Bellet, Camille and Woodnutt, Joanna and Green, Laura E. and Kaler, Jasmeet (2015) Preventative services offered by veterinarians on sheep farms in England and Wales: opinions and drivers for proactive flock health planning. Preventive Veterinary Medicine, 122 (4). pp. 381-388. ISSN 0167-5877

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Preventative services offered by veterinarians on sheep farms in England and Wales: opinions and drivers for proactive flock health planning

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Abstract

Recent independent UK government reports and studies have highlighted the importance, but lack, of flock health services provided by veterinarians. Qualitative interviews were analysed by thematic analysis to construct belief statements to understand veterinarians’ opinions on preventative advice and drivers for current services to sheep farmers. A postal questionnaire was sent to 515 sheep practices registered with the Royal College of Veterinary Surgeon (RCVS) in England and Wales in 2012 to gather quantitative data on these belief statements and to gather demographic information and current services provided by the veterinarian. Exploratory factor analysis with heuristic approaches was conducted on the respondents’ belief statements to identify common factors of veterinarian beliefs. Three main factors were identified: motivation for proactiveness, perceived capability to offer preventative services and perceived opportunity to deliver these services. A beta regression model was built to identify the factors significantly associated with the time veterinarians spent in an advisory role. The relative proportion of time increased by 10% (1.01-1.19), 16% (1.03-1.30) and 29% (CI: 1.09-1.53) for each unit increase in score for factor 1 motivation, factor 2 capability and factor 3 opportunity respectively, indicating that these latent factors explained time veterinarians spent in an advisory role with sheep clients. There was a significant correlation between these factors suggesting influence of the associated beliefs between factors. This study provides insight into the nature and drivers of veterinarians’ current behaviour and beliefs. These results could be further tested in behaviour intervention studies and help in designing efficient strategies aiming at promoting proactive health services offered by veterinarians on sheep farms in England and Wales.

Keywords: Sheep, Farmer, Veterinarians, Preventative services, Factor analysis, Beta regression modelling, Behaviour
1. Introduction

A government report in 2009 (Lowe, 2009) highlighted that farm animal veterinarians needed to orientate their services away from treatment of individual sick animals to preventative advice. The reasons for this shift to preventative advice were identified as increasing farm sizes, diminishing profit margins, higher expectations from consumers’ for high health status meat products, increased farmers’ demand and needs by farmers for differentiated veterinary services. Preventative advice included farm specific monitoring of health and disease of livestock and providing action plans on health, nutrition, genetic selection and husbandry to prevent disease. In addition, the advice needed to be bespoke to a farm business and individual farmer’s attitudes and beliefs (LeBlanc et al., 2006; Lowe, 2009).

The Department for Environment Food and Rural Affairs (DEFRA) has been developing strategies, such as the Farm Health Planning Initiative, to encourage preventative advisory services (i.e. an active process measuring, managing and monitoring livestock to maximize the health and welfare of farm animals) in England and Wales since 2004. One of the main aims of these strategies is the development of close partnerships between farmers and veterinarians to facilitate and improve the implementation of preventative practices on farms (DEFRA, 2004; Osmond, 2009). There is, to date, no evidence that preventative advisory services are being used more on sheep farms. Recent surveys showed that sheep farms were the predominant farm businesses not receiving preventative advice from veterinarians, with only 22% of sheep farmers reporting all-year-round contact with their veterinarian whilst 68% contacted them for emergencies only (ADAS, 2007; DEFRA, 2013).

Although sheep farmers believe their veterinarians are their most useful source of new information (i.e. a disease in the flock unrecognised by the farmer), they also consider veterinarians’ inconsistent service, high turnover and lack of both expertise and independence in advice as key
barriers to using them in preventative advice for their flocks (Kaler and Green, 2013). There is no information on veterinarians’ beliefs about the services that they offer to their sheep clients and veterinarians’ views of their sheep clients’ use of their vet. Because the perception of both farmers and veterinarians is crucial to develop an effective proactive relationship and to fulfil both parties’ objectives to improve sheep health, there is a need to understand better the views and beliefs of veterinarians on the services they currently offer to sheep farmers and how they believe these are received.

There are over 83 psychosocial theories that have been developed in human health to explain behavioural processes and how to change various health behaviours (Sutton, 2001; Michie et al., 2014) with considerable overlap between the theories. The use of these theories to understand behaviour is relatively new in veterinary science and most of the studies to date have focused on farmer behaviour (Ellis-Iversen et al., 2010; Garforth et al., 2013). However, without fully understanding the most relevant and common underlying factors or constructs of a behaviour, for a particular population, the choice of theory can be challenging (Michie et al., 2014); currently, there is no evidence on the underlying beliefs or important constructs for veterinarians’ behaviour towards preventative services on sheep farms.

The aims of the current study were to use psychosocial approaches to i) understand better veterinarians’ beliefs on providing advice on flock health, ii) use exploratory factor analysis to identify common constructs that explain veterinarians’ beliefs, and iii) identify whether those factors are associated with the relative proportion of time veterinarians spent in an advisory role on sheep farms.

2. Materials and methods

2.1. Study Design
2.1.1. Interviews

In the first part of the study, 12 face-to-face semi-structured individual interviews with sheep veterinarians were conducted by JK. Veterinarians were selected using a non-probability snowballing technique to ensure the collection of key information related to the specific purpose of the study. The discussion guide covered areas around current contact with sheep farmers, services offered and views on how these were received and the veterinarian’s perception of their expertise. The interview was pilot tested on two veterinarians before commencing the study. Interviews lasted for 60 to 90 minutes and were audio-recorded and transcribed.

2.1.2. Postal questionnaires

In 2012, a list of all Royal College of Veterinary Surgeon (RCVS)-registered practices was used to select the sample. From the 4642 practices on the list, any that did not register treating sheep were discarded. Practices registered as ‘branch practices’ or ‘supporting practices’ were also discarded to avoid contacting the same veterinarian twice, as well as those with an address outside England and Wales. This resulted in 515 veterinary practices selected for the postal questionnaire study.

Based on themes identified by veterinarians from analysis of the interviews and previous work with sheep farmers (Kaler and Green, 2013), thirty belief statements relating to veterinarians’ preventative advisory services were formed. A five-point Likert-based scale with descriptors from 1 to 5: ‘strongly agree’, ‘agree’, ‘neither agree nor disagree’, ‘disagree’, ‘strongly disagree’ was used to collect scores on the belief statements. Veterinarians were also asked to provide the proportion of time they spent in an advisory role (defined as ‘preventative, non-emergency work on a regular basis’) to sheep farmers, together with general demographic data and number of sheep clients they had. The questionnaire was pilot tested and then sent by post with a cover letter and a prepaid envelope; postal reminders including a copy of the questionnaire were sent within twelve working days of no response from the practice and an additional two-week period was given for the respondents to reply.
2.2. Qualitative analysis

Thematic analysis (Braun and Clarke, 2006) was used relying on the constant comparative method (Maykut and Morehouse, 1994) to examine the perceptions of veterinarians on the advisory role they played with their sheep clients. The first step consisted of reading and re-reading transcripts and becoming familiar with the content. Interesting features of the data were then systematically generated using general non-overlapping codes across the dataset. Further sub themes were generated after reviewing the codes. The transcripts were double coded to enhance the reliability and data saturation across the themes was assessed (Kaler and Green, 2013). The qualitative analysis was performed using NVivo 10.0 (QSR International) software.

2.3. Quantitative analysis

Data from the questionnaires were coded, checked and entered into a database (Microsoft Access, 2010). The data were analysed using STATA 12.1 (STATA Inc., Texas, USA). A first stage descriptive analysis was conducted to summarize the data.

2.3.1. Exploratory Factor Analysis

An exploratory factor analysis (EFA) was then performed on the belief statement variables to explore which of the veterinarians’ belief statements loaded together to form a common construct/latent variable and to understand their relationship to the core dimension/construct identified. Statement variables were standardized prior to the analysis and the appropriateness of the correlation matrix was checked (Ferguson and Cox, 1993). The Kaiser-Mayer-Olkin (KMO) test of sampling adequacy was conducted for both the entire correlation matrix and each variable individually (weighted value > 0.5). The Bartlett test of sphericity (weighted $p$ value for $\chi^2 < 0.05$), indicating the strength of association among variables was conducted (Ferguson and Cox, 1993). In order to avoid any violation of distributional assumptions, the estimation of factor loadings was
made using iterated principal factor analysis (IPFA). Both the scree test and parallel analysis using eigenvalues from the reduced correlation matrix were used to determine the number of factors. An oblique factor rotation (promax) was performed, to allow any correlation between factors (Fabrigar et al., 1999; Costello and Osborne, 2005). Factor loadings greater than ± 0.3 were considered and statement variables with low reliability (i.e. high uniqueness) were discarded from the analysis (Fabrigar et al., 1999). Complex variables (i.e. loading on two or more factors) were avoided, either excluding the item from the analysis or, in the case of large discrepancy (>0.2), considering the highest loading variable (Ferguson and Cox, 1993). A minimum criteria of four items per factor was retained (Fabrigar et al., 1999). Finally, for model diagnostics, the resulting sets of items per factor were examined for internal consistency, using both Cronbach's alpha and inter-item covariance (Cronbach, 1951; Tavakol and Dennick, 2011).

2.3.2. Beta regression modelling

A maximum likelihood regression technique based on beta regression modelling (Ferrari and Cribari-Neto, 2004; Smithson and Verkuilen, 2006) was used to identify significant factors associated with the relative proportion of time veterinarians spent in an advisory role (outcome), which was assumed to follow a beta distribution. The beta regression model used was the one described by Ferrari and Cribari-Neto (2004), where the outcome y follows the density:

\[
f(y; \mu, \phi) = \frac{\Gamma(\phi)}{\Gamma(\mu \phi) \Gamma((1 - \mu) \phi)} y^{\mu \phi - 1} (1 - y)^{(1 - \mu) \phi - 1}
\]

where \(0 < y < 1\), \(\mu\) is the mean of \(y\) and \(\phi\) the unknown precision parameter of its distribution, and \(\Gamma(\cdot)\) is the gamma function. Considering the \(n\) outcome data \(y_1 \ldots y_n\), the beta regression model assumes that each \(y_t\), \((t=1, \ldots, n)\) follows a beta distribution and the mean of these random variables can be written as:

\[
g(\mu_t) = \sum_{i=1}^{k} x_{ti} \beta_i + \beta_0 = \eta_t
\]
where $\beta_0$ represents the intercept, $\beta_i$ the coefficient of the $i$ predictor variables, $x_i$ are observations on $i$ predictor variables, $\eta_i$ is a linear predictor and $g(.)$ the link function (Ferrari and Cribari-Neto, 2004). A logit link function was used to build the model (Ferrari and Cribari-Neto, 2004; Smithson and Verkuilen, 2006). Outcome observations, i.e. reported proportion of time spent by veterinarians in an advisory role were transformed to the open unit interval (0, 1), adding a very small amount (0.0001) to the 0-valued observations and subtracting the same amount to the 1-valued observations (Smithson and Verkuilen, 2006).

Predictor variables included general demographic characteristics of veterinarians and the 3 factors generated from EFA of belief statements. Each of the 3 factors comprised scores, which were computed using a non-refined method of weighted sum scores, thereby taking into account the strength (or lack of strength) of each factors’ items (DiStefano et al., 2009). Predictor variables with a category wise Wald test p value ≤0.05 were retained in the model.

The measure of association between the predictor variables and the outcome from the beta regression was expressed as a relative proportion ratio (STATA). The fit of the model was evaluated by visual examination of the residuals and identification of the potential outliers (Ferrari and Cribari-Neto, 2004; Smithson and Verkuilen, 2006).

3. Results

3.1. Qualitative analysis

The 12 vets that were included in the study consisted of 5 males and 7 females with age range of 28 to 50 years and were from practices in central England (n=5), south-west England and Wales (n=4) and north of England (n=3). After final coding of the data there were 4 key themes: i) services offered, 2) knowledge and expertise, 3) sheep farmer clients, and 4) ways of interacting with sheep farmers. Data saturation among the themes was achieved.

3.1.1. Services offered
Veterinarians perceived a problem with the contact they currently had with farmers. The veterinarians used phrases such as “a ‘fire-brigade’ service” and “only after several sheep have died”, showing an awareness of the limited nature of the contact. There was a general feeling among the veterinarians that the result of not doing advisory work that prevented diseases was delivering reactive services when disease events occurred, as expressed in the quote below:

“I suppose most of what we do sheep-wise, as I say, is lambings or post-mortems unfortunately because we don’t get called to sheep farms to do preventative work. And I suppose because we’re not being proactive enough in getting the preventative medicine out to them which is why we then end up doing this… we have a very reactive service, what one of my old lecturers would’ve called a ‘fire brigade service’ rather than a preventative”.

There was also a feeling among veterinarians that lack of records was a key contributor to them being unable to offer the preventative services, for example as highlighted in this quote:

“I think if we got on the farm more we could add value offering proactive services, we could tighten things up, we could see where things were going wrong. But I think the main thing is records, if a farmer doesn’t have any records then you can’t see where things are going wrong, and we’ve got a few clients who have got very good records and I can see how to add value to their flocks, but I can’t necessarily see how to add value if the record keeping isn’t there and that’s something the farmers need to do”.

Most veterinarians had negative emotions towards reactive care of sheep indicating that they were not happy with their current situation. The quote below demonstrates their state of mind towards this:

“I think as a practice we find that we’ve got a lot of sheep on our books but we very rarely see them. I think you’d probably find that around a lot of the country, I don’t think we’re unique in that
but it’s something that’s been niggling at myself and one of the other vets a bit recently that we’ve not got enough contact with our sheep farmers”.

Flock health plans (FHP) were mentioned by veterinarians as a form of service but the availability and structure of FHPs varied among interviewees from static FHPs - “We have got a sheep health plan which we can offer if people are interested”- to active ones requiring two visits a year - “I’ve set up a flock health initiative scheme thing so I see them twice a year, they pay an amount per month for two visits a year so I certainly see them at least twice a year [...] They will have written flock health plans, once I’ve set up an original plan every time I go back after that they get a written review”.

Most of the veterinarians described not charging for all the time they spent on a FHP for fear of it being too expensive, as shown by these comments:

“I’d always think ‘he’s never going to pay for this’”.

“We’re sort of almost obliged to do it but it’s impossible to charge a realistic rate, so when work gets busy that’s the first thing that then suffers”.

“The difficult thing was balancing cost, how much you thought farmers would be prepared to pay against our own economics”.

3.1.2. Knowledge and expertise

Most veterinarians believed that they did not have sufficient knowledge and expertise and this affected their confidence to be proactive on farms. They blamed lack of contact with sheep farmers and their own lack of enthusiasm for this gap in knowledge and expertise. The quotes below describe these views:
“I think that a lot of us don’t necessarily have invested enough time in getting enough knowledge and I think we’ve not necessarily enough knowledge to really supply the farmer with something that he really thinks ‘wow that was really useful, I didn’t know that’.”

“If you graduate and all you do is a couple of lambings each year and talk to the odd farmer that comes in to collect some drugs then a) you’re going to feel that that’s how it is and not aspire to doing anymore, and b) you quickly don’t see enough sheep to be able to feel confident in your knowledge when you’re giving advice”.

There were two veterinarians, who mentioned they invested time and effort to gain this knowledge and expertise, and mentioned that support from their boss was crucial in this. The quote below describes this:

“I had to look a lot of stuff up and learn a lot from reading around the subject, talking to other people and learning from the sheep farmers as well. Just trying to keep it quite simple initially, work out what they do, work out what their aims are, work out what their initial problems are, stick to three things that I think I can make a difference on starting with the obvious and hopefully building on it”.

“I was perfectly prepared and luckily I’ve got a boss who’s perfectly prepared for me to take this by the horns and go with it and not worry too much. But I could be very confident in saying in the last year we’ve done more sheep work than we have done in previous years”.

Veterinarians also believed that sheep farmers did not trust in their knowledge and expertise and how veterinarians could add value to the farm. The two quotes below describe both these beliefs:

“I think they (sheep farmers) probably think that generally we’ve got the same knowledge level as they’ve got <chuckles> or slightly more or slightly skewed towards the medicine side but I don’t know that most of them aren’t aware of what else we can offer them”.

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“I think a lot of the farmers around here seem to give the impression that they know what they’re doing and we can’t tell them anymore”.

3.1.3. Sheep farmer clients

There were general feelings among veterinarians that their sheep farmer clients were just not prepared to pay for the services. For example this quote below highlights this:

“We do have trouble getting the farmers to pay for education. So they will pay for you to go and see a sick ewe but they don’t want to pay you to educate them to prevent them getting a sick ewe, do you see what I mean?”.

Most of those interviewed assumed that sheep farmers would not pay for advice without asking them. This was identified by one vet as being a problem, as shown in the following quote:

“I think the reason it’s hard is, and I’m myself really to blame here, is assuming farmers won’t pay for it and that’s exactly the same as trying to charge them for coming to meetings, is we assume that farmers, you know for so long they’ve got it for free or … yeah so it’s possibly a lack of self-confidence and lack of trying”.

Most veterinarians mentioned that in their view, their sheep clients did not wish to engage with them and veterinarians were frustrated with this, for example the quotes below describe these views clearly:

“Our farmers are not wanting to engage with us, I think it’s almost like they don’t feel there’s a need to somehow”.

“[…] that’s the frustration, for instance, quite recently we tried to have a farmer forum and selected some key farmers to come in and, not with me there or anyone necessarily, but to talk about what they would like and we had a very poor response turning up so we didn’t hold it”.
3.1.4. Ways of interacting with sheep farmers

Telephone contact and meetings were the two most common ways veterinarians interacted with their sheep farmer clients.

Most veterinarians acknowledged that free telephone advice was the most common way they interacted with their sheep clients and the fact it was free meant farmers would use it quite often. Where some veterinarians thought free telephone advice was a barrier to them getting onto the farms, others thought that free telephone advice sometimes gave them an opportunity to initiate a farm visit. The quotes below express veterinarians’ views:

“I think that we should (not give free telephone advice) because I think that’s where we end up not being able to get onto the farm, because if they feel that they can glean as much information as they need just by talking to you then that negates the need for you to go out to the farm”.

“[…] often you’ll end up on a visit through the telephone; we do a mixed practice, so each of them (farmers) will have maybe five collies in working dogs and we end up doing their farm work”.

There were mixed views among veterinarians on the subject of charging for telephone advice. Some were of the opinion that telephone advice should be charged because of the time taken and knowledge given, but were not sure of how to charge and were fearful of losing the only contact they had with sheep farmers. This is illustrated in the quotes below:

“It’s really difficult because I suppose being creatures of habit we’ve never charged for it (telephone advice) and I sort of think well why should we start? But at the same time it is time out of my day and it should be seen as valuable advice I suppose, ultimately they’re seeking my opinion as a professional and thus there should be some charge; quite how you’d go about instigating that I’m not sure”.

“I would hate to think that people didn’t want to ring me if they had a problem, and sheep guys are reluctant to get you to come out anyway, if you then started charging for your phone advice god knows what would happen out there”.
There were others who thought offering free telephone advice was traditional and that there was goodwill associated with it, as described by this veterinarian below:

“I guess it’s traditional and historical that’s possibly why you don’t (charge for telephone advice) and also there’s a lot of other goodwill that comes off the back of it”.

Veterinarians organised farmers’ meetings and saw these as an opportunity to engage more and build relationships with farmers:

“[…] through the meetings really and any opportunity if they’re coming in or anything, just trying to engage”.

“I think if we can offer them a training meeting or just even an evening meeting talking about worms or something. Even just something to pull them back in and we can start off that relationship again then I think there is the potential to develop it”.

However, they felt since most of these meetings were sponsored and free for farmers, farmers did not see value:

“Yeah we tend to do a fair bit in conjunction with drug companies”. “And I think with hindsight not charging is probably a mistake, because I don’t think they value it enough”.

### 3.2. Quantitative analysis

A total of 162 out of 515 questionnaires were returned, representing a response rate of 31%. Fifteen questionnaires were returned empty or with apologies for not having been completed due to the practice no longer treating sheep, resulting in 147 questionnaires included in the analysis.

### 3.2.1. Demographic characteristics of the respondents
The majority (76%) of veterinarians had at least five years professional experience with 60% having ten or more years of experience. The majority graduated from the UK; the top-five Universities being the Royal Veterinary College of London (24%), Liverpool (18%), Bristol (16%), Edinburgh (14%) and Glasgow (10%); 10% of the veterinarians graduated from abroad.

3.2.2. Veterinarians’ current practice

Overall, the median number of sheep clients per practice was 53 (IQR 20 - 130). The median percentage of clients that ran their sheep business as a primary enterprise was 30%, with the remaining enterprises being secondary or tertiary. A total of 78% (114/147) of veterinarians reported their relative proportion of time spent in an advisory role with their sheep clients; the median time spent reported was 20% [IQR: 5-50]. Ninety-five per cent (139/147) of the veterinarians reported providing advice to their clients by telephone, of which only 4% (5/139) asked their clients to pay a fee. Approximately 40% of the veterinarians reported attending Continuing Professional Development on sheep in 2012.

3.2.3. Belief statement scoring and exploratory factor analysis

Of the 147 veterinarians who answered the questionnaire, 26 had ten sheep clients or fewer and were removed from the EFA. The suitability of the belief statements for EFA, assessed by the overall Kaiser-Meyer-Oklin value, was meritorious (KMO=0.81), with no items having an individual sampling adequacy of less than 0.5, and by the Bartlett’s test of sphericity, which was statistically significant $\chi^2 = 644.3$ (df = 153, p < 0.001), supported the factorability of the resulting items correlation matrix (Kaiser, 1974; Ferguson and Cox, 1993).

The IPFA on the belief statements after inspection of a scree plot and parallel analysis, considering factor loadings, gave a three factor solution with eigenvalues exceeding 1.0 (5.02, 1.64, 1.30). This three-factor solution accounted for 65.1% of the total variance of the veterinarians’ belief
The factors were: factor 1 (with 10 items), factor 2 (with 4 items) and factor 3 (4 items). The factor loading for the three-factor solution, items for the factors along with measures of internal consistency and mean scores of the given items are presented in Table 1. There were positive correlations between factors: r=0.4 between factor 1 and 2; r=0.3 between factor 2 and 3 and r=0.2 between factor 1 and 3. All factors had good internal consistency taking into account both the number of items and the inter-item covariance measure (Cronbach, 1951; Tavakol and Dennick, 2011). The higher factor scores were related to the individuals either agreeing or strongly agreeing with the related items (data not shown).

Within factor 1 (“motivation”) were items related to veterinarians’ motivation (Table 1). The majority of veterinarians “agreed” or “strongly agreed” (65-75%) that they provided a good service to their sheep clients and that either their boss/colleagues or their sheep clients were happy with the services they offered. Approximately 44% of veterinarians “agreed” or “strongly agreed” that they offered sufficient preventative advice. However, only 6% of veterinarians “agreed” or “strongly agreed” that they were seeing their clients enough and 24% that they were the primary source of advice to their sheep clients. About 18-23% of the veterinarians either “agreed” or “strongly agreed” that their sheep clients were aware or prepared to pay for their services or that veterinarians themselves had enough marketing skills to promote their services.

In factor 2 (“capability”) were items related to the veterinarians’ capability (Table 1). About 45-53% of the veterinarians believed they knew enough about their clients’ needs, had enough knowledge about non-veterinarian aspects of sheep enterprises and that their clients were interested in the additional services they could offer. Approximately 70% of the veterinarians “agreed” or “strongly agreed” that they had sufficient sheep health expertise.
Within factor 3 (“opportunity”) were items related to external components or opportunities (table 1). The majority of veterinarians “agreed’ or “strongly agreed” that proactive services could provide additional income to the practice (74%) and thought what their sheep clients (97%) or boss/colleagues (58%) thought was important to them. There was general agreement (92% either “agreed” or “strongly agreed”) that veterinarians would not prefer external consultants to provide these services to the sheep clients.

3.2.4. Beta regression modelling

The multivariable beta regression model results are presented in table 2. All three factors were significantly associated with the proportion of time sheep veterinarians spent in an advisory role. The relative proportion of time veterinarians spent in an advisory role increased by 10% (1.01-1.19), 16% (1.03-1.30) and 29% (CI: 1.09-1.53) with each unit of increase in score for factor 1 “motivation”, factor 2 “capability” and factor 3 “opportunity”, respectively. There was no significant association between any demographic factor and the proportion of time veterinarians spent in an advisory role.

Visual examination of the Pearson residuals suggested the model fit was reasonable (data not shown).

4. Discussion

To the authors’ knowledge this is the first study to explore veterinarians’ beliefs towards the services they offer to their sheep clients and the impact of those beliefs on the time they spend in an advisory role. In the current study, EFA generated three factors that described the veterinarians’ beliefs with good internal consistency. These three factors map to the three components proposed by the COM-B system of behaviour: Capability, Opportunity and Motivation (Michie et al., 2011). According to the COM-B model (Michie et al., 2011), a behaviour occurs as a result of these three
necessary factors (capability, opportunity and motivation). Capability is defined as the psychological and physical abilities to perform behaviour, and includes knowledge. Motivation includes ‘reflective’ processes that direct behaviour - e.g. evaluations, beliefs - and ‘automatic’ processes that involve emotions and impulses. Opportunity involves factors that are external to an individual that may influence behaviour; this could be physical (time, resources, environment or ‘affordance’) or social (interpersonal influences, social environment). The COM-B model and previous research has highlighted that motivations, capabilities and opportunities are correlated and influenced by the behaviour itself (Michie et al., 2011). Results from the current study also indicate this because these three factors were correlated with each other and significantly influenced the veterinarians’ current behaviour, measured as the relative proportion of time spent in an advisory role. These factors are discussed below in context of this framework.

Items included in factor 1 demonstrated both the automatic motivation (e.g. ‘my clients/boss or colleagues are happy with my services’) and reflective motivation (e.g. ‘I think I am my clients’ primary source of advice’ or ‘my clients are prepared to pay for services’) among veterinarians. The reflective evaluation included not only veterinarians’ own actions (e.g. I see my sheep clients enough) but also their sheep clients’ actions (e.g. my sheep clients are prepared to pay to use the services I could offer), suggesting some associations between these two sets of motivations. Veterinarians’ perception of their sheep farmer clients’ unwillingness to pay could be a reflection of economics of sheep farming and/or their own assumption due to lack of trying, as highlighted by the qualitative interviews in the current study. However, for sheep farmers to be willing to pay for veterinarians’ advisory services, they first need to be able to see how these services could add value. In the current study, most veterinarians believed that sheep farmers were not aware of the services they could offer. This could be a consequence of poor marketing skills by veterinarians and/or lack of record keeping on sheep farms, as reported in the current and previous studies (Kaler and Green, 2013), making farmers unable to see the value of veterinarians’ services.
Despite the fact that most veterinarians believed they did not visit their sheep clients sufficiently often and that their clients were not aware of the services they, the veterinarians, could offer, vets still believed they had sufficient knowledge, were providing a good service and that their sheep clients were happy with their service. This is an example of cognitive bias (Burke, 2006), where there is disparity between associated beliefs. This has been reported previously in sheep farmers’ management of lameness (Wassink et al., 2010), where footbathing and foot trimming managements were reported to be an unsatisfactory use of time and money by farmers, but also identified as the optimal way to manage lameness. These biases can present an impasse in changing behaviour.

Other studies have demonstrated associations between motivations and behaviours (e.g. farmers’ perceptions of control of mastitis (Jansen et al., 2009)) and perception of having biosecurity measures on farm (Gunn et al., 2008) have been linked to effective mastitis control and action to improve biosecurity respectively. In the current study, veterinarians with relative higher factor scores on the common factor ‘motivation’ spent significantly higher proportion of time in an advisory role, suggesting that veterinarians, with positive beliefs about their service and positive beliefs about how their clients perceived their service, tended to spend more time doing advisory work with their sheep farmer clients.

Items in factor 2 demonstrated veterinarians’ awareness of their ‘capability’ to engage in the advisory role. These were measures related to psychological capability; for example, knowing enough about client needs, having sufficient expertise in sheep health with knowledge about non-veterinary aspects of sheep husbandry and farming. Veterinarians’ lack of knowledge of sheep husbandry and farming was highlighted by sheep farmers (Kaler and Green, 2013) and, in the qualitative analysis, by veterinarians as their key barrier for working proactively with sheep farmers. The findings from the quantitative study suggest that only half of the veterinarians agreed
that they had sufficient knowledge of sheep husbandry and farming and of their sheep clients’ needs. However, it is difficult to see how veterinarians could develop their knowledge, gain expertise and know enough about their clients’ needs without being on farms given that 80% of the veterinarians stated in the current study that they did not see their sheep clients sufficiently often.

The veterinarians in the qualitative interviews also highlighted this lack of contact with sheep farmers, which impacted on their confidence and was a barrier to them developing their expertise.

The factor ‘capability’ was significantly associated with the proportion of time veterinarians spent in an advisory role on sheep farms. This suggested that veterinarians, who were more aware of their clients’ expectations and had stronger capability in sheep health and non-health related areas of expertise, were spending more time doing advisory work.

Factor 3 included both physical opportunity (for example in terms of source of additional income and external consultants as competitors) and social opportunity (importance of what boss/colleagues or sheep clients’ opinions). Sheep farmers have highlighted that there is a lack of availability of routine flock health plans or models demonstrating benefits to them and that veterinarians, not farmers, should instigate these (Kaler and Green, 2013). The results from the current study suggest that most veterinarians are aware of having to make such an opportunity because it could provide them with additional income and they would prefer external consultants not to provide these advisory services. However, there is not only a need to create such opportunities but also, as highlighted above, veterinarians would need to gain marketing skills to sell those opportunities. The majority of veterinarians also considered that their boss/colleagues and sheep clients’ views were important, suggesting strong impact of social and interpersonal influences on the preventative services they offered. This was also highlighted in the qualitative interviews, where support from the boss appeared to have influenced veterinarians to take a more proactive role with their sheep farmer clients. The factor score ‘opportunity’ had the strongest association with the relative proportion of time veterinarians spent in an advisory role, indicating that veterinarians with stronger
beliefs in the income opportunity of their services, who did not want external consultants to provide these services and who felt supported by their boss and clients, spent relatively more time in advisory services with their sheep clients.

Due to the nature of the current study there are some limitations; the response rate was typical for a postal questionnaire to a non-engaged target population (Kaler and Green, 2008) and there is a possibility of response bias to the survey and to specific questions (e.g. the proportion of time spent in an advisory role); However, there was no significant difference between the respondents and non-respondents with respect to their geographical location. Data on beliefs and time spent were collected by self-report, which is the most common method of assessment used in psychological research; however, there is a possibility of self-presentational and recall biases (Horne and Weinman, 1999). As recommended in the literature (Rand and Wise, 1994), we took steps to diminish the biases by phrasing belief statements in a non-judgmental way and assuring participants that responses were anonymous and confidential. The question on the outcome (i.e. proportion of time spent by veterinarians) was asked in a separate section (with few other questions between) to where belief statements were asked; thus limiting the possibility of any recall.

In addition, EFA is driven by the set of items included and additional factors not identified in the analysis may exist. However, there was consistency in some beliefs expressed by veterinarians with previous work done with sheep farmers (Kaler and Green, 2013) and the common factors identified map to all three main behavioural components of the COM-B framework that explains behaviour, thus the results are plausible. The factors explain differences in the amount of time veterinarians spent in an advisory role with their clients and these might be predictive - i.e. improving expertise might increase the time spent advising sheep farmers. However, this would need to be tested in intervention studies. Finally, the outcome variable was a proportion with a non-normal distribution and so standard models were not suitable. Due to the challenges related to any data transformation (Smithson and Verkuilen, 2006; Schmid et al., 2013) and the highly flexible shape of the beta
distribution, a beta regression (Ferrari and Cribari-Neto, 2004), was used and allowed the specification and fit of a model for our continuous proportion outcome (Smithson and Verkuilen, 2006).

5. Conclusions

The study results suggest 3 key correlated factors ‘motivation’ ‘capability’ and ‘opportunity’ underlying veterinarians’ beliefs about the preventative services they provide on sheep farms. There was some discrepancy in the associated beliefs because, although most veterinarians believed that they provided a good service, they also believed they did not see their clients sufficiently often nor that their clients were aware of the services they could offer. Increased positive belief in their own motivation, clients’ perception of their services, own perception of their expertise to offer advice and viewing preventative advice as a source of additional income, together with support from boss and clients, significantly increased the proportion of time veterinarians spent in an advisory role. The current study gives us an insight to veterinarians’ current beliefs and how these could be impacting on their behaviour; this remains to be tested in a behaviour intervention study. These results could therefore be used to design effective strategies to target and promote proactive flock health planning on sheep farms.

6. Conflict of interest

The authors declare that they have no competing interests.

7. Acknowledgments

The work was funded by BBSRC-IIP award (BBSRC grant BB/E01870X/1) and as a part of a student project at SVMS, University of Nottingham. We especially thank all the veterinarians who participated in this study.
References


Tables

Table 1. Exploratory factor analysis of 147 English and Welsh veterinarians’ belief statements regarding their advisory role on sheep farms (Only loadings > 0.30 are displayed)

Table 2. Beta regression model outcomes of psychosocial factors associated with the time sheep veterinarians spent in an advisory role on farms
Table 1.

<table>
<thead>
<tr>
<th>Items</th>
<th>Scores Mean ± SD</th>
<th>Factor 1 “Motivation”</th>
<th>Factor 2 “Capability”</th>
<th>Factor 3 “Opportunity”</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think I provide good services to my clients</td>
<td>2.18 ± 0.77</td>
<td>0.608</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I see my clients often enough</td>
<td>4.10 ± 0.94</td>
<td>0.642</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think I offer sufficient preventive advice</td>
<td>2.69 ± 0.89</td>
<td>0.517</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think I am my clients’ primary source of advice</td>
<td>3.17 ± 0.99</td>
<td>0.557</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My boss/colleagues are happy with my services</td>
<td>1.97 ± 0.72</td>
<td>0.667</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My clients are happy with my services</td>
<td>2.18 ± 0.74</td>
<td>0.635</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My clients wish to use the services I could offer</td>
<td>2.40 ± 0.86</td>
<td>0.442</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My clients are prepared to pay for my services</td>
<td>3.26 ± 1.09</td>
<td>0.429</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My clients are aware about services I could offer</td>
<td>2.77 ± 1.00</td>
<td>0.425</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have enough marketing skills to encourage uptake of advice</td>
<td>3.12 ± 0.93</td>
<td>0.411</td>
<td></td>
<td></td>
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<tr>
<td>I believe I know enough my clients’ needs</td>
<td>2.48 ± 1.16</td>
<td></td>
<td>0.534</td>
<td></td>
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<tr>
<td>My clients are interested about additional services</td>
<td>2.66 ± 1.08</td>
<td></td>
<td>0.495</td>
<td></td>
</tr>
<tr>
<td>I have enough sheep health expertise to provide advice</td>
<td>2.14 ± 0.93</td>
<td></td>
<td>0.578</td>
<td></td>
</tr>
<tr>
<td>I know enough about non-vet aspects of sheep enterprises</td>
<td>2.60 ± 1.12</td>
<td></td>
<td>0.700</td>
<td></td>
</tr>
<tr>
<td>Preventive services could provide additional income</td>
<td>2.05 ± 1.02</td>
<td></td>
<td></td>
<td>0.385</td>
</tr>
<tr>
<td>What my boss/colleague thinks is important</td>
<td>2.40 ± 1.09</td>
<td></td>
<td></td>
<td>0.387</td>
</tr>
<tr>
<td>What my clients think is important</td>
<td>1.40 ± 0.56</td>
<td></td>
<td></td>
<td>0.494</td>
</tr>
<tr>
<td>I wouldn’t prefer external consultants providing advice</td>
<td>1.39 ± 0.76</td>
<td></td>
<td></td>
<td>0.671</td>
</tr>
</tbody>
</table>

| Cronbach’s alpha | 0.82 | 0.70 | 0.60 |
| Average Inter-item covariance | 0.30 | 0.40 | 0.20 |
Table 2.

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Coefficients</th>
<th>SE</th>
<th>RPR*</th>
<th>95% CI**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1 “Motivation”</td>
<td>.0955</td>
<td>.0421</td>
<td>1.1002</td>
<td>[1.0130-1.1948]</td>
</tr>
<tr>
<td>Factor 2 “Capability”</td>
<td>.1466</td>
<td>.0609</td>
<td>1.1580</td>
<td>[1.0276-1.3048]</td>
</tr>
<tr>
<td>Factor 3 “Opportunity”</td>
<td>.2562</td>
<td>.0870</td>
<td>1.2920</td>
<td>[1.0894-1.5323]</td>
</tr>
<tr>
<td>Precision parameter phi (Φ)</td>
<td>2.1593</td>
<td>.2854</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*RPR- Relative Proportion Ratio; **CI – Confidence Interval