special place pets occupy in society (Frankel, 2006; Degeling et al., 2013), and as seen in chapter 5 this also directly impacts the relationship between the veterinarian and their animal patients. Veterinarians' responsibility towards their patient and accountability towards their clients, but also society as a whole, are enhanced by the deep human-animal bond existing in families who own a pet (Cohen, 2002; Crawford and Balzer, 2017) and the high regard pets are held into by most. In turn, this pressure is likely to affect clinical decisions by the veterinarian but also policy decisions by governing bodies. In this context, veterinarians seem to believe that public opinion would advocate for pets to have access to necessary treatment, as long as risks to human life could be managed.

Finally, the chapter explored the notion that veterinarians believed that AMR was likely to worsen over the years and have a direct impact on companion animal practice, both through an increase prevalence of resistant cases and potentially restrictions being put on the prescription privileges of veterinarians. To mitigate that risk, veterinarians agreed that self-regulating the profession's handling of antimicrobials effectively was the right approach. It is difficult to know if veterinarians in other countries would be in agreement, however, as the veterinary profession in the UK has long been self-regulating (Hobson-West and Timmons, 2016). Veterinarians also emphasise the need to educate pet owners, a role of the profession that has been recognised in other areas

(Dolby and Litster, 2015), both directly in a practice setting and through wider information campaigns. Unfortunately, tensions existing among individual veterinarians, as well as between veterinarians and their governing body, emerged and could endanger progress towards improved stewardship. Promoting a common in-group identity (Armitage-Chan et al., 2016) could be a way forward although the practicality of such an approach would need to be investigated further in future studies. The next chapter will bring together the conclusions drawn in chapters 5 to 8 from the data analysis, put in the context of the literature summarised in chapters 1 to 3, to set out what this thesis's implications are for academia and for clinical practice.

Chapter 9—Reframing the ethical challenges created by antimicrobial stewardship in companion animal practice.

9.1. Introduction

This thesis aims to examine major gaps in our understanding of the issues surrounding the promotion of antimicrobial stewardship in companion animal practice, namely the veterinarian's experience of such efforts and how stewardship principles interact and / or compete with the ethical challenges existing at the core of modern veterinary work.

The tensions inherent in antimicrobial stewardship that requires weighing the interests of an individual patient whose health and welfare are the foundation of the clinician's work against the interests of a nebulous population that cannot be directly visualised or interacted with have been discussed in previous chapters. As such the concept of 'moral distance' has been discussed to help better describe and support our understanding of the challenges faced by prescribers when discussing antimicrobial stewardship. Notions of experience and evidence also inform prescription behaviours of veterinarians, as do their understanding and beliefs regarding AMR and public health.

According to antibiotic stewardship guidelines, behaving ethically in veterinary practice requires curtailing the use of antibiotics for animal patients in the interests of preserving critical antibiotics for human medicine. This thesis has examined the ethical nature of prescribing practice from the perspective of practicing clinicians and provides empirical evidence that challenges this simplistic view of the veterinarian's obligations and duties which does not reflect the reality of the ethical dilemmas faced by clinicians. Drawing on the findings of the empirical work presented in this thesis, the examination of the ethical challenges linked to antimicrobial prescription in companion animal medicine reveals valuable insights to help shape and improve antimicrobial stewardship policies in order to support responsible prescribing in companion animal medicine. From a wider perspective, it also highlights the value of looking at the broader ethical challenges faced by veterinarians in their day-to-day work. This empirical work has shown that managing antimicrobial resistance, and applying antimicrobial stewardship guidelines, involves considering ethical tensions, not only within the companion animal practice at the level of the pet-client-vet relationship, but also beyond this setting, around concepts of evidence and public health. Although, some of these issues have been examined by those interested in applied ethics questions in veterinary practice, they have generally been investigated independently. The empirical analysis in this work points to the need to consider how these elements link to and interact with one another. As a result, this final chapter draws together the findings of the empirical analysis to highlight insights that are of value for the veterinary profession when considering how to take forward ethically sound antimicrobial prescribing. This chapter also discusses some of the wider ethical dilemmas in veterinary practice which can be informed by this examination of the case of antimicrobial prescribing in companion animal medicine.

This chapter focuses on drawing together the three pivot points (i) the vet-pet-client relationship, (ii) science and evidence, and finally (iii) public health (see sections 9.3-9.5) which support the presentation of a framework that

can support policy process in the area of AM prescribing. The new framework is initially discussed before the details of pivot points are drawn together. For each of those, three themes are discussed that bring together the findings of this thesis to highlight its implications for future antimicrobial stewardship initiatives and guidelines aimed at companion animal veterinary practice:

- Professional considerations, i.e. how the veterinarian's work is affected and changed by the influence of each specific aspect in companion animal practice and antimicrobial prescribing.
- Ethical considerations, i.e. a description of what ethical tensions stem from these professional considerations in companion animal veterinary practice and how do they affect antimicrobial stewardship.
- Policy implications that can be drawn from these professional and ethical considerations, i.e. how can policy, guidelines and communication with the veterinary profession be enhanced by taking into account these aspects.

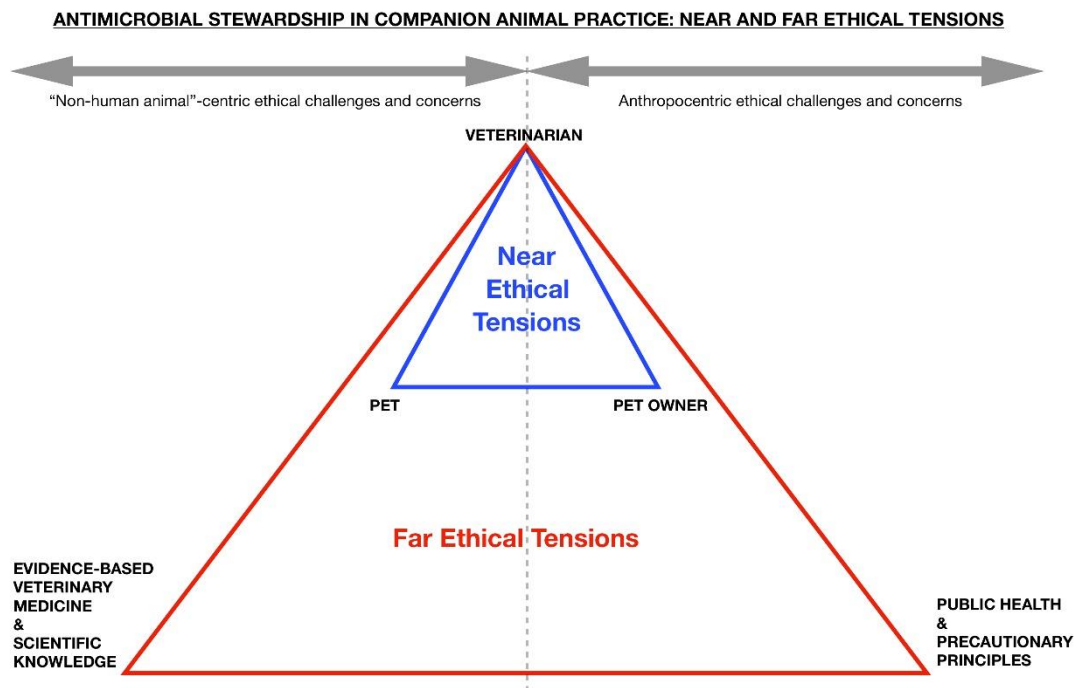
It should be noted that the organisation of the different sections and subsections presented above, both in the empirical chapters of this thesis as well as in this conclusion chapter, is a structuring narrative device that helps to clarify the key issues that are examined in this thesis. In the daily practice of veterinary medicine, all the ethical tensions and concerns that are detailed here are deeply intertwined and are challenging to tease out and consider in isolation. As discussed previously, Rollin (2006a) notes: 'veterinarians find themselves enmeshed in a web of moral duties and obligations that can and often do conflict' (p.15), and the case of antimicrobial prescribing further amplifies this complexity but also reveals key aspects of the ethical dimensions of veterinary practice. By bringing to light and examining these dimensions, this work can help veterinarians make sense of and navigate the tensions they experience every day in practice, including why and how disagreement with clients, but also with colleagues, might arise and why applying antimicrobial stewardship principles can sometimes appear to be a fraught endeavour. It is, indeed, important to remember that as seen in other contexts (De Graaf, 2005; Speksnijder et al., 2015b), or with other professions (Rodrigues et al., 2013), veterinarians are individuals, each with their own set of ethical views and attitudes, influenced by what they believe to be their ethical priorities, their views on the ethical status of the animals they treat, and their framing of their wider responsibilities towards other professionals and within society. With that said, as professionals, they demonstrated reflective skills and readily examined their assumptions and values. Consequently, finding ways to describe and analyse the ethical dimensions that veterinarians face will in turn supports reflexivity and the reviewing and redefining of good practice. For example, factors such as the veterinarian's belief that they must be an advocate for their animal patient (see chapter 5) or that the prescribing behaviours gained through experience are highly valuable (see chapter 7) can sway their decision as to whether to follow antimicrobial stewardship guidelines. As such, while the ethical tensions surrounding antimicrobial prescription are experienced by all, the mesh of ethical dilemmas carries various weights and intricacies depending on the individual clinician's ethical positions and the circumstances of the cases they face. Recognising these variations is essential in order to support the evaluation of current guidance and support more ethically informed development of guidelines and policies that can be successfully operationalised in clinical

practice, or even the development of innovative approaches better suited to improving antimicrobial prescribing behaviour in veterinary practice.

Finally, the last section of this chapter discusses an ethical framework that emerges from the empirical work that is needed to expand our understanding of the challenges faced by veterinarians. As a descriptive tool, it focuses on the issue of AMR but it may have relevance when examining other ethical concerns encountered in veterinary practice. This discussion therefore concludes with a final section which highlights further research would be helpful to the veterinary profession and other stakeholders who are struggling with approaches to antimicrobial prescription.

9.2. An ethical framework to explore the ethical tensions surrounding antimicrobial stewardship in companion animal practice

As discussed in the framing of this work (set out in chapter 1 and 2) there has been notable emphasis placed on characterising ethical tensions in veterinary practice through the dynamic of the veterinarian, owner and patient interactions. This construction of ethical dilemmas has been a useful concept when attempting to understand the unique challenges that veterinarians face when compared to other professionals, such as doctors in human medicine. However, this thesis has revealed that the classic focus on the vet-patient-client relationships does not fully explain the ethical challenges faced by veterinarians when grappling with antimicrobial prescribing. Other important dimensions beyond what might be seen as individualised ethical issues of the veterinarian, patient and owner are in play. Consequently, these new aspects of the ethical tensions and their interactions need to be made more transparent, analysed and discussed. Therefore, there is a need to explore an extension of the classical approach and build a new framework to conceptualise and understand the ethical tensions surrounding antimicrobial prescription in companion animal practice within the wider context of antimicrobial resistance. This new framework is presented below (see fig.1), setting out the main areas that ethical conflicts stem from, and is initially introduced through a visual representation.



(Fig 1—Antimicrobial stewardship in companion animal practice: near and far ethical tensions)

The rest of this section explains how this diagram is built and the various ways it can be interpreted. Starting from the usual focus on the veterinarian, animal patient, and pet owner relationship, the first subsection reinforces the importance of this dynamic in practice while also uncovering its limitations and the need to expand beyond such a narrow view of veterinary work. The second and third subsections show that the diagram can be separated through a vertical line down the centre into ethical challenges focused respectively on non-human and anthropocentric concerns. Both sides are different, yet mirror each other to a certain extent.

9.2.1. Antimicrobial stewardship in companion animal practice: the importance and limitations of the veterinarian-pet-client relationship

Antimicrobial prescription is part of the clinical decision-making process in practice and as such focusing on the veterinarian-pet-client dynamic is extremely important when attempting to understand the various factors surrounding antimicrobial treatment and their implications. Indeed, antimicrobial prescription decisions are at the core of managing antimicrobial resistance in practice, as well as reducing the impact of clinical practice on the further development of AMR, and are the focus of antimicrobial guidelines aimed at clinicians (Teale and Moulin, 2012; Danish Small Animal Veterinary Association, 2013).

Companion animal medicine is largely practiced within the intimate and privileged space of the consultation room. In this setting, the veterinarian, client and pet build a relationship and exchange information before co-

constructing treatment plans. Therefore, the triangular relationship (see blue triangle above in figure 1) between vet, client and pet is acutely experienced in the daily exercise of veterinary medicine, and as such is the source of the most frequently encountered and well understood ethical dilemmas in companion animal practice (see chapter 2, section 2). Unsurprisingly, these dilemmas are the ones that are most often described and reported within the veterinary ethics literature and are the focus of work in this field (Main, 2006; Morgan and McDonald, 2007; Yeates, 2009). The close and private nature of the veterinarian-pet-owner relationship influences ethical considerations. Indeed, and as discussed previously, we often prioritise the needs and wishes of individuals who are close to us physically and / or emotionally over those of individuals more removed from our immediate life, a concept coined 'moral distance' (Chatterjee, 2003; Abelson, 2005). As discussed in section 4 of chapter 2, it should be noted here that this thesis is not taking a stance on the philosophical or ethical soundness of acting following the tendencies promoted by 'moral distance', but rather uses the concept as a descriptive tool to refer to the nature of the ethical challenges engendered by AMR in practice. Literature has shown that 'moral distance' impacts the provision of medical care and how doctors experience their professional role (Weinstein, 2001; Hunter, 2007). It can also be applied to the issue of AMR and explains why clinicians—in human and veterinary medicine—may be reluctant to apply antimicrobial stewardship principles. The impact of 'moral distance' on companion animal veterinary practice and the importance of the concept are discussed further in section (9.3).

Ethical challenges stemming from the veterinarian-pet-owner relationship revolve around notions of individual animal health and welfare and how they are conceptualised and understood by veterinarians and pet owners (Morgan and McDonald, 2007; Yeates, 2009; Morris, 2012a). Once again, what is valued and prioritised on those topics varies between individual veterinarians (De Graaf, 2005), as well as individual pet owners (Degeling et al., 2013). The pet also influences decisions made in the consult room in many respects, such as how well their welfare needs are understood, their expected lifespan, their individual personality, etc. Each consultation is therefore made unique by the complexity and breadth of the individuals, and consequently of the relationships, it contains.

Beyond the natural focus on animal health and welfare, the practice of companion animal medicine must also take into consideration the mental health and wellbeing of pet owners, but also of veterinarians themselves. Financial considerations come into play for both parties as well, as pet owners have to be able to afford the chosen treatment, and veterinarians must ensure that their practice generates enough revenue (Tannenbaum, 1995; Rollin, 2006a).

While the importance of the dynamic between the veterinarian, pet and client cannot be underestimated, concentrating on this relationship alone ignores the wider societal context in which its main actors live and how it affects the practice of veterinary medicine, both in terms of scientific knowledge and public health. As revealed by the work presented in this thesis, and represented in red in figure 1, expanding ethical considerations beyond the walls of the clinical setting and understanding the tensions generated by these more removed and nebulous, yet essential, concepts is necessary if one wants to understand how antimicrobial stewardship and AMR considerations are experienced and handled in companion animal practice.

9.2.2. Antimicrobial stewardship in companion animal practice: ethical challenges and concerns centred on non-human-animals

Veterinarians are involved with two different aspects of care of non-human-animals: health and welfare. Both are important factors when prescribing antimicrobials and are discussed in this section in turn in relationship to the development of the new framework. This discussion builds on the issues discussed in various places throughout this thesis, but especially chapter 5 and the role of veterinarians as animals' advocates.

Indeed, non-human-animal health relies on the provision of veterinary services and the application of veterinary knowledge. As discussed in section 5 of chapter 3, how such knowledge is generated and transferred has changed remarkably over the course of the last few decades. Indeed, following in the footsteps of human medicine, veterinary medicine is striving to be evidence-based, i.e. for its clinical decision-making process to be justifiable on the grounds of reliable and relevant scientific evidence. The practice of evidence-based veterinary medicine has been promoted as desirable (Doig, 2003), and should ideally guide veterinarians when they make clinical decisions (Williams, 2010), including antimicrobial prescription. However, scientific evidence available in veterinary medicine is limited (Mills, 2015), with certain illnesses and species being over-represented in publications, whereas others may only have little or no evidence to rely on. As a result, veterinary medicine is especially reliant on the veterinarian's clinical experience (both their own and that of their colleagues) (Faunt et al., 2007). If relying on clinical experience, however, one must differentiate between informed conclusions obtained through critical reflection on a meaningful number of case outcomes and clinical habits that might have been impressed on the clinician by only a few significant experiences or formed out of convenience (Cockcroft, 2007).

To be their patient's advocate, the veterinarian must therefore navigate the uncertainty created by limited evidence and prescription habits that must be critically evaluated before being trusted (see chapter 7 for more on this topic). In section 4.3 of chapter 2, factors supporting the concept of moral distance were discussed, in particular the 'uncertainty of benefits' (Abelson, 2005, p.33) that might be gained by going against the human tendency to prioritise those close to us. This section also pointed out that since antimicrobial stewardship guidelines are based on precautionary principles, their benefits are still unproven (Dar et al., 2016). Importantly, however, this initial approach only revealed part of the issue veterinarians face when applying prudent use principles. Findings from chapters 5 and 7 demonstrate that the risks of withholding potentially beneficial treatment from a patient are often themselves unknown or at least uncertain. In such a case, if the veterinarian sees themselves as an advocate for the patient, the interests of the animal will likely align with the prescription of an antimicrobial. This can be argued to be linked to the question of patient safety not being addressed in antimicrobial stewardship publications (George and Morris, 2010). Not only are the benefits of stewardship principles uncertain but so are their risks, a state of affairs likely difficult to accept by any profession dedicated to patient care.

Illustrating the tensions described above, the left-hand side of the diagram (fig. 1) therefore pertains to ethical questions centred around the non-human animal and the minimising of risks to its health and welfare, through the application of knowledge gained from evidence and the veterinarian's experience.

9.2.3. Antimicrobial stewardship in companion animal practice: anthropocentric ethical challenges and concerns

Like any other profession, companion animal veterinary practice exists in a societal context and includes explicit and implicit contracts between the profession and other members of society, e.g. clients, paraprofessionals, governmental bodies, etc., but also with society itself. Indeed, society is characterised by evolving sets of acceptable behaviours and rules. For example, societal ideas regarding acceptable standards of animal health and welfare inform expectations of the veterinary profession (British Veterinary Association, 2016; Hernandez et al., 2018) and consequently influence how veterinarians understand their professional behaviour and role and how they practice veterinary medicine (Royal College of Veterinary Surgeons, 2012) (see chapter 3 for more details).

This is reflected in the various oaths that are taken by veterinarians upon graduation. For example, and as mentioned in chapter 2, in the UK, graduates agreed to: ‘above all, my constant endeavour will be to ensure the health and welfare of animals committed to my care’ (Royal College of Veterinary Surgeons, 2012, p.13). This is important as it can be argued that this oath—which must be taken to become a member of the Royal College of Veterinary Surgeons—reflects the professional role society expects veterinarians to play and how it wants them to behave. By itself, it would align well with the role of the veterinarian as an animal’s advocate discussed in the previous subsection (9.2.2) and in chapter 5. Societal expectations of veterinarians, however, are more complex than this statement would suggest.

As discussed in chapter 3, another societal conceptualisation of importance is the existence of a sociozoological scale that is reflected not only in UK law (e.g. vertebrates having higher protections than invertebrates) (Arluke and Sanders, 1996), but also in the standards of care that are expected of veterinarians. Considering how this is operationalised, the veterinary profession in the UK regulates itself through the Royal College of Veterinary Surgeons, a professional body composed mostly of other veterinarians and some lay members elected by the profession at large (Hobson-West and Timmons, 2016) and as such enforcement of societal expectations is actively endorsed by the profession itself and helps to maintain its reputation and prestige. As discussed previously, the sociozoological scale is reinforced by the idea of more-than-human solidarity, i.e. the idea that an object, place or non-human animal gains extrinsic value due to the emotional significance it holds for another human being (Rock and Degeling, 2015). Any animal kept as a pet therefore gains extrinsic value due to its relationship with its human owner; and consequently, this extrinsic value also leads to increased expectations when it comes to veterinary care. From this conclusion, and as has been made clear in chapter 6, the role of the veterinary surgeon is also to provide their client with a service that respects their wishes for their pet and the emotional bond they share with it.

The privileged status of pet animals is relevant to the question of antimicrobial resistance and stewardship. Indeed, while public health is concerned with human health on a large scale, ethical tensions exist between the needs and desires of individuals and the guidelines surrounding public health issues, including where medical treatments and options are concerned. Precautionary principles aim at protecting the largest number of people possible and may at times be seen as endangering or reducing individual choices and freedoms (Pieterman and Hanekamp, 2002).

In unclear human medicine clinical cases the use of 'just-in-case' prescription of antimicrobials is frowned upon; and the use of antimicrobials in settings such as ICUs or palliative care facilities is contentious (Marcus et al., 2001b; George and Morris, 2010; Oczkowski, 2017). As discussed in chapter 5, such scenarios also apply in companion animal practice where animals may be treated when critically ill and are kept alive for as long as their quality of life can be maintained even if this requires palliative therapies (Main, 2007; Moore, 2011). Despite the precedence human life usually takes over animal ones, treatment expectations for companion animals are likely to go beyond such a simplistic stance. As pointed out by veterinarians in chapter 8, society as a whole—not only pet owners—expects animals, and in particular companion animals, to be provided with adequate care.

Of course, and as discussed in section 2 of chapter 3, despite all those considerations related to the place of animals in society, veterinarians are also expected to promote and protect public health (Royal College of Veterinary Surgeons, 2012), and by extension human health, including through the practice of good antimicrobial stewardship. This theme is explored further in section 5 of this chapter (9.5.), but is essential to recall here as, alongside the previous duties mentioned here, it illustrates the complexity of societal expectations that veterinarians shoulder.

The right part of the diagram (fig.1), therefore, encompasses anthropocentric concerns and challenges. As seen in chapter 6, the client plays an important role in practice as part of the veterinarian-pet-client triad, but is also a lay member of society who carries expectations of the role of the veterinary surgeon shaped by the societal context they live in, such as recognising the importance of the human-animal bond they share with their pet. Beyond such concepts, however, public health issues, such as zoonoses or AMR, must also be taken into account by the veterinarians potentially creating tensions between their duties towards individuals and their responsibility towards society as a whole.

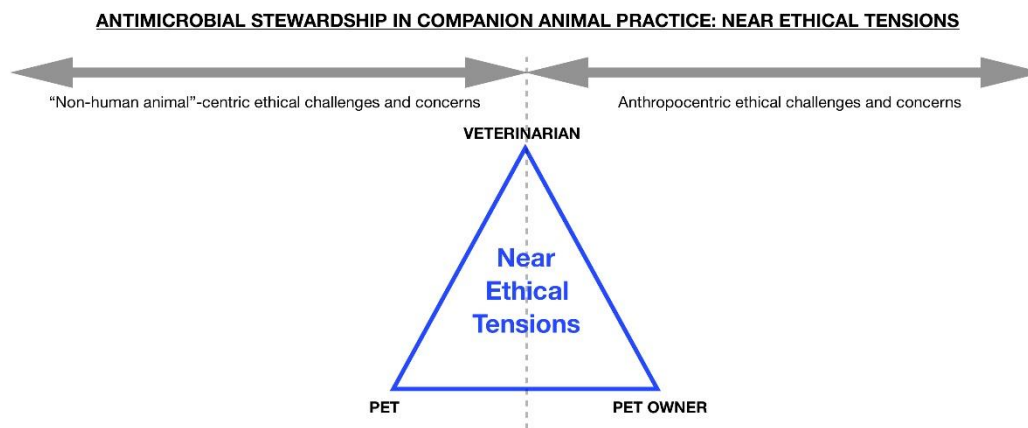
Building on the issues from the literature summarised above and explored in more depth in chapters 1 to 3, the next three sections summarise this thesis's findings on the issue of AMR and antimicrobial stewardship in companion animal practice by exploring the tensions highlighted above that are also illuminated by the empirical work of this study. As such, section three focuses on the findings that relate to near ethical tensions, section four draws on the constructions and concepts of evidence and scientific knowledge as relates to AMR. Finally, section five details the tensions related to the framing of AMR through public health and precautionary principles.

The final section of this chapter then draws together these findings and explore the implications of this work for other key issues in veterinary practice and discusses the limitations of the study alongside the opportunities to take this work forward in terms of AMR and beyond

9.3. Antimicrobial stewardship and the triangular vet-pet-owner relationship: tensions or alliance?

The relationships between the companion animal veterinarian and the animal patient, and the companion animal veterinarian and their client were presented in Chapter 5 and 6 respectively as constructed by the veterinarians while reflecting on the issue of antimicrobial prescription. This section brings together those findings and discusses

how they mesh together when considering antimicrobial prescription decisions. Doing so is essential to understand the tensions emerging from within the consult room and from the triangular relationship (captured in blue in figure 1 above and figure 2 below) between veterinarian, pet and vet.



(Fig 2—Antimicrobial stewardship in companion animal practice: near ethical tensions)

9.3.1. Antimicrobial stewardship and the triangular vet-pet-owner relationship: professional considerations

Veterinarians who took part in this study framed their professional responsibilities around individual care, in particular their role as the animal’s advocate as discussed in section 9.2.1 and chapter 5. They largely agreed that giving antimicrobials if they might be needed is considered safe for the individual patient in most cases. On the other hand, withholding treatment with antimicrobials if unsure if they are absolutely needed can be perceived as stressful and a risk to the patient. They also noted that when not all clients ask for or expect antimicrobials, pet owners seemed satisfied when receiving such a prescription for their pets.

From the conclusions of chapters 5 and 6, it becomes obvious that the narrow triangular relationship between vet, patient and client often pushes towards defensive prescribing of antimicrobials, as it is seen to: promote pet’s health and recovery with little risk, ensure client’s satisfaction as they are satisfied with the consultation’s outcome, and reduce the need for potential further veterinary visits.

Another essential part of this triangle is the veterinarian themselves and their wellbeing. Interviewed clinicians reported that their job could be a source of significant stress and looking after their own mental wellbeing by avoiding conflicts whenever possible is therefore important (see chapter 6), a position supported by the literature (Gardner and Hini, 2006; Cohen, 2007; Bartram and Baldwin, 2010; Batchelor and McKeegan, 2012; Moses et al., 2018). Prescribing antimicrobials can therefore be seen as a way to avoid stress by reducing risk of treatment failure as the drugs will treat potential infections even if unconfirmed, and by lowering the likelihood of client’s complaining and being unhappy with the service given, especially if the veterinarian believes that the client desires an antimicrobial prescription for their pet (see section 3 of chapter 6).

Interviewed veterinarians also believed that their clients should not be making decisions regarding the appropriateness of antimicrobial prescription due to their lack of expert knowledge (see 6.2). They pointed out that the existence of prescription privileges supports that view. Yet, as discussed in 2.2, veterinarians must gain informed consent from pet owners before proceeding with treatment. In some cases, however, veterinarians admitted to intentionally obfuscating the nature of the treatment given to avoid explicitly stating that no antimicrobials were given, therefore avoiding a possible argument with their clients (see 6.3.2). While the result of this approach aligns better with antimicrobial stewardship guidelines than prescribing antimicrobials to avoid conflicts, it is still ethically questionable and does not fulfil the veterinarians obligations to gain informed consent prior to treatment, as per their Professional Code of Conduct (Royal College of Veterinary Surgeons, 2012).

Financial gain has been described as a potential motivator for veterinarians to recommend treatment or carry out procedures (Grimm et al., 2018). However, interviews' findings do not support financial considerations as being particularly significant to veterinarians when deciding whether to prescribe antimicrobials or not (see chapter 5 and 6), an attitude shared by most but not all veterinarians in current published literature (Hopman et al., 2018). The drive not to waste medication once procured, however, was noted as potentially driving prescribing not aligned with stewardship guidelines (see 7.4.2). And while not prescribing medication might lead to a loss of revenue, interviewees mentioned that alternative treatment is usually provided and therefore withholding antimicrobial treatment does not necessarily lead to a drop in fees. Overall, veterinarians were more concerned with providing a competitive service to ensure that their clients stay faithful to their veterinary practice in the long term (see 6.4). Clients' financial situations could also be a barrier to antimicrobial stewardship due to the cost of investigations such as culture and sensitivity testing.

9.3.2. Antimicrobial stewardship and the triangular vet-pet-owner relationship: ethical considerations

As discussed above, pet, client and veterinarian's interests may be perceived as aligning towards a near consequentialist approach promoting antimicrobial prescription for the health and wellbeing of the individual animal, which is also the path of least stress for the veterinarian and fulfil their duty of care towards their patient. At the difference of other circumstances in companion animal practice, antimicrobial prescription did not appear to be an important source of ethical debate or conflicting interests when only considering the triangular vet-pet-client relationship highlighted in 9.2.1. Antimicrobial stewardship, however, demands that clinicians widen their ethical scope and as such take into account public health concerns. Principles such as only using antimicrobials when absolutely necessary, rather than whenever they might be beneficial, consequently transform public health into a new party whose interests have to be taken into account and therefore an added source of stress affecting the veterinarian, pet, client relationship (see chapters 5 and 6). Due to the risks and uncertainty involved in applying such principles, as discussed in 9.2.1 (see also (George and Morris, 2010)), it can also be seen as contradicting the oath taken by veterinary surgeon to have the health and welfare of their patient as their first priority (see 3.4.2) and their professional identity as the patient's advocate and client's guide (see chapter 5 and 6, as well as (Armitage-Chan et al., 2016)). The ethical issues raised by such a challenge to a clinician's professional identity are well documented in human medicine (Weinstein, 2001; Hunter, 2007); chapter 5 demonstrated that

veterinarians often found reconciling their traditional role and duty of care towards their patient with responsible use of antimicrobials difficult.

As guidelines regarding antimicrobial stewardship in companion animal practice are aimed at veterinarians (Danish Small Animal Veterinary Association, 2013; British Small Animal Veterinary Association, 2018), responsibility for following their recommendations rests squarely on veterinarians' shoulders, leaving them to educate clients and the role they have to play in good stewardship. Interestingly, interviewees overall believed that client education was an integral part of their professional role (Dolby and Litster, 2015) and were reluctant to let anybody else play this role when it came to veterinary matters (see chapter 8), although some agreed that communication with pet owners or the general public through organised and widespread campaigns could also be beneficial. How individual veterinarians construct their responsibility to their clients, however, is likely dependent on their own view of their professional role, since, as mentioned above, some clinicians admitted to withholding information from their clients even if it went against the concept of informed consent.

In conclusion, depending on veterinarians' views and beliefs regarding the importance of companion animal practice in the wider landscape of AMR, and as highlighted in chapter 5, withholding antimicrobial treatment in cases that may potentially benefit from it, can be perceived as contradicting the profession's main goal of ensuring the health and welfare of the individual animals committed to their care, thereby challenging veterinarians' professional identity and how they understand their role and the service they provide. Chapter 6 also showed that applying antimicrobial stewardship principles can also create challenging interactions with some clients that veterinarians used different strategies to tackle or avoid.

9.3.3. Antimicrobial stewardship and the triangular vet-pet-owner relationship: policy implications

This section covers several policy implications that have emerged from the analysis of the data in the empirical chapters. It focuses first on how guidelines can affect the triangular vet-pet-owner relationship, then touches on implications of such findings for veterinary education, and finally discusses how communication challenges involving the veterinary profession could be tackled. Considering all that has been detailed above, it is important to remember that treatment decisions are not made simply by relying on interpreting clinical examination results and scientific knowledge. Instead, veterinarians incorporate those elements but also depend on communication and rapport building between themselves and their clients. When it comes to antimicrobial stewardship guidelines, acknowledging how such guidelines can affect the triangular relationship between the pet, the veterinarian and the pet owner is essential. Indeed, considering the benefits and interests of those three parties, proactive antimicrobial prescription often appears a logical choice as explained above. As a result, limiting the veterinarian's willingness or ability to prescribe antimicrobials may put them in an antagonistic position that would not occur if the guidelines did not exist. It is well recognised that companion animal veterinarians experience a lot of stress in their professional life (see 2.2.2) and that most of this stress stems from tensions involving the veterinarian / client relationship (Batchelor and McKeegan, 2012). As a result, it would be natural for the veterinarian to try and avoid situations that might create conflict with the client if possible. In addition, given the

focus of veterinary education, ethics and graduation oaths on individual animal patient's health and welfare, as has been described in multiple places in this thesis, it is unsurprising that veterinarians may find making decisions that they perceive to put their patient at risk to be uncomfortable and difficult. Put into the context of 'moral distance', such a focus may also reinforce veterinarians' belief that their duty to their patient and client most often supersedes any other. One way forward to balance this situation is the approach taken by the Danish Veterinary Association and to publish comprehensive, but easy to follow clinical guidelines (Danish Small Animal Veterinary Association, 2013), that are evidence-based rather than relying on principles of prudent use, and therefore do consider patient safety in their recommendations. Such an approach has been shown to improve prescription behaviour in veterinary practice (Jessen et al., 2017).

Many parties may want to communicate with veterinarians about antimicrobial stewardship, such as governmental agencies, governing professional bodies (e.g. RCVS in the UK), professional associations (e.g. BVA or BSAVA in the UK), providers of CPD training (e.g. veterinary schools, specialist clinicians), etc. It is likely that the strategy best to employ will depend on the exact goal that is pursued and the circumstances and scope under which such communication is attempted. Some general considerations should, however, be kept in mind. Although not the focus of this thesis, some of the topics discussed here may also apply to veterinary students and the teaching they are provided with by veterinary schools.

Improving ethics teaching at vet school and in the form of CPD events to help veterinarians make better decisions in practice is important, but some of the interviews presented here suggested that current teaching efforts are not always embraced by students (and ethics CPD post-graduation is rarely available). Format of teaching may be important in this instance and needs further investigation. For example, and as discussed in chapter 4 and demonstrated by this thesis' analysis of veterinarians' interviews, the use of anecdotes (or more formally of case studies) has been shown to be a favourite communication method among clinicians (Patel et al., 2015; Mutonyi, 2016). Although not well-regarded in the EBVM world (Ratzen, 2002; Lyden et al., 2010), the power of stories is a powerful tool in the clinical setting that allows for illustration of the clinician's emotional involvement in their work (and therefore acknowledges the pitfalls created by moral distance) and address issues that are difficult to illustrate in more academically acceptable format.

Beyond veterinary education, confusion between prudent use and clinical guidelines is likely to make rational decision-making and self-reflection difficult for clinicians, as well as give them unmeetable expectations regarding the evidence supporting prudent use guidelines. If any of the aforementioned parties wish to improve their communication with the veterinary profession, being frank about and explaining the difference between the two different kinds of guidelines would be a useful first step. In particular, the risk and uncertainty inherent to the application of stewardship guidelines, as well as the nature of prudent use principles as precautionary rather than evidence-based, should be acknowledged and critically discussed. Using the popular, but not necessarily peer-reviewed but widely read, veterinary press would likely be useful to highlight the above. It would be a useful vessel as well as to introduce actual clinical knowledge that can be added to the precautionary approach of stewardship and will help address clinicians' concerns regarding patient's safety. It hopefully would also encourage interest in research focusing on stewardship strategies, supported by clinical evidence. Such strategies could therefore be

tailored to the veterinary setting as many initiatives developed in human hospital require access to specialists such as specialised pharmacists or infectious disease specialists (Raineri et al., 2008; Ashiru-Oredope et al., 2016), and are likely unrealistic to implement broadly in veterinary care.

Some attempt to link the veterinary profession with some of the professions listed above would be positive, however, and could be developed over time.

As discussed in the introduction, there have been calls to give companion animal veterinarians more public health responsibilities (Wohl and Nusbaum, 2007; Trevejo, 2009). However, while veterinarians often mentioned that having more knowledge about public health issues would be helpful, they did not express the desire for more responsibilities in that area. Again, if we consider the idea of moral distance, it is likely that public health responsibilities would clash with clinical responsibilities towards individual patients and may seem impossible to handle for one person alone, a conflict that has been recognised in human medicine (Weinstein, 2001; Hunter, 2007). Attempting to impose new or broader duties on companion animal veterinarians is likely to be resented as they may be experienced as an added source of stress. If governmental or professional bodies decided to ask the profession to be more focused on public health, then student recruitment strategies would need to be adapted, as the focus on individual medicine and animal health and welfare is usually what attracts veterinarians to the profession (see chapter 5).

Moreover, policy makers and public health representatives should discuss the public health role of veterinarians with the profession as a whole, not just with its governing or professional bodies, as only a minority of vets are actively involved with the RCVS in the UK (see 8.5.2), and not all are members of a professional body. Further research studies or consultations through the veterinary press may be helpful in order to reach as many veterinarians as possible. Strategies to encourage veterinarians to get more involved in the regulation of their profession are beyond the scope of this thesis but would likely be beneficial as well, especially in the UK given the self-governing and regulating nature of the profession (Hobson-West and Timmons, 2016). If, as interviews seem to indicate in chapter 8, there is an appetite for more information but not for more responsibilities around topics such as AMR, other professionals (e.g. ethicist, veterinary laboratories, public health officials, etc) could be brought in to help veterinarians navigate the murky waters surrounding public health and individual medicine. In particular, some veterinarians expressed a desire for closer ties with the medical profession. Here again, the proposal of linking veterinarians to other professions possessing an expertise they do not is raised.

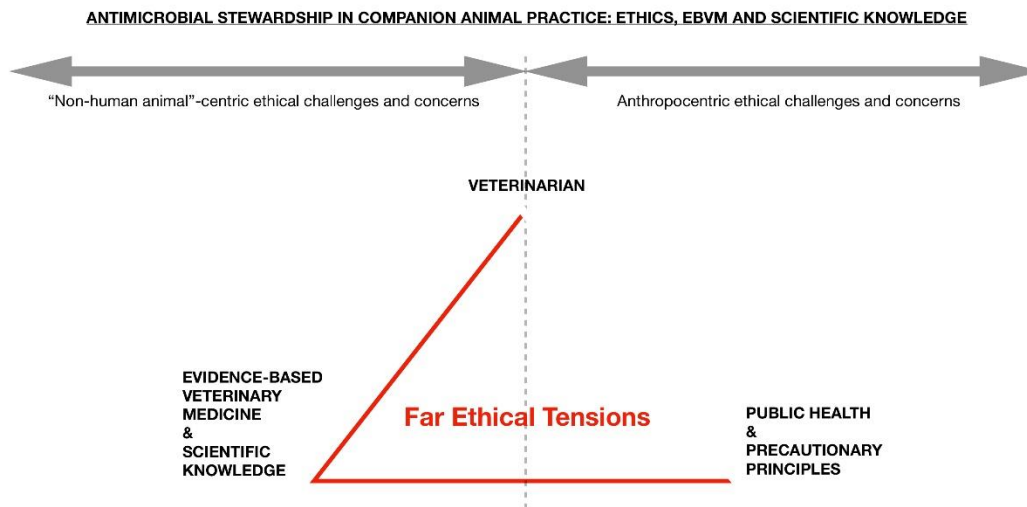
Antimicrobial stewardship campaigns aimed at pet owners, or more generally publics, would also be helpful (see above and chapter 8) as veterinarians could more easily share stewardship responsibility with their clients. Such initiatives could be launched by the profession governing body or be part of governmental initiatives, or even a joint effort. More research on the views of pet owners and the general public on antimicrobial use in animals would be helpful in order to justify and secure financing for such a campaign. Stewardship efforts aimed at pet owners would give weight to any discussion around antimicrobial use happening in the veterinary consult room. Of course, animal keepers in general are mentioned in most veterinary guidelines, but those are still aimed at veterinary professionals, technical in content, and not widely distributed. More education of animal owners both through

and besides veterinary practice is therefore needed. Once again, this could be a space where human and veterinary medicine join their efforts, moving beyond the pervasive blame-culture that plagues the AMR debate (Clark, 2019), and present a united front and message.

9.4. Antimicrobial stewardship and evidence-based veterinary medicine: the challenge of applying precautionary principles

This section sets out the role of scientific knowledge / EBVM as a key factor that affects veterinary decision-making and therefore needs to be more clearly acknowledged (see fig 1.) As discussed in chapter 1, antimicrobial stewardship aims to reduce the development and spread of antimicrobial resistance, based on the idea that reducing overall use of antimicrobials will reduce evolutionary pressure on bacterial populations and therefore lessen the selection for resistance in future bacterial generations. In particular, reducing the use of particular classes of antibiotics will stop resistance to those specific drugs from becoming widespread. While strong arguments for this approach have been presented, this is a precautionary approach which is unpinning by comprehensive scientific evidence, similarly the efficacy of such guidelines is not well understood (Dar et al., 2016). Nevertheless, implementation of this approach is deemed necessary based on projections of the consequences of antimicrobial resistance nowadays and in the future (Review on Antimicrobial Resistance, 2014; Review on Antimicrobial Resistance, 2016).

On the other hand, medical decisions (veterinary and human) are increasingly becoming rooted in scientific evidence, as well as patient / client's preferences and choices when presented with evidence-based risks and outcomes. It is important to recognise that current understanding of medical best practice is constructed as fully incorporating up-to-date scientific knowledge. Clinicians are then required to gain informed consent from patients or clients before treatment with the understanding that the 'informed' aspect of consent implies the communication of this robust scientific knowledge. Consequently, when applying antimicrobial stewardship principles in practice, clinicians must find a way forward that incorporates both the precautionary approach to antimicrobial prescription and the risks and benefits of various treatment options as informed by scientific literature and the body of professional knowledge they are surrounded by. Perhaps unsurprisingly, this is far from a straightforward task and balancing both sides can engender fresh ethical dilemmas.



(Fig 3—Antimicrobial stewardship in companion animal practice: ethics, EBVM and scientific knowledge)

9.4.1. Antimicrobial stewardship and evidence-based veterinary medicine: professional considerations

Individual veterinarians experience ethical tensions caused by the push for EBVM which can for many interact with their identity as veterinary scientists, as represented in Figure 3. As presented in chapter 3, EBVM has been promoted in the literature as the ideal way to practice veterinary medicine (Doig, 2003; Holmes, 2009; Alkoff, 2015), and this goal was seen in the analysis of the interviewed veterinarians' discourse (as highlighted in chapter 7). The veterinarians interviewed expressed their wish for solid evidence to support their clinical decisions, while recognising the limitations of current veterinary literature in terms of quantity, quality and species covered.

The professional views expressed represented a range of opinions on treatment options for specific topics (e.g. antimicrobial use when carrying out dental work, see 7.5.2). The interviewees explained that their prescribing was often based on personal experience, but this experience was sometimes gained from a limited number of cases, sometimes as little as one. However, singular cases had made a strong impression on the individual clinician. Veterinarians recognised that differentiating between habits and experience can be difficult and that professional growth through both self-reflection and continued training was essential to avoid becoming entrenched in prescription habits rather than rooted in carefully curated clinical experience gained directly through practice or through discussion with colleagues. The importance of colleagues as a source of knowledge is well recognised in human medicine (Skodvin et al., 2015), and within this work was also deemed to be important in companion animal veterinary medicine.

A lack of regular updates and information about the development of antimicrobial resistance, but also about the consequences and risks of implementing antimicrobial principles, was noted by several clinicians (see Chapter 8). The push towards using an evidence-based approach in practice has led both physicians and veterinarians to expect to be provided with supporting evidence when asked to alter their approach to cases. Clinical guidelines are usually understood as drawing on a robust analysis of the scientific literature which is then translated into an accessible

format aimed at clinical practice. Antimicrobial stewardship guidelines, however, are as discussed above based on a combination of evidence and the application of precautionary principles, an approach that is seldom encountered in veterinary clinical settings which is different to the use of precautionary approach, for example, environmental science (Kriebel et al., 2001). Due to the nature of antimicrobial prescription as a clinical decision, guidelines, however, are often mixed in nature and may contain clinical advice (Danish Small Animal Veterinary Association, 2013) and their precautionary nature can easily be opaque or not understood. It is important to open-up and make more transparent the ethical significance of the precautionary nature of antimicrobial stewardship guidelines related to companion animal medicine to support clinicians and to make them more aware of the ethical nature of tensions that they experience when making prescribing decisions.

9.4.2. Antimicrobial stewardship and evidence-based veterinary medicine: ethical considerations

Part of the veterinarian's role is to gain informed consent from their client prior to administering treatment to their patient (Royal College of Veterinary Surgeons, 2012; Ashall et al., 2018) (see also 2.2), i.e. veterinarians have to explain to their client the different treatment options available to them, as well as the risks and likely outcomes for each of them, informed by scientific evidence and professional experience. Interviewees acknowledged the difficulty of gaining 'true' or robust informed consent. The risk and uncertainty inherent in the application of stewardship principles (see above 9.3.2) complicate the notion of informed consent. Indeed, if the veterinarian is unsure of the consequences or of the risks and benefits of a course of action, it is very challenging to then communicate them to the client. This is especially important since it is recognised that truthfully communicating the risks of a treatment can disproportionately affect its uptake by the patient (in human medicine) and the perceived incidence of side effects (Wells and Kaptchuk, 2012). In this context, once again, it is unsurprising that a number of veterinarians lean towards defensive prescribing (as presented in chapter 5) or even restrict the information they give to the client (as discussed in chapter 6).

The strict application of antimicrobial stewardship precautionary principles in specific circumstances can cause new ethical tensions. For example, as discussed in the literature (Chapter 2) the use of antimicrobials as part of palliative care in elderly or very sick patients contradicts antimicrobial stewardship principles; yet, as argued by interviewees (Chapter 5), such use is necessary for welfare reasons in many cases if the owner is not prepared to consider euthanasia or at least a shorten lifespan. Similar situations in human medicine have shown that both clinicians and the family of patients receiving palliative care support the use of antimicrobial therapy (Marcus et al., 2001b).

Besides informed consent, various responsibilities regarding prescription of drugs might interfere and confuse the prescription of antimicrobials. For example, as discussed in chapter 7, the prescription cascade requires veterinarians to use medication licensed in a given species if available. It is unclear, however, if a better spectrum of action or route of administration is a good enough justification to use medications licensed in different species (Royal College of Veterinary Surgeons, 2012, p.44). This is important as respecting cascade principles is a legal requirement for veterinarians whereas antimicrobial stewardship guidelines are advisory. In some cases, veterinarians may have no choice but to divert from guidelines due to the legal implications of the cascade. This

type of dilemma was represented in the interviews, for example an interviewee spoke of the cascade when asked about their knowledge of guidelines, revealing some confusion between the legal standards governing prescription and the stewardship guidelines. Confusion between the prominence of various, and sometimes contradictory, texts is likely to be another source of tension in practice that veterinarians have to manage.

Osler has famously said that 'medicine is the science of uncertainty and the art of probability' (Osler et al., 1961); this holds true in veterinary medicine, maybe even more so, as the patient cannot describe their symptoms and might resent examination, owners might misinterpret or not notice relevant clinical signs, and as discussed in the bulk of evidence and information available to the clinicians is limited and incomplete, and often difficult to obtain. In these circumstances, ethical values and constructions of responsibilities have play an important role in antimicrobial prescription as dilemmas are presented as the clinician endeavours to manage clients' expectations, their right to informed consent and the drive to make the best treatment choice for the patient's health and welfare.

9.4.3. Antimicrobial stewardship and evidence-based veterinary medicine: policy implications

Many parties may be involved in communicating with the veterinary profession about antimicrobial stewardship principles, as listed in 9.3.3. As mentioned, and regardless of their exact goal, better communication regarding the nature of antimicrobial stewardship guidelines and the principles they are based on would be beneficial in order to manage veterinarians' expectations regarding underlying evidence. Making clear the ethical values embedded in the guidelines and how they are formulated would be helpful in weighing prescription decisions in practice. Confusion about the goal, origin and nature of the guidelines may impair their implementation. This is important as clinical guidelines have been shown to be better accepted if further training on the nature of the content of policy positions in guidance is given at a local level (Timmermans and Mauck, 2005). So here again, clarifying the ethically relevant nature of the guidance is important, such as making more transparent the clinical and precautionary components of the guidelines, and is likely to lead to better prescription behaviours by veterinarians. Local guidelines (i.e. at the level of the individual practice or hospital) is a worthy goal and is the approach that has been taken in the UK with the 'Protect your antimicrobials' posters being distributed for practices to fill themselves (British Small Animal Veterinary Association, 2012). Interviews have, however, revealed that in many cases such posters had not been filled as they were supposed to (see chapter 7, for full details) or that the antimicrobial options proposed in these tools, were simply reflecting the historical prescription habits of the established clinicians at the practice.. Others reported that the posters were not used much, even if filled in and displayed.

The Danish guidelines mentioned in 9.4.1 (Danish Small Animal Veterinary Association, 2013) were distributed in many different formats, allowing veterinarians to individually chose the presentation they prefer. The clinical components of these guidelines also involved the input of various specialists, not only veterinarians, and have been updated once already. Arguably, such an approach does not have the advantage of having a tailored / local approach which may reduce its uptake by clinicians. However, and while local guidelines may be beneficial based on medical initiatives (Timmermans and Mauck, 2005), veterinarians are more isolated from other specialist professions than doctors are and may struggle to have the knowledge and time to produce consistently high-

quality guidelines at a local level. While Danish guidelines lack the local component that the Protect poster had, an intensive supportive campaign from the publishing association led to a wide distribution among clinicians and a recent study has shown a positive influence on prescription behaviour (Jessen et al., 2017). Such data is not available for the Protect your poster initiative. In view of the perspective presented and analysed in this thesis, one may argue that the Danish approach may be more effective. It is worth noting here that the guidelines have been translated in English and are freely available online (Danish Small Animal Veterinary Association, 2013).

Beyond clinical advice, the precautionary nature of antimicrobial stewardship is rarely acknowledged or explained in official publication. Indeed, prudent use guidelines have little evidence to support their effectiveness (Dar et al., 2016); and therefore may not be fully accepted or understood unless one is aware of the potential consequences of antimicrobial resistance and is supportive of the way these concerns are operationalised in the guidance.. This, in turn, could help veterinarians reconcile their diverse opinions on the role of the veterinary profession in the context of AMR (see 8.3 and 8.4) with a more transparent rationale behind the precautionary approach of antimicrobial stewardship. Indeed, many of the veterinarians interviewed (see chapter 8) felt that they did not know enough about the issue of antimicrobial resistance as a whole, including the situation in veterinary medicine. Regular communication across various professions affected by AMR, and in particular those holding prescription privileges, would therefore help keep the issue at the forefront of clinicians' thoughts. Open and direct feedback on new evidence surrounding the use of guidelines in practice would also be helpful (Dar et al., 2016). Dialogue and feedback regarding current stewardship efforts could be invaluable (and could also be the focus of research in the future) and could promote out of the box thinking by the profession, as many of the strategies used in human medicine (global professional audits, review of prescription decision by microbiologist, easy access to culture and sensitivity, etc.) are out of reach of the veterinary profession due to limited resources. Improving communication and dialogue on values, assumptions and evidence between all professions impacted by antimicrobial stewardship initiatives would be beneficial and was seen as important by many interviewees (see chapter 8), although such initiatives do not currently exist in the UK, at least not for the general veterinary practitioner. Such an approach would also embody the spirit of the One Health principle and may alleviate some of the concerns expressed by veterinarians in interviews regarding One Health.

As discussed in chapter 7, the lack of conformity between veterinary laboratories is also problematic compared to medical laboratories as it prevents overall improvement of culture and sensitivity reporting and does not allow for widespread surveillance of AMR in veterinary practice. Indeed, human laboratories have to follow set standards of reporting while carrying out culture and sensitivity testing (from the Clinical and Laboratory Standards Institute (CLSI) and the European Committee on Antimicrobial Susceptibility Testing (EUCAST)) and their output is collated and audited to keep the development of AMR under surveillance. In contrast, veterinary laboratories do not have to follow standardised testing and reporting, which in turn makes any collation and interpretation of their results on a national or international scale impossible.

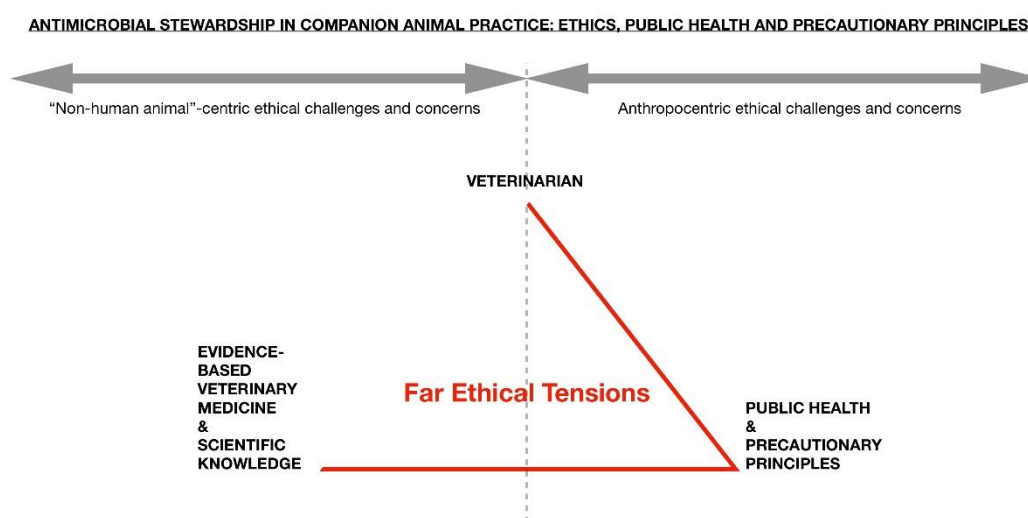
To improve those issues and understand how best to implement new and helpful initiatives, and as discussed in 9.3.3, consultation of the profession as a whole is important; efforts should not be limited to governing and professional bodies in the UK as they only represent a small portion of veterinarians. CPD events (usually organised

by universities or veterinary referral centres, either in person or online) focusing on practical aspects of antimicrobial stewardship, for example using mock clinical cases to illustrate how and when to apply antimicrobial principles would be useful, particular around issues of spectrum, route of administration, and prescription cascade. This would also be a good way to enhance clinical knowledge and promote self-reflection to ensure veterinarians are encouraged to differentiate between prescription habits and those rooted in clinical knowledge and experience. It is important, however, as highlighted by interviewees in chapter 7, that such events provide clinicians with practical and useful knowledge to use in practice and therefore should have a strong clinical approach in order to maintain clinicians' interest and lead to a direct improvement in stewardship.

9.5. Antimicrobial stewardship and companion animal veterinarians: public health considerations and professional standing.

This section aims at explaining the role of public health and precautionary principles as an anchor point of the framework illustrated in fig1. As discussed in section 3 of chapter 3, concerns surrounding antimicrobial resistance, as well as the promotion of antimicrobial stewardship, are inherently embedded into public health discourse and the concepts of inter and intra generational justice (Littmann, 2014). Promoting antimicrobial stewardship in companion animal practice therefore involves bringing into the veterinary setting notions of responsibility towards public health that in turn engender new ethical tensions within the veterinary practice.

The importance of public health when considering AMR-related issues also has implications when considering the standing of the veterinary profession as a whole. To preserve prescription privileges and professional reputation, veterinarians must be seen to adhere to guidelines and to do their best to preserve the efficacy of antimicrobials, and consequently public health itself. As illustrated now by fig. 4, it is important to focus on the way in which public health and the precautionary principles creates ethical tensions for the individual veterinarian.



(Fig 4—Antimicrobial stewardship in companion animal practice: ethics, public health, and precautionary principles)

9.5.1. Antimicrobial stewardship, public health and professional standing: professional considerations

The impact of antimicrobial resistance on public health means that veterinarians are expected to incorporate in their prescription decisions considerations beyond the health of the patient and the treatment choices of their clients (see section 4 of chapter 2 and chapter 8). Beyond clinical particulars such as efficacy and side effects of a drug, the importance of individual drugs for human health and their contribution to emerging resistance are expected to be taken into account, as highlighted by the publication of stewardship guidelines from regulatory and governmental bodies (Publications Office - European Union, 2015). Here again, the attention an individual veterinarian pays to such concerns varies widely as demonstrated by interviewees in section 3 of chapter 8, and depends in part on how much they believe veterinary work, and in particular companion animal medicine, contributes to the global issue of AMR and impacts human health.

As discussed in chapter 2, veterinary organisations that represent the profession—or particular segments of it—have also strongly promoted antimicrobial stewardship, sending the message to their members that good antimicrobial handling was recognised as an important duty by and for the profession (British Small Animal Veterinary Association, 2012; Danish Small Animal Veterinary Association, 2013). As acknowledged by veterinarians in chapter 8, beyond real public health concerns, such initiatives can be seen as an effort to preserve and promote the reputation of the profession and preserve some of the privileges veterinarians enjoy, such as the right to prescribe restricted drugs. Maintaining those privileges helps to ensure continued professional prestige, which in turn enhances the reputation of the veterinary profession.

Finally, and as mentioned in 9.4.3, it should be noted that the fact that some legal rules surrounding prescription of medicine (i.e. the prescription cascade) often renders application of stewardship principles difficult has not been clearly addressed by any organisation at time of writing, potentially resulting in confusing communication originating from policymakers and governmental bodies.

9.5.2. Antimicrobial stewardship, public health and professional standing: ethical considerations

How clinicians understand their responsibility towards antimicrobial stewardship differs between individuals—both in human (Rodrigues et al., 2013) and veterinary medicine (Tompson et al., 2020); this was illustrated throughout chapter 5 to 8, but especially in chapter 8). Individual attitudes and beliefs regarding the importance of AMR as a risk to public health—now and in the future, the contribution of small animal vets to the problem, and the efficacy of stewardship guidelines, will all impact how veterinarians handle ethically challenging clinical situations.

As discussed in section 2.3 of chapter 3, some bacterial populations can cross between non-human and human animal populations and vice-versa, and pet animals have the potential to act as reservoirs of resistant bacteria that can affect human populations (Guardabassi et al., 2004; Abraham et al., 2014; Goni et al., 2018). As highlighted at the start of the thesis in chapter 1, reducing the prevalence of AMR overall should have benefits for all animals, following the principles of the One Health approach. However, this study (see 8.2) has provided evidence that not all UK based veterinarians, however, believe in the benefits of considering medicine and veterinary medicine under the One Health umbrella, and this in turn will influence how they weigh prescription decisions in practice. Benefits

of antimicrobial stewardship and of curbing antimicrobial resistance are still largely unproven (Dar et al., 2016) and usually illustrated by reporting projected impacts on the medical system and human health. Many veterinarians in this study wanted to know more about the current and future impact of AMR both on human health, but also on their own patients. As discussed in section 5 of chapter 2, and as argued by Abelson (2005), acting following the concept of moral distance, i.e. by prioritising the rights and needs of those close to us, can be ethically justified if acting otherwise would have uncertain or statistically trivial benefits, or indefinite beneficiaries which can help us understand how some veterinarians construct their responsibilities to antimicrobial stewardship. If veterinarians have little knowledge of AMR and of the impact of antimicrobial prescription, it is natural for them to believe that their own contribution may be statistically insignificant (see 6.3 for example). Similarly, if the influence of veterinary prescriptions on human health is unclear, antimicrobial stewardship could be driven by a concern to limit the spread and worsening of resistance in veterinary medicine. If the beneficiaries of stewardship initiatives are not clearly identified and justified, however, the argument holds little weight. In such circumstances, and to mitigate the strong influence of moral distance on a profession whose identity is tied to its duty of care (see 3.4.2 and 9.3), knowledge and critical information are essential, as demonstrated by interviewees in chapter 8, in order to weigh the interests of all parties involved in a decision and successfully navigate ever-evolving ethical challenges.

Guidelines have various tenets (see 1.3.1 for a summary) that are presented as equally important. Consequently, many questions are left at the discretion of the clinician, e.g. should the choice of the antimicrobial be more important than ensuring good compliance? Or is the reverse true? This is of particular importance in veterinary medicine where administering drugs to fractious patients is often challenging. In section 3 of chapter 8, a veterinarian emphasised how little control clinicians have over antimicrobials once they have been dispensed and how they can often be used inappropriately once in people's home. This is another argument for creating stewardship directives aimed at pet owners and lay members of the public, as improving pet owners' compliance with prescription directives is an essential step towards better antimicrobial use in veterinary medicine as discussed in 2.4.2.

How veterinarians interpret and prioritise guidelines is likely to depend on their personal knowledge of efficacy, spectrum and impact of specific drugs, but also their personal experience or habits (see chapter 7). For example, in this study, most interviewees agreed that they did not use fluoroquinolones without significant reason to do so (see 7.2.2), but many were less keen on withholding antimicrobials in situations where they were of potential benefit. Not using fluoroquinolones helped clinicians construct a positive narrative around their antimicrobial stewardship approach, which in turn allowed them to be less strict in other circumstances. This illustrates the tension created by antimicrobial stewardship policies on veterinarians' decision-making process. Indeed, such reasoning demonstrates a wish to respect the guidelines, while keeping to simple rules and limiting the impact of stewardship onto the individual patient. The veterinarian respects the guidelines by not using fluoroquinolones; yet, they reduce the perceived risk to their patient by still prescribing a different antimicrobial. Depending on specific circumstances, such an approach may be reasonable or could lead to repeated unnecessary prescription of antimicrobials, and illustrates the need to weigh each clinical situation individually.

9.5.3. Antimicrobial stewardship, public health and professional standing: policy implications

This study showed that individual veterinarians have diverse views on antimicrobial stewardship and the importance and impact of resistance (see chapter 8). It is, therefore, important to understand that various strategies are needed to effectively communicate with the profession as a whole. Overall, however, veterinarians in this study demonstrated a strong affinity for scientific evidence-based knowledge. Therefore, a discussion about the evidence, known facts and limitations surrounding AMR as a global issue must be a stepping stone, or at the very least an easily accessible addendum, to introducing any AMR policy and guidelines. As discussed in 9.4.3, the nature of precautionary principles and rational reasoning behind antimicrobial stewardship should also be clearly communicated, including an admission of the limitations and risks involved, both to human and veterinary patients. New knowledge should be fed back regularly to keep clinicians motivated and aware of the issue, although it is unclear who such a responsibility should fall to. Existing initiatives to transfer knowledge among veterinarians (see 7.5.2) could be built upon to take on that role. From the conclusions of chapter 7, it is essential to remember that veterinarians' time and access to academic resources are limited, and communication on any topic should therefore be concise, centred on clinical impacts and already critically appraised and referenced. This is also important as veterinarians have an obligation to gain informed consent from their client, and if unable to explain the risks and implications of a particular course of action are likely to fall back on defensive prescribing instead.

As discussed previously, encouraging links between the veterinary profession and other professions is important. In particular, veterinarians are likely to respond more positively to professionals involved in the provision of clinical care and who are able to curate information to be most relevant to veterinarians' clinical work. Chapter 7 showed that veterinarians can find results and conclusions from academic papers difficult to translate into practice. Expanding strategies to tackle the AMR issue, alongside traditional EBVM that does not address the question of prudent use principles, is therefore needed to communicate most effectively with veterinarians.

Consequently, a clearer approach to antimicrobial stewardship is needed, one that acknowledges patient safety as an endpoint of use, which guidelines and stewardship literature have failed to do to date (see 5.4.2 and (George and Morris, 2010)). It is likely that such an approach could only be developed through consultation with the profession as discussed earlier in this chapter and by utilising and acknowledging the vast body of knowledge that veterinarians have gathered through their combined experience alongside published evidence. In particular explaining how to prioritise various facets of antimicrobial prescription, such as compliance, individual drug choice, course length, etc in varied circumstances would help guide decision-making in practice. Further studies and scientific knowledge giving clinicians information on the need for antimicrobials in specific situations would also be useful. A clarification of how stewardship guidelines fit within the legal prescription rules is also needed as discussed in the previous section.

Finally, it should be recognised that veterinarians' opinions and views of the One Health principle affect how guidelines are perceived by individuals, e.g. guidelines may be seen as existing for human benefit while putting veterinary patients at risk. Veterinarians' reservations towards the One Health approach deserve to be heard, investigated and answered in order to ensure that they trust the current approach to AMR. The benefits of One

Health for veterinary patients should be clearly reported and emphasised as veterinarians have shown a clear interest in understanding AMR's impact on their patients, not only in the present but also in the future. This is likely to lead to an increased perception of One Health as being relevant to veterinary work. The consequences of veterinary prescription of antimicrobials may also be more easily understood.

Here again, the concept of 'moral distance' can be recognised and used as a tool to improve rather than impede stewardship effort. Veterinarians understandably feel more responsibility towards their patients, present and future, and therefore emphasising the impact of AMR on animal populations, alongside human ones, would be helpful in communicating the impact and consequences of AMR and why curbing it is essential.

9.6. Expanding this framework to other ethical veterinary concerns and further research.

While AMR is an important issue, the ethical framework described in this chapter and illustrated in figure 1 at the start, can also be applied in other contexts. The most significant feature of this framework is the understanding that ethical challenges faced by veterinarians have many sources, but may be experienced differently based on their origin. In particular, the concept of moral distance may come into play when faced with conflicting ethical tensions and instead of being ignored, should be taken into account when communicating with, reporting on, or studying the veterinary profession.

9.6.1. Distinction between near and far ethical tensions

As demonstrated through the analysis of the veterinarians' interviews in chapter 5 to 8, it is clear that some ethical dilemmas are experienced closely and acutely by companion animal veterinarians in the practice of their profession, usually ones that exclusively involve close relationships such as the typical triangle formed by the veterinarian, their patient and client. For example, emotional language was used when describing potential risk to the patient and poor case outcomes (see chapter 5). Relationship with other members of staff in the clinic are likely to be experienced in a similar way as well, as demonstrated by veterinarians' reliance on colleagues' opinions and knowledge (see chapter 7).

Ethical dilemmas generated by regulations, guidelines, public health considerations, etc. will often appear further removed from daily practice, and less morally significant in comparison. For example, and as discussed in 9.5.2, how good antimicrobial stewardship will benefit the health of nebulous generations of future humans may seem less important compared to the ill pet and worried human that the veterinarian directly interact with in their consult room and who may be perceived as having a superseding moral claim by the veterinarian. Similar observations have been made regarding the relationship between physicians and their patients as well (Littmann, 2014). This is particularly important if the benefits in question are unproven and ill-defined. Consequently, imagining all ethical tensions as having an equal standing from the start and ignoring moral distance and how it affects human decision-making process is unhelpful and likely to adversely affect attempts at communicating with the veterinary profession (see section 5 of chapter 2 for more detail). It should be noted here that this thesis does not attempt to make a philosophical argument on the righteousness of moral distance, but only recognises its importance in the decision-making process of clinicians as repeatedly described by interviewees and its potential as a tool to improve the effectiveness of communication with veterinarians. More help and support might be

needed to ensure individual clinicians can effectively face the ethical challenges they face in their work, especially when they originate from beyond the practice walls.

Recognising the emotional impact of veterinary work and how it affects the moral dilemmas veterinarians are balancing when practicing can be used as a tool to improve clinical performance and professional behaviour, but may also be important to reduce the stress generated by those dilemmas. As discussed previously, veterinarians experience high levels of stress in practice and this must be kept in mind while addressing ethical dilemmas, as any approach that fails to address and lessen its impact on the profession's stress will be resented and poorly accepted. It may also have real-life negative consequences on professionals dealing with a high prevalence of mental health issues and suicide attempts and it would be irresponsible not to take this into account when implementing any strategies affecting veterinary practice.

9.6.2. Application in other ethical contexts

The distinction between far and near responsibilities is not limited to the issue of AMR. Any area of companion animal veterinary medicine that involve either public health, the local community, or pet populations, will likely experience a similar divide in how ethical tensions are generated. For example, topics such as zoonoses, pet vaccinations, the role of the veterinary profession in promoting animal welfare, or pet breeding would all fit within a similarly constructed ethical framework.

The ethical conceptualisation presented in fig.1 could be applied to other ethically challenging issues in veterinary practice as mentioned above. But it could also be adapted to investigate issues involving food-producing animal, with some modifications.

9.6.3. Further research

To expand and build on the framework presented here, more research is needed. In the context of AMR, subsequent studies focusing on pet owners and investigating how they experience antimicrobial prescription in veterinary practice, but also how they understand AMR and the role they, and their pet, play within this issue would be helpful.

As mentioned in section 5.3 of chapter 4, my dual role—as both a researcher and a veterinarian—has unavoidably informed my approach to this study. While I believe that it allowed me to quickly build rapport with the interviewees through the acknowledgement of shared experiences, and led to frank and honest answers in many (but probably not all) cases, repeating this work with a researcher not possessing a veterinary background and analysing how answers from veterinarians might differ would be fascinating and may allow to refine the framework further. Such an approach may reveal facts from interviewees that they did not share with me, either because they were not comfortable doing so or because they would consider it evident given our shared experience of companion animal practice. Getting veterinarians to examine and reflect on the framework presented here, most likely using focus groups or a Delphi study, could also provide invaluable insights into their conceptualisation of their professional role and the ethical tensions they navigate.

As discussed in section 4.3 of chapter 4, further analysis could be carried out on the data collected and analysed in this thesis. Indeed, thematic analysis allows for further analysis to be carried out retrospectively; applying, for example, a theory of practice (e.g. Bourdieu's, as done on a dataset investigating antimicrobial stewardship in a human hospital by Broom et al. (2014)) to the analysed data may yield further and richer insight into veterinarians' experience in companion animal practice. In the medium to long term, and alongside the conclusions of this thesis, findings from applying a theory of practice to the dataset could help formulate a stewardship approach that supersedes the reductive nature of precautionary guidelines, acknowledges the benefits of considering the role of moral distance in the clinical decision-making process, and actively reflects on patient safety as an endpoint of stewardship strategies.

Bibliography

- Abelson, R. 2005. Moral distance: What do we owe to unknown strangers? *Philosophical Forum*, 36(1), 31-39.
- Abraham, S., Wong, H. S., Turnidge, J., Johnson, J. R. & Trott, D. J. 2014. Carbapenemase-producing bacteria in companion animals: a public health concern on the horizon. *Journal of Antimicrobial Chemotherapy*, 69(5), 1155-1157.
- Acar, J. 1997. Broad- and narrow-spectrum antibiotics: an unhelpful categorization. *Clinical Microbiology and Infection*, 3(4), 395-396.
- Adams, M. P. 2014. Dual Agency and Role Morality. *American Journal of Bioethics*, 14(9), 44-45.
- Aiello, A. E., King, N. B. & Foxman, B. 2006. Ethical conflicts in public health research and practice - Antimicrobial resistance and the ethics of drug development. *American Journal of Public Health*, 96(11), 1910-1914.
- Akkad, A., Jackson, C., Kenyon, S., Dixon-Woods, M., Taub, N. & Habiba, M. 2006. Patients' perceptions of written consent: questionnaire study. *British Medical Journal*, 333(7567), 528-528.
- Alder, M. & Easton, G. 2005. Human and veterinary medicine. *British Medical Journal*, 330(7496), 858-859.
- Alkoff, R. 2015. Evidence-based veterinary medicine. *Veterinary Record*, 177(12), 320-320.
- Altiner, A. 2004. Acute cough: a qualitative analysis of how GPs manage the consultation when patients explicitly or implicitly expect antibiotic prescriptions. *Family Practice*, 21(5), 500-506.
- American Animal Hospital, A. 2003. *The path to high quality care : practical tips for improving compliance*, Lakewood, American Animal Hospital Association.
- Anonymous 2005. One medicine? *Veterinary Record*, 157(22), 669-669.
- Anonymous 2014. Making evidence-based veterinary medicine work for clinicians. *Veterinary Record*, 175(20), 499-499.
- Anonymous 2015. EBVM: application in everyday practice. *Veterinary Record*, 177(24), 614-614.
- Anonymous 2016. Applying EBVM in practice. *Veterinary Record*, 179(12), 295-295.
- Appelbaum, P. C. 2012. 2012 and beyond: potential for the start of a second pre-antibiotic era? *Journal of Antimicrobial Chemotherapy*, 67(9), 2062-2068.
- Appelbaum, A. I. 1999. *Ethics for Adversaries : the Morality of Roles in Public and Professional Life*, Princeton, Princeton University Press.
- Arlt, S. P. & Heuwieser, W. 2011. Training Students to Appraise the Quality of Scientific Literature. *Journal of Veterinary Medical Education*, 38(2), 135-140.
- Arluke, A. & Sanders, C. 1996. *Regarding animals*, Philadelphia, Temple University Press.

- Armitage-Chan, E., Maddison, J. & May, S. A. 2016. What is the veterinary professional identity? Preliminary findings from web-based continuing professional development in veterinary professionalism. *Veterinary Record*, 178(13), 318-323.
- Ashall, V., Millar, K. M. & Hobson-West, P. 2018. Informed Consent in Veterinary Medicine: Ethical Implications for the Profession and the Animal 'Patient'. *Food Ethics*, 1, 247-258.
- Ashiru-Oredope, D., Budd, E. L., Bhattacharya, A., Din, N., McNulty, C. a. M., Micallef, C., Ladenheim, D., Beech, E., Murdan, S., Hopkins, S. & Espaur 2016. Implementation of antimicrobial stewardship interventions recommended by national toolkits in primary and secondary healthcare sectors in England: TARGET and Start Smart Then Focus. *Journal of Antimicrobial Chemotherapy*, 71(5), 1408-1414.
- Askitopoulou, H. & Vgontzas, A. N. 2018. The relevance of the Hippocratic Oath to the ethical and moral values of contemporary medicine. Part II: interpretation of the Hippocratic Oath-today's perspective. *European Spine Journal*, 27(7), 1491-1500.
- Asselin, M. E. 2003. Insider research: issues to consider when doing qualitative research in your own setting. *Journal for Nurses in Staff Development*, 19(2), 99-103.
- Atlas, R. M. 2013. One Health: its origins and future. *Curr Top Microbiol Immunol*, 365, 1-13.
- Balasubramanyam, M. 2005. Transforming 'traditional anecdotes' to 'evidence-based medicine' and its relation to diabetes. *Current Science*, 89(3), 428-428.
- Bamford, R. 2014. Getting Even More Specific About Physicians' Obligations: Justice, Responsibility, and Professionalism. *American Journal of Bioethics*, 14(9), 46-47.
- Banja, J. 2014. A Mask Tells Us More Than a Face. *American Journal of Bioethics*, 14(9), 47-49.
- Barbisch, D., Koenig, K. L. & Shih, F. Y. 2015. Is There a Case for Quarantine? Perspectives from SARS to Ebola. *Disaster Medicine and Public Health Preparedness*, 9(5), 547-553.
- Barbonis, T. & Endenburg, N. 2007. Aggressive clients in Dutch veterinary practice. *Tijdschrift voor Diergeneeskunde*, 132(10), 380-384.
- Barnard, N. & Foster, A. 2018. How to treat Pseudomonas otitis in dogs. *Veterinary Record*, 182(4), 109.
- Bartram, D. J. & Baldwin, D. S. 2010. Veterinary surgeons and suicide: a structured review of possible influences on increased risk. *Veterinary Record*, 166(13), 388-397.
- Batchelor, C. E. & Mckeegan, D. E. 2012. Survey of the frequency and perceived stressfulness of ethical dilemmas encountered in UK veterinary practice. *Veterinary Record*, 170(1), 19.
- Bateson, P. 1991. Assessment of pain in animals. *Animal Behaviour*, 42(5), 827-839.
- Beauchamp, T. L. & Childress, J. F. 2013. *Principles of biomedical ethics*, New York, Oxford University Press.

- Begemann, S., Perkins, E., Van Hoyweghen, I., Christley, R. & Watkins, F. 2018. How Political Cultures Produce Different Antibiotic Policies in Agriculture: A Historical Comparative Case Study between the United Kingdom and Sweden. *Sociologia Ruralis*, 58(4), 765-785.
- Bell, A., Helm, J. & Reid, J. 2014. Veterinarians' attitudes to chronic pain in dogs. *Veterinary Record*, 175(17), 428.
- Bignall, J. & Horton, R. 1995. Learning from stories—The Lancet's Case Reports. *The Lancet*, 346(8985), 1246.
- Bloor, M., Frankland, J., Thomas, M. & Robson, K. 2002. *Focus groups in social research*, London, SAGE Publications.
- Bourelly, C., Fortane, N., Calavas, D., Leblond, A. & Gay, E. 2018. Why do veterinarians ask for antimicrobial susceptibility testing? A qualitative study exploring determinants and evaluating the impact of antibiotic reduction policy. *Preventive Veterinary Medicine*, 159, 123-134.
- Bowe, W. P., Patel, N. B. & Logan, A. C. 2014. Acne vulgaris, probiotics and the gut-brain-skin axis: from anecdote to translational medicine. *Beneficial Microbes*, 5(2), 185-199.
- Bradley, C. P. 1992. Turning anecdotes into data - The critical incident technique. *Family Practice*, 9(1), 98-103.
- Braun, V. & Clarke, V. 2013. *Successful qualitative research : a practical guide for beginners*, London, SAGE Publications.
- Bresalier, M., Cassidy, A. & Woods, A. 2015. *One Health in History*, Wallingford, CAB International.
- British Small Animal Veterinary Association. 2012. *PROTECT Your Antimicrobials Poster* [Online]. Available: https://www.bsava.com/Portals/0/resources/documents/Protect%20poster_2017.pdf [Accessed 28/09/20].
- British Small Animal Veterinary Association 2018. *BSAVA/SAMSoc Guide to Responsible Use of Antibacterials: PROTECT ME*, British Small Animal Veterinary Association. Available: <https://www.bsavalibrary.com/content/book/10.22233/9781910443644> [Accessed 29/09/20].
- British Veterinary Association. 2016. Vets Speaking Up for Animal Welfare - BVA animal welfare strategy. *BVA Animal Welfare Strategy* [Online]. Available: https://www.bva.co.uk/uploadedFiles/Content/News,_campaigns_and_policies/Policies/Ethics_and_welfare/BVA-animal-welfare-strategy-feb-2016.pdf [Accessed 29/09/2020].
- Broom, A., Broom, J. & Kirby, E. 2014. Cultures of resistance? A Bourdieusian analysis of doctors' antibiotic prescribing. *Social Science & Medicine*, 110, 81-88.
- Broom, D. M. 2010. Cognitive ability and awareness in domestic animals and decisions about obligations to animals. *Applied Animal Behaviour Science*, 126(1-2), 1-11.
- Brown, E. M. 2002. Guidelines for antibiotic usage in hospitals. *Journal of Antimicrobial Chemotherapy*, 49(4), 587-592.

- Brown, N. 1994. Dawn of the post-antibiotic age? *British Medical Journal*, 309(6954), 615.
- Brown, N. & Nettleton, S. 2017. Bugs in the blog: Immunitary moralism in antimicrobial resistance (AMR). *Social Theory & Health*, 15(3), 302-322.
- Brudney, D. & Lantos, J. D. 2014. Whose interests count? *Pediatrics*, 134, S78-S80.
- Buckland, E., O'Neill, D., Summers, J., Pereira Mateus, A., Church, D., Redmond, L. & Brodbelt, D. 2016. Characterisation of antimicrobial usage in cats and dogs attending UK primary care companion animal veterinary practices. *Veterinary Record*, 179, 489-496.
- Burck, R. 2002. Minimal risk: The debate goes on. *Critical Care Medicine*, 30(5), 1180-1181.
- Burke, S., Black, V., Sánchez-Vizcaíno, F., Radford, A., Hibbert, A. & Tasker, S. 2016. Use of cefovecin in a UK population of cats attending first-opinion practices as recorded in electronic health records. *Journal of Feline Medicine and Surgery*, 19(6), 687-692.
- Burnham, J. P., Olsen, M. A. & Kollef, M. H. 2018. Re-estimating annual deaths due to multidrug-resistant organism infections. *Infection Control and Hospital Epidemiology*, 0, 1-2.
- Burns, E., Fenwick, J., Schmied, V. & Sheehan, A. 2012. Reflexivity in midwifery research: The insider/outsider debate. *Midwifery*, 28(1), 52-60.
- Burns, K. 2013. AAHA president sees uncertainty for profession. *Journal of the American Veterinary Medical Association*, 242(10), 1329.
- Busani, L., Graziani, C., Franco, A., Di Egidio, A., Binkin, N. & Battisti, A. 2004. Survey of the knowledge, attitudes and practice of Italian beef and dairy cattle veterinarians concerning the use of antibiotics. *Veterinary Record*, 155(23), 733-738.
- Butler, C. C., Rollnick, S., Pill, R., Maggs-Rapport, F. & Stott, N. 1998. Understanding the culture of prescribing: qualitative study of general practitioners' and patients' perceptions of antibiotics for sore throats. *British Medical Journal*, 317(7159), 637-642.
- Butterfield, M. E., Hill, S. E. & Lord, C. G. 2012. Mangy mutt or furry friend? Anthropomorphism promotes animal welfare. *Journal of Experimental Social Psychology*, 48(4), 957-960.
- Byrne, S., Bradley, C. P. & Murphy, M. 2012. Antibiotic prescribing in primary care, adherence to guidelines and unnecessary prescribing - an Irish perspective. *BMC Family Practice*, 13(1), 43.
- Cardwell, J. M. & Lewis, E. G. 2017. Vocation, Belongingness, and Balance: A Qualitative Study of Veterinary Student Well-Being. *Journal of Veterinary Medical Education*, 44(1), 29-37.
- Carling, P., Fung, T., Killion, A., Terrin, N. & Barza, M. 2003. Favorable impact of a multidisciplinary antibiotic management program conducted during 7 years. *Infection Control and Hospital Epidemiology*, 24.

- Cartwright, N. 2011. A philosopher's view of the long road from RCTs to effectiveness. *The Lancet*, 377(9775), 1400-1401.
- Casewell, M., Friis, C., Marco, E., McMullin, P. & Phillips, I. 2003. The European ban on growth-promoting antibiotics and emerging consequences for human and animal health. *Journal of Antimicrobial Chemotherapy*, 52(2), 159-161.
- Cassini, A., Högberg, L. D., Plachouras, D., Quattrocchi, A., Hoxha, A., Simonsen, G. S., Colomb-Cotinat, M., Kretzschmar, M. E., Devleeschauwer, B., Cecchini, M., Ouakrim, D. A., Oliveira, T. C., Struelens, M. J., Suetens, C., Monnet, D. L., Strauss, R., Mertens, K., Struyf, T., Catry, B., Latour, K., Ivanov, I. N., Dobрева, E. G., Tambic Andrašević, A., Soprek, S., Budimir, A., Paphitou, N., Žemlicková, H., Schytte Olsen, S., Wolff Sönksen, U., Märtin, P., Ivanova, M., Lyytikäinen, O., Jalava, J., Coignard, B., Eckmanns, T., Abu Sin, M., Haller, S., Daikos, G. L., Gikas, A., Tsiodras, S., Kontopidou, F., Tóth, Á., Hajdu, Á., Guólaugsson, Ó., Kristinsson, K. G., Murchan, S., Burns, K., Pezzotti, P., Gagliotti, C., Dumpis, U., Liuimiene, A., Perrin, M., Borg, M. A., De Greeff, S. C., Monen, J. C. M., Koek, M. B. G., Elstrøm, P., Zabicka, D., Deptula, A., Hryniewicz, W., Caniça, M., Nogueira, P. J., Fernandes, P. A., Manageiro, V., Popescu, G. A., Serban, R. I., Schréterová, E., Litvová, S., Štefkovicová, M., Kolman, J., Klavs, I., Korošec, A., Aracil, B., Asensio, A., Pérez-Vázquez, M., Billström, H., Larsson, S., Reilly, J. S., Johnson, A. & Hopkins, S. 2019. Attributable deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in the EU and the European Economic Area in 2015: a population-level modelling analysis. *The Lancet Infectious Diseases*, 19(1), 56-66.
- Charani, E., Cooke, J. & Holmes, A. 2010. Antibiotic stewardship programmes--what's missing? *Journal of Antimicrobial Chemotherapy*, 65(11), 2275-2277.
- Chatterjee, D. K. 2003. Moral Distance: Introduction. *The Monist*, 86(3), 327-332.
- Chitty, J. 2006. Dealing with the informed client. *In Practice*, 28(5), 290.
- Christiansen, S. B., Kristensen, A. T., Lassen, J. & Sandøe, P. 2016. Veterinarians' role in clients' decision-making regarding seriously ill companion animal patients. *Acta Veterinaria Scandinavica*, 58(1), 30.
- Clark, K. 2019. 'Ditch the blame culture to tackle AMR'. *Veterinary Record*, 184(21), 636-636.
- Clarke, C. A. & Knights, D. 2018. Practice makes perfect? Skillful performances in veterinary work. *Human Relations*, 71(10), 1395-1421.
- Clarke, P., Henning, J., King, E., Coleman, G. & Schull, D. 2019. What makes a great clinical team? Stakeholder perspectives on the attributes of effective veterinary health care teams in Australia. *Australian veterinary journal*, 97(11), 424-432.
- Cleton, N. B. & Meijboom, F. L. B. 2009. A framework to address conflicts in veterinary responsibilities. In: MILLAR, K. M., HOBSON-WEST, P. & NERLICH, B. (eds.) *Ethical Futures: Bioscience and Food Horizons*. Wageningen: Wageningen Academic Publishers.

- Cockcroft, P. D. 1998. A survey of pattern recognition methods in veterinary diagnosis. *Journal of Veterinary Medical Education*, 25(2), 21-23.
- Cockcroft, P. D. 2007. Clinical reasoning and decision analysis. *Veterinary Clinics of North America - Small Animal Practice*, 37(3), 499-520.
- Coe, J. B., Weijts, C. A., Muise, A., Christofides, E. & Desmarais, S. 2011. Teaching veterinary professionalism in the Face(book) of change. *Journal of Veterinary Medical Education*, 38(4), 353-359.
- Coenen, S., Michiels, B., Renard, D., Denekens, J. & Van Royen, P. 2006. Antibiotic prescribing for acute cough: the effect of perceived patient demand. *British Journal of General Practice*, 56(524), 183.
- Cohen, S. P. 2002. Can pets function as family members? *West J Nurs Res*, 24(6), 621-638.
- Cohen, S. P. 2007. Compassion fatigue and the veterinary health team. *Veterinary Clinics of North America - Small Animal Practice*, 37(1), 123-134; abstract ix.
- Collignon, P. & Voss, A. 2015. China, what antibiotics and what volumes are used in food production animals? *Antimicrobial Resistance and Infection Control*, 4, 16.
- Colville, P., Everitt, S. & Radford, A. 2016. Collecting the evidence for EBVM. *Veterinary Record*, 178(7), 174-174.
- Committee for Medicinal Products for Veterinary Use 2015. Reflection paper on the risk of antimicrobial resistance transfer from companion animals. European Medicine Agency.
- Cook, P. P., Catrou, P. G. & Christie, J. D. 2004. Reduction in broad-spectrum antimicrobial use associated with no improvement in hospital antibiogram. *Journal of Antimicrobial Chemotherapy*, 53(5), 853-859.
- Cook, P. P., Das, T. D., Gooch, M. & Catrou, P. G. 2008. Effect of a program to reduce hospital ciprofloxacin use on nosocomial *Pseudomonas aeruginosa* susceptibility to quinolones and other antimicrobial agents. *Infection Control and Hospital Epidemiology*, 29.
- Cope, A. L., Wood, F., Francis, N. A. & Chestnutt, I. G. 2015. General practitioners' attitudes towards the management of dental conditions and use of antibiotics in these consultations: a qualitative study. *BMJ open*, 5(10), 8.
- Corbin, J. & Strauss, A. 2015. *Basics of qualitative research : techniques and procedures for developing grounded theory*, Thousand Oaks, SAGE Publications.
- Cornell, K. K. & Kopcha, M. 2007. Client-Veterinarian Communication: Skills for Client Centered Dialogue and Shared Decision Making. *Veterinary Clinics of North America: Small Animal Practice*, 37(1), 37-47.
- Cornish, A. R., Caspar, G. L., Collins, T., Degeling, C., Fawcett, A., Fisher, A. D., Freire, R., Hazel, S. J., Hood, J., Johnson, A. J., Lloyd, J., Phillips, C. J. C., Stafford, K., Tzioumis, V. & Mcgreevy, P. D. 2016. Career Preferences and Opinions on Animal Welfare and Ethics: A Survey of Veterinary Students in Australia and New Zealand. *Journal of Veterinary Medical Education*, 43(3), 310-320.

- Corrigan, O. 2003. Empty ethics: the problem with informed consent. *Social Health Illn*, 25(7), 768-792.
- Cortoos, P. J. D. W., K, Schreurs, B. H. J., Laekeman, G. & Peetermans, W. E. 2012. Divergent Intentions to Use Antibiotic Guidelines: A Theory of Planned Behavior Survey. *Medical Decision Making*, 32(1), 145-153.
- Costantini, O., Papp, K. K., Como, J., Aucott, J., Carlson, M. D. & Aron, D. C. 1999. Attitudes of faculty, housestaff, and medical students toward clinical practice guidelines. *Academic Medicine*, 74(10), 1138-1143.
- Courtenay, M., Conrad, P., Wilkes, M., La Ragione, R. & Fitzpatrick, N. 2014. Interprofessional initiatives between the human health professions and veterinary medical students: a scoping review. *Journal of Interprofessional Care*, 28(4), 323-330.
- Coxeter, P. D., Del Mar, C. & Hoffmann, T. C. 2017. Parents' Expectations and Experiences of Antibiotics for Acute Respiratory Infections in Primary Care. *Annals of Family Medicine*, 15(2), 149-154.
- Crawford, J. & Balzer, M. 2017. Are pets really part of the family? *Australian veterinary journal*, 95(5), N18-N20.
- Croskerry, P. & Norman, G. 2008. Overconfidence in Clinical Decision Making. *American Journal of Medicine*, 121(5, Supplement), S24-S29.
- Currie, K., King, C., Nuttall, T., Smith, M. & Flowers, P. 2018. Expert consensus regarding drivers of antimicrobial stewardship in companion animal veterinary practice: a Delphi study. *Vet Rec*, 182(24), 691.
- Danish Small Animal Veterinary Association 2013. *Antibiotic Use Guidelines for Companion Animal Practice*, Companion Animal Group, Danish Veterinary Association. Available:https://www.ddd.dk/media/2175/assembled_final.pdf [Accessed 29/09/20].
- Dar, O. A., Hasan, R., Schlundt, J., Harbarth, S., Caleo, G., Dar, F. K., Littmann, J., Rweyemamu, M., Buckley, E. J., Shahid, M., Kock, R., Li, H. L., Giha, H., Khan, M., So, A. D., Bindayna, K. M., Kessel, A., Pedersen, H. B., Permanand, G., Zumla, A., Røttingen, J.-A. & Heymann, D. L. 2016. Exploring the evidence base for national and regional policy interventions to combat resistance. *The Lancet*, 387(10015), 285-295.
- Das, P. & Horton, R. 2016. Antibiotics: achieving the balance between access and excess. *The Lancet*, 387(10014), 102-104.
- Davey, P., Brown, E., Fenelon, L., Finch, R., Gould, I. M., Homes, A., Ramsay, C. R., Taylor, E., Wiffen, P. & Wilcox, M. 2006. Systematic review of antimicrobial drug prescribing in hospitals.
- Davidoff, F., Haynes, B., Sackett, D. & Smith, R. 1995. Evidence based medicine. *British Medical Journal*, 310(6987), 1085-1086.
- Davies, J. & Davies, D. 2010. Origins and evolution of antibiotic resistance. *Microbiology and Molecular Biology Reviews*, 74(3), 417-433.
- Davis, M., Whittaker, A., Lindgren, M., Djerf-Pierre, M., Manderson, L. & Flowers, P. 2018. Understanding media publics and the antimicrobial resistance crisis. *Global Public Health*, 13(9), 1158-1168.

- Dawes, M. & Sampson, U. 2003. Knowledge management in clinical practice: a systematic review of information seeking behavior in physicians. *International Journal of Medical Informatics*, 71(1), 9-15.
- Dawson, A. & Verweij, M. F. 2007. Ethics, prevention, and public health.
- Dawson, B. F. Y. & Thompson, N. J. 2017. The Effect of Personality on Occupational Stress in Veterinary Surgeons. *Journal of Veterinary Medical Education*, 44(1), 72-83.
- De Briyne, N., Price, S., Atkinson, J., Pokludová, L. & Borriello, S. P. 2013. Factors influencing antibiotic prescribing habits and use of sensitivity testing amongst veterinarians in Europe. *Veterinary Record*, 173(19), 475-475.
- De Graaf, G. 2005. Veterinarians' discourses on animals and clients. *Journal of Agricultural & Environmental Ethics*, 18(6), 557-578.
- De Souza, V., Macfarlane, A., Murphy, A. W., Hanahoe, B., Barber, A. & Cormican, M. 2006. A qualitative study of factors influencing antimicrobial prescribing by non-consultant hospital doctors. *Journal of Antimicrobial Chemotherapy*, 58(4), 840-843.
- De Sutter, A. I., De Meyere, M. J., De Maeseneer, J. M. & Peersman, W. P. 2001. Antibiotic prescribing in acute infections of the nose or sinuses: a matter of personal habit? *Family Practice*, 18(2), 209-213.
- Dean, R. & Brennan, M. 2016. Dearth of evidence for EBVM. *Veterinary Record*, 179(10), 258-259.
- Degeling, C., Kerridge, I. & Rock, M. 2013. What to Think of Canine Obesity? Emerging Challenges to Our Understanding of Human-Animal Health Relationships. *Social Epistemology*, 27(1), 90-104.
- Degerliyurt, K., Gunsolley, J. C. & Laskin, D. M. 2010. Informed Consent: What Do Patients Really Want to Know? *Journal of Oral and Maxillofacial Surgery*, 68(8), 1849-1852.
- Del Carmen, M. G. & Joffe, S. 2005. Informed consent for medical treatment and research: a review. *Oncologist*, 10(8), 636-641.
- Dellit, T. H., Owens, R. C., MCGowan, J. E., Gerding, D. N., Weinstein, R. A., Burke, J. P., Huskins, W. C., Paterson, D. L., Fishman, N. O., Carpenter, C. F., Brennan, P. J., Billeter, M. & Hooton, T. M. 2007a. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship. *Clinical Infectious Diseases*, 44(2), 159-177.
- Dellit, T. H., Owens, R. C., MCGowan, J. E., Gerding, D. N., Weinstein, R. A., Burke, J. P., Huskins, W. C., Paterson, D. L., Fishman, N. O., Carpenter, C. F., Brennan, P. J., Billeter, M., Hooton, T. M., America, I. D. S. O. & America, S. F. H. E. O. 2007b. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clinical Infectious Diseases*, 44(2), 159-177.

- Deplano, A., Denis, O., Poirel, L., Hocquet, D., Nonhoff, C., Byl, B., Nordmann, P., Vincent, J. L. & Struelens, M. J. 2005. Molecular characterization of an epidemic clone of panantibiotic-resistant *Pseudomonas aeruginosa*. *Journal of Clinical Microbiology*, 43.
- Di Girolamo, N. & Reynders, R. M. 2016. Deficiencies of effectiveness of intervention studies in veterinary medicine: A cross-sectional survey of ten leading veterinary and medical journals. *PeerJ*, 2016(1).
- Dixon, W. H. R., Kinnison, T. & May, S. A. 2017. Understanding the primary care paradigm: an experiential learning focus of the early veterinary graduate. *Veterinary Record*, 181(18), 480-484.
- Dodd, L. 2007. The impact of Problem-Based Learning on the information behavior and literacy of veterinary medicine students at University College Dublin. *Journal of Academic Librarianship*, 33(2), 206-216.
- Doig, G. S. 2003. Evidence-based veterinary medicine: What it is, what it isn't and how to do it. *Australian veterinary journal*, 81(7), 412-415.
- Dolby, N. & Litster, A. 2015. Understanding veterinarians as educators: an exploratory study. *Teaching in Higher Education*, 20(3), 272-284.
- Dryden, M., Johnson, A. P., Ashiru-Oredope, D. & Sharland, M. 2011. Using antibiotics responsibly: Right drug, right time, right dose, right duration. *Journal of Antimicrobial Chemotherapy*, 66(11), 2441-2443.
- Duncan, I. J. H. 2006. The changing concept of animal sentience. *Applied Animal Behaviour Science*, 100(1-2), 11-19.
- Dwyer, S. C. & Buckle, J. L. 2009. The Space Between: On Being an Insider-Outsider in Qualitative Research. *International Journal of Qualitative Methods*, 8(1), 54-63.
- Edwards, A. & Elwyn, G. 2001. *Evidence-based patient choice: inevitable or impossible?*, Oxford; New York, Oxford University Press.
- Edwards, R. & Holland, J. 2013. *What is Qualitative Interviewing?*, London, Bloomsbury Publishing.
- Ellis, S. J. 1999. Rationing. Fidelity and stewardship are incompatible when attempted by same individual. *British Medical Journal*, 318(7188), 941.
- Enkin, M. W. & Jadad, A. R. 1998. Using anecdotal information in evidence-based health care: Heresy or necessity? *Annals of Oncology*, 9(9), 963-966.
- Epstein, R. M. 1999. Mindful practice. *Journal of the American Medical Association*, 282(9), 833-839.
- Estrada, A. H., Behar-Horenstein, L., Estrada, D. J., Black, E., Kwiatkowski, A., Bzoch, A. & Blue, A. 2016. Incorporating Inter-Professional Education into a Veterinary Medical Curriculum. *Journal of Veterinary Medical Education*, 43(3), 275-281.

- Evidence-Based Medicine Working Group 1992. Evidence-based medicine. A new approach to teaching the practice of medicine. *Journal of the American Medical Association*, 268(17), 2420-2425.
- Eysenbach, G., Powell, J., Kuss, O. & Sa, E. R. 2002. Empirical studies assessing the quality of health information for consumers on the world wide web: a systematic review. *Journal of the American Medical Association*, 287(20), 2691-2700.
- Fair, R. J. & Tor, Y. 2014. Antibiotics and bacterial resistance in the 21st century. *Perspect Medicin Chem*, 6, 25-64.
- Falagas, M. E. & Kopterides, P. 2006. Risk factors for the isolation of multi-drug-resistant *Acinetobacter baumannii* and *Pseudomonas aeruginosa*: A systematic review of the literature. *Journal of Hospital Infection*, 64.
- Fassler, M., Meissner, K., Schneider, A. & Linde, K. 2010. Frequency and circumstances of placebo use in clinical practice--a systematic review of empirical studies. *BMC Med*, 8, 15.
- Faunt, K., Lund, E. & Novak, W. 2007. The Power of Practice: Harnessing Patient Outcomes for Clinical Decision Making. *Veterinary Clinics of North America - Small Animal Practice*, 37(3), 521-532.
- Ferreira, J. P. 2017. Why Antibiotic Use Data in Animals Needs to Be Collected and How This Can Be Facilitated. *Frontiers in Veterinary Science*, 4, 5.
- Fettman, M. J. & Rollin, B. E. 2002. Modern elements of informed consent for general veterinary practitioners. *Journal of the American Veterinary Medical Association*, 221(10), 1386-1393.
- Finland, M., Kirby, W. M., Chabbert, Y. A., Chain, E. B., Dowling, H. F., Garrod, L. P., Pettinga, C. W. & Todd, A. C. 1965. Round table: are new antibiotics needed? *Antimicrob Agents Chemother (Bethesda)*, 5, 1107-1114.
- Fischer, A. J. & Ghelardi, G. 2016. The Precautionary Principle, Evidence-Based Medicine, and Decision Theory in Public Health Evaluation. *Frontiers in Public Health*, 4, 7.
- Foster, K. R. & Grundmann, H. 2006. Do We Need to Put Society First? The Potential for Tragedy in Antimicrobial Resistance. *Public Library of Science Medicine*, 3(2), e29.
- Fox, M. W. 1985. Veterinary Ethics and Ecologic Concerns. *Journal of the American Veterinary Medical Association*, 186(3), 212-&.
- Francis, J. J., Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., Eccles, M. P. & Grimshaw, J. M. 2010. What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychol Health*, 25(10), 1229-1245.
- Frankel, R. M. 2006. Pets, vets, and frets: What relationship-centered care research has to offer veterinary medicine. *Journal of Veterinary Medical Education*, 33(1), 20-27.
- Franklin, A., Liu, Y., Li, Z., Nguyen, V., Johnson, T. R., Robinson, D., Okafor, N., King, B., Patel, V. L. & Zhang, J. 2011. Opportunistic decision making and complexity in emergency care. *Journal of Biomedical Informatics*, 44(3), 469-476.

- Fraser, A. F. 2008a. Veterinarians and animal welfare - A comment. *Canadian Veterinary Journal*, 49(1), 8.
- Fraser, D. 2008b. Understanding animal welfare. *Acta Veterinaria Scandinavica*, 50(1), S1.
- Garau, J. 2006. Impact of antibiotic restrictions: the ethical perspective. *Clinical Microbiology and Infection*, 12, 16-24.
- Gardner, D. H. & Hini, D. 2006. Work-related stress in the veterinary profession in New Zealand. *New-Zealand Veterinary Journal*, 54(3), 119-124.
- Garner, R. 2008. The Politics of Animal Rights. *British Politics*, 3(1), 110-119.
- George, P. & Morris, A. M. 2010. Pro/con debate: Should antimicrobial stewardship programs be adopted universally in the intensive care unit? *Critical Care*, 14(1), 205.
- Gibbs, E. P. J. 2014. The evolution of One Health: a decade of progress and challenges for the future. *Veterinary Record*, 174(4), 85-91.
- Gibbs, S. E. & Gibbs, E. P. 2013. The historical, present, and future role of veterinarians in One Health. *Curr Top Microbiol Immunol*, 365, 31-47.
- Ginsburg, S., Bernabeo, E. & Holmboe, E. 2014. Doing what might be "wrong": understanding internists' responses to professional challenges. *Academic Medicine*, 89(4), 664-670.
- Ginsburg, S., Bernabeo, E., Ross, K. M. & Holmboe, E. S. 2012. "It depends": results of a qualitative study investigating how practicing internists approach professional dilemmas. *Academic Medicine*, 87(12), 1685-1693.
- Giubilini, A. 2019. Antibiotic resistance as a tragedy of the commons: An ethical argument for a tax on antibiotic use in humans. *Bioethics*, 0(0), 1-9.
- Giuffrida, M. A. 2014. Type II error and statistical power in reports of small animal clinical trials. *Journal of the American Veterinary Medical Association*, 244(9), 1075-1080.
- Glaser, B. G. & Strauss, A. L. 1967. *Discovery of grounded theory: Strategies for qualitative research*, Chicago, Aldine.
- Glover, J. 1977. *Causing death and saving lives*, Harmondsworth, Penguin.
- Golding, S. E., Ogden, J. & Higgins, H. M. 2019. Shared Goals, Different Barriers: A Qualitative Study of UK Veterinarians' and Farmers' Beliefs About Antimicrobial Resistance and Stewardship. *Frontiers in Veterinary Science*, 6, 17.
- Goni, M. D., Muhammad, I. J., Bitrus, A. A., Jajere, S. M., Shahs, M. K., Aliyu, A. & Goje, M. 2018. Public health significance of companion animals in emergence and re-emergence of bacterial zoonoses. *Journal of Advanced Veterinary and Animal Research*, 5(2), 101-109.

- Gothwal, R. & Shashidhar, T. 2015. Antibiotic Pollution in the Environment: A Review. *CLEAN – Soil, Air, Water*, 43(4), 479-489.
- Goyder, C. R., Jones, C. H. D., Heneghan, C. J. & Thompson, M. J. 2015. Missed opportunities for diagnosis: lessons learned from diagnostic errors in primary care. *British Journal of General Practice*, 65(641), E838-E844.
- Graber, M. A. & Tansey, J. F. 2005. Autonomy, consent, and limiting healthcare costs. *Journal of Medical Ethics*, 31(7), 424.
- Gray, C. 2014. Editorial: Similar but not the same: The teaching of veterinary and medical ethics. *Veterinary Record*, 175(23), 590-591.
- Gray, C., Fox, M. & Hobson-West, P. 2018. Reconciling Autonomy and Beneficence in Treatment Decision-Making for Companion Animal Patients. *Liverpool Law Review*.
- Green, J. & Thorogood, N. 2018. *Qualitative Methods for Health Research*, London, Sage.
- Greene, M. J. 2014. On the inside looking in: Methodological insights and challenges in conducting qualitative insider research. *The qualitative report*, 19(29), 1-13.
- Greenhalgh, T., Howick, J. & Maskrey, N. 2014. Evidence based medicine: a movement in crisis? *British Medical Journal*, 348.
- Grimm, H., Bergadano, A., Musk, G. C., Otto, K., Taylor, P. M. & Duncan, J. C. 2018. Drawing the line in clinical treatment of companion animals: recommendations from an ethics working party. *Veterinary Record*, 182(23), 664-+.
- Guardabassi, L., Schwarz, S. & Lloyd, D. H. 2004. Pet animals as reservoirs of antimicrobial-resistant bacteria. *Journal of Antimicrobial Chemotherapy*, 54(2), 321-332.
- Guest, G., Bunce, A. & Johnson, L. 2006. How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability. *Field Methods*, 18(1), 59-82.
- Guinovart, M. C., Figueras, A. & Llor, C. 2018. Selling antimicrobials without prescription - Far beyond an administrative problem. *Enfermedades Infecciosas Y Microbiología Clínica*, 36(5), 290-292.
- Haigler, S. W. 1949. Veterinary Ethics. *Journal of the American Veterinary Medical Association*, 114(865), 191-193.
- Hamilton, L. 2013. The Magic of Mundane Objects: Culture, Identity and Power in a Country Vets' Practice. *The Sociological Review*, 61(2), 265-284.
- Hand, K. 2007. Antibiotic pharmacists in the ascendancy. *Journal of Antimicrobial Chemotherapy*, 60, 173-176.
- Hardefeldt, L. Y., Browning, G. F., Thursky, K., Gilkerson, J. R., Billman-Jacobe, H., Stevenson, M. A. & Bailey, K. E. 2017. Antimicrobials used for surgical prophylaxis by companion animal veterinarians in Australia. *Vet Microbiol*, 203, 301-307.

- Hardin, G. 1968. The tragedy of the commons. The population problem has no technical solution; it requires a fundamental extension in morality. *Science*, 162(3859), 1243-1248.
- Hargreaves, L. 2009. The Status and Prestige of Teachers and Teaching. In: SAHA, L. J. & DWORKIN, A. (eds.) *International Handbook of Research on Teachers and Teaching*. New York: Springer.
- Harris, A. & Martin, R. 2004. The exercise of public health powers in an era of human rights: the particular problems of tuberculosis. *Public Health*, 118(5), 313-322.
- Hartnack, S., Grimm, H., Kunzmann, P., Doherr, M. G. & Aerts, S. 2009. Ethics for vets: Can ethics help to improve animal disease control? In: MILLAR, K. M., HOBSON-WEST, P. & NERLICH, B. (eds.) *Ethical Futures: Bioscience and Food Horizons*. Wageningen: Wageningen Academic Publishers.
- Hartnack, S., Springer, S., Pittavino, M. & Grimm, H. 2016. Attitudes of Austrian veterinarians towards euthanasia in small animal practice: impacts of age and gender on views on euthanasia. *Bmc Veterinary Research*, 12(1), 26.
- Heid, C., Knobloch, M. J., Schulz, L. T. & Safdar, N. 2016. Use of the Health Belief Model to Study Patient Perceptions of Antimicrobial Stewardship in the Acute Care Setting. *Infection Control and Hospital Epidemiology*, 37(5), 576-582.
- Helliwell, R., Morris, C. & Raman, S. 2019. Can resistant infections be perceptible in UK dairy farming? *Palgrave Communications*, 5(1), 12.
- Helm, P. 1978. Who is my neighbour - a defence of moral distance. *Third Way*.
- Heneghan, C., Glasziou, P., Thompson, M., Rose, P., Balla, J., Lasserson, D., Scott, C. & Perera, R. 2009. Diagnostic strategies used in primary care. *British Medical Journal*, 338, b946.
- Hennink, M. M., Kaiser, B. N. & Marconi, V. C. 2017. Code Saturation Versus Meaning Saturation: How Many Interviews Are Enough? *Qual Health Res*, 27(4), 591-608.
- Hernandez, E., Fawcett, A., Brouwer, E., Rau, J. & Turner, P. V. 2018. Speaking Up: Veterinary Ethical Responsibilities and Animal Welfare Issues in Everyday Practice. *Animals*, 8(1), 22.
- Hesse, B. W., Nelson, D. E., Kreps, G. L., Croyle, R. T., Arora, N. K., Rimer, B. K. & Viswanath, K. 2005. Trust and sources of health information: the impact of the Internet and its implications for health care providers: findings from the first Health Information National Trends Survey. *Archives of Internal Medicine*, 165(22), 2618-2624.
- Heuberger, R., Petty, M. & Huntingford, J. 2016. Companion Animal Owner Perceptions, Knowledge, and Beliefs Regarding Pain Management in End-of-Life Care. *Topics in Companion Animal Medicine*, 31(4), 152-159.
- Heuer, O. E., Jensen, V. F. & Hammerum, A. M. 2005. Antimicrobial Drug Consumption in Companion Animals. *Emerging Infectious Diseases*, 11(2), 344-345.

- Himmel, W., Lippert-Urbanke, E. & Kochen, M. M. 1997. Are patients more satisfied when they receive a prescription? The effect of patient expectations in general practice. *Scandinavian Journal of Primary Health Care*, 15(3), 118-122.
- Hobson-West, P. 2004. The construction of lay resistance to vaccination. In: SHAW, I. & KAUPPINEN-TOROPAINEN, K. (eds.) *Constructions of health and illness : European perspectives*. Aldershot: Ashgate.
- Hobson-West, P. & Jutel, A. 2020. Animals, veterinarians and the sociology of diagnosis. *Social Health Illn*, 42(2), 393-406.
- Hobson-West, P. & Timmons, S. 2016. Animals and anomalies: an analysis of the UK veterinary profession and the relative lack of state reform. *The Sociological Review*, 64(1), 47-63.
- Holmes, M. A. 2009. Philosophical foundations of evidence-based medicine for veterinary clinicians. *Journal of the American Veterinary Medical Association*, 235(9), 1035-1039.
- Hopman, N. E. M., Hulscher, M., Graveland, H., Speksnijder, D. C., Wagenaar, J. A. & Broens, E. M. 2018. Factors influencing antimicrobial prescribing by Dutch companion animal veterinarians: A qualitative study. *Preventive Veterinary Medicine*, 158, 106-113.
- Howick, J., Bishop, F. L., Heneghan, C., Wolstenholme, J., Stevens, S., Hobbs, F. D. & Lewith, G. 2013. Placebo use in the United Kingdom: results from a national survey of primary care practitioners. *Public Library of Science One*, 8(3), e58247.
- Huddle, T. S. 2014. Political Activism is not Mandated by Medical Professionalism. *American Journal of Bioethics*, 14(9), 51-53.
- Hughes, L. A., Pinchbeck, G., Callaby, R., Dawson, S., Clegg, P. & Williams, N. 2013. Antimicrobial prescribing practice in UK equine veterinary practice. *Equine Veterinary Journal*, 45(2), 141-147.
- Hughes, L. A., Williams, N., Clegg, P., Callaby, R., Nuttall, T., Coyne, K., Pinchbeck, G. & Dawson, S. 2012. Cross-sectional survey of antimicrobial prescribing patterns in UK small animal veterinary practice. *Preventive Veterinary Medicine*, 104(3-4), 309-316.
- Hunt, J. R., Knowles, T. G., Lascelles, B. D. X. & Murrell, J. C. 2015. Prescription of perioperative analgesics by UK small animal veterinary surgeons in 2013. *Veterinary Record*, 176(19), 493.
- Hunt, P. W. 2018. The Clinical-Translational Physician-Scientist: Translating Bedside to Bench. *Journal of Infectious Diseases*, 218, S12-S15.
- Hunter, D. 2007. Am I my brother's gatekeeper? Professional ethics and the prioritisation of healthcare. *Journal of Medical Ethics*, 33(9), 522-526.
- Hunter, K. M. 1986. There was this one guy - The uses of anecdotes in medicine. *Perspectives in Biology and Medicine*, 29(4), 619-630.

- Hutchinson, N., Baird, G. L. & Garg, M. 2016. Examining the Reading Level of Internet Medical Information for Common Internal Medicine Diagnoses. *American Journal of Medicine*, 129(6), 637-639.
- Institute of Medicine Committee to Advise the Public Health Service on Clinical Practice Guidelines 1990. *Clinical Practice Guidelines: Directions for a New Program*, Washington (DC), National Academies Press (US).
- Irvine, L. & Vermilya, J. R. 2010. Gender Work in a Feminized Profession: The Case of Veterinary Medicine. *Gender & Society*, 24(1), 56-82.
- Iseppi, R., Messi, P., Anacarso, I., Bondi, M., Sabia, C., Condò, C. & De Niederhausern, S. 2015. Antimicrobial resistance and virulence traits in Enterococcus strains isolated from dogs and cats. *New Microbiologica*, 38(3), 369-378.
- Jackson, C. & Gray, C. 2004. Difficult choices: helping clients to arrive at an informed decision. *In Practice*, 26(4), 223.
- Jeffery, R., Navarro, T., Lokker, C., Haynes, R. B., Wilczynski, N. L. & Farjou, G. 2012. How current are leading evidence-based medical textbooks? An analytic survey of four online textbooks. *Journal of Medical Internet Research*, 14(6), e175.
- Jessen, L. R., Sorensen, T. M., Lilja, Z. L., Kristensen, M., Hald, T. & Damborg, P. 2017. Cross-sectional survey on the use and impact of the Danish national antibiotic use guidelines for companion animal practice. *Acta Veterinaria Scandinavica*, 59, 9.
- Kahn, L. H. 2017. Antimicrobial resistance: a One Health perspective. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 111(6), 255-260.
- Kang, S. 2010. Anecdotes in medicine—15 years of Lancet Case Reports. *The Lancet*, 376(9751), 1448-1449.
- Kao, A. C. & Parsi, K. P. 2004. Content analyses of oaths administered at U.S. medical schools in 2000. *Academic Medicine*, 79(9), 882-887.
- Keene, B. W. 2000. Towards evidence-based veterinary medicine. *Journal of Veterinary Internal Medicine*, 14(2), 118-119.
- Kennedy, P. G. E. 2015. My Life as a Clinician-Scientist: Trying to Bridge the Perceived Gap Between Medicine and Science. *DNA and Cell Biology*, 34(6), 383-390.
- King, C., Smith, M., Currie, K., Dickson, A., Smith, F., Davis, M. & Flowers, P. 2018. Exploring the behavioural drivers of veterinary surgeon antibiotic prescribing: a qualitative study of companion animal veterinary surgeons in the UK. *Bmc Veterinary Research*, 14, 9.
- Kinnison, T., Guile, D. & May, S. A. 2015a. Errors in veterinary practice: preliminary lessons for building better veterinary teams. *Veterinary Record*, 177(19), 492-492.

- Kinnison, T., Guile, D. & May, S. A. 2015b. Veterinary team interactions, part 2: the personal effect. *Veterinary Record*, 177(21), 541.
- Kinnison, T., May, S. & Guile, D. 2014. Inter-Professional Practice: From Veterinarian to the Veterinary Team. *Journal of Veterinary Medical Education*, 41, 1-7.
- Kinnison, T., May, S. A. & Guile, D. 2015c. Veterinary team interactions, part one: the practice effect. *Veterinary Record*, 177(16), 6.
- Kirchner, M., Mafura, M., Hunt, T., Abu-Oun, M., Nunez-Garcia, J., Hu, Y. M., Weile, J., Coates, A., Card, R. & Anjum, M. F. 2014. Antimicrobial resistance characteristics and fitness of Gram-negative fecal bacteria from volunteers treated with minocycline or amoxicillin. *Frontiers in Microbiology*, 5, 9.
- Kishimoto, M., Yamada, K., Shimizu, J., Lee, K.-J., Watarai, H., Hassan, H. Y., Iwasaki, T. & Miyake, Y.-I. 2009. Providing an intelligible explanation to pet owners by using three-dimensional CT images: Use of clinical imaging for better informed consent. *Veterinary Research Communications*, 33(4), 387-393.
- Klein, E. Y., Van Boeckel, T. P., Martinez, E. M., Pant, S., Gandra, S., Levin, S. A., Goossens, H. & Laxminarayan, R. 2018. Global increase and geographic convergence in antibiotic consumption between 2000 and 2015. *Proceedings of the National Academy of Sciences*.
- Klingborg, D. J. & Klingborg, J. 2007. Talking with Veterinary Clients About Money. *Veterinary Clinics of North America: Small Animal Practice*, 37(1), 79-93.
- Knights, C. B., Mateus, A. & Baines, S. J. 2012. Current British veterinary attitudes to the use of perioperative antimicrobials in small animal surgery. *Veterinary Record*, 170(25), 646-646.
- Kollef, M. H., Sherman, G., Ward, S. & Fraser, V. J. 1999. Inadequate antimicrobial treatment of infections: A risk factor for hospital mortality among critically ill patients. *Chest*, 115.
- Kosko, J., Klassen, T. P., Bishop, T. & Hartling, L. 2006. Evidence-based medicine and the anecdote: Uneasy bedfellows or ideal couple? *Paediatrics & Child Health*, 11(10), 665-668.
- Kottow, M. 2012. Health Care Strategies. In: KOTTOW, M. (ed.) *From Justice to Protection: A Proposal for Public Health Bioethics*. New York: Springer.
- Kriebel, D., Tickner, J., Epstein, P., Lemons, J., Levins, R., Loechler, E. L., Quinn, M., Rudel, R., Schettler, T. & Stoto, M. 2001. The precautionary principle in environmental science. *Environ Health Perspect*, 109(9), 871-876.
- Kuehle, T., Goetz, K., Laux, G., Gutscher, A., Szecsenyi, J. & Joos, S. 2011. Antibiotics in urinary-tract infections. Sustained change in prescribing habits by practice test and self-reflection: a mixed methods before-after study. *BMJ Qual Saf*, 20(6), 522-526.
- Lachmann, P. J. 1998. Public Health and Bioethics. *Journal of Medicine and Philosophy*, 23(3), 297-302.

- Lambert, H. 2006. Accounting for EBM: notions of evidence in medicine. *Social Science & Medicine*, 62(11), 2633-2645.
- Last, J. M. 2007. *A dictionary of public health*, Oxford, Oxford University Press.
- Laxminarayan, R., Duse, A., Wattal, C., Zaidi, A. K. M., Wertheim, H. F. L., Sumpradit, N., Vlieghe, E., Hara, G. L., Gould, I. M., Goossens, H., Greko, C., So, A. D., Bigdeli, M., Tomson, G., Woodhouse, W., Ombaka, E., Peralta, A. Q., Qamar, F. N., Mir, F., Kariuki, S., Bhutta, Z. A., Coates, A., Bergstrom, R., Wright, G. D., Brown, E. D. & Cars, O. 2013. Antibiotic resistance—the need for global solutions. *The Lancet Infectious Diseases*, 13(12), 1057-1098.
- Laxminarayan, R., Matsoso, P., Pant, S., Brower, C., Røttingen, J.-A., Klugman, K. & Davies, S. 2016. Access to effective antimicrobials: a worldwide challenge. *The Lancet*, 387(10014), 168-175.
- Lee, L. M. 2012. Public health ethics theory: review and path to convergence. *Journal of Law, Medicine & Ethics*, 40(1), 85-98.
- Levy, N. 2014. Forced to be free? Increasing patient autonomy by constraining it. *Journal of Law, Medicine & Ethics*, 40(5), 293-300.
- Levy, S. B. & Barbosa, T. M. 2000. The impact of antibiotic use on resistance development and persistence. *Drug Resistance Updates*, 3(5), 303-311.
- Levy, S. B. & Marshall, B. 2004. Antibacterial resistance worldwide: causes, challenges and responses. *Nat Med*, 10(12 Suppl), S122-129.
- Limbirt, C. & Lamb, R. 2002. Doctors' use of clinical guidelines: Two applications of the Theory of Planned Behaviour. *Psychology, Health & Medicine*, 7(3), 301-310.
- Littmann, J., Buyx, A. & Cars, O. 2015. Antibiotic resistance: An ethical challenge. *International Journal of Antimicrobial Agents*, 46(4), 359-361.
- Littmann, J. R. 2014. *Antimicrobial resistance and distributive justice*. Philosophy Thesis, University College, London.
- Livorsi, D., Comer, A., Matthias, M. S., Perencevich, E. N. & Bair, M. J. 2015. Factors Influencing Antibiotic-Prescribing Decisions Among Inpatient Physicians: A Qualitative Investigation. *Infection Control and Hospital Epidemiology*, 36(9), 1065-1072.
- Lloyd, D. H. 2007. Reservoirs of antimicrobial resistance in pet animals. *Clinical Infectious Diseases*, 45 Suppl 2(Supplement 2), S148-152.
- Lloyd, D. H. & Page, S. W. 2018. Antimicrobial Stewardship in Veterinary Medicine. *Microbiology Spectrum*, 6(3), 22.
- Lovbrand, E. & Oberg, G. 2005. Comment on "How science makes environmental controversies worse" by Daniel Sarewitz, *Environmental Science and Policy*, 7, 385-403 and "When scientists politicise science: making

- sense of the controversy over The Skeptical Environmentalist" by Roger A. Pielke Jr., *Environmental Science and Policy*, 7, 405-417. *Environmental Science & Policy*, 8(2), 195-197.
- Lund, E. M., James, K. M. & Neaton, J. D. 1994. Clinical trial design: veterinary perspectives. *Journal of Veterinary Internal Medicine*, 8(5), 317-322.
- Lund, E. M., James, K. M. & Neaton, J. D. 1998. Veterinary randomized clinical trial reporting: a review of the small animal literature. *Journal of Veterinary Internal Medicine*, 12(2), 57-60.
- Lyden, P. D., Meyer, B. C., Hemmen, T. M. & Rapp, K. S. 2010. An Ethical Hierarchy for Decision Making during Medical Emergencies. *Annals of Neurology*, 67(4), 434-440.
- Lyon, B. R. & Skurray, R. 1987. Antimicrobial resistance of Staphylococcus aureus: genetic basis. *Microbiological reviews*, 51(1), 88-134.
- Lysaght, T., Capps, B., Bailey, M., Bickford, D., Coker, R., Lederman, Z., Watson, S. & Tambyah, P. A. 2017. Justice Is the Missing Link in One Health: Results of a Mixed Methods Study in an Urban City State. *Public Library of Science One*, 12(1), 11.
- Macdougall, C. & Polk, R. E. 2005. Antimicrobial stewardship programs in health care systems. *Clinical microbiology reviews*, 18(4), 638-656.
- Maddison, J. E. & Watson, A. 2001. Systemic antibacterial drug use in dogs in Australia. *Australian veterinary journal*, 79(11), 740-746.
- Magalhaes-Sant'ana, M. 2014. Ethics teaching in European veterinary schools: a qualitative case study. *Veterinary Record*, 175(23), 592-+.
- Magalhaes-Sant'ana, M., Lassen, J., Millar, K. M., Sandoe, P. & Olsson, I. a. S. 2014. Examining Why Ethics Is Taught to Veterinary Students: A Qualitative Study of Veterinary Educators' Perspectives. *Journal of Veterinary Medical Education*, 41(4), 350-357.
- Magalhães-Sant'ana, M., Olsson, I. a. S., Sandoe, P. & Millar, K. 2010. How ethics is taught by European veterinary faculties: A review of published literature and web resources. In: CASABONA ROMEO, C. M., SAN EPIFANIO, L. E. & CIRIÓN, A. E. (eds.) *Global Food Security: Ethical and Legal Challenges*. Wageningen: Wageningen Academic Publishers.
- Magalhães-Sant'ana, M. 2015. A theoretical framework for human and veterinary medical ethics education. *Advances in Health Sciences Education*, 1-14.
- Main, D. C. J. 2006. Offering the best to patients: Ethical issues associated with the provision of veterinary services. *Veterinary Record*, 158(2), 62-66.
- Main, D. C. J. 2007. Promoting quality of life discussions between the veterinary profession and the pet-owning public. *Animal Welfare*, 16(Supplement 1), 159-163.

- Malterud, K., Siersma, V. D. & Guassora, A. D. 2015. Sample Size in Qualitative Interview Studies: Guided by Information Power. *Qual Health Res*, 26(13), 1753-1760.
- Marcus, E.-L., Clarfield, A. M. & Moses, A. E. 2001a. Ethical Issues Relating to the Use of Antimicrobial Therapy in Older Adults. *Clinical Infectious Diseases*, 33(10), 1697-1705.
- Marcus, E. L., Clarfield, A. M. & Moses, A. E. 2001b. Ethical issues relating to the use of antimicrobial therapy in older adults. *Clinical Infectious Diseases*, 33(10), 1697-1705.
- Marques, C., Belas, A., Franco, A., Aboim, C., Gama, L. T. & Pomba, C. 2018. Increase in antimicrobial resistance and emergence of major international high-risk clonal lineages in dogs and cats with urinary tract infection: 16 year retrospective study. *Journal of Antimicrobial Chemotherapy*, 73(2), 377-384.
- Marques, C., Gama, L. T., Belas, A., Bergström, K., Beurlet, S., Briend-Marchal, A., Broens, E. M., Costa, M., Criel, D., Damborg, P., Van Dijk, M. a. M., Van Dongen, A. M., Dorsch, R., Espada, C. M., Gerber, B., Kritsepi-Konstantinou, M., Loncaric, I., Mion, D., Misic, D., Movilla, R., Overesch, G., Perreten, V., Roura, X., Steenberg, J., Timofte, D., Wolf, G., Zanoni, R. G., Schmitt, S., Guardabassi, L. & Pomba, C. 2016. European multicenter study on antimicrobial resistance in bacteria isolated from companion animal urinary tract infections. *Bmc Veterinary Research*, 12(1), 213-213.
- Martin, L. R., Williams, S. L., Haskard, K. B. & Dimatteo, M. R. 2005. The challenge of patient adherence. *The Clin Risk Manag*, 1(3), 189-199.
- Mateus, A. L. P., Brodbelt, D. C., Barber, N. & Stark, K. D. C. 2014. Qualitative study of factors associated with antimicrobial usage in seven small animal veterinary practices in the UK. *Preventive Veterinary Medicine*, 117(1), 68-78.
- Mathie, R. T. & Clausen, J. 2015. Veterinary homeopathy: Meta-analysis of randomised placebo-controlled trials. *Homeopathy*, 104(1), 3-8.
- Mathie, R. T., Hacke, D. & Clausen, J. 2012. Randomised controlled trials of veterinary homeopathy: Characterising the peer-reviewed research literature for systematic review. *Homeopathy*, 101(4), 196-203.
- Mattick, K., Kelly, N. & Rees, C. 2014. A window into the lives of junior doctors: narrative interviews exploring antimicrobial prescribing experiences. *Journal of Antimicrobial Chemotherapy*, 69(8), 2274-2283.
- May, S. A. 2013. Clinical Reasoning and Case-Based Decision Making: The Fundamental Challenge to Veterinary Educators. *Journal of Veterinary Medical Education*, 40(3), 200-209.
- Mccausland, C. 2014. The Five Freedoms of Animal Welfare are Rights. *Journal of Agricultural & Environmental Ethics*, 27(4), 649-662.
- Mcconnell, I. 2014. One Health in the context of medical and veterinary education. *Revue scientifique et technique (International Office of Epizootics)*, 33(2), 651-657.

- Mcculloch, S. P. 2013. A Critique of FAWC's Five Freedoms as a Framework for the Analysis of Animal Welfare. *Journal of Agricultural & Environmental Ethics*, 26(5), 959-975.
- Mcintosh, W. & Dean, W. 2015. Factors Associated with the Inappropriate Use of Antimicrobials. *Zoonoses and Public Health*, 62(s1), 22-28.
- McNulty, C. a. M. & Francis, N. A. 2010. Optimizing antibiotic prescribing in primary care settings in the UK: findings of a BSAC multi-disciplinary workshop 2009. *Journal of Antimicrobial Chemotherapy*, 65(11), 2278-2284.
- Mellor, D. J. 2016. Updating Animal Welfare Thinking: Moving beyond the "Five Freedoms" towards "A Life Worth Living". *Animals*, 6(3), 21.
- Metlay, J. P., Shea, J. A. & Asch, D. A. 2002a. Antibiotic prescribing decisions of generalists and infectious disease specialists: thresholds for adopting new drug therapies. *Medical Decision Making*, 22(6), 498-505.
- Metlay, J. P., Shea, J. A., Crossette, L. B. & Asch, D. A. 2002b. Tensions in antibiotic prescribing: pitting social concerns against the interests of individual patients. *J Gen Intern Med*, 17(2), 87-94.
- Mepham, T. B. 2008. *Bioethics: An introduction for the biosciences*. Oxford, Oxford University Press.
- Milani, M. 2008. What veterinary clients really want, too? *Canadian Veterinary Journal*, 49(10), 1021-1024.
- Millar, M. 2011. Can antibiotic use be both just and sustainable ... or only more or less so? *Journal of Medical Ethics*, 37(3), 153-157.
- Mills, D. 2015. Is EBVM ethical? *Veterinary Record*, 177(7), 181-182.
- Mol, P. G. M., Denig, P., Gans, R. O. B., Nannanpanday, P. V., Degener, J. E., Laseur, M. & Haaijer-Ruskamp, F. M. 2006. Limited effect of patient and disease characteristics on compliance with hospital antimicrobial guidelines. *European Journal of Clinical Pharmacology*, 62(4), 297-305.
- Moore, A. S. 2011. Managing cats with cancer: An examination of ethical perspectives. *Journal of Feline Medicine & Surgery*, 13(9), 661-671.
- Moore, I. C., Coe, J. B., Adams, C. L., Conlon, P. D. & Sargeant, J. M. 2014. The role of veterinary team effectiveness in job satisfaction and burnout in companion animal veterinary clinics. *Journal of the American Veterinary Medical Association*, 245(5), 513-524.
- Morgan, C. A. 2009. *Stepping up to the plate: Animal Welfare, Veterinarians and Ethical Conflicts*. Philosophy Thesis, The University of British Columbia.
- Morgan, C. A. & McDonald, M. 2007. Ethical dilemmas in veterinary medicine. *Veterinary Clinics of North America-Small Animal Practice*, 37(1), 165-179.

- Morley, P. S., Apley, M. D., Besser, T. E., Burney, D. P., Fedorka-Cray, P. J., Papich, M. G., Traub-Dargatz, J. L. & Weese, J. S. 2005. Antimicrobial Drug Use in Veterinary Medicine. *Journal of Veterinary Internal Medicine*, 19(4), 617-629.
- Morris, P. 2012a. *Blue juice: Euthanasia in veterinary medicine*, Philadelphia, Temple University Press.
- Morris, P. 2012b. Managing Pet Owners' Guilt and Grief in Veterinary Euthanasia Encounters. *Journal of Contemporary Ethnography*, 41(3), 337-365.
- Morse, J. M. 1995. The Significance of Saturation. *Qual Health Res*, 5(2), 147-149.
- Morse, J. M. 2000. Determining Sample Size. *Qual Health Res*, 10(1), 3-5.
- Morse, J. M., Barrett, M., Mayan, M., Olson, K. & Spiers, J. 2002. Verification Strategies for Establishing Reliability and Validity in Qualitative Research. *International Journal of Qualitative Methods*, 1(2), 13-22.
- Morse, J. M. & Field, P.-A. 1996. *Qualitative research methods for health professionals*, Thousand Oaks, SAGE Publications.
- Morton, D. B. 2010. A Commentary on the Animal Welfare Symposium, with Possible Actions. *Journal of Veterinary Medical Education*, 37(1), 107-113.
- Moses, L., Malowney, M. J. & Wesley Boyd, J. 2018. Ethical conflict and moral distress in veterinary practice: A survey of North American veterinarians. *Journal of Veterinary Internal Medicine*, 32(6), 2115-2122.
- Mossop, L. H. & Cobb, K. 2013. Teaching and assessing veterinary professionalism. *Journal of Veterinary Medical Education*, 40(3), 223-232.
- Munthe, C., Nijsingh, N., De Fine Licht, K. & Joakim Larsson, D. G. 2019. Health-related Research Ethics and Social Value: Antibiotic Resistance Intervention Research and Pragmatic Risks. *Bioethics*, 33(3), 335-342.
- Murphy, M., Bradley, C. P. & Byrne, S. 2011. Influence of patient payment on antibiotic prescribing in Irish general practice: a cohort study. *British Journal of General Practice*, 61(590), 549-555.
- Mutonyi, H. 2016. Stories, proverbs, and anecdotes as scaffolds for learning science concepts. *Journal of Research in Science Teaching*, 53(6), 943-971.
- Namey, E., Guest, G., Mckenna, K. & Chen, M. 2016. Evaluating Bang for the Buck: A Cost-Effectiveness Comparison Between Individual Interviews and Focus Groups Based on Thematic Saturation Levels. *American Journal of Evaluation*, 37(3), 425-440.
- Newitt, S., Oloyede, O., Puleston, R., Hopkins, S. & Ashiru-Oredope, D. 2019. Demographic, Knowledge and Impact Analysis of 57,627 Antibiotic Guardians Who Have Pledged to Contribute to Tackling Antimicrobial Resistance. *Antibiotics*, 8(1), 16.

- Nunn, R. 2011. Mere anecdote: evidence and stories in medicine. *Journal of Evaluation in Clinical Practice*, 17(5), 920-926.
- O'Neill, D. 2016. Putting the evidence in EBVM at BSAVA Congress. *Veterinary Times*, (May), 24 - 26.
- O'Reilly, M. & Parker, N. 2013. 'Unsatisfactory Saturation': a critical exploration of the notion of saturated sample sizes in qualitative research. *Qualitative Research*, 13(2), 190-197.
- Oczkowski, S. 2017. Antimicrobial stewardship programmes: bedside rationing by another name? *Journal of Medical Ethics*, 43(10), 684-687.
- Oliveri, R. S., Gluud, C. & Wille-Jorgensen, P. A. 2004. Hospital doctors' self-rated skills in and use of evidence-based medicine - a questionnaire survey. *Journal of Evaluation in Clinical Practice*, 10(2), 219-226.
- One Health Initiative Task Force 2008. One health : a new professional imperative. Schaumburg, IL: American Veterinary Medical Association.
- Oreskes, N. 2004. Science and public policy: what's proof got to do with it? *Environmental Science & Policy*, 7(5), 369-383.
- Osler, W., Bean, R. B. & Bean, W. B. 1961. *Sir William Osler aphorisms: from his bedside teachings and writings*, Springfield, Charles C. Thomas Publisher.
- Owens, R., Jones, L. F., Moore, M., Pilat, D. & McNulty, C. 2017. Self-Assessment of Antimicrobial Stewardship in Primary Care: Self-Reported Practice Using the TARGET Primary Care Self-Assessment Tool. *Antibiotics*, 6(3).
- Oxtoby, C. & Mossop, L. 2016. Checklists and clinical governance: learning from the NHS. *In Practice*, 38(8), 408-410.
- Page, E. 1999. Intergenerational Justice and Climate Change. *Political Studies*, 47(1), 53-66.
- Parker, M. 2001. The ethics of evidence-based patient choice. *Health Expectations*, 4(2), 87-91.
- Parmley, W. W. 1996. Anecdotes in medicine: Do they have value? *Journal of the American College of Cardiology*, 28(3), 795-795.
- Paskovaty, A., Pflomm, J. M., Myke, N. & Seo, S. K. 2005. A multidisciplinary approach to antimicrobial stewardship: Evolution into the 21st century. *International Journal of Antimicrobial Agents*, 25.
- Patel, P., Fan, W. Q., Livert, D. & Krishnamurthy, M. 2015. The power of anecdotes on resident HVCCC curriculum. *Journal of Community Hospital Internal Medicine Perspectives*, 5(3), 4.
- Pearce, W., Raman, S. & Turner, A. 2015. Randomised trials in context: practical problems and social aspects of evidence-based medicine and policy. *Trials*, 16(1), 1-7.

- Pedersen, K., Pedersen, K., Pedersen, K., Jensen, H., Finster, K., Jensen, V. F. & Heuer, O. E. 2007. Occurrence of antimicrobial resistance in bacteria from diagnostic samples from dogs. *Journal of Antimicrobial Chemotherapy*, 60(4), 775-781.
- Petrini, C. 2010. Theoretical models and operational frameworks in public health ethics. *International journal of environmental research and public health*, 7(1), 189–202.
- Phillips, I., Casewell, M. & Cox, T. 2004. Does the use of antibiotics in food animals pose a risk to human health? A critical review of published data. *Journal of Antimicrobial Chemotherapy*, 53(1), 28-52.
- Philpotts, I., Dillon, J. & Rooney, N. 2019. Improving the Welfare of Companion Dogs-Is Owner Education the Solution? *Animals*, 9(9), 662.
- Pieterman, R. & Hanekamp, J. C. 2002. *The Cautious Society. An Essay on the Rise of the Precautionary Culture. The Precautionary Principle or Striving for Ignorance.*, Amsterdam, Heidelberg Appeal Nederland Foundation.
- Piper, B. J., Lambert, D. A., Keefe, R. C., Smukler, P. U., Selemon, N. A. & Duperry, Z. R. 2018. Undisclosed conflicts of interest among biomedical textbook authors. *AJOB Empirical Bioethics*, 9(2), 59-68.
- Pomba, C., Rantala, M., Greko, C., Baptiste, K. E., Catry, B., Van Duijkeren, E., Mateus, A., Moreno, M. A., Pyörälä, S., Ružauskas, M., Sanders, P., Teale, C., Threlfall, E. J., Kunsagi, Z., Torren-Edo, J., Jukes, H. & Törneke, K. 2017. Public health risk of antimicrobial resistance transfer from companion animals. *Journal of Antimicrobial Chemotherapy*, 72(4), 957-968.
- Powers, J. H. 2004. Antimicrobial drug development--the past, the present, and the future. *Clinical Microbiology and Infection*, 10 Suppl 4, 23-31.
- Publications Office - European Union 2015. Commission Notice — Guidelines for the prudent use of antimicrobials in veterinary medicine *Official Journal Of the European Union*, 2015/C 299/04, 1-20.
- Pulcini, C. & Gyssens, I. C. 2013. How to educate prescribers in antimicrobial stewardship practices. *Virulence*, 4(2), 192-202.
- Quinney, L., Dwyer, T. & Chapman, Y. 2016. Who, Where, and How of Interviewing Peers: Implications for a Phenomenological Study. *SAGE Open*, 6(3), 2158244016659688.
- Rabinowitz, P. M., Pappaioanou, M., Bardosh, K. L. & Conti, L. 2018. A planetary vision for one health. *Bmj Global Health*, 3(5), e001137.
- Radford, A. D., Noble, P. J. & Coyne, K. P. 2011. Antibacterial prescribing patterns in small animal veterinary practice identified via SAVSNET: the small animal veterinary surveillance network. *Veterinary Record*, 169(12), 310.
- Raineri, E., Pan, A., Mondello, P., Acquarolo, A., Candiani, A. & Crema, L. 2008. Role of the infectious diseases specialist consultant on the appropriateness of antimicrobial therapy prescription in an intensive care unit. *American Journal of Infection Control*, 36, 283-290.

- Ramsay, C. 2003. Room for improvement: a systematic review of the quality of evaluations of interventions to improve hospital antibiotic prescribing. *Journal of Antimicrobial Chemotherapy*, 52(5), 764-771.
- Ratzan, S. C. 2002. The plural of anecdote is not evidence. *J Health Commun*, 7(3), 169-170.
- Rawson, T. M., Moore, L. S. P., Hernandez, B., Castro-Sanchez, E., Charani, E., Ahmad, R. & Holmes, A. H. 2016. Missed opportunities for shared decision making in antimicrobial stewardship: The potential consequences of a lack of patient engagement in secondary care. *International Journal of Infectious Diseases*, 45, 122-123.
- Reader, S. 2014. Distance, Relationship and Moral Obligation. *The Monist*, 86(3), 367-381.
- Review on Antimicrobial Resistance 2014. Antimicrobial Resistance: Tackling a crisis for the health and wealth of nations. In: O'NEILL, J. (ed.) *The Review on Antimicrobial Resistance*.
- Review on Antimicrobial Resistance 2016. Tackling drug-resistant infections globally: final report and recommendations. In: O'NEILL, J. (ed.) *The Review on Antimicrobial Resistance*. http://amr-review.org/sites/default/files/160525_Final%20paper_with%20cover.pdf.
- Ricci, P. F., Cox, L. A. & Macdonald, T. R. 2004. Precautionary principles: a jurisdiction-free framework for decision-making under risk. *Human & Experimental Toxicology*, 23(12), 579-600.
- Ricci, P. F., Rice, D., Ziagos, J. & Cox, L. A. 2003. Precaution, uncertainty and causation in environmental decisions. *Environment International*, 29(1), 1-19.
- Riggs, K. R. & Decamp, M. 2014. Physicians' Dual Agency, Stewardship, and Marginally Beneficial Care. *American Journal of Bioethics*, 14(9), 49-51.
- Robinson, T. P., Bu, D. P., Carrique-Mas, J., Fevre, E. M., Gilbert, M., Grace, D., Hay, S. I., Jiwakanon, J., Kakkar, M., Kariuki, S., Laxminarayan, R., Lubroth, J., Magnusson, U., Ngoc, P. T., Van Boeckel, T. P. & Woolhouse, M. E. J. 2016. Antibiotic resistance is the quintessential One Health issue. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 110(7), 377-380.
- Rock, M. J. & Degeling, C. 2015. Public health ethics and more-than-human solidarity. *Social Science & Medicine*, 129, 61-67.
- Rodrigues, A. T., Roque, F., Falcão, A. & Figueiras, A. 2013. Understanding physician antibiotic prescribing behaviour: a systematic review of qualitative studies. *International Journal of Antimicrobial Agents*.
- Rollin, B. 2001. Ethics, science, and antimicrobial resistance. *Journal of Agricultural & Environmental Ethics*, 14(1), 29-37.
- Rollin, B. E. 1978. Updating veterinary medical ethics. *Journal of the American Veterinary Medical Association*, 173(8), 1015-1018.
- Rollin, B. E. 1987. Euthanasia and Moral Stress. *Loss, Grief & Care*, 1(1-2), 115-126.

- Rollin, B. E. 1998. *The unheeded cry : animal consciousness, animal pain, and science*, Ames, Iowa State University Press.
- Rollin, B. E. 2000. Veterinary ethics and animal welfare. *Journal of the American Animal Hospital Association*, 36(6), 477-479.
- Rollin, B. E. 2006a. *An Introduction to Veterinary Medical Ethics Theory and Cases*, Ames, Blackwell Publishing.
- Rollin, B. E. 2006b. *Science and Ethics*, Cambridge, Cambridge University Press.
- Rollin, B. E. 2011. Euthanasia, Moral Stress, and Chronic Illness in Veterinary Medicine. *Veterinary Clinics of North America: Small Animal Practice*, 41(3), 651-659.
- Rollin, B. E. 2018. "We Always Hurt the Things We Love"-Unnoticed Abuse of Companion Animals. *Animals*, 8(9), 157.
- Rönnerstrand, B. & Lapuente, V. 2017. Corruption and use of antibiotics in regions of Europe. *Health Policy*, 121(3), 250-256.
- Roser, D. 2017. The Irrelevance of the Risk-Uncertainty Distinction. *Science and Engineering Ethics*, 23(5), 1387-1407.
- Ross, K. M. & Bernabeo, E. 2014. When Professional Obligations Collide: Context Matters. *American Journal of Bioethics*, 14(9), 38-40.
- Ross, L. E. 2017. An account from the inside: Examining the emotional impact of qualitative research through the lens of "insider" research. *Qualitative Psychology*, 4(3), 326-337.
- Rothwell, P. M. 2010. Commentary: External validity of results of randomized trials: disentangling a complex concept. *International Journal of Epidemiology*, 39.
- Royal College of Veterinary Surgeons. 2012. *Code of Professional Conduct for Veterinary Surgeons* [Online]. RCVS Website. Available: <http://www.rcvs.org.uk/advice-and-guidance/code-of-professional-conduct-for-veterinary-surgeons/pdf/> [Accessed 15/09/2020].
- Rozier, M. D. 2016. Structures of Virtue as a Framework for Public Health Ethics. *Public Health Ethics*, 9(1), 37-45.
- Rutgers, L. J. & Baarda, D. B. 1994. Normatieve vragen in de diergeneeskundige beroepspraktijk: een verkenning. *Tijdschrift voor Diergeneeskunde*, 119(18), 525-535.
- Rutherford, K. M. D. 2002. Assessing Pain in Animals. *Animal Welfare*, 11(1), 31-53.
- Sabateb, E. & World Health Organisation 2003. *Adherence to long-term therapies : evidence for action*, Geneva, World Health Organization.
- Sabbatini, A. K., Tilburt, J. C., Campbell, E. G., Sheeler, R. D., Egginton, J. S. & Goold, S. D. 2014. Controlling health costs: physician responses to patient expectations for medical care. *J Gen Intern Med*, 29(9), 1234-1241.

- Sabin, J. E. 1998. Fairness as a problem of love and the heart: a clinician's perspective on priority setting. *British Medical Journal*, 317, 1002-1004.
- Sackett, D. L. 2000. *Evidence-based medicine : how to practice and teach EBM*, Edinburgh, Churchill Livingstone.
- Sackett, D. L., Rosenberg, W. M. C., Gray, J. a. M., Haynes, R. B. & Richardson, W. S. 1996. Evidence based medicine: what it is and what it isn't. *British Medical Journal*, 312(7023), 71-72.
- Sakeena, M. H. F., Bennett, A. A. & Mclachlan, A. J. 2018. Non-prescription sales of antimicrobial agents at community pharmacies in developing countries: a systematic review. *International Journal of Antimicrobial Agents*, 52(6), 771-782.
- Sanders, C. R. 1994a. Annoying owners: Routine interactions with problematic clients in a general veterinary practice. *Qualitative Sociology*, 17(2), 159-170.
- Sanders, C. R. 1994b. Biting the Hand that Heals You: Encounters with Problematic Patients in a General Veterinary Practice. *Society & Animals*, 2(1), 47-66.
- Sanders, C. R. 1995. Killing with Kindness: Veterinary Euthanasia and the Social Construction of Personhood. *Sociological Forum*, 10(2), 195-214.
- Sanger, V. 1946. Ethics in the practice of veterinary medicine. *The North American veterinarian*, 27(7), 420.
- Sans, P., Mounier, L., Benet, J. J. & Lijour, B. 2011. The Motivations and Practice-Area Interests of First-Year French Veterinary Students (2005-2008). *Journal of Veterinary Medical Education*, 38(2), 199-206.
- Sarewitz, D. 2000. Science and Environmental Policy: An Excess of objectivity. In: FRODEMAN, R. (ed.) *Earth matters : the earth sciences, philosophy, and the claims of community*. Upper Saddle River: Prentice Hall.
- Sarewitz, D. 2004. How science makes environmental controversies worse. *Environmental Science & Policy*, 7(5), 385-403.
- Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., Burroughs, H. & Jinks, C. 2018. Saturation in qualitative research: exploring its conceptualization and operationalization. *Quality & Quantity*, 52(4), 1893-1907.
- Sally, G. & Donaldson, L. J. 1998. Clinical governance and the drive for quality improvement in the new NHS in England. *British Medical Journal*, 317(7150), 61-65.
- Schattner, A., Abel, N. & Von Der Walde, J. 2013. Doctor Google, Mister PubMed? *Netherlands Journal of Medicine*, 71(3), 166-166.
- Schmidt, P. L. 2009. Companion Animals as Sentinels for Public Health. *Veterinary Clinics of North America-Small Animal Practice*, 39(2), 241-+.

- Schneider, S., Salm, F., Vincze, S., Moeser, A., Petruschke, I., Schmucker, K., Ludwig, N., Hanke, R., Schroder, C., Gropmann, A., Behnke, M., Lubke-Becker, A., Wieler, L. H., Hagel, S., Pletz, M. W., Gensichen, J., Gastmeier, P. & Grp, R. a. I. S. 2018. Perceptions and attitudes regarding antibiotic resistance in Germany: a cross-sectoral survey amongst physicians, veterinarians, farmers and the general public. *Journal of Antimicrobial Chemotherapy*, 73(7), 1984-1988.
- Schnobel, S. 2014. Veterinary Negligence: Ethical and Legal Perspectives on Formulating a Duty of Care. *ReValuing Care Research Network* [Online]. Available: <http://revaluingcare.net/veterinary-negligence-ethical-and-legal-perspectives-on-formulating-a-duty-of-care/> [Accessed 29/09/20].
- Sears, C. L. 2018. The Contributions of Physician-Scientists Within Divisions of Infectious Diseases. *Journal of Infectious Diseases*, 218, S16-S19.
- Seguin, J. C., Walker, R. D., Caron, J. P., Kloos, W. E., George, C. G., Hollis, R. J., Jones, R. N. & Pfaller, M. A. 1999. Methicillin-resistant *Staphylococcus aureus* outbreak in a veterinary teaching hospital: potential human-to-animal transmission. *Journal of Clinical Microbiology*, 37(5), 1459-1463-1463.
- Selgelid, M. J. 2007. Ethics and drug resistance. *Bioethics*, 21(4), 218-229.
- Shahvisi, A. 2016. No Understanding, No Consent: The Case Against Alternative Medicine. *Bioethics*, 30(2), 69-76.
- Shaw, D. & Gardiner, D. 2015. Moral distance and distributive justice: how the increase in organ donation is helping us make better ethical decisions. *Anaesthesia*, 70(1), 10-13.
- Shurtz, S., Fajt, V., Heyns, E. P., Norton, H. F. & Weingart, S. 2017. Teaching Evidence-Based Veterinary Medicine in the US and Canada. *Journal of Veterinary Medical Education*, 44(4), 660-668.
- Sidebotham, P. 2003. The doctor, the father, and the social scientist. *Archives of disease in childhood*, 88(1), 44-45.
- Sikkens, J. J., Kramer, M. H. H., Van Der Steen, J. T., Van Buul, L. W., Hertogh, C. M. P. M. & Van Agtmael, M. A. 2014. Participatory action research in antimicrobial stewardship: a novel approach to improving antimicrobial prescribing in hospitals and long-term care facilities. *Journal of Antimicrobial Chemotherapy*, 69(7), 1734-1741.
- Silver, M. P. 2015. Patient Perspectives on Online Health Information and Communication With Doctors: A Qualitative Study of Patients 50 Years Old and Over. *Journal of Medical Internet Research*, 17(1), 15.
- Silverman, J., Kurtz, S. & Draper, J. 1998. *Skills for Communicating with Patients*, Oxford, Radcliffe Medical Press Ltd.
- Simon, T. 2010. Just who is at risk? The ethics of environmental regulation. *Human & Experimental Toxicology*, 30(8), 795-819.
- Singer, P. 1993. *Practical ethics*, Cambridge, Cambridge University Press.
- Singer, P. 2006. *In defense of animals : the second wave*, Malden, Blackwell Publishing.

- Singleton, D. A., Sánchez-Vizcaíno, F., Dawson, S., Jones, P. H., Noble, P. J. M., Pinchbeck, G. L., Williams, N. J. & Radford, A. D. 2017. Patterns of antimicrobial agent prescription in a sentinel population of canine and feline veterinary practices in the United Kingdom. *The Veterinary Journal*, 224(Supplement C), 18-24.
- Skodvin, B., Aase, K., Charani, E., Holmes, A. & Smith, I. 2015. An antimicrobial stewardship program initiative: a qualitative study on prescribing practices among hospital doctors. *Antimicrobial Resistance and Infection Control*, 4, 8.
- Smith, R. 2003. Medical journals and pharmaceutical companies: uneasy bedfellows. *British Medical Journal*, 326(7400), 1202-1205.
- Smulders, F. J. M., Buncic, S., Fehlhaber, K., Huey, R. J., Korkeala, H., Prieto, M. & Steinhäuserova, I. 2012. Toward Harmonization of the European Food Hygiene/Veterinary Public Health Curriculum. *Journal of Veterinary Medical Education*, 39(2), 169-179.
- Sox, H. C., Marton, K. I., Blatt, M. A. & Higgins, M. C. 1988. *Medical decision making*, Boston, Butterworth Heinemann.
- Speksnijder, D., J. Mevius, D., J. M. Brusckke, C. & A. Wagenaar, J. 2015a. Reduction of Veterinary Antimicrobial Use in the Netherlands. The Dutch Success Model. *Zoonoses and Public Health*, 62(Suppl. 1), 79-87.
- Speksnijder, D. C., Jaarsma, A. D., Van Der Gugten, A. C., Verheij, T. J. & Wagenaar, J. A. 2015b. Determinants associated with veterinary antimicrobial prescribing in farm animals in the Netherlands: a qualitative study. *Zoonoses and Public Health*, 62 Suppl 1, 39-51.
- Stach, L. M., Hedican, E. B., Herigon, J. C., Jackson, M. A. & Newland, J. G. 2012. Clinicians' Attitudes Towards an Antimicrobial Stewardship Program at a Children's Hospital. *Journal of the Pediatric Infectious Diseases Society*, 1(3), 190-197.
- Steele, M., Crabb, N. P., Moore, L. J., Reyher, K. K., Baillie, S. & Eisler, M. C. 2013. Online Tools for Teaching Evidence-Based Veterinary Medicine. *Journal of Veterinary Medical Education*, 40(3), 272-277.
- Steinman, M. A., Landefeld, C. S. & Gonzales, R. 2003. Predictors of broad-spectrum antibiotic prescribing for acute respiratory tract infections in adult primary care. *Journal of the American Medical Association*, 289(6), 719-725.
- Supady, A., Voelkel, A., Witzel, J., Gubka, U. & Northoff, G. 2011. How is informed consent related to emotions and empathy? An exploratory neuroethical investigation. *Journal of Medical Ethics*, 37(5), 311-317.
- Tannenbaum, J. 1985. Ethics and Human-Companion Animal Interaction - a Plea for a Veterinary Ethics of the Human-Companion Animal Bond. *Veterinary Clinics of North America-Small Animal Practice*, 15(2), 431-447.
- Tannenbaum, J. 1995. *Veterinary ethics : animal welfare, client relations, competition, and collegiality*, St. Louis, Mosby.

- Taylor, J. 2011. The intimate insider: negotiating the ethics of friendship when doing insider research. *Qualitative Research*, 11(1), 3-22.
- Teale, C. J. & Moulin, G. 2012. Prudent use guidelines: a review of existing veterinary guidelines. *Revue scientifique et technique (International Office of Epizootics)*, 31(1), 343-354.
- Tebala, G. D. 2018. The Emperor's New Clothes: a Critical Appraisal of Evidence-based Medicine. *International Journal of Medical Sciences*, 15(12), 1397-1405.
- Thomson, O. P., Petty, N. J. & Moore, A. P. 2014. Diagnostic reasoning in osteopathy - A qualitative study. *International Journal of Osteopathic Medicine*, 17(2), 83-93.
- Tilburt, J. C. 2014a. Addressing Dual Agency: Getting Specific About the Expectations of Professionalism. *American Journal of Bioethics*, 14(9), 29-36.
- Tilburt, J. C. 2014b. Response to Open Peer Commentaries on "Addressing Dual Agency: Getting Specific About the Expectations of Professionalism". *American Journal of Bioethics*, 14(10), W4-W5.
- Timmermans, S. & Mauck, A. 2005. The promises and pitfalls of evidence-based medicine. *Health Affairs*, 24.
- Toews, L. 2011. The Information Infrastructure that Supports Evidence-Based Veterinary Medicine: A Comparison with Human Medicine. *Journal of Veterinary Medical Education*, 38(2), 123-134.
- Tompson, A. C., Chandler, C. I. R., Mateus, A. L. P., O'neill, D. G., Chang, Y.-M. & Brodbelt, D. C. 2020. What drives antimicrobial prescribing for companion animals? A mixed-methods study of UK veterinary clinics. *Preventive Veterinary Medicine*, 105117.
- Trejejo, R. T. 2009. Public health for the twenty-first century: what role do veterinarians in clinical practice play? *Veterinary Clinics of North America - Small Animal Practice*, 39(2), 215-224.
- Turner, P. & Williams, C. 2002. Informed consent: patients listen and read, but what information do they retain? *The New Zealand Medical Journal*, 115(1164), U218.
- Turner, S. W. & Royle, N. 2015. Evidence-based veterinary medicine. *Veterinary Record*, 177(11), 293-294.
- Ubel, P. A. 2014. Agency Is Messy: Get Used to It. *American Journal of Bioethics*, 14(9), 37-38.
- Umber, J. K. & Bender, J. B. 2009. Pets and Antimicrobial Resistance. *Veterinary Clinics of North America: Small Animal Practice*, 39(2), 279-292.
- Van Boeckel, T. P., Gandra, S., Ashok, A., Caudron, Q., Grenfell, B. T., Levin, S. A. & Laxminarayan, R. 2014. Global antibiotic consumption 2000 to 2010: an analysis of national pharmaceutical sales data. *The Lancet Infectious Diseases*, 14(8), 742-750.
- Vandeweerd, J.-M., Clegg, P. & Buczinski, S. 2012a. How Can Veterinarians Base Their Medical Decisions on the Best Available Scientific Evidence? *Veterinary Clinics: Food Animal Practice*, 28(1), 1-11.

- Vandeweerd, J. M., Kirschvink, N., Clegg, P., Vandenput, S., Gustin, P. & Saegerman, C. 2012b. Is evidence-based medicine so evident in veterinary research and practice? History, obstacles and perspectives. *The Veterinary Journal*, 191(1), 28-34.
- Vandeweerd, J. M., Vandeweerd, S., Gustin, C., Keesemaecker, G., Cambier, C., Clegg, P., Saegerman, C., Reda, A., Perrenoud, P. & Gustin, P. 2012c. Understanding veterinary practitioners' decision-making process: Implications for veterinary medical education. *Journal of Veterinary Medical Education*, 39(2), 142-151.
- Veterinary Medicines Directorate 2019. UK One Health Report - Joint report on antibiotic use and antibiotic resistance, 2013–2017. New Haw, Addlestone: Veterinary Medicines Directorate.
- Viens, A. M. & Littmann, J. 2015. Is Antimicrobial Resistance a Slowly Emerging Disaster? *Public Health Ethics*, 8(3), 255-265.
- Viner, B. 2010. Clinical Effectiveness - What does it mean for practitioners - and cats? *Journal of Feline Medicine and Surgery*, 12(7), 561-568.
- Vliet Vlieland, T. P. M. 2002. Managing chronic disease: Evidence-based medicine or patient centred medicine? *Health Care Analysis*, 10(3), 289-298.
- Wadsworth, J. R. 1947. On Veterinary Ethics. *Journal of the American Veterinary Medical Association*, 110(843), 364-364.
- Walker, A. E., Grimshaw, J. M. & Armstrong, E. M. 2010. Salient beliefs and intentions to prescribe antibiotics for patients with a sore throat. *British Journal of Health Psychology*, 6(4), 347-360.
- Wall, L. L. & Brown, D. 2002. Pharmaceutical sales representatives and the doctor/patient relationship. *Obstet Gynecol*, 100(3), 594-599.
- Wasserman, D. & Wertheimer, A. 2014. In Defense of Bunkering. *American Journal of Bioethics*, 14(9), 42-43.
- Webb, L. E., Veenhoven, R., Harfeld, J. L. & Jensen, M. B. 2019. What is animal happiness? *Annals of the New York Academy of Sciences*, 1438(1), 62-76.
- Weber, J. T. & Courvalin, P. 2005. An emptying quiver: Antimicrobial drugs and resistance. *Emerg Infect Dis*, 11.
- Weese, J. S. 2006. Investigation of antimicrobial use and the impact of antimicrobial use guidelines in a small animal veterinary teaching hospital: 1995–2004. *Journal of the American Veterinary Medical Association*, 228(4), 553-558.
- Weese, J. S. 2008. Antimicrobial resistance in companion animals. *Animal Health Research Reviews*, 9(02), 169-176.
- Weiner, S. A., Stephens, G. & Nour, A. Y. M. 2011. Information-Seeking Behaviors of First-Semester Veterinary Students: A Preliminary Report. *Journal of Veterinary Medical Education*, 38(1), 21-32.

- Weinstein, M. C. 2001. Should physicians be gatekeepers of medical resources? *Journal of Medical Ethics*, 27(4), 268-274.
- Wells, R. E. & Kaptchuk, T. J. 2012. To Tell the Truth, the Whole Truth, May Do Patients Harm: The Problem of the Nocebo Effect for Informed Consent. *American Journal of Bioethics*, 12(3), 22-29.
- West, C., Stewart, L., Foster, K. & Usher, K. 2013. Accidental insider: Living the PhD study. *Collegian*, 20(1), 61-65.
- White, A. C., Jr., Atmar, R. L., Wilson, J., Cate, T. R., Stager, C. E. & Greenberg, S. B. 1997. Effects of requiring prior authorization for selected antimicrobials: expenditures, susceptibilities, and clinical outcomes. *Clinical Infectious Diseases*, 25(2), 230-239.
- Whitehead, M. 2015. Ethics of EBVM. *Veterinary Record*, 177(9), 237-238.
- Whiting, M., Alexander, A., Habiba, M. & Volk, H. A. 2017. Survey of veterinary clients' perceptions of informed consent at a referral hospital. *Veterinary Record*, 180(1), 20-20.
- Wildermuth, B. E., Griffin, C. E., Rosenkrantz, W. S. & Boord, M. J. 2007. Susceptibility of Pseudomonas isolates from the ears and skin of dogs to enrofloxacin, marbofloxacin, and ciprofloxacin. *Journal of the American Animal Hospital Association*, 43(6), 337-341.
- Wilkes, M. S., Conrad, P. A. & Winer, J. N. 2019. One Health-One Education: Medical and Veterinary Inter-Professional Training. *Journal of Veterinary Medical Education*, 46(1), 14-20.
- Williams, D. 2016. Dearth of evidence for EBVM. *Veterinary Record*, 179(8), 202-202.
- Williams, H. C. 2010. Evidence-based veterinary dermatology--better to light a candle than curse the darkness. *Vet Dermatol*, 21(1), 1-3.
- Williams, S. & Jordan, H. 2015. Veterinary futures: the drivers of change, a review of the literature. <http://vetfutures.org.uk/download/reports/Vet%20Futures%20literature%20review.pdf>: Vet Futures.
- Wirshing, D. A., Wirshing, W. C., Marder, S. R., Liberman, R. P. & Mintz, J. 1998. Informed consent: assessment of comprehension. *American Journal of Psychiatry*, 155(11), 1508-1511.
- Wohl, J. S. & Nusbaum, K. E. 2007. Public health roles for small animal practitioners. *Journal of the American Veterinary Medical Association*, 230(4), 494-500.
- Wood, F., Butler, C. C. & Simpson, S. 2007. Socially responsible antibiotic choices in primary care: a qualitative study of GPs' decisions to prescribe broad-spectrum and fluoroquinolone antibiotics. *Family Practice*, 24(5), 427-434.
- Wood, F., Phillips, C., Melbye, H., Hood, K., Jakobsen, K., Goossens, H., Butler, C. C., Godycki-Cwirko, M., Brookes-Howell, L., Worby, P., Little, P., Verheij, T. & Coenen, S. 2012. Primary care clinicians' perceptions of antibiotic resistance: a multi-country qualitative interview study. *Journal of Antimicrobial Chemotherapy*, 68(1), 237-243.

- Woods, A. & Bresalier, M. 2014. One health, many histories. *Veterinary Record*, 174(26), 650-654.
- World Animal Health Organisation 2015. *OIE standards, guidelines and resolution on antimicrobial resistance and the use of antimicrobial agents*, Paris, OIE. Available: http://www.oie.int/fileadmin/Home/eng/Media_Center/docs/pdf/PortailAMR/EN-book-AMR.PDF [Accessed 29/09/20].
- World Health Organisation 2001. Global strategy for containment of antimicrobial resistance. *WHO (WHO/CDS/CSR/DRS/2001.2)*, Geneva.
- World Health Organisation 2016. Critically Important Antimicrobials for Human Medicine. *In: AGISAR (ed.) 5th Revision*. Raleigh, USA.
- World Health Organisation. 2018. *Antimicrobial Resistance* [Online]. Available: <https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance> [Accessed 29/09/2020].
- Yeates, J. 2018. Naturalness and Animal Welfare. *Animals*, 8(4), 53.
- Yeates, J., Everitt, S., Innes, J. F. & Day, M. J. 2013. Ethical and evidential considerations on the use of novel therapies in veterinary practice. *Journal of Small Animal Practice*, 54(3), 119-123.
- Yeates, J. W. 2009. Response and responsibility: An analysis of veterinary ethical conflicts. *The Veterinary Journal*, 182(1), 3-6.
- Zhuo, A., Labbate, M., Norris, J. M., Gilbert, G. L., Ward, M. P., Bajorek, B. V., Degeling, C., Rowbotham, S. J., Dawson, A., Nguyen, K. A., Hill-Cawthorne, G. A., Sorrell, T. C., Govendir, M., Kesson, A. M., Iredell, J. R. & Dominey-Howes, D. 2018. Opportunities and challenges to improving antibiotic prescribing practices through a One Health approach: results of a comparative survey of doctors, dentists and veterinarians in Australia. *BMJ open*, 8(3), 12.

Interview Guide

Record participant information (age, sex, year graduated, vet school name), discuss Participant Information Sheet (PIS) and consent form.

- **Q – Tell me a little about your work and interests as a companion animal vet.**
P – What attracted you to this field? What is a typical day like for you?
- **Q – How important are antimicrobials in your daily work?**
P – Do they present any unique challenges? How are they different from other drugs? What drives your prescription decisions? Have you ever had any issues because of either prescribing or not prescribing an antimicrobial?
- **Q – Do you find published evidence useful when using antimicrobials?**
P – How and when do you use it? What main sources of evidence do you use? What are the challenges of using evidence in practice?
- **Q – What about antimicrobial resistance? Is it relevant to your work?**
P – Have you experienced a problematic case because of AMR? Is it an important consideration when you make prescription decisions? How does it influence you? Do you think the situation might change in the future?
- **Q – Have you had discussions as a practice about antimicrobials?**
P – Is there a strategy in your practice to try and improve clinical use of antimicrobials? Do you think that's doing more or less than the average practice? Is there anything else you think the profession should be doing?
- **Q – What role do clients play in your decision to prescribe antimicrobials?** (might be skipped if covered in previous answers)
P – Has it changed in recent years? Do they ever insist on antimicrobial treatment? How would you handle it if they do/did? What are the limits of client autonomy in that context?
- **Q – Do you think the current concerns regarding antimicrobials are likely to change how you work in the coming years?**
P – Can you think of any similar issues? What would be the best way to balance human and animal interests? How would you define 'acceptable risk'? What factors could influence or change this definition?
- **Q – Is there anything else you would like to add regarding antimicrobial stewardship, antimicrobial resistance or anything else we discussed in this interview, or anything you think I have missed?**
- **Thank you**

Information for Study Participants:

Analysis of ethical responsibilities of companion animal veterinarians in antimicrobial stewardship

Lead researcher: Clio Cartelet, MRCVS (Clio.Cartelet@nottingham.ac.uk)

Supervisors: Dr Kate Millar (School of Biosciences), Dr Pru Hobson-West (School of Veterinary Medicine and Science), Dr Sujatha Raman (School of Sociology and Science Policy)

Funding: The Leverhulme Trust – ‘Making Science Public’ Project.

What is this study about? This research project focuses on antimicrobial prescription by veterinary surgeons in companion animal practice in the UK. In the larger context of antimicrobial resistance, it seeks to understand the nature of the clinical and non-clinical challenges faced by companion animal vets while using antimicrobials. This work is supported by the School of Biosciences (University of Nottingham) and The Leverhulme Trust. It has been approved by the School of Sociology and Science Policy Ethics Committee at the University of Nottingham.

What are we asking you to do? We are asking you to take part in a 45 to 90 minutes face-to-face interview that will explore a range of themes linked to antimicrobial use and daily life in companion animal practice. It will be an in-depth discussion of your professional experience with no right or wrong answers. The interview will be conducted at a time suitable for you.

Who’s participating? We are looking for veterinary surgeons who have worked full time in the UK for a least a year (or part-time equivalent) with a workload constituted of at least 50% companion animals (dogs, cats, rabbits, small rodents).

What are the benefits of participating? This work will help us understand more about the challenges faced by companion animal veterinary surgeons when prescribing antimicrobials. It is hoped that the results will inform future policies and guidelines to ensure they are useful and relevant to daily life in companion animal practice. In the larger context of antimicrobial resistance, this work hopes to identify the main barriers to improving and promoting antimicrobial stewardship in companion animal practice.

Participation is entirely voluntary. If you are unable to participate or do not want to participate, please just inform the researcher.

What happens to the information collected? The interview will be audio-recorded to allow the contents to be transcribed at a later date. The recording will not be used for any other purpose and will be destroyed once transcribed. All data will be encrypted and stored on a secure university server, as well as anonymised before any publication. Your identity and information, including the name of your practice, will be kept strictly confidential. You will also have the right to withdraw all the data linked to your interview from this research project, without giving reasons, up to publication. The data will be kept for seven years after the publication of research outputs and then destroyed (as set out in the University of Nottingham Data Policy).

Research outputs: The data collected will be used by the main researcher to write a PhD thesis. It will also be used to develop and publish academic research papers. These will be available to participants upon request.

Researcher contact details: If you have any questions or concerns about the research, then in the first instance please contact Clio Cartelet (Clio.Cartelet@nottingham.ac.uk). If this does not resolve the matter please contact Dr Kate Millar, 0115 9516303 (Kate.Millar@nottingham.ac.uk) and then the Research Ethics Officer for the School of Sociology and Science Policy, Dr Alison Mohr (Alison.Mohr@nottingham.ac.uk).

We would like to thank you for your time and consideration