Evaluation of a pharmacist-led intervention to reduce prescribing costs in general practice

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ABSTRACT

Introduction and aim

It has been suggested that the employment of pharmacists in general practice might moderate the growth in prescribing costs. However, empirical evidence for this proposition has been lacking. The aim of this study was to evaluate a controlled trial of pharmacist-led intervention in general practice to determine whether intervention practices made savings relative to controls and if so, exactly how these savings were made and whether quality of prescribing was maintained. Since this process of rationalisation has implications for patients, an additional aim was to explore the views of patients on changes made to their medication.

Methods

The study was an evaluation of an initiative set up by Doncaster Health Authority. Eight practices received intensive input from five pharmacists for one year (September 1996 to August 1997) at a cost of £163 000. Changes in prescribing patterns were investigated using Prescribing Analysis and CosT (PACT) data by comparing these practices with eight individually matched controls for both the year of the intervention and the previous year. A postal survey of 314 patients who had undergone a change in medication between October 1997 and January 1998 was used to explore patient views.

Results

The evaluation showed that the rise in prescribing costs for intervention practices was significantly lower than for control practices ($p=0.025$). Had the cost growth of the intervention group been as high as that of the controls, their total prescribing expenditure would have been around £347 000 higher. Detailed analysis showed that these savings were achieved by controlling both prescribing volume and cost per unit volume in areas believed to be without detriment to patient care. The majority of patients were reasonably satisfied or very satisfied with the way in which they found out about their medication change and satisfaction was positively associated with being told why the change was taking place, being given a choice and being told by the GP, a practice pharmacist or by letter.

Conclusions

Compared with previous studies, this evaluation has advantages in the fact that a control group was used to compare changes in prescribing patterns. The evaluation has shown that the use of pharmacists controlled prescribing expenditure sufficiently to off-set the costs of their employment. Results of the patient survey indicated that patients were not so much concerned about changes in medication per se, but rather the manner in which it was conveyed to them. These results have important implications for the control of prescribing costs in primary care. However, this study took place in motivated practices that had relatively high prescribing costs and this may limit the generalisability of the results.

DECLARATION

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other institute of learning.

The Doncaster Prescriber Support Project was established by Dr Keith Doran, Medical Adviser, Doncaster Health Authority. Professor Tony Avery was responsible for the overall design of the evaluation along with Dr David Meechan, Director of Research and Information, Doncaster Health Authority.

The Pharmaceutical Adviser, Sandra Briant, gave professional guidance and helped employ the pharmacists, liaised with the Local Pharmaceutical Committee (LPC) and devised the information packs to guide the pharmacists. The assistant to the Advisers, Michael Geraghty, had a significant role in dealing with personnel issues and provided the pharmacists with information including feedback on prescribing. In addition, he was responsible for forwarding PACTline data to the researcher on a monthly basis and for requesting the Level 3 PACT data from the Prescription Pricing Authority.

At the request of the researcher, paper based Level 3 PACT data were entered onto computer by Enigma Medical Systems and costs were assigned using the September 1997 Drug Tariff. In addition, Enigma Medical Systems were requested to write software to analyse the Audit Commission type categories, developed by Avery et al. (2000) and validated by a group of academic GPs and pharmacists involved in the study. The researcher was responsible for all data processing, manipulation and analysis of both the PACTline and Level 3 PACT with clinical input from her supervisor in interpreting the results.

With regards the patient satisfaction survey, the researcher had the main responsibility for developing the questionnaire, survey administration, data collection, data input and analysis with the exception of the ordered logistic regression analysis which was performed by Dr Ciaran O'Neill at the request of the researcher.

The whole of the literature review was undertaken by the researcher alone.

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My apologies to my two daughters, Jemma and Jessica, who have recently seen too much of my back in front of a computer. I promise to make it up to you!

for Jemma and Jessica

LIST OF ABBREVIATIONS

The following gives a list of abbreviations used in the thesis. A full glossary of terms can be obtained from the National Prescribing Centre "Glossary of Prescribing Terms" [available at www.npc.co.uk].

ADQ	Average Daily Quantity
ACEI	Angiotensin Converting Enzyme Inhibitors
ASTRO-PU	Age, Sex and Temporary Resident Originated Prescribing Units
BNF	British National Formulary
DDD	Defined Daily Dose
DOH	Department of Health
EBM	Evidence Based Medicine
GP	General Practitioner
HRT	Hormone Replacement Therapy
ITS	Interrupted Time Series analysis
LREC	Local Research Ethics Committee
MR	Modified Release
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
NHS	National Health Service
NPC	National Prescribing Centre
NIC	Net Ingredient Cost
OR	Odds Ratio
OTC	Over-the-counter
PACT	Prescribing Analysis and CosT data

PACTline	Prescribing Analysis and CosT electronic Standard Report
PCGs	Primary Care Groups
PCTs	Primary Care Trusts
PPA	Prescription Pricing Authority
PPIs	Proton Pump Inhibitors
PSP	Prescriber Support Project
PSU	Prescribing Support Unit
PU	Prescribing Unit
PPA	Prescription Pricing Authority
RCT	Randomised Controlled Trial
RPSGB	Royal Pharmaceutical Society of Great Britain
SPSS	Statistical Package for Social Scientists
SSRIs	Selective Serotonin Re-uptake Inhibitors
STAR-PU	Specific Therapeutic group Age-sex Related Prescribing Units
WHO	World Health Organisation

CHAPTER 1

BACKGROUND

1.1 INTRODUCTION

The aims of this chapter are to explain the context of the studies presented in the thesis, explain how the project was established, give the main aim and objectives of the research and outline the content of the other chapters in the thesis.

1.2 CONTEXT

In 1993/4 Doncaster Health Authority had the highest general practice prescribing costs per patient of all health authorities in the country. It was recognised that, although there might be good reasons for these high costs (such as patient morbidity), the continued upward trend in drug budget overspend had to be addressed, particularly as existing measures had met with limited success. The decision was made that a more radical approach was needed. The Health Executive Team (HET) challenged the Professional Advisers to design a strategy to tackle the problem. Realising that the problem could not be tackled without funding, they were prepared to commit a significant portion of development monies to the initiative.

The strategy decided upon by Doncaster Health was to provide prescriber support in the form of a pharmacist resource dedicated to each practice. The initial aims were to:

- bring drug expenditure in Doncaster to within acceptable financial limits
- provide on-going, independent practice-based prescriber support
- maximise health gain to the people of Doncaster within the resources available
- maximise effectiveness, minimise risk, minimise costs and respect patients' choices

Three possible resources were identified for providing prescriber support. These were practice-based pharmacists; community pharmacists or general practice

(GP) prescribing associates; it was decided that practice-based pharmacists would be best placed to achieve the desired results.

During their training, pharmacists learn all aspects of the action and uses of medicines, from the origin and preparation of drugs, to the laws and standards applying to pharmacy. To qualify as a pharmacist in the UK it is necessary to complete a four year degree course followed by one year's practical training in pharmacy (pre-registration training) and then pass an examination to register with the Royal Pharmaceutical Society of Great Britain, which acts as the regulatory and professional body for pharmacists in England, Scotland and Wales. Doncaster Health Authority believed that pharmacists had the necessary skills and knowledge to provide the type of prescriber support required for the project. The more difficult question was deciding on the type of intervention the pharmacists were to deliver. The role of the pharmacist has traditionally been that of dispensing and advice giving working in settings such as high street community pharmacy and hospitals. Although the possibility of collaborating with local pharmacists was raised, potential conflicts of interests with community pharmacists over remuneration systems for drug dispensing, and the amount of pharmacist time required to deliver the intervention, contributed to the decision that the pharmacists should be practice-based rather than working on an "outreach" basis.

In 1996, all general practices in the Doncaster Health Authority area were invited to take part in the Prescriber Support Project (PSP) and a workshop, accredited for Post Graduate Education Allowance, was held to provide more information. Eight practices (including four fundholders, two single-handed general practices and one dispensing practice) and a total purchasing pilot (Primary Care 2000) were recruited. The practices covered 30% of the population in the Doncaster Health Authority area. There were no entry criteria for these practices (apart from a willingness to work with a practice-based pharmacist) and so all interested practices were included. All practices were volunteer practices and none were coerced into participating.

The period of employment for the pharmacists was to be for one year in the first instance, and the Health Authority was to provide ongoing development in the form of education, training and prescribing information. There was agreement that while the Health Authority would pay the salaries of the pharmacists, fundholding practices would pay towards these costs from any savings that they had made on their budgets during the year of the intervention.

Pharmacists were recruited by local and national advertisements. The Authority was seeking pharmacists with at least 5 year's experience who were appropriate for appointment at a senior/principal pharmacist grade (Whitley Council scale D-F). Of the many applicants, 20 fulfilled the criteria and five of these were employed. A pharmacist was seconded from the local acute Trust to cover the purchasing pilot.

The five pharmacists who were appointed had a wide range of skills and experiences. Two came from community pharmacy, one came from an academic post and the other two had hospital backgrounds. The skills and experiences of the pharmacists were taken into consideration when assigning them to the different practices. Also, a certain amount of "personality matching" took place. The total purchasing pilot was covered by 0.7 whole time equivalent (WTE) of pharmacist time while the other eight practices were covered by 5 WTE of pharmacist time (the amount of time per practice being dependent on list size). In total, two of the pharmacists worked full-time in two of the practices, one pharmacist worked half-time in two of the practices and the four remaining practices were covered by two pharmacists each working 0.6 WTE and 0.4 WTE in two practices.

The intended role of the pharmacists was to work with the practices to help control prescribing costs while maintaining or improving prescribing quality.

The Health Authority provided the practices with feedback on their prescribing and each practice decided on its own priorities for action in conjunction with the pharmacist assigned to that practice. It was felt that the scheme would not require

a large time commitment from GPs, because the pharmacists were capable of making agreed changes to patients' medications and dealing with patients' questions and concerns.

1.2.1 Training and support for pharmacists

Pharmacists were provided with the following options for training and support:

- an introduction to the Project with an information pack
- half day training sessions on aspects of therapeutics at the University of Sheffield
- regular meetings with other pharmacists involved in the Project to share ideas and gain support

At the introductory session, pharmacists were provided with background information on the Project. They were supplied with information on the wide range of prescribing data that they could request from the Health Authority on their practices and given information on the analysis of Prescribing and CosT (PACT) data. In addition, they received an information pack that included:

- feedback on the prescribing of their practices based on PACT data
- a glossary of terms used for the interpretation of PACT data
- information on prescribing indicators
- an example of a "pharmacist's diary"

The pharmacists were asked to keep a diary in which they would record any actions that they or their practice took to review or alter prescribing during the course of the project. These diaries were then returned for analysis by Doncaster Health Authority staff.

The half-day training sessions at the University of Sheffield took place in the Department of Pharmacology and Therapeutics under the direction of Professor Ramsay. Eight sessions were organised and each of these focused on different

therapeutic areas. There was strong emphasis on evidence-based medicine in the sessions.

The pharmacists met regularly (approximately monthly) following the introductory session. These meetings provided a forum for the exchange of information, ideas and strategies for managing change in the practices. The meetings also provided an environment where the pharmacists could support each other. It was felt that with the pharmacists coming from different backgrounds, there was much that they could learn from each other.

1.2.2 The intervention

Although each practice decided on its own priorities for action in conjunction with the pharmacist assigned to that practice, analysis of the pharmacist diaries showed that a range of strategies were employed by the pharmacists and these are summarised below:

- Repeat prescription review
- Generic substitution
- Nursing and residential home reviews
- Formulary review
- Review of gastro-intestinal drugs
- Review of cardiovascular drugs
- The establishment of pharmacist-run asthma clinics

Further details can be found in Appendix 6.

1.2.3 Key personnel involved in the Project at Doncaster Health

The establishment of the Prescriber Support Project required considerable input from a number of personnel at Doncaster Health and the key roles are outlined below:

1. Medical Adviser

   The Medical Adviser led and co-ordinated the whole project. He acted as a major driving force to get the project up and running.

2. Pharmaceutical Adviser

   The Pharmaceutical Adviser gave professional guidance and helped to draw up the strategy, employ the pharmacists, liaise with the Local Pharmaceutical Committee (LPC) and devise the information packs to guide the pharmacists.

3. Assistant to the Advisers

   The assistant to the Advisers had an essential role in dealing with enquiries from the pharmacists and in helping to provide information including feedback on prescribing. He had a significant role in dealing with personnel issues.

4. Finance and Personnel

   Input from Health Authority staff with expertise in finance and personnel issues was very important. Initially the pharmacists were to be employed by the practices themselves with the Personnel Department at Doncaster Health acting in an advisory capacity. However, it was eventually decided that Doncaster Health would act as an 'agency' for the pharmacists, with the GPs paying for services and then claiming for those services from General Medical Services monies.

1.3 RATIONALE FOR THE STUDY

In evaluating the Prescriber Support Project, Doncaster Health decided to seek help from an academic partner. Doncaster Health were keen to collaborate with an academic partner with a track record in prescribing research and so they approached Professor Tony Avery, then Senior Lecturer, at the Division of General Practice, Nottingham. At the time, I was employed as a Research Associate to work with Professor Avery on the Department of Health funded

study "NHS Prescribing Research Initiative: identifying how some general practices control their prescribing costs" (Avery et al. 2000). It was decided that I would take the lead for this evaluation and register, initially, for the degree of MPhil, and then latterly for the degree of PhD, with Professor Avery acting in the role of supervisor.

By September 1996 the pharmacists had started working with the eight intervention practices and for the purposes of the evaluation, this date was taken as the beginning of the first year's intervention. The total purchasing pilot was not included in the evaluation. The total cost of the scheme including employment of the pharmacists, training and set-up was £163 000.

1.4 AIM OF THE STUDY

The main aim of the study was to evaluate the pharmacist-led intervention to determine whether this helped general practices to control their prescribing costs. Although there was evidence to suggest that there were benefits to employing pharmacists in general practice (Burton, Duffus and Williams, 1995; Corbett, 1995; Jenkins, 1996; Macgregor et al. 1996), little had been done by way of economic analysis. In cases where financial gains had been cited (Bradley, 1996; Speak and Gibson, 1996), it was difficult to say whether the savings had been made as a result of the employment of the practice pharmacist, rather than any other factors. This is why a control group was used in this study and it was this factor, in conjunction with the type of analysis done, which contributed to the originality of the work.

In order to achieve the overall aim of the study a series of research questions was devised. The research questions, which form the basis of my thesis, were:

1. Do intervention practices make savings in prescribing costs compared with matched controls?
2. Do any savings cover the costs of the intervention?

3. What changes do intervention practices make in their prescribing patterns compared with matched controls?
4. Is the quality of prescribing maintained on the basis of any changes in prescribing patterns?
5. What are the views of patients on changes made to their medication?

1.5 STUDY DESIGN AND THESIS STRUCTURE

The research questions were addressed in three discrete studies. Each study has been presented as a separate chapter in this thesis, containing an introduction, aims, methods, results and summary of main findings. To avoid repetition, discussion of methodological issues and key findings from each study has been presented in the final discussion chapter. A brief summary of the contents of each chapter is given below.

Chapter 2: Literature review

A review of international policy and peer-reviewed literature was undertaken at the beginning of the study and updated as new publications appeared. This chapter places the study in context of this literature and identifies the gaps in the knowledge that this thesis set out to examine.

Chapter 3: Changes in prescribing costs of intervention and control practices

An observational study was conducted to assess differences in prescribing costs of intervention and control practices using Prescribing Analyses and CosT (PACT) data from the Prescription Pricing Authority (PPA).

Changes for overall prescribing costs and prescribing costs within chapters and subchapters of the British National Formulary (BNF) were assessed using PACT standard reports (PACTline) for each of the intervention and control practices. This data contains an analysis of general practitioner (GP) prescribing and, at the time of data collection, was transferred electronically to the health authority on a

monthly basis. The results of this analysis made it possible to determine whether the intervention practices made relative savings in prescribing costs compared with their matched controls and whether any relative savings were sufficient to cover the costs of the intervention.

Chapter 4: Changes in prescribing patterns of intervention and control practices

In order to assess the types of changes that took place, a second observational study was carried out which entailed a much more detailed analysis of PACT catalogues (Level 3 PACT) using specially designed computer software (Optimise). Level 3 PACT catalogues contain detailed feedback on a practice's prescribing down to the level of formulations, doses and quantities given and, at the time of the study, came on paper from the PPA on request. Results of this analysis made it possible to examine changes in prescribing volume and costs per unit volume right down to individual drug and preparation level. The calculation of potential savings that could be made through generic substitution of brand-named products was also possible. Proxy measures of prescribing quality using Level 3 PACT data were used to assess whether quality of prescribing was being maintained (or improved) by the intervention practices.

Chapter 5: Patient satisfaction with changes in their medication

Assessing the views of patients was seen to be an important part of the evaluation, and this chapter presents the results of a questionnaire survey of patients who had undergone a change in their medication in the intervention practices. The aims of the survey were to explore patients' satisfaction with changes in their medication and identify levels of satisfaction in relation to the way in which the change was carried out.

Chapter 6: Discussion

Methodological issues and key findings from each of the three studies are discussed in this final chapter in light of recent national policy and peer-reviewed

literature. Policy implications of the findings and future areas for research are also discussed.

1.6 ETHICAL CONSIDERATIONS AND DATA PROTECTION

Ethical approval for the analysis of PACT data was not required at the time of the study. However, approval was required for the patient satisfaction survey and was obtained from the Local Research Ethics Committee (LREC) at the start of the study. All data were stored with strict adherence to Data Protection Act (1998) regulations. All electronic data were stored in password protected files on a computer used solely by the researcher and was recognisable only by its Prescription Pricing Authority (PPA) number. This number, assigned by the PPA, is unique to each practice. All paper-based data, completed questionnaires and correspondence relating to the study were stored in a locked filing cabinet accessed only by the researcher. At the end of the study all data were archived in accordance with the 1998 Data Protection Act.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents the background to the study and places it the context of international peer-reviewed literature. It focuses on the variation in, and the need to control, the rise in GP prescribing costs, and the various methods which have been employed to improve prescribing practice. The growing collaboration between GPs and pharmacists is discussed and a number of studies where this collaboration has been used to rationalise prescribing are highlighted. This process of rationalisation has implications for patient outcomes in terms of satisfaction with health services and compliance with medications. These issues are addressed in light of the growing body of literature surrounding the move towards shared decision-making in the doctor-patient relationship. The gaps in the literature that this thesis set out to examine are identified.

A great deal has happened since the time of this study and there have been many developments in the role of the pharmacist. A number of studies evaluating a range of pharmacist interventions in general practice to improve prescribing outcomes have taken place, and publications from this thesis (Rodgers et al. 1999; Rodgers, Avery and O'Neill, 2000) have contributed to this body of work. This chapter therefore concludes with a summary of the recent developments in the field and highlights those studies relevant to this thesis.

2.1.1 How the literature was identified

The literature was identified by searching computerised databases (e.g. Medline and Cochrane library, Web of Science, BIDS etc) and journals such as the British Medical Journal, British Journal of General Practice, Pharmaceutical Journal, International Journal of Pharmacy Practice, Journal of the American Medical Association and Quality in Health Care. Key words used in the searches can be found in Appendix 1. In addition reference lists of relevant articles were hand searched.

The information presented is not the result of a structured systematic review, and in many cases, where more than one study had similar findings, only one study has been referenced. Due to the volume of published work in this field, in many cases, details of individual studies have not been given. However, details have been given of those studies thought to be particularly relevant to the thesis. Only articles published in English have been included in the review and due to differences in the organisation of health care systems, the review has mainly been confined to work conducted in the United Kingdom (UK), although reference is made to studies conducted in the United States of America (USA), Canada, South Africa and Europe.

2.2 BACKGROUND

Drug treatment is extremely common in general practice with an estimated 60% to 75% of patients receiving a prescription on consulting their GP (Bligh and Walley, 1992). In 1994, 456 million prescription items were dispensed at a cost of £3 404 million, an increase of 5.9 % in real terms compared to the previous year (Department of Health Statistical Bulletin, 1995). The number of prescription items dispensed has now risen to 650 million and the costs incurred more than doubled to £7 510 million in the year 2003 (Department of Health, 2004). When it is considered that 83% of the prescription items dispensed in 2003 were free to patients (Department of Health Statistical Bulletin, 2004), it is understandable why the control of prescribing costs is of great concern to the government.

In 1990 the Audit Commission became responsible for external audit of National Health Service (NHS) bodies in England and Wales, including health authorities. At the time, health authorities were responsible for overseeing primary care delivered by GPs and dispensing by community pharmacists.

In 1994 the Commission published the results of its study of prescribing in 54 practices, located in ten health authorities (HAs), in the report "A prescription for improvement: towards more rational prescribing in general practice" (Audit

Commission, 1994). The study found great variation in prescribing costs between health authorities and individual practices and deemed much of this prescribing as unnecessary and wasteful. Repeat prescribing was highlighted as a particularly problematic area. The report concluded that the NHS could save up to £425 million per year if general practitioners agreed to change their prescribing habits by:

- increasing prescribing of the "top 20" generic drugs
- substituting comparable but cheaper drugs
- more appropriate use of expensive preparations
- prescribing fewer drugs of limited clinical therapeutic value
- using less drugs often over prescribed

Although the strategies proposed by the Audit Commission were viewed as potentially useful for cost control, there was little evidence that the strategies were being used to control the rise in prescribing costs. There was therefore a need to influence prescribing behaviour and it was hoped that this could be achieved by encouraging GPs to "rationalise" their prescribing.

2.2.1 Rational prescribing

Rational prescribing has been defined by Manojlovic and colleagues (see Buetow et al. 1997) as the "application of an appropriate drug by a correct route in an adequate dose over a sufficiently long period of time" and has been described as the process whereby prescribing decisions are made (Buetow et al. 1997). According to Parish (1973) rational prescribing should be "appropriate, safe, effective and economic." In other words, rational prescribing should take into consideration whether the patient's problem is best solved by taking a medicine (appropriate), and if it is, deciding whether the drug will work (effective), whether it will do more harm than good (safe) and whether there is a cheaper alternative which would be just as effective (economic). In 1995, Barber proposed a wider definition of what a prescriber should be trying to achieve which included the right of patients to make choices in treatment: a 'good'

prescriber should aim to maximise effectiveness, minimise risks and costs, and respect the choices of patients (Barber, 1995). With increasing downward pressure on the drugs bill, there was the need for health organisations to assess both the appropriateness and cost effectiveness of treatments in order to maximise the use of resources.

2.2.2 Appropriate prescribing

Appropriate prescribing is what results (or should result) from the process of rational prescribing; in other words appropriate prescribing is "the outcome of a process of decision-making that maximises net individual health gains within society's available resources" (Buetow et al. 1997). Inappropriate prescribing not only has implications in monetary terms, but also in terms of quality

Lunn et al. (1997), in their study of five nursing homes and 13 general practices in the North West of England, found that elderly residents in nursing homes are at high risk of inappropriate prescribing. A later study by Strand and Rokstad (1999) showed that inappropriate prescribing for elderly patients is common in general practice and the authors suggest that a substantial number of elderly people may be at risk of suffering adverse drug reactions.

A study by Britten et al. (1995a) which examined the continued inappropriate prescribing of 25 drugs in 40 patients in general practice found that the influence of the original prescriber, coupled with the patient's dependence on the drug, in part explained its continued use. It is interesting to note that the study found that almost half of the patients were willing to change their medication and shows the importance of medication review in long-term medication.

Inappropriate prescribing can be attributed to a number of factors including differences in perspectives of the patient and GP or the result of the complex interplay in the doctor-patient relationship (Little et al. 2004a). For this reason, it has been argued that patient involvement in the decision making process is essential for appropriate prescribing (Barber 1995).

2.2.2.1 Shared decision making and concordance

The recognition of the need for patient centred consultations has been documented by Stevenson et al. (2000) in their paper "Doctor-patient communication about drugs: the evidence for shared decision making". This two-way communication between patients and health professionals has been termed "concordance" (Royal Pharmaceutical Society, 1997) and is used to define the process of successful prescribing and medicines taking, based on a partnership whereby:

- the patient and health care professional act as partners in making decisions and agreeing on the treatment
- agreements take into account the experiences, wishes and beliefs of the patient as to when, how and why the medicines are used
- health care professionals treat each other as partners and work together to improve patient participation

Concordance is fundamentally different from "compliance" or "adherence" (which have paternalistic connotations and assume obedience on the part of the patient) in that it focuses on the consultation process rather than on a specific patient behaviour. Therefore, although it is possible to have a non-compliant or non-adherent patient, it is not possible to have a non-concordant patient (Weiss and Britten, 2003).

Although GPs are likely to learn about concordance as part of their training, there is evidence that this does not always translate into practice (Stevenson et al. 2000; Jones, 2003). Despite numerous interventions to promote a patient-centred approach in clinical consultations (Lewin et al. 2004), many GPs still focus on diseases and disease management rather than on patients, their lives and their health needs. For concordance to take place, communication between the doctor and patient is essential.

2.2.2.2 Communication between doctors and patients

A systematic review of communication between patients and healthcare professionals about medicine taking and prescribing has been conducted by Cox et al. (2004). Based on 124 studies, published between 1991 and 2000, this showed that patients consider talking to doctors about medicines to be very important and consider it is essential to discuss possible side-effects of their medicines with them. However, according to one of the studies identified by the review, (Britten et al. 2000), a number of misunderstandings can arise out of these discussions. In this qualitative study 14 different categories of misunderstandings were identified which occurred in GP consultations with patients. Many of the misunderstandings were "based on inaccurate assumptions and guesses by both parties" and related to patient/doctor unawareness of information known to the other party, conflicting information, disagreement about side-effects, failure of communication about doctors' decisions and relationship factors. All the misunderstandings were associated with the lack of patients' participation in the consultation and all were associated with potential or actual adverse outcomes such as non-adherence to treatment.

These findings were later confirmed by the results of a second study aimed at developing quantitative measures for use in monitoring communication and prescribing (Jenkins et al. 2003) which showed that problems in communication were more likely to lead to poor outcomes in terms of non-adherence. Also, a Canadian review of 21 studies published between 1983 and 1993 of effective physician-patient communication, showed that increased communication with patients was associated with improved patient outcomes (Stewart, 1995).

Communication problems are often linked to unvoiced agendas in the GP consultation (Barry, 2000) or to different beliefs about medicines (Horne and Weinman, 1999) and studies have shown that many GPs are largely unaware of their patients' views concerning medicines (Stevenson et al. 2000). Although it is a common perception amongst GPs that patients go to the doctor to receive a

prescription (Stevenson et al. 1999), many would prefer not to receive one (Jenkins et al. 2003). Indeed, one study has shown that up to five per cent of prescriptions issued by doctors are not redeemed by their patients (Beardon et al 1993) and many more that are dispensed are not consumed (Britten et al. 2000).

GPs perceptions of the reactions of patients to changes made in their medications have also been shown to be inaccurate. A study by Wood et al. (1997) to assess GPs' and patients' perspectives on three types of prescribing changes to repeat medication in one fundholding general practice, found that GPs had expected higher levels of resistance and complaints from patients than had been the case. In contrast, there were high levels of patient acceptance of changes to medication provided the proposed change was appropriately communicated.

Thus it would appear that doctor-patient communication should be encouraged to prevent the unnecessary use of resources and inappropriate prescribing.

2.2.3 Quality of prescribing

Inappropriate prescribing has financial implications in terms of drug wastage through non-compliance (McGavock, Britten and Weinman, 1996). However, it also has implications in terms of the quality of prescribing although it is often not clear what "quality" of prescribing means, how it can be achieved or how it can be measured.

In a study by Dowell, Snadden and Dunbar (1995) which examined changes in prescribing patterns and patient satisfaction in one urban, Scottish fundholding practice, it was uncertain whether the quality of prescribing had improved or deteriorated due to the "absence of any accepted standards for appropriate prescribing by general practitioners." Various instruments have been developed for measuring the appropriateness of prescribing at the individual patient level and these are discussed below.

2.2.3.1 Medication Appropriateness Index (MAI)

The Medication Appropriateness Index (MAI) developed by the American pharmacist, Joseph Hanlon and colleagues (Hanlon et al. 1992) is one such example. In summary, the MAI may be used to measure the appropriateness of any medication in any patient according to ten criteria: indication, effectiveness, dosage, directions, drug-drug interactions, drug-disease interactions, expense, practicality, duplication and duration (Buetow et al. 1997). The criteria each have an operational definition, and are worded as questions which can be scored on a three-point Likert scale. The drug is then deemed appropriate; marginally appropriate; or inappropriate (or don't know). By combining the scores, a weighted MAI score can serve as a summary measure of the drug's overall appropriateness (Schmader et al. 1994).

2.2.3.2 Prescribing Appropriateness Index (PAI)

The National Primary Care Research and Development Centre, University of Manchester has investigated different aspects of prescribing appropriateness and quality indicators (Buetow et al. 1996; Buetow et al. 1997; Cantrill, Sibbald and Buetow, 1998; Campbell, Cantrill and Roberts, 2000). In a systematic literature review of 62 UK studies published between 1980 and 1995, the researchers found that although inappropriate prescribing had occurred, the extent of the problem was difficult to quantify given the variety of indicators used for the assessments of quality and the uncertainty surrounding the context of the prescribing decisions (Buetow et al. 1996). Based on the MAI, the researchers produced the Prescribing Appropriateness Index (PAI) (Buetow et al. 1997) which uses nine indicators to judge the appropriateness of long-term prescribing on the basis of what is recorded in the patients' notes and is not specific to any given condition or particular drug. However it does not take account of patient perspectives. This aspect is essential for appropriate prescribing since good prescribing involves interaction between GPs and patients (Barber, 1995; Royal Pharmaceutical Society et al. 1997; Stevenson et al. 2000; Cox et al. 2004). An

instrument that includes patients' views is currently being developed (the Pharmacolgical Appropriateness Rating of Medications, PARM), but this has not yet been validated for wider use (Britten et al 2003).

The major limitations of both the MAI and the PAI are that they are time consuming to use and that they require access to patients' medical records, which has implications in terms of research governance. For these reasons, Prescribing Analysis and CosT (PACT) data are often used as a proxy measure of prescribing quality (Naish, Sturdy and Toon, 1995).

2.2.3.3 Prescribing Analysis and CosT (PACT) data

In the UK, the monitoring of prescribing in primary care is carried out through the Prescription Pricing Authority (PPA), which compiles national statistical data relating to the volume and types of drugs prescribed in primary care. Population-based measures of prescribing appropriateness or quality (e.g. use of generic drugs; levels of antibiotic prescribing) are derived from PACT data, which contain an analysis of GP prescribing but which do not include diagnostic or other individualised information. This type of quality assessment places its focus more on the costs of prescribing and looks for reductions in costs in areas where savings can be made without detriment to patients. For example, by reducing wasteful and expensive prescribing practice in the areas highlighted by the Audit Commission (1994):

- combination products
- modified/sustained release products
- drugs of limited therapeutic value
- drugs that could be bought over the counter (OTC)
- new and expensive drugs
- topical NSAIDs
- expensive hospital-initiated drugs

Although PACT data are used as a proxy measure of quality of prescribing, few validated quality indicators exist (Campbell et al. 1998) and according to Avery et al. (1998) "further research is needed into the development and use of indicators based on PACT." The major drawback of using PACT data for assessing the quality of prescribing is the inability to link a prescription to a diagnosis, particularly relevant when a drug is indicated for more than one condition (Cantrill, Sibbald and Buetow, 1998).

2.3 VARIATIONS IN PRESCRIBING COSTS

According to the Audit Commission, up to 80% of patients consulting GPs have similar conditions which could potentially be treated in standard ways (Audit Commission, 1994). Nevertheless, in their study, the Audit Commission found a great deal of variation in prescribing costs between the different health authorities and between individual practices within each authority. A number of studies have looked at whether certain practice socio-demographic characteristics are associated with success at controlling prescribing costs. In one study (Morton-Jones and Pringle, 1993) the researchers found that 81% of the variation in prescribing costs at family health services authority level (the precursor to health authorities) could be attributed to 24 demographic, morbidity and practice factors, suggesting that "variations in prescribing costs essentially reflect demand." In a more recent study, socio-demographic characteristics were again shown to have an influence on overall prescribing costs (Rice et al. 2000), and these factors are taken into consideration in budget allocation. With the exception of GP training status, which was shown to be influential in one study (Wilson et al. 1996), other practice characteristics have not consistently been associated with the control of prescribing costs (Baines et al. 1998).

Although these factors may have accounted for the majority of the variation in prescribing costs seen at practice or health authority level, studies have shown that a number of other factors give rise to variations in prescribing costs at the level of the individual practitioner.

2.4 FACTORS WHICH INFLUENCE GP PRESCRIBING

A wide range of factors, including GP views on prescribing costs, have been shown to influence GP prescribing decisions (Bradley, 1991; Avery et al. 2000a; Carthy et al. 2000; Jones, Greenfield and Bradley, 2001a). According to Bradley (1992a), a number of patient specific factors (such as age, gender, social class and education) and GP specific factors (such as peer influences, concerns about drugs and self expectations) influence the decision whether or not to prescribe. In one study which set out to assess whether GPs working in practices with high or low prescribing costs have different views on prescribing cost issues, the researchers found that the only differences between the two groups of GPs were in relation to "substitution with comparable but cheaper drugs" (Avery et al. 2000a). GPs in higher cost practices were more likely to favour drugs such as modified release NSAIDs "because they are convenient for patients" (Avery et al. 2000a). In a recent study by Watkins et al. (2003), certain attitudes and behaviour were found to be more prevalent in practices with higher prescribing costs e.g. GPs in high cost practices were more likely to see pharmaceutical company representatives.

2.4.1 The pharmaceutical industry

The pharmaceutical industry has been shown to influence prescribing decisions, especially in the uptake of new drugs (Peay and Peay, 1988; McGavock et al. 1993; Jones, Greenfield and Bradley, 2001b; Prosser and Walley, 2003;); so too have hospital consultants (Feely et al.1999). According to Prosser, Almond and Walley (2003) the decision to initiate a new drug is influenced by "who says what" and found that the pharmaceutical industry, in particular the company representative, exerted most influence. It would seem that GPs see the drug company representative as an important source of information about new drugs (Jones, Greenfield and Bradley, 2001b).

2.4.2 Patients' expectations

In the Audit Report (1994) "patients' inappropriate expectations" were cited as one cause of over prescribing in general practice (Audit Commission, 1994). It has been shown that GPs' perceptions of patients' expectations (even when they are not accurate) are indeed a major influence on prescribing decisions (Britten, and Ukoumunne, 1997; Cockburn and Pit, 1997; Butler et al. 1998). The GP's concern to maintain their relationship with the patient has been identified as having a strong influence on prescribing behavoiur (Bradley, 1992b; Cockburn and Pitt (1997) and it has been shown that GPs sometimes write inappropriate prescriptions to preserve this relationship (Macfarlane et al. 1997; Butler et al. 1998). The results of a nested observational study within a recent randomised control trial of the effect of leaflets to empower patients in GP consultations (Little et al. 2004a), found that "a significant minority of examining, prescribing, and referral, and almost half of investigations, are still thought by the doctor to be slightly needed or not needed at all, and perceived patient pressure is a strong independent predictor of all doctor behaviours."

2.4.3 Collaboration with pharmacists

As early as the mid 1980's the potential for collaboration between GPs and pharmacists was being recognised. The Nuffield Report (Nuffield Foundation, 1986) stated "closer relations between GPs and community pharmacists would be in the interests of patients and.....more efficient use of resources within the NHS." By the early 1990's, the need for greater collaboration between pharmacists and GPs to rationalise prescribing was increasingly highlighted (Royal Pharmaceutical Society, 1992; National Audit Office, 1993; Audit Commission, 1994; Schneider and Barber, 1996; Bradley, Taylor and Blenkinsopp, 1997) and before long there was growing interest in the expansion of the role of the community pharmacist (Morton-Jones and Pringle, 1994; Britten et al.1995a; Hanlon, 1996; Lunn et al. 1997; Begley et al. 1997).

2.4.3.1 The traditional role of the pharmacist

The traditional role of the pharmacist is that of providing pharmaceutical care in the dispensing of drugs and (in the case of community pharmacists) over-the-counter preparations used to self-treat minor ailments. The term "pharmaceutical care" has been defined by Hepler and Strand (1990) as the identification of potential and actual drug-related problems, the resolution of actual drug-related problems and the prevention of potential drug-related problems. The pharmaceutical care that pharmacists give to patients is usually in the form of product-related information (i.e. relating directly to the drug therapy) although non-product-related information (e.g. information pertaining to health promotion activities) is also given. Although pharmacists have extensive knowledge of medicines, it has only been in the hospital setting that pharmacists have had the opportunity to fully utilise their skills, having a highly significant role in medicines management (Tweedie, 2001). However, by the 1990's the under-utilisation of pharmacist's skills was being recognised and the view of the pharmacist as the provider of expert advice was one of the central themes of the "Pharmacy in a New Age" discussion document (Royal Pharmaceutical Society, 1995). The combination of their pharmacological knowledge as well as their knowledge of drug costs, something which many GPs lacked (Ryan et al. 1990; Ryan et al. 1992), meant that pharmacists were well placed to help rationalise prescribing in primary care.

2.4.3.2 The changing role of the pharmacist

In 1994, the Department of Health announced additional funding for projects to investigate the feasibility of more formal working arrangements between GPs and pharmacists (Department of Health, 1994) and a number of studies were funded to assess the training needs of pharmacists to support and influence prescribers in primary care. One such study was that done by Web and Barton (1997) whereby six pharmacists were employed to work on a one day per week basis as prescribing advisers to practices in the Birmingham FHSA. Initial competencies

of the pharmacists were assessed and a training programme devised to resolve any deficiencies. It was found that the pharmacists initially lacked the confidence required to influence prescribers. However, subsequent to the training programme (which included four days training on communication, negotiating and influencing skills) the confidence of the pharmacists improved significantly. However, no formal evaluation of the impact of the pharmacist advice was done.

In total, by the mid 1990's, 17 projects were being funded by the NHS Executive, all of which were looking at different ways in which community pharmacists could influence prescribing in areas such as formulary development and repeat medication reviews. One of these project, known as known as IMPACT (independent monitoring of prescribing costs and trends) involved the recruitment of ten pharmacists, to deliver targeted prescribing messages to GPs on a one-to-one basis (Anon, 1998; Chapman, 1996). However, the results of many of these projects were never published.

New ways of working were also being investigated, with pharmacists being employed in general practices or working on a sessional basis in practice-based outpatient clinics and these are discussed further in section 2.5.4.

2.4.3.3 Barriers to collaboration between pharmacists and GPs

Expanding the role of pharmacists inevitably impacts on the role of the GP and quantitative surveys addressing GP attitudes towards pharmacists have shown mixed reactions. A study conducted by Spencer and Edwards (1990) showed that approximately one third of 744 GPs surveyed thought pharmacists should "stick to dispensing" and felt that pharmacists were too influenced by commercial pressures to provide unbiased advice. In contrast, a survey of 266 Scottish GPs by Bond et al. (1995) found a more positive attitude towards increasing the role of pharmacists, particularly in areas such as advice on medicines storage within surgery premises and simplification of drug regimes for the elderly. However, there was less support for the pharmacist acting independently and having a direct effect on patient care, such as selection of medicines and dosage according

to agreed protocols. A post-survey workshop showed this lack of support for the proposed "new" roles to be attributed to factors such as the professional boundary infringement, lack of appreciation on the part of the GPs of pharmacists' knowledge and training, and concerns about the pharmacists' commercial interests.

Lack of understanding of the pharmacists' extended roles was also shown to lie behind the perceived attitude of some GPs in a study by Reebye et al. (1999). This study, which explored community pharmacists' perceptions of their professional relationships with GPs in Canada and the Netherlands, found that the major barriers to closer working included the lack of face-to-face contact, the work environment and issues of territoriality (Reebye et al. 2002). To improve collaboration between the two groups of professionals the authors suggest that levels of professional interaction should be increased through structured meetings or joint initiatives with an emphasis on patient care. In addition, pharmacists should be more explicit about their extended role so that a mutual understanding of roles can be achieved thus minimising the issue of territoriality. Other studies have cited the inability of pharmacists to contact GPs as a perceived barrier to closer working (Raisch, 1993). Perhaps the structured meetings suggested by Reebye et al. (2002) could help overcome this obstacle.

2.5 INTERVENTIONS TO INFLUENCE PRESCRIBING BEHAVIOUR

A range of interventions have been developed in an attempt to control the rise in GP prescribing costs which have been shown to result in varying degrees of success and some of these are discussed below.

2.5.1 Incentive schemes

In the early 1990's a number of incentive schemes were in place at both national and local level which aimed to influence GP prescribing behaviour with the end result of controlling the rise in prescribing costs in primary care. One of the major initiatives was the fundholding scheme.

2.5.1.1 Fundholding scheme

The fundholding scheme allocated general practices annual cash-limited budgets, to cover three aspects of patient care: a range of non-emergency hospital services, the salaries of non-medical staff and prescribed medicines and appliances (Keeley, 1997). Savings made on these budgets could be moved between the different components or used at the practice's discretion to enhance services to patients. The objective of introducing the initiative was to give practices a direct incentive to contain the rise in prescribing costs and fundholders who persistently failed to manage their budgets effectively risked the removal of their fundholding status. A number of studies showed that relative savings were made by fundholders in their first year in the scheme (Whynes, Heron and Avery, 1997; Harris and Scrivener, 1996; Wilson et al. 1997; Rafferty, Wilson-Davis and McGavock, 1997). These relative savings were made by increasing generic prescribing (Wilson, Buchan and Walley, 1995; Dowell, Snadden and Dunbar, 1995), and decreasing the average cost per item, rather than by prescribing fewer items (Harris and Scrivener, 1996). However, the cost-reducing effect did not appear to extend beyond the first year in the scheme (Stewart-Brown et al. 1995; Whynes, Heron and Avery, 1997) except by dispensing practices. It was thought that this was due to the fact that dispensing GPs were better informed about prescribing costs and so responded more effectively to the initiative (Stewart-Brown et al. 1995).

2.5.1.2 Indicative prescribing schemes

Those practices that either chose not to enter into fundholding (or were restricted from doing so due to their list size), were allocated indicative prescribing amounts with incentives, based on previous spending and adjusted for variables such as price rises, changes in list size etc. The objective was to encourage GPs to critically examine their prescribing and to look to ways to make it more rational. The relative savings that were seen in fundholding practices were to some extent also seen in non-fundholding practices in their response to these

incentives (Bateman et al. 1996). However, the lack of studies to investigate the costs and benefits of such schemes makes it difficult to evaluate the factors which are crucial for cost control. With the formation of primary care groups (PCGs) in 1999, a new incentive scheme was devised which was more closely linked to the quality of prescribing. This new incentive scheme was evaluated by Ashworth et al. (2002) in 2000 by means of a questionnaire survey of prescribing advisers in 145 primary care groups in London and South East England. The researchers found that the size of incentive payments was not associated with cost control or quality of prescribing and questioned the use of such schemes to control prescribing costs.

2.5.2 Prescribing Advisers, guidelines and formulary development

Introduction of the indicative prescribing scheme in the early 1990's included the provision of medical advisers employed by health authorities to provide impartial advice on prescribing (Bligh and Walley, 1992) by means of practice visits, facilitation of educational meetings, production of local bulletins or a combination of approaches. Although seen by the Audit Commission as essential for rational prescribing (Audit Commission, 1994), few studies have assessed their impact on prescribing costs (Newton-Syms et al. 1992).

The objective behind the development of practice formularies was to encourage rational prescribing by selecting cost effective and acceptable drugs for patients presenting with the most common conditions seen in general practice. Although of educational value to those involved in their development (Essex, 1989), it has been found that they have been associated with relatively small changes in prescribing costs (Hill-Smith, 1996; Avery et al. 1997). The evidence would suggest that the same can be said for guidelines (Watson et al. 2001; Wathen and Dean, 2004).

2.5.3 Educational interventions

With the drugs bill forming such a large proportion of health care expenditure a wide range of educational interventions have been introduced with the aim of reducing prescribing costs.

In 1995 Davis and colleagues published a systematic literature review of studies published between 1975 and 1994 that looked at the effectiveness of education strategies designed to change physician performance and health care outcomes (Davis et al. 1995). They identified 99 trials containing 160 intervention strategies which included:

- dissemination of educational materials
- formal continuing medical education activities
- outreach visits (such as academic detailing)
- audit and feedback (including the use of PACT data)
- development of guidelines, formularies or standards
- a combination of the above

They concluded that commonly used methods of delivering education such as conferences or prescribing feedback without any discussion with the prescriber have little impact on improving professional practice. These findings were later confirmed in 1999 by a large randomised controlled trial from Australia involving 2 440 GPs in which the investigators found that sending the GPs prescribing feedback along with some therapeutic recommendations did not alter their subsequent prescribing rates (O'Connell, Henry and Tomlins, 1999).

It was anticipated that the introduction of Prescribing Analysis and CosT (PACT) data in the UK in 1988 would enable GPs to look critically at their prescribing and help them to prescribe more rationally. The data give an analysis of what GPs have prescribed (and how much their prescribing has cost) in the preceding three month period and are produced by the Prescription Pricing Authority (PPA) following the reimbursement of community pharmacists and dispensing GPs for

dispensing FP10 prescriptions. The data give information on both individual GPs and the practices' prescribing costs and at the time of the study, compared these costs with those of other GPs in the same health authority as well as nationally (Cantrill, Sibald and Buetow, 1998). However, as has been found with other "passive" interventions, it met with limited success. Nevertheless, there is some evidence that GPs find PACT data useful, even if rarely used to examine prescribing in any great depth (Jones et al. 2002).

The results of the review by Davis at al. (1995) showed that other interventions such as the dissemination of printed material were also ineffective. A later review of 79 mainly American studies of 96 separate interventions to change the prescribing behaviour of GPs drew the same conclusions (Gill et al. 1999). More successful strategies included systematic practice-based interventions and outreach visits including academic detailing (Avorn and Soumerai, 1983). According to Thomson O'Brien et al. (2004) an "outreach visit" is used to describe the use of a trained professional to visit a health provider in their practice setting with the aim of influencing the provider's performance. In their systematic review of 18 studies involving more than 1 896 GPs, Thomson O'Brien et al. (2004) found that the effects of outreach visits (comprising of meetings and written material) were "small to moderate" but that the evidence did suggest that, when combined with other interventions (such as reminders or audit and feedback), they were successful in reducing inappropriate prescribing behaviour. However, according to the authors, the cost-effectiveness of the visits was not adequately evaluated and further research is needed to identify the key factors for success.

In contrast to the findings of Davis et al. (1995), a recent systematic review 85 studies to assess the effects of audit and feedback on the practice of health care professionals found that this type of intervention can be effective in improving professional practice (Jamtvedt et al. 2004). However, the effects tend to be small but as the authors point out "may be worthwhile, if the costs of the intervention are small relative to the benefits gained."

2.5.4 Pharmacist-led interventions

By the mid 1990's, the role of the community pharmacist was being expanded to include working with other health care professionals and the public providing pharmaceutical care in the form of "prescribing support." Prescribing support has been defined by the National Prescribing Centre and the NHS Executive (1998) as:

> "...the use of additional professional input into one or more elements involved in the prescribing process. It has the overall objectives of promoting high quality, cost-effective medicine use and of improving the pharmaceutical care of patients. This should allow NHS resources to be used more effectively and practices to operate with greater efficiency allowing GPs more time to spend with individual patients and also to improve the health of their practices populations."

This expanded role encompassed any role undertaken by the pharmacist beyond drug formulation and dispensing. From as early as the late 1970's to the mid 1990's a number of models for the provision of prescribing support involving pharmacists with the aim of rationalising GP prescribing were devised and evaluated. These included the integration of a pharmacist into the general practice setting, outreach visits by pharmacists and pharmacist-led medication reviews. Details of studies thought pertinent to this thesis have been outlined below.

2.5.4.1 Integration into general practice

One model put forward for the provision of prescribing support was that of the pharmacist being integrated into the general practice to either review a number of areas relating to prescribing or to focus on one specific area. Examples from the literature are shown below:

A study by Macgregor et al. (1996) conducted in a single UK general practice aimed to evaluate a pharmacist managed primary care anticoagulant clinic. Results showed that pharmacists have the necessary skills to run such clinics, achieving good therapeutic control in the surgery and improved patient knowledge. In addition the authors suggest that the liaison between the GPs and the pharmacist reduced the risk of toxicity and treatment failure and overall, the GPs believed the quality of care improved.

Burton, Duffus and Williams (1995) examined the impact of a clinical pharmacist attached to an urban, non-dispensing general practice on a part-time basis (three days per week) for four months. The pharmacist examined all the areas within the practice where medicine and prescribing were involved. It was found that the presence of the pharmacist was non-threatening to the practice and that positive benefits were obtained by GPs, staff, patients and the pharmacist. However, changes in prescribing costs were not examined.

Jameson, VanNoord and Vanderwoud (1995) also demonstrated the benefits of integrating a clinical pharmacist into the primary care setting. In this study, 27 patients at risk for medication-related problems were randomised to receive a one hour pharmacist-patient consultation to improve, simplify and explain complicated drug regimens. Twenty nine patients were randomised to a control group and received usual care. The results of the intervention showed reductions in costs, and simplification of drug treatment with no reduction in quality of care. However, no statistical inference could be made due to the small size of the study.

2.5.4.2 Outreach visits

As shown by the review by Thomson O'Brien et al. (2004), systematic practice-based interventions and outreach visits including "academic detailing" are more effective methods for improving professional practice than other methods such as audit and feedback and educational materials. For this reason a number of models

have investigated the effect on prescribing patterns of outreach visits to general practice by a pharmacist.

The work of Avorn and Sourmerai (1982) in the USA showed the value of face-to-face meetings between clinical pharmacists and GPs in changing prescribing habits and improving the quality of prescribing for three drug groups. The results of this randomised controlled trial showed that physicians who were offered personal educational visits by pharmacists reduced their prescribing of the target drugs by 14% as compared with controls resulting in substantial cost savings.

In a randomised controlled trial, Lipton et al. (1992) found that pharmacists' consultations with geriatric outpatients and their physicians resulted in improved drug prescribing decisions. Changes in dosage, choice of medication and appropriateness of drug treatment showed that the pharmacist consultations had a positive impact on the quality of prescribing.

Quality of prescribing was also shown to improve in a study by Corbett (1995) in which five pharmacists were employed on a sessional basis in five general practices in Northamptonshire, UK, to provide advice on 360 prescriptions for non-steroidal anti-inflammatory drugs. As well as being beneficial to the patients, the pharmacist intervention resulted in more cost-effective prescribing (through the increased use of generic substitutions and use of cheaper therapeutic equivalents), was well received by the GPs, and enhanced the professional role of the pharmacists.

2.5.4.3 Medication review

Repeat prescribing was one area which was highlighted by the Audit Commission (1994) as being particularly problematic in terms of costs, with the majority of prescriptions being issued with no face-to-face contact between the patient and the GP (Zermansky, 1996).

In the USA, medication review by pharmacists, which has become known as "brown bag" review, was developed in 1982 (Larrat, Taubman and Willey, 1990) and has become an established part of community health care in the USA. The method involves patients bringing all their medications from home for review by a pharmacist, either to the pharmacy or some other convenient setting. In the original study, a brown supermarket bag was provided by the pharmacists, hence the name for this type of review. Although well established in the USA, by the mid 1990's only small scale projects were being reported in both the UK (Anon, 1995; Edmondson, 1995) and Denmark (Anon, 1993).

Hanlon et al. (1996) studied a pharmacist intervention involving the review of 208 patients aged 65 years or older with polypharmacy (greater than or equal to 5 medications) from a general medicine clinic. A clinical pharmacist met with the patients during their scheduled visits to evaluate their drug regimens and made recommendations to them and their physicians. The results showed that physicians implemented just over half of the recommended medication changes resulting in a highly significant reduction in inappropriate prescribing scores (and potentially adverse drug effects) compared with controls.

Another American study (Cowper et al. 1998), examined the cost-effectiveness of a pharmacist-led prescribing practice protocol for elderly patients in primary care. Two-hundred and eight patients aged 65 years or older on at least 5 medications were randomised, 105 patients to the intervention group and 103 to a control group. The comparator was usual prescribing practice. Follow up was for the period of one year and the authors concluded that although MAI scores improved significantly in the intervention group, there were only minor differences in costs. However, improved MAI scores are associated with a lower need for care and hospitalisation. The major limitation of this study was that it was conducted in a single practice setting, thus limiting it's generalisability.

A Scottish study involving 10 GP practices, evaluated the review of patients' repeat medication by a pharmacist facilitator (Sykes, Westwood and Gilleghan, 1996). The pharmacist recommended treatment changes after discussion with the

GPs at a review meeting and it was found that, of the 28% (370) of all items reviewed, 20% (255) were changed according to the pharmacist's recommendation. A post-intervention questionnaire survey showed that the majority of the GPs who responded, would like to see the programme provided on a regular basis.

2.6 PATIENT VIEWS

Although many of these studies assessed the quality of prescribing in terms of the appropriateness of the drug(s) in question, little attention had been paid to patients' views on having their medication changed, especially where the changes were being made to control prescribing costs.

As early as the late 1970's both the Department of Health (1977) and the World Health Organisation (1978) stressed the importance of involving patients in the evaluation of health services. It was recognised that patients' acceptance of advice may be influenced by their satisfaction with health services (Kincey, Bradshaw and Ley, 1975) and that by assessing patients' views it may be possible to ascertain information that could lead to improvements. The 1990 contract for general practitioners (Department of Health, 1989) stipulated that Family Health Services Authorities were required to undertake patient opinion surveys and this was further encouraged by the Patients' Charter for Primary Care (1992) whereby patients were seen as "users" or "consumers" of healthcare. The importance of patients' involvement in health care is now widely recognised by the medical profession (Richards, 1999; Royal Pharmaceutical society, 1997) and the need to measure patient outcomes as a result of interventions is increasingly required (Bero et al. 1999). One form of outcome that can be used to measure the impact of changes in prescribing patterns is patient satisfaction.

2.6.1 Patient satisfaction

Although it would seem that measuring satisfaction is a relatively simple process, the difficulty lies in the definition of satisfaction and what it means to different

people. Satisfaction is related to a number of factors such as past experiences, expectations, lifestyle and values (Locker and Dunt, 1978) and can take on a variety of meanings depending on the situation and the individual involved. For example what a GP constitutes as good quality medicine (such as refusing to prescribe an antibiotic for a sore throat) may not seem so to the patient (who was hoping for a prescription) with the end result of low patient satisfaction with the consultation. Therefore the way in which satisfaction is measured, where it is measured and when it is measured all need to be taken into consideration in the interpretation of the results (Keeble and Keeble, 1989).

A wide range of surveys of patient satisfaction have taken place over the years (Hall and Dornan, 1988a; Hall and Dornan, 1988b; Baker and Streatfield, 1995; Poulton, 1996; Largey and O'Neill, 1996) and some of these have focused on prescribing in general practice (Lervy and Clayton, 1986; Dowell, Snadden and Dunbar, 1995).

In 1995 John Dowell and colleagues studied changes in prescribing patterns and patient satisfaction in one urban, Scottish fundholding practice upon its entry into the third wave of the scheme (Dowell, Snadden and Dunbar, 1995). During its first two months in the scheme, the practice transferred 1187 patients to a newly developed formulary and employed a communication strategy to inform patients about changes to their drug regimes. In consequence, the practice's generic prescribing rate rose from 37% to 58%, average costs per treatment day were reduced by 9.4% and prescribing volumes fell by 10.4 %. To ascertain reactions to the changes made, a questionnaire was sent to a stratified random sample of 280 patients whose medication had been changed. Of the 167 patients who returned the questionnaires, 44% of patients were slightly "unhappy" or "very unhappy" with the changes made to their treatment. Interviews suggested that the main reason for unhappiness was with the communication they received rather than the change itself.

2.6.2 Factors that may be associated with patient satisfaction

Studies which have looked at patient sociodemographic characteristics to investigate whether they are associated with patient satisfaction (Hall and Dornan, 1990; Lewis, 1994) have found that satisfaction is associated with characteristics such as the age and gender of the respondent. Older patients and female patients tend to report higher levels of satisfaction (Largey and O'Neill, 1996). In addition, levels of educational attainment and social class have been shown to effect patient satisfaction with health care services (Largey and O'Neill, 1996).

Baker and Streatfield (1995) set out to examine the characteristics of general practices that influence patient satisfaction. Using a surgery satisfaction questionnaire, shown to have validity and reliability (Baker, 1990), 220 patients in 89 general practices were surveyed with a mean response rate of 82%. Results showed that patients preferred smaller practices, non-training practices and practices that had personal list systems. The association between levels of satisfaction and continuity of care has also been demonstrated in other studies (Hjortdahl and Laerum, 1992; Freeman and Richards, 1993; Freeman and Hjortdahl 1997).

Increased communication with patients has been shown to be associated with improved patient outcomes, including levels of satisfaction (Stewart, 1995). In a recent study, Little et al. (2004b) found that satisfaction, particularly in short consultations, was increased by encouraging patients to raise issues and to discuss symptoms and other health related issues in the consultation.

One of the reasons for assessing patient satisfaction is that it has been linked to adherence to medication. A study by Horne, Hankins and Jenkins (2001) showed that "levels of satisfaction with medicines information were associated with higher levels of reported adherence and lower levels of satisfaction were associated with stronger concerns about the potential adverse effects of medicines."

2.7 IMPLICATIONS FOR RESEARCH

It can be seen that by the mid 1990's the potential for collaboration between GPs and pharmacists to rationalise prescribing had been recognised. In a review of 14 studies published between 1977 and 1996 to examine the effect of expanding the role of outpatient pharmacists on health services utilisation, costs and patient outcomes, Bero et al. (1999) found that pharmacist services targeted at health professionals resulted in favourable outcomes (such as decreased prescribing and drug costs) compared to health professionals who did not receive the intervention. However, since many of the studies reviewed (including that by Jameson, VanNoord and Vanderwoud (1995)) were conducted at single sites outside the UK, it was questionable whether the findings were generalisable to the UK setting.

In their conclusion, the authors of the review (Bero et al. 1999) highlighted the fact that "studies that measure the costs as well as the effects of pharmacist interventions are needed." In addition the authors commented on the fact that "none of the studies assessing decreased prescribing by physicians evaluated the impact of the changes in prescribing patterns on patient outcomes." The studies presented in this thesis set out to investigate both these gaps in the literature.

2.8 DEVELOPMENTS SINCE THE TIME OF THE STUDY

Since completing this study, many changes have occurred, in both policy and practice. The abolition of regional health authorities and schemes such as fundholding coupled with the development of Primary Care Groups (PCGs) in 1999 and more recently Primary Care Trusts (PCTs) in 2002, (Department of Health, 2001) have changed the way health care is delivered enormously. In July 2000, the NHS Plan set out its vision of health services shaped around the needs and aspirations of patients (Department of Health, 2000a). The under utilisation of the skills and expertise of pharmacists has been recognised, opening up new opportunities for pharmacists designed around the needs of patients and

integrated with other services (Department of Health, 2000b). Initiatives such as one-stop primary care centres (Department of Health, 1999) and repeat dispensing (Bond et al. 2000; Iverson et al. 2001) have been instigated to improve convenience for patients and reduce waste. Pharmacists now have a key role to play within PCTs as pharmaceutical advisers (Braybrook and Walker, 1996; Mason, 1996) and have expanded into health care services such as medicines use review (Nathan et al. 1999; Petty, Zermansky and Raynor, 2001) (for example as required in the Older People National Service Framework), medicines management, supply of medicines under minor ailment schemes (Whittington et al. 2001) and patient group directions (such as emergency hormonal contraception and smoking cession). One key aspect of their role is routine analysis of PACT data which affords them an excellent overview of prescribing patterns within a PCT (Jones and Kendall, 2004). According to the Audit Commission Report (2003) the number of pharmacists providing prescribing support to GPs has increased from 150 in 1998 to an estimated figure in excess of 600 in April 2002.

In addition to the expansion of the range of medicines which pharmacies can supply without a prescription (Bond and Bradley, 1996; Blenkinsopp and Bradley, 1996; Thomas and Noyce, 1996), the legal framework has been put in place to allow pharmacists to act as supplementary prescribers, (Department of Health, 2003) whereby pharmacists are able, after an initial assessment and diagnosis of a patient's condition by an independent prescriber (GP), to prescribe for that patient in accordance with a clinical management plan. This form of prescribing is particularly suitable for pharmacists working with patients with chronic conditions, for example, asthma, diabetes, heart disease and mental illness. However, the expansion of the pharmacist's role in this way may be perceived as a threat to the status quo from the GPs' perspective (Reebye et al. 2002; Reebye et al. 1999; Lambert, 1996; Spencer and Edwards 1992). Role boundaries with nurse (and other) supplementary prescribers may not be easily negotiated, as they move into general practice and begin to prescribe for patients with long-term conditions. Primary care nurses view chronic disease management as one of their core activities. A study by Gilbert (1997) which

examined the perceptions of pharmacists, GPs and nurses on the role of the pharmacist as a member of the primary health care team in South Africa found that GPs and nurses strongly protect their own domains when it comes to the allocation of potential tasks. This has implications with regard to the effective implementation of this extended role for pharmacists.

It is intended that the role of the pharmacist will eventually be expanded to include independent prescribing (Department of Health, 2003). Pharmacist prescribing for mild self-limiting medical conditions has been permitted in Florida, in the USA for some years and a qualitative study revealed that the two major perceived barriers to pharmacist prescribing were time costs and liability exposure (Szeinbach et al. 1998). However, the greatest concern was over liability exposure. As pointed out by Boatwright (1998), pharmacists need to be aware of the legal and ethical issues surrounding the adoption of these new roles and concludes that "the pharmacy profession needs to prepare for expanded prescribing authority in order to avoid negative reactions from patients, physicians and possibly the legal community."

In the UK a further barrier to the adoption of new pharmaceutical care models is the lack of access to patients' medical records (Tully, Seston and Cantrill, 2000). It is interesting to note that in a pilot study in one urban general practice in Grampian, UK (Iverson et al. 2001), fewer than half of the respondents to a questionnaire survey to ascertain attitudes of the general public to the expanding role of community pharmacists were in favour of pharmacists accessing medical records. However, as the authors acknowledge, the low response rate (55%) and the location of the study practice limit the generalisability of the findings.

The evidence base for the benefits of pharmacist intervention in primary care is growing (Geoghegan et al. 1998; Bradley, Round and Ramsden, 2000; Malone et al. 2000; Nazareth et al. 2002; Freemantle et al. 2002; Fish, Watson and Bond, 2002; Beney, Bero and Bond, 2004). In one UK-based randomised controlled study (Zermansky et al. 2002), in which the pharmacist intervention involved a review of 608 patients receiving one or more drugs on repeat prescription, the

results showed a significant increase in the mean number of medication changes per patient compared to the usual-care group. In addition, the number of medications prescribed and the mean medication cost per patient was less in the intervention group than in the control group. However, the generalisability of these findings are limited by the fact that the study took place in just 4 general practices and the pharmacist involved in the study was an academic research pharmacist. A larger project involving more practices and pharmacists would be needed to substantiate these findings.

A recent systematic review of practiced-based pharmaceutical services showed that educational outreach resulted in the desired outcomes in seven out of the eight trials identified (Fish, Watson and Bond, 2002). One UK randomised controlled study evaluated educational outreach visits to general practices by trained pharmacists to influence GP prescribing in line with four evidence-based clinical guidelines (Freemantle et al. 2002). The results showed that, overall, the intervention was associated with a significant improvement in prescribing practice, although it would appear that the larger the practice, the harder it was to influence prescribing behaviour. Barriers to the implementation of the guidelines were identified as being "organisational difficulties, the GPs' scepticism of the evidence presented to them and the doctors' lack of interest in changing their prescribing behaviour" (Nazareth et al. 2002).

Another recent systematic review, based on information from 324 papers (Royal Pharmaceutical Society, 2003), found that collaboration with other health professionals and patients is a prominent issue in relation to the extension of pharmacists' roles within primary care service delivery (Tully, Seston and Cantril, 2000; Dowell et al. 1998). In circumstances where this type of collaboration has taken place, the review found evidence to suggest that the pharmacists have been well received and their contributions valued (Petty, Zermansky and Raynor, 2001; Spencer and Edwards, 1992; Williams, Bond and Menzies, 2000; Bond and Bradley, 1996). A number of barriers to the provision of extended services have been identified, such as time constraints, renumeration systems and issues relating to appropriate staff-mix (Petty, Zermansky and

Raynor, 2001; Szeinbach, Allen and Barnes, 1998). However, the most significant challenge will be the provision of appropriate training and professional development support (Tully, Seston and Cantrill, 2000; Smith, Salkind and Jolly, 1990; Fish et al. 2001). In a qualitative study by Rushton (2001), 81% of pharmacists surveyed considered that they required further training and development to undertake new and extended roles.

Pharmacists have an important role to play in the process of concordance and this has been highlighted in a number of studies identified in the review by Cox et al. (2004). The review identified two UK based pharmacist interventions comprising of new or modified pharmacy services (Blenkinsopp et al. 2000; Raynor et al. 2000) which resulted in improvements in a number of patients' health outcomes, including adherence, satisfaction with services and reductions in the number and cost of their medications. The first study (Blenkinsopp et al. 2000) assessed the impact of a patient-centred pharmaceutical intervention involving 25 community pharmacists targeted at 117 hypertensive patients. Patients in the intervention group reported significantly increased adherence and greater satisfaction. The second study (Raynor et al. 2000) involved community pharmacist visits to 143 patients aged over 65 years who lived alone and were regularly prescribed 4 or more drugs. Results showed a significant increase in adherence and the majority of patients felt that the intervention had made their medicines easier to manage. These are important findings and lend weight to the argument that pharmacist intervention can lead to improved patient outcomes.

Although there has been much emphasis on prescribing costs in this programme of work, it is important to recognise that the most important role for practice-based pharmacists is likely to be in promoting high quality patient-centred care (Ryan-Woolley et al. 2001; Tadros et al. 2003). It is recognised that there is scope for improving prescribing in primary care (Audit Commission, 2003) and there is great potential for the involvement of pharmacists in the reduction of inappropriate prescribing (Mackie et al. 1999; Zermansky et al. 2001) and medication-related problems in general practice (Yuan, Hay and McCombs, 2003).

Ten key roles for the future of pharmacy have been identified (Department of Health, 2003):

- to provide convenient access to prescription and other medicines
- to advise patients and other health professionals on the safe and effective use of medicines
- to be a point of first contact with healthcare services for people in the community
- to provide medicines management services, especially for people with enduring illness
- to promote patient safety by preventing, detecting and reporting adverse drug reactions and medication errors
- to contribute to seamless and safe medicines management throughout the patient journey
- to support patients as partners in medicine taking
- to prescribe medicines and to monitor clinical outcomes
- to be a public health resource and provide health promotion, health improvement and harm reduction services
- to promote value for money in the use of medicines and to reduce wastage

It could be argued that all of the above roles could be best filled by pharmacists working within a general practice setting.

CHAPTER 3

CHANGES IN PRESCRIBING COSTS OF INTERVENTION AND CONTROL PRACTICES

3.1 INTRODUCTION

At the time of this study, a number of reports had suggested benefits from practice-based pharmacists (Bradley, 1996; Burton, Duffus and Williams, 1995; Corbett, 1995; Jameson, VanNoord and Vanderwoud, 1995; Jenkins, 1996; Macgregor, 1996; Macgregor et al. 1996; Macgregor and Hamley, 1996; Mason, 1996; Moorhouse, 1996; Pilling, 1997; Stephenson, 1996) but it was recognised that there had been little in the way of detailed evaluation making it difficult to determine whether any changes in prescribing were primarily due to the pharmacist intervention rather than any other factors.

3.2 OBJECTIVE

The objective of this aspect of the study was to determine whether intervention practices made savings on their prescribing costs, relative to controls and if so, whether these savings covered the costs of the intervention. To do this, PACTline data were used to assess the differences in prescribing costs between the intervention and control practices for the year of the intervention (September 1996 to August 1997) and the 12 months prior to the intervention (September 1995 to August 1996).

3.3 METHODS

3.3.1 Study Design

An observational study was conducted using PACT data to determine whether intervention practices made savings in their prescribing costs relative to matched controls. Analysis of PACT data has been widely used by researchers to investigate variations and differences in prescribing costs (Morton-Jones and Pringle, 1993; Wilson et al. 1996; Harris and Scrivener, 1996). While a randomised controlled trial (RCT) might have given a more reliable answer to the question of whether pharmacists working in general practices can help to control

prescribing costs, this was not possible using the approach taken by Doncaster Health Authority.

3.3.2 Selection of practices

3.3.2.1 Intervention practices

All 50 practices in the Doncaster Health Authority were offered the services of dedicated pharmacists. Eight practices volunteered to join the scheme and received intensive input from five WTE pharmacists for a twelve-month period (September 1996 to August 1997).

3.3.2.2 Controls

Before the intervention took place, the practices were individually matched with controls on the basis of several characteristics that might have an influence on changes in prescribing costs. These were fundholding, dispensing status, list size, limiting long-term illness (Majeed et al. 1995) and NIC (net ingredient cost) per ASTRO-PU (age, sex, temporary resident-originated prescribing unit) for the quarter January to March 1996 (Roberts and Harris, 1993). The matching was done by David Meechan from Doncaster Health Authority. Further details are given in section 3.4.1.

3.3.3 Use of PACTline Data

3.3.3.1 Data collection and manipulation

Changes for overall prescribing costs and prescribing costs within chapters and subchapters of the British National Formulary (BNF) (Joint Formulary Committee, 1996) were assessed using PACT standard reports (PACTline) for each of the intervention and control practices (Majeed, Evans and Head, 1997). These data contain details of general practitioner (GP) prescribing that has taken place during the previous quarter and, at the time of data collection, was

transferred electronically to health authorities from the Prescription Pricing Authority (PPA). The PPA, which is a Special Health Authority within the NHS, is responsible for processing all NHS prescriptions that are dispensed by any community pharmacy or dispensing doctor in England. The data contained information at practice level for each month on:

- prescribing costs (net ingredient cost (NIC) which is the basic price of a drug as listed in the Drug Tariff)
- numbers of items prescribed (an item is equivalent to a single product order on a prescription form and does not take quantity prescribed into consideration)
- generic prescribing (that is prescribing of drugs using non-proprietary names)
- practice populations (including numbers over 65 years and temporary residents) from which prescribing units (PU) could be calculated. (Prescribing units give a weighting of three to patients over the age of sixty five, recognising the increased need for medication in elderly patients).

Data were available for overall prescribing and prescribing within chapters and subchapters (sections) of the BNF (Joint Formulary Committee, 1996). The BNF, which is published twice a year by the British Medical Association (BMA) and the Royal Pharmaceutical Society of Great Britain (RPSGB), consists of classified notes on clinical conditions, drugs and preparations and is divided into 15 chapters, each of which is related to a particular system of the body or to an aspect of medical care. Each chapter is then divided into sections which are structured as a form of hierarchy e.g. chapter 2 covers the drugs affecting the cardiovascular system, section 2.2 diuretics and section 2.2.2 loop diuretics.

Monthly PACTline data for the period September 1995 to August 1997 were obtained for the 16 practices under investigation. For the purposes of the evaluation, the monthly data were combined for the 12 months of the study (September 1996 to August 1997) and the 12 months prior to the study (September 1995 to August 1996) to give yearly data for both the intervention practices and their respective controls.

3.3.3.2 Use of ASTRO-PUs

Although the PU was to be used initially in the study, it was decided that the age, sex and temporary resident originated prescribing unit (ASTRO-PU) would be a more appropriate denominator for measuring changes in overall prescribing costs (Roberts and Harris, 1993). This is because it takes more account of the cost implications of differences in the age-sex distribution of practice populations by weighting patients according to age and sex and also numbers of temporary residents. Therefore, ASTRO-PU figures (which were available on a quarterly basis from Doncaster Health) were assigned to the relevant monthly PACTline data for each practice. This made it possible to calculate NIC/ASTRO-PU and items per ASTRO-PU for each practice for each of the two years. Also, by combining the ASTRO-PU figures, it was possible to calculate NIC/ASTRO-PU and items/ASTRO-PU for the two groups of practices.

3.3.3.3 British National Formulary chapters examined

Most drug costs come from chapters 1 to 6 and 10 of the British National Formulary (BNF) and so it was decided that the analysis would focus on these BNF chapters:

- Chapter 1: gastro-intestinal system
- Chapter 2: cardiovascular system
- Chapter 3: respiratory system
- Chapter 4: central nervous system
- Chapter 5: infections
- Chapter 6: endocrine system
- Chapter 10: musculoskeletal and joint diseases

3.3.3.4 Excluded chapters

The following chapters were not included in the analysis:

- Chapter 7: obstetrics, gynaecology and urinary tract disorders
- Chapter 8: malignant disease and immunosupression
- Chapter 9: nutrition and blood
- Chapter 11: eye
- Chapter 12: ear, nose and oropharynx
- Chapter 13: skin
- Chapter 14: immunological products and vaccines
- Chapter 15: anaesthesia

3.3.3.5 Use of STAR-PUs

STAR-PUs (specific therapeutic area related prescribing units) are considered to be appropriate denominators for measuring changes in prescribing costs within BNF therapeutic chapters (Lloyd, Harris and Roberts, 1995). For each of these chapters, STAR-PUs assign weightings to patients according to their age and sex, to take account of demographic differences in the use of different types of drugs. STAR-PU figures for each practice were obtained for chapters 1 to 6 and 10 of the BNF for quarters ending March 1996 and March 1997. These figures were assigned to the relevant BNF chapter level PACTline data so that it was possible to calculate costs (NIC) per STAR-PU for each of the intervention and control practices.

3.3.3.6 Prescribing-related outcome measures

Primary and secondary prescribing-related outcome measures were used to assess changes.

1. Primary outcome measures:

    - change in total NIC between the years September 1995 to August 1996 and September 1996 to August 1997
    - change in total NIC per ASTRO-PU
    - change in number of items between the two years
    - change in number of items per ASTRO-PU
    - change in total NIC per item
    - change in percentage of prescriptions written generically between the two years

2. Secondary outcome measures:

    - changes in NIC per STAR-PU for chapters 1 to 6 and 10 of the BNF
    - changes in items per STAR-PU for chapters 1 to 6 and 10 of the BNF
    - change in percentage of prescriptions written generically between the two years for chapters 1 to 6 and 10 of the BNF

3.3.4 Analysis

3.3.4.1 Data manipulation

Data manipulation was carried out using Microsoft Excel (versions 95 and 97). Monthly data were combined (or averaged in the case of ASTRO-PUs) to give yearly data for each practice for the year of the intervention (September 1996 to August 1997) and the previous year (September 1995 to August 1996). This made it possible to calculate NIC per ASTRO-PU and items per ASTRO-PU for each of the practices for each of the two years. In addition, the data on costs and

items were added together to give overall figures for the eight intervention practices and eight control practices for each of the two years. By combining the ASTRO-PU figures, it was possible to calculate NIC per ASTRO-PU and items per ASTRO-PU for the two groups of practices. A similar approach to data processing was taken with data obtained from chapters 1 to 6 and 10 of the BNF (using STAR-PUs rather than ASTRO-PUs).

3.3.4.2 Choice of statistical test

The data were imported into the software programme Statistics Package for Social Scientists (SPSS-PC version 8) and tests of normality were carried out on changes in the different variables between the two years to determine the nature of the data. The results of these tests showing the Normal Q-Q (Quantile-Quantile) plots, detrended normal Q-Q plots and values of the Kolmogorov-Smirnov statistic with the Lillifors correction applied, are shown in Appendix 2. It can be seen that there was deviation from the straight line for all the plots and, in addition, the significance level was found to be small in more than one instance. The data could therefore not be taken as having a normal distribution and so a non-parametric statistical test (Wilcoxon matched-pairs signed-ranks test) was chosen to investigate differences between the practices. The Wilcoxon Test is the most appropriate test for a matched case-control study, as it allows for the pairing to be taken into account in the analysis (Campbell and Machin, 1999). It is used for paired (two related) samples where the differences observed can be meaningfully ranked in both magnitude and sign. (Seigel and Castellan, 1988). The main disadvantage of using this type of test is that it is less powerful than the equivalent parametric test (the paired t-test).

3.3.4.3 Statistical analysis

Statistical analysis of changes in prescribing variables for intervention and control practices was carried out using SPSS. The primary analysis was conducted on changes in overall prescribing variables using a significance level

of $p<0.05$. Secondary analysis was performed on changes in prescribing at BNF chapter level.

3.3.4.4 Calculation of savings

One of the main objectives of the study was to calculate any savings made by intervention practices compared with controls. Relative savings were calculated by applying the percentage increase in NIC per ASTRO-PU of control practices to intervention practices for the year September 1995 to August 1996 to give a projected NIC per ASTRO-PU for the year of the intervention. This figure was then multiplied by the mean number of ASTRO-PUs for intervention practices for the period September 1996 to August 1997 to give projected total costs. The actual costs of the intervention practices were then subtracted from the projected costs to give an estimate of the relative savings made.

3.3.4.5 Assessing whether control practices were unusual in their increases in prescribing costs

In order to compare changes in prescribing costs for intervention and control practices with other practices, data were obtained for the Trent region as a whole and for the 10 most similar health authorities in England (selected by the Prescribing Support Unit, Leeds, on the basis of sociodemographic characteristics).

3.4 RESULTS

3.4.1 The study population

Table 3.1 shows how the intervention and control practices were matched in terms of dispensing and fundholding status.

Table 3.1. Dispensing and fundholding status of cases and controls

Group	Dispensing	Non-Dispensing	Fundholding	Non-Fundholding
Intervention (n=8)	1	7	4	4
Controls (n=8)	1	7	4	4
Totals	2	14	8	8

As mentioned earlier, practices were also matched with controls on the basis of initial NIC per ASTRO-PU, list size, locality and estimated percentage of the population with limiting long term illness. Details are given below.

The median NIC per ASTRO-PU for January to March 1996 (minimum to maximum) was £6.39 (£5.23 to £10.69) for intervention practices and £6.44 (£5.44 to 8.13) for controls. For the same time period, the median list sizes (minimum to maximum) for the intervention and control practices were 8 285 (1 370 to 11 674) and 8 394 (2 065 to 13 261) respectively. The interquartile ranges for the list sizes were 2 984 to 10 874 and 4 909 to 9 814 respectively. Postcodes of individual patients in each practice were applied to Census data, to estimate the percentage of patients with limiting long-term illness in each of the two groups (Majeed et al. 1995). The median estimated percentage of population with limiting long term illness (minimum to maximum) were 15.6 (13.0 to 17.2) for intervention practices and 15.4 (9.1 to 17.6) for controls. Using the Mann-Whitney U test, (Campbell and Machin, 1993) there were no statistically significant differences between intervention and control practices in any of the above variables at the start of the study.

Differences between the groups of practices in terms of actual changes in list size or ASTRO-PUs over the study period were investigated using Wilcoxon Matched-Pairs Signed Ranks Test and, as can be seen in Table 3.2, there were no statistically significant differences.

Table 3.2. Changes in ASTRO-PU figures and list size for intervention practices between September 1995 and August 1997 compared with matched controls

Variable	Median data for intervention practices (minimum to maximum)			Median data for control practices (minimum to maximum)			Wilcoxon Test	
	Sept to Aug 95/96	Sept to Aug 96/97	Change	Sept to Aug 95/96	Sept to Aug 96/97	Change	Z	2-Tailed P
ASTRO-PU figures	30313 (4306 to 41687)	30493 (4863 to 41925)	217 (-547 to 1017)	30800 (6663 to 22605)	30911 (6984 to 50812)	-37 (-1879 to 452)	1.54	0.123
List size	8343 (1386 to 11780)	8340 (1546 to 11646)	-51 (-186 to 274)	8463 (2107 to 13339)	8150 (2139 to 13183)	-17 (-665 to 69)	0.70	0.484

3.4.2 PACTline analysis of the study practices

3.4.2.1 Overall prescribing variables for intervention practices and controls

Figure 3.1 shows combined monthly prescribing costs per ASTRO-PU for the intervention practices and the controls. It can be seen that having started off slightly more expensive than control practices, the intervention practices were making relative savings soon after the start of the project in September 1996.

Statistical analysis of PACTline data for overall prescribing variables is shown in Table 3.4. It can be seen that the change in NIC per ASTRO-PU for intervention practices was significantly lower than the change in NIC per ASTRO-PU for controls ($p=0.025$). The intervention practices achieved a significantly higher growth in generic prescribing ($p=0.025$), despite their median baseline proportion of generics being higher than that of controls. While there were small changes in the number of items prescribed per ASTRO-PU in both intervention and control practices there were no significant differences between the two groups. However, the rise in NIC per item for intervention practices was significantly lower than for control practices ($p=0.017$).

Figure 3.1. Combined net ingredient cost per ASTRO-PU per month for intervention practices and matched controls

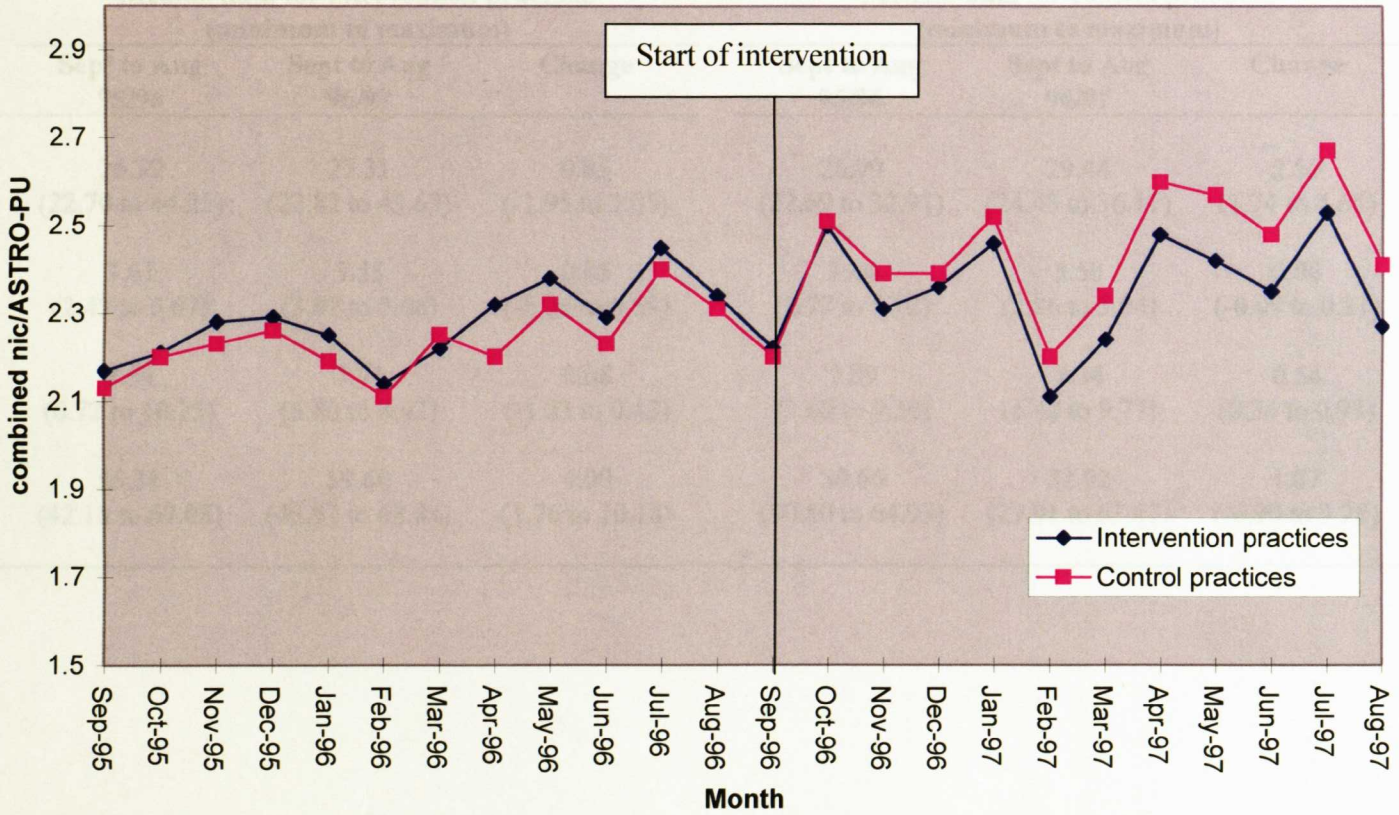


Table 3.3. Changes in prescribing variables for intervention practices between September 1995 and August 1997 compared with matched controls

Variable	Median data for intervention practices (minimum to maximum)			Median data for control practices (minimum to maximum)			Wilcoxon Test	
	Sept to Aug 95/96	Sept to Aug 96/97	Change	Sept to Aug 95/96	Sept to Aug 96/97	Change	Z	2-tailed P
NIC (£) per ASTRO-PU	26.79 (22.70 to 44.25)	27.31 (22.82 to 43.69)	0.85 (-1.95 to 2.05)	26.99 (22.69 to 32.91)	29.44 (24.43 to 36.17)	2.55 (1.74 to 4.65)	-2.24	0.025
Items per ASTRO-PU	3.61 (2.43 to 5.67)	3.55 (3.02 to 5.66)	0.05 (-0.26 to 0.59)	3.44 (2.77 to 5.12)	3.50 (2.86 to 5.04)	0.08 (-0.09 to 0.31)	-0.28	0.779
NIC (£) per item	7.54 (6.72 to 10.25)	7.71 (6.80 to 8.42)	0.08 (-1.83 to 0.43)	7.89 (5.60 to 9.30)	8.34 (6.42 to 9.77)	0.54 (0.34 to 0.93)	-2.38	0.017
Items prescribed generically (%)	55.31 (42.18 to 67.08)	59.60 (45.92 to 68.84)	4.00 (1.76 to 10.18)	50.66 (30.80 to 64.93)	52.92 (29.91 to 67.87)	1.67 (-0.90 to 3.28)	-2.24	0.025

Table 3.4 shows combined data for the intervention and control practices between September 1995 to August 1996 and September 1996 to August 1997. It can be seen that intervention practices increased their NIC per ASTRO-PU by 3.4% compared with a 9.2% increase for controls. Had the cost growth of the intervention group been as great as that of the control group, their total prescribing expenditure would have been around £347 000 higher (Appendix 3). Given that the cost of the scheme was £163 000, it was estimated that the project made a net saving of £184 000.

For the same time period, the percentage increase in NIC per ASTRO-PU for the control practices was similar to that of practices in the 10 most similar health authorities in England (8.5%) (Roberts, D. personal communication) and the Trent region as a whole (8.4 %) (Wilson, J. personal communication).

Table 3.4. Changes in combined overall prescribing variables for intervention practices between September 1995 and August 1997 compared with matched controls

Variable	Combined data for intervention practices				Combined data for control practices			
	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change
NIC (£) per ASTRO-PU	27.34	28.26	0.92	3.37	26.82	29.28	2.46	9.17
Items per ASTRO-PU	3.53	3.63	0.10	2.80	3.35	3.42	0.07	2.23
NIC (£) per item	7.75	7.79	0.04	0.56	8.02	8.56	0.54	6.82
Items prescribed generically (%)	58.49	62.67	4.18	7.15	52.63	54.67	2.04	3.87
Total NIC (£) for all practices combined	5 893 767	6 131 619	237 852	4.04	6 327 539	6 861 616	534 077	8.44

3.4.2.2 Overall prescribing variables for individual intervention practices and controls

Changes in prescribing variables for individual intervention practices and controls over the two years can be found in Appendix 4. Figures 3.2 to 3.5 illustrate the percentage change in these variables. It can be seen that with one exception, all the intervention practices managed to control prescribing costs relative to their matched controls. Although the inverse was true in relation to the number of items prescribed, it can be seen that in general, the intervention practices were better able to control costs per item and increase generic prescribing, compared to controls.

Figure 3.2. Percentage change in NIC/ASTRO-PU for intervention practices and matched controls

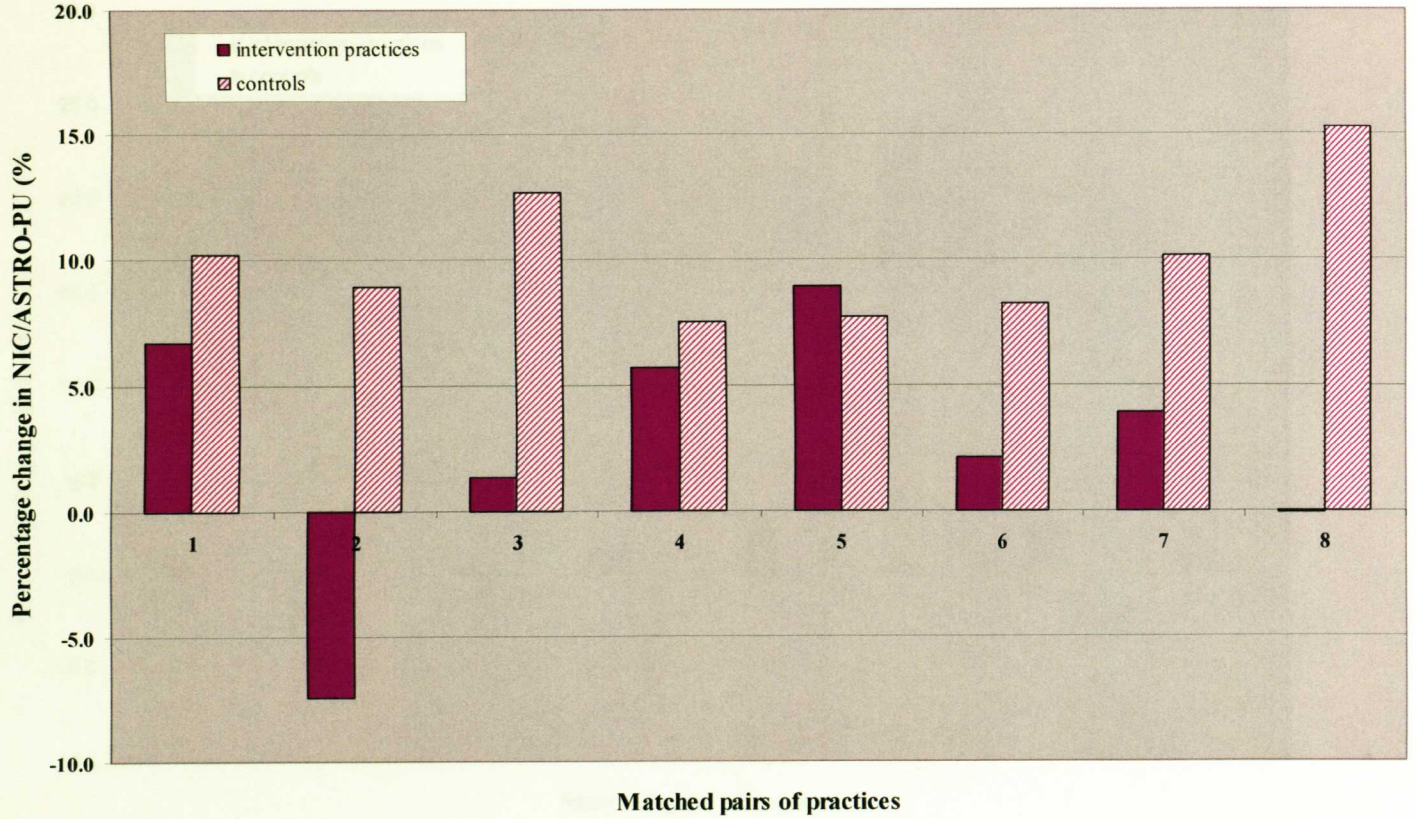


Figure 3.3. Percentage change in number of items per ASTRO-PU for intervention practices and matched controls

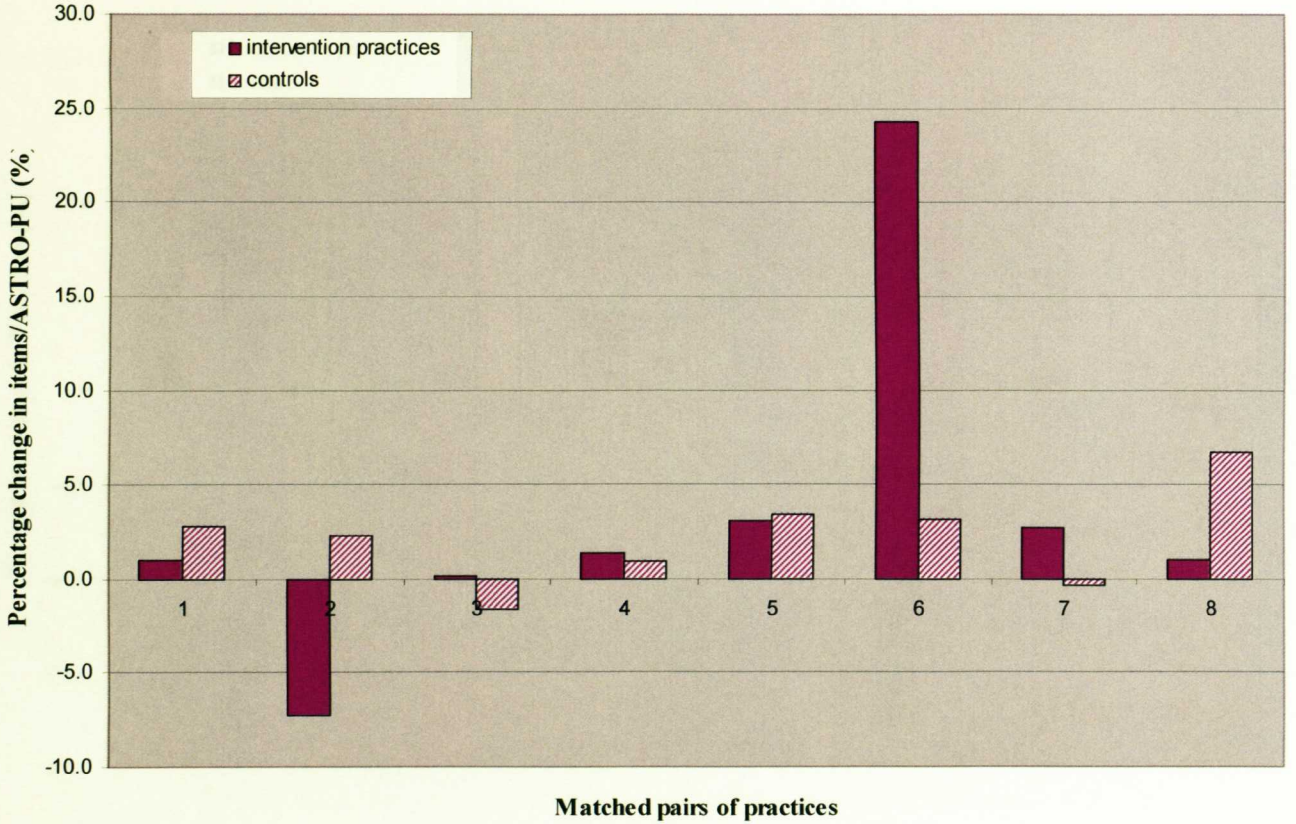


Figure 3.4. Percentage change in NIC/item for individual intervention and control practices

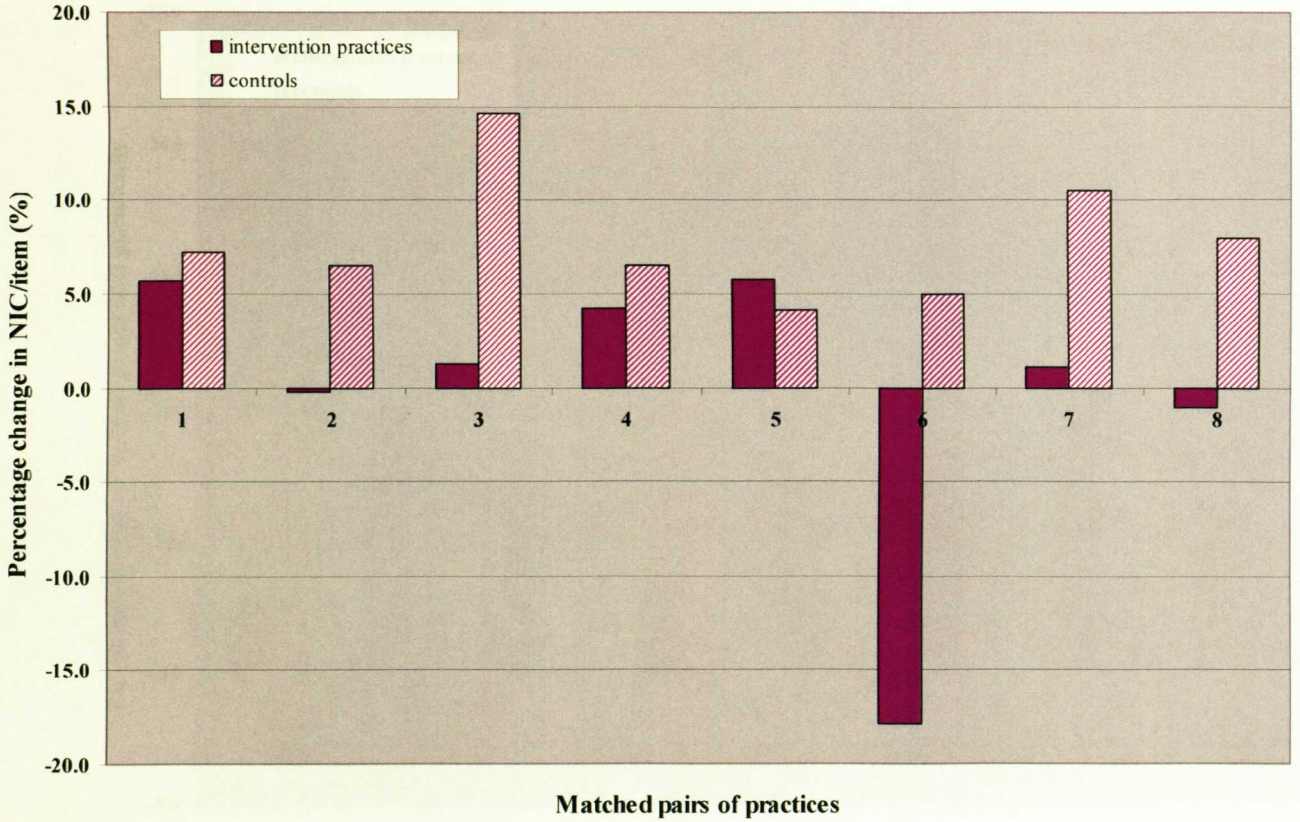
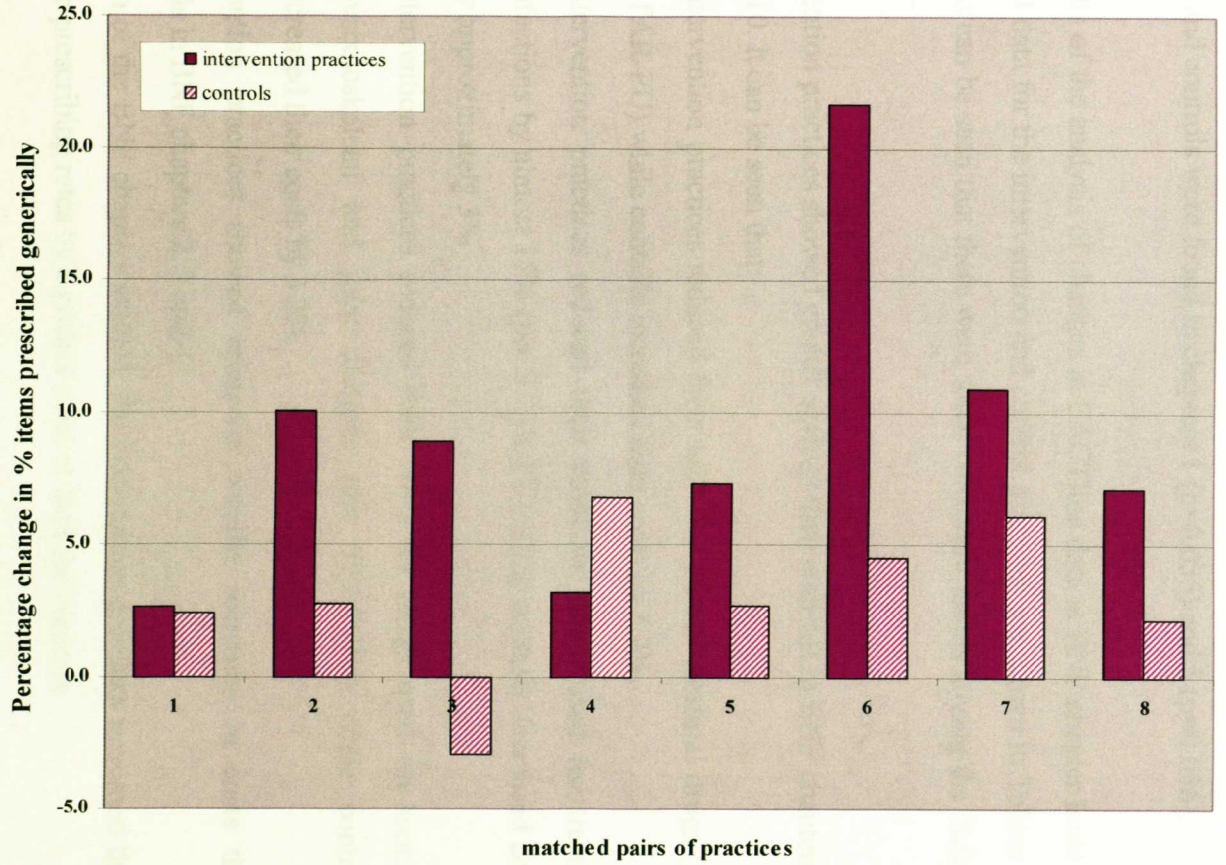


Figure 3.5. Percentage change in the % items prescribed generically for intervention practices and matched controls



3.4.2.3 Changes at BNF chapter level

The results of the analysis of changes in PACTline data at BNF chapter level are shown in Table 3.5. Statistically significant differences between intervention practices and controls were found in chapters 1 ($p=0.035$) and 5 ($p=0.036$).

The results of the analysis of changes in PACTline data at BNF chapter level for combined data for the intervention and control practices are shown in Tables 3.6 and 3.7. It can be seen that there were some consistent trends among the data. In summary:

- intervention practices showed greater savings than controls in BNF chapters 1, 5 and 10. It can be seen that:
  - intervention practices reduced their costs for gastro-intestinal drugs (per STAR-PU) while controls increased their costs by 6.7%
  - intervention practices reduced their costs for drugs used for treating infections by almost 15% (per STAR-PU) while controls decreased costs by approximately 3%
  - intervention practices reduced their costs for drugs used for treating musculoskeletal and joint diseases (per STAR-PU) while controls increased their costs by 3.2%
- intervention practices showed relatively smaller increases in costs than controls in BNF chapters 2, 3 and 4
- in each of the BNF chapters studied, the intervention practices increased their generic prescribing rates by a greater amount than the controls

Chapter 2.12 of the BNF, which consists of lipid-lowering drugs, was specifically looked at, as this is a group of drugs where increases in items and costs would be expected if practices were taking account of evidence-based medicine (Scandinavian Survival Study Group, 1994; Oliver, 1995; Shepherd et al. 1995). Although it is recognised that the use of PACT data to assess quality of prescribing in this way has many limitations (Naish, Sturdy and Toon, 1995; McGavock, 2001) the fact that the intervention practices increased their costs for

these drugs by almost 90% suggests no lack of enthusiasm for increasing the prescribing of this important class of drugs. Findings relating to the quality of prescribing for intervention practices are presented in Chapter 4.

Table 3.5. Changes in net ingredient cost per STAR-PU for chapters 1 to 6 and 10 of the BNF for intervention practices between September 1995 and August 1997 compared with matched controls

BNF Chapter	Median NIC/STAR-PU data for intervention practices (minimum to maximum)			Median NIC/STAR-PU data for control practices (minimum to maximum)			Wilcoxon Test	
	Sept to Aug 95/96	Sept to Aug 96/97	Median Change	Sept to Aug 95/96	Sept to Aug 96/97	Median Change	Z	2-Tailed P
Chapter 1: Gastro-intestinal system	1.96 (1.49 to 3.78)	1.96 (1.55 to 3.11)	0.01 (-0.67 to 0.14)	2.12 (1.56 to 2.47)	2.29 (1.72 to 2.86)	0.15 (0.05 to 0.39)	-2.10	0.035
Chapter 2: Cardiovascular system	1.76 (1.63 to 3.75)	1.91 (1.55 to 3.72)	0.05 (-0.08 to 0.25)	1.97 (1.77 to 2.55)	2.18 (1.93 to 2.70)	0.17 (-0.03 to 0.29)	-1.12	0.263
Chapter 2.12: Lipid-lowering drugs	0.10 (0.06 to 0.16)	0.18 (0.12 to 0.29)	0.08 (0.06 to 0.14)	0.11 (0.04 to 0.25)	0.22 (0.09 to 0.38)	0.10 (0.04 to 0.17)	-1.40	0.161
Chapter 3: Respiratory system	3.09 (1.60 to 5.42)	2.92 (2.04 to 5.44)	0.08 (-0.37 to 0.44)	2.95 (2.07 to 4.46)	3.19 (2.39 to 4.41)	0.18 (-0.05 to 0.39)	-0.70	0.484
Chapter 4: Central nervous system	2.24 (1.91 to 4.32)	2.55 (1.97 to 4.18)	0.33 (-0.32 to 0.63)	2.24 (1.76 to 2.70)	2.58 (2.16 to 3.35)	0.37 (0.23 to 1.12)	-0.70	0.484
Chapter 5: Infections	1.87 (1.62 to 3.03)	1.71 (1.37 to 2.68)	-0.26 (-0.51 to -0.07)	1.90 (1.46 to 3.21)	1.93 (1.28 to 2.97)	-0.07 (-0.23 to 0.11)	-2.10	0.036
Chapter 6: Endocrine system	2.17 (1.69 to 3.92)	2.12 (1.84 to 4.29)	0.11 (-0.22 to 0.37)	2.11 (1.76 to 2.36)	2.11 (1.95 to 2.64)	0.22 (-0.13 to 0.50)	-0.42	0.674
Chapter 10: Musculoskeletal and joint diseases	1.65 (1.17 to 2.07)	1.66 (1.41 to 2.14)	-0.05 (-0.22 to 0.24)	1.43 (1.31 to 3.15)	1.50 (1.22 to 2.98)	-0.02 (-0.17 to 0.21)	-0.14	0.889

Table 3.6. Changes in overall prescribing variables for chapters 1 to 3 of the BNF for combined data for intervention practices between September 1995 and August 1997 compared with matched controls

Variable	Combined data for intervention practices				Combined data for control practices			
	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change
Chapter 1: Gastro-intestinal System								
NIC per STAR-PU (£)	2.14	2.13	-0.01	-0.5	2.09	2.23	0.14	6.7
Items per STAR-PU	0.16	0.16	0.00	0.0	0.15	0.15	0.00	0.0
% items prescribed generically	53.9	57.8	3.9	7.3	49.9	52.2	2.3	4.6
Chapter 2: Cardiovascular System								
NIC per STAR-PU (£)	1.81	1.91	0.10	5.5	1.98	2.14	0.16	8.1
Items per STAR-PU	0.28	0.30	0.02	7.1	0.25	0.26	0.01	4.0
% items prescribed generically	75.8	80.2	4.4	5.8	65.5	69.1	3.6	5.5
Section 2.12: Lipid-lowering Drugs								
NIC per STAR-PU (£)	0.09	0.17	0.08	88.9	0.13	0.22	0.09	69.2
Items per STAR-PU	0.00	0.01	0.01	∞	0.00	0.01	0.01	∞
% items prescribed generically	57.6	70.6	13.0	22.5	40.9	46.4	5.4	13.3
Chapter 3: Respiratory System								
NIC per STAR-PU (£)	3.15	3.20	0.05	1.6	3.02	3.22	0.20	6.6
Items per STAR-PU	0.28	0.29	0.01	3.6	0.27	0.27	0.00	0.0
% items prescribed generically	36.0	39.6	3.6	10.0	34.1	34.4	0.3	0.9

∞ denotes infinity

Table 3.7. Changes in overall prescribing variables for chapters 4 to 6 and 10 of the BNF for combined data for intervention practices between September 1995 and August 1997 compared with matched controls

Variable	Combined data for intervention practices				Combined data for control practices			
	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change
Chapter 4: Central Nervous System								
NIC per STAR-PU (£)	2.29	2.68	0.39	17.0	2.16	2.54	0.38	17.6
Items per STAR-PU	0.41	0.43	0.02	4.9	0.40	0.41	0.01	2.5
% items prescribed generically	74.0	76.9	2.9	3.9	72.6	72.5	-0.1	-0.1
Chapter 5: Infections								
NIC per STAR-PU (£)	2.08	1.77	-0.31	-14.9	2.03	1.97	-0.06	-2.9
Items per STAR-PU	0.43	0.41	-0.02	-4.7	0.41	0.40	-0.01	-2.4
% items prescribed generically	82.6	88.6	6.1	7.4	67.1	69.4	2.3	3.4
Chapter 6: Endocrine System								
NIC per STAR-PU (£)	2.09	2.21	0.12	5.7	2.07	2.18	0.11	5.3
Items per STAR-PU	0.25	0.26	0.01	4.0	0.24	0.25	0.01	4.2
% items prescribed generically	64.3	65.8	1.5	2.3	60.4	61.1	0.7	1.2
Chapter 10: Musculoskeletal and Joint Diseases								
NIC per STAR-PU (£)	1.76	1.67	-0.09	-5.1	1.58	1.63	0.05	3.2
Items per STAR-PU	0.23	0.24	0.01	4.4	0.20	0.21	0.01	5.0
% items prescribed generically	61.0	64.3	3.3	5.3	50.1	51.7	1.6	3.2

3.5 SUMMARY OF MAIN FINDINGS

3.5.1 Results of PACTline analysis of overall prescribing variables

The change in NIC per ASTRO-PU between September 1995 to August 1996 and September 1996 to August 1997 for intervention practices was significantly lower than the change for controls (p=0.025). While there were small changes in the number of items prescribed per ASTRO-PU in both intervention and control practices, there were no significant differences between the two groups. However, there was a significant difference between the groups in terms of percentage change in the percentage of items prescribed generically (p=0.025) and NIC per item (p=0.017).

Compared with their matched controls, the intervention practices made relative savings of more than twice the amount that the project cost in terms of the employment and training of the practice based pharmacists. The relative differences between the two groups of practices did not appear to be the result of control practices increasing their costs at an extraordinary rate. For the same time period, the percentage increase in net ingredient costs for the control practices (9.2%) was similar to that of practices in the Trent region as a whole (8.4%) (Wilson, J. personal communication) and the ten most similar health authorities in England (8.5%) (Roberts, D. personal communication).

Individual practice level analysis showed that, with one exception, all the intervention practices managed to control prescribing costs relative to their matched controls. Although the majority of intervention practices increased the number of items prescribed per ASTRO-PU, in general they were better able to control costs per item and increase generic prescribing compared to controls.

3.5.2 Results of PACTline analysis at BNF chapter level

The results of the analysis of changes in PACTline data at BNF chapter level found statistically significant differences between intervention practices and controls in chapters 1 ($p=0.035$) and 5 ($p=0.036$). Overall:

- intervention practices showed greater savings than controls in BNF chapters 1, 5 and 10
- intervention practices showed relatively smaller increases in costs than controls in BNF chapters 2, 3 and 4
- in each of the BNF chapters studied, the intervention practices increased their generic prescribing rates by a greater amount than the controls

Analysis of section 2.12 of the BNF, which consists of lipid-lowering drugs, showed that intervention practices increased their costs for these drugs by almost 90%.

A detailed account of how exactly practices changed their prescribing costs is given in Chapter 4.

CHAPTER 4

CHANGES IN PRESCRIBING PATTERNS OF INTERVENTION AND CONTROL PRACTICES

4.1 INTRODUCTION

The main aim of the study was to evaluate a pharmacist-led intervention to determine whether this helped general practices to control their prescribing costs. Chapter 3 has shown that overall, intervention practices did indeed control their prescribing costs relative to matched controls but it does not give a great deal of insight into how this was achieved.

There were 3 key hypotheses:

1. Intervention practices that were successful in making savings were likely to have introduced specific measures aimed at tackling prescribing costs
2. These measures were likely to have focused on areas of prescribing where changes could be predicted to produce significant savings e.g. generic substitution or use of less expensive drugs
3. Intervention practices would have chosen to make savings in areas of prescribing where cost reduction is unlikely to cause detrimental effects to patients

The first two hypotheses were tested by analysing changes in prescribing patterns in order to identify the types of strategy used. The third hypothesis was tested by investigating the different ways in which it has been suggested that GPs could make savings (without detriment to patients). Many of these suggested methods for cost control were outlined in the Audit Commission Report: "A Prescription for Improvement: Towards more Rational Prescribing in General Practice" (1994) and are shown below:

- increased prescribing of the "top 20" generic drugs
- substitution of comparable but cheaper drugs
- appropriate use of expensive preparations
- prescription of fewer drugs of limited therapeutic value
- less use of drugs often over prescribed

Although previous studies have suggested that general practices can control their prescribing costs by reducing the volume of prescribing (Bradlow and Coulter, 1993, Dowell, Snadden and Dunbar, 1995; Maxwell et al. 1993; Wilson, Buchan and Walley, 1995), and the cost per unit volume (Bradlow and Coulter, 1993, Dowell, Snadden and Dunbar, 1995; Maxwell et al. 1993), and by increasing their rates of generic prescribing (Bradlow and Coulter, 1993, Dowell, Snadden and Dunbar, 1995; Maxwell et al. 1993; Wilson, Buchan and Walley, 1995; Stewart-Brown et al. 1995) few studies have looked in detail at the range of cost control strategies suggested by the Audit Commission (1994) (Baines, Tolley and Whynes, 1997; Baines, Whynes and Tolley, 1997). A key issue for this part of the study was to identify which of these suggested methods were actually used by the intervention practices.

4.2 OBJECTIVES

The objectives of this aspect of the study were to determine exactly how the practices either controlled or increased their prescribing costs in terms of changes in:

1. Volume of prescribing
2. Cost per unit of prescribing volume
3. Generic prescribing
4. Areas of prescribing where the Audit Commission suggested that savings might be made (without detriment to patients) :

    - combination products
    - modified/sustained release products
    - drugs of limited therapeutic value
    - drugs that could be bought over the counter (OTC)
    - new and expensive drugs
    - topical NSAIDs
    - expensive hospital initiated drugs

5. BNF chapters
6. BNF therapeutic groups
7. Specific drugs and preparations

A supplementary objective was to assess whether quality of prescribing was maintained by practices that made relative savings on their prescribing costs. Due to time and financial constraints, it was not possible to visit the individual practices to do detailed analyses of prescribing quality. It was therefore decided to use PACT data to provide proxy measures of prescribing quality.

4.3 METHODS

4.3.1 Analysis of Level 3 PACT data

An observational study was carried out using Level 3 PACT data to do detailed analyses of changes in prescribing (Majeed, Evans and Head, 1997). These data provide information on practices' prescribing patterns right down to the level of individual drugs and preparations. From Level 3 PACT data it was possible to calculate defined daily doses, which, according to Bogle and Harris (1994) are a more accurate measure of prescribing volume than items.

Changes in prescribing patterns were based on combined data for each of the two groups. The combined data were produced by the Optimise software using a function that allows for the combination of different data files.

4.3.1.1 Use of Optimise software

Enigma Medical Systems (EMS) developed Optimise software in order to help analyse changes in Level 3 PACT data. The software was designed to help general practitioners and health authorities to:

- identify potential savings that could be made on prescribing costs
- look at prescribing indicators of their choice
- compare changes in prescribing costs (and other prescribing patterns) between two years

The software worked in the following way. Paper-based Level 3 PACT data were entered onto computer. The following information was recorded on a database:

- name of preparation
- strength of preparation in milligrams (or mg/5mL for liquids)
- number of "units" prescribed (a unit is a single tablet or 5mL of a liquid)

From this information the number of defined daily doses (DDDs) could be calculated (World Health Organisation, 1978):

$$\text{Number of defined daily doses} = \frac{\text{strength of drug x number of units}}{\text{defined daily dose for the drug}}$$

The system of DDDs, developed and maintained by the World Health Organisation (WHO), gives each drug a value that represents the assumed average maintenance dose per day for a drug used for its main indication in adults and is a unit of measurement, not a recommended dose.

The Optimise software did not automatically record the prescribing costs assigned by the PPA. Instead, a computerised "drug file" was used to assign costs to the drugs recorded on the database. This drug file was based on the Drug Tariff (Department of Health, 1997) for any chosen month. Using this system, it was possible to look at potential savings on prescribing costs using the most recent drug costs according to the Drug Tariff.

4.3.1.2 Use of the Drug Tariff

"Produced monthly by the Pharmaceutical Directorate of the PPA on behalf of the Secretary of State, the Drug Tariff outlines the rules to be followed when

dispensing, the fees and allowances for dispensing and what will be reimbursed for supplying drugs and appliances against an NHS prescription form" (National Prescribing Centre, 2004). For the purposes of the study, it was necessary to be sure that the costs assigned to the data were as close as possible to those that had been used by the Prescription Pricing Authority (PPA) and so the September 1997 Drug Tariff was used. This meant that when comparing a time before the intervention with one after the intervention, the costs of the drugs were artificially inflated, particularly for the first year of the study. The advantage of this method was that it was possible to assess changes in prescribing behaviour without having to account for inflation in drug costs. The disadvantage was that the calculated changes in drug costs did not tally exactly with real changes in costs.

4.3.1.3. Data validation

Initially there were concerns about errors that might occur from inputting paper-based PACT data onto computer. However, double-entry was done on at least 20% of the data and the data entry was found to be at least 99% accurate. Also, there were other checks on the accuracy of data recording. Firstly, all data entered were visually checked for accuracy by an experienced supervisor. Secondly, the Optimise system was designed to alert the data entry clerk should they input an unusual quantity for a drug. Thirdly, the data were closely scrutinised as part of the analysis and any potential inaccuracies were highlighted. In these cases, it was possible to refer back to the initial paper-based PACT data to check the computer records. Comparison with data obtained from PACT catalogues was also carried out to ensure accuracy of the data.

4.3.1.4 Chapters examined

Most drug costs come from chapters 1 to 6 and 10 of the British National Formulary (BNF). Given the costs of data entry, detailed analysis was focused on these BNF chapters:

- Chapter 1: gastro-intestinal system
- Chapter 2: cardiovascular system
- Chapter 3: respiratory system
- Chapter 4: central nervous system
- Chapter 5: infections
- Chapter 6: endocrine system
- Chapter 10: musculoskeletal and joint diseases

Chapter 8 of the BNF (malignant disease and immunosupression) was also examined, as it was possible that some practices might have had important changes in their prescribing costs attributable to these potentially expensive, hospital initiated drugs. Therefore, when considering changes in "total costs" based on the Optimise analysis, this included chapters 1 to 6, 8 and 10 of the BNF.

4.3.1.5 Chapters excluded

For the reasons given in the section 4.3.1.4, the following chapters were not included in the analysis:

- Chapter 7: obstetrics, gynaecology and urinary tract disorders
- Chapter 9: nutrition and blood
- Chapter 11: eye
- Chapter 12: ear, nose and oropharynx
- Chapter 13: skin
- Chapter 14: immunological products and vaccines
- Chapter 15: anaesthesia

4.3.1.6 Transfer of data

Doncaster Health Authority were requested to order level 3 PACT catalogues from the PPA for the financial years:

- September 1995 to August 1996
- September 1996 to August 1997

When the catalogues arrived at the Health Authority, they were delivered by secure transport to Enigma Medical Systems for entry onto computer and were kept securely until all data validation had been completed. The Level 3 PACT catalogues were then destroyed.

Optimise software was used to assign costs to the prescribing data and to conduct further analyses as outlined below. Processed data were sent on floppy disks or by email with identification of each practice only by its PPA code.

4.3.2 Types of analysis done using Optimise software

This section describes the types of analysis done using the Optimise software.

4.3.2.1 Analysis of changes in overall prescribing variables

Optimise analysis was used to investigate changes in the following variables for both intervention and control practices:

- total costs
- total units (= tablets or 5mL quantities of liquid)
- total cost per unit
- generic and cost Optimise (explanation given in section 4.3.4)

4.3.2.2 Changes in costs at BNF chapter level

The results of this analysis were used to validate the data obtained from Enigma Medical Systems with data obtained from the PPA (PACTline data).

4.3.2.3 Changes in costs at BNF subchapter level

From changes in cost at BNF subchapter level it was possible to identify those sections where there appeared to be important differences between the 2 groups. For these sections, a detailed analysis was done to look at exactly how prescribing patterns had changed. Defined daily doses for the drugs and preparations used were calculated (World Heath Organisation, 1978), and changes in the following variables were analysed:

- prescribing volume
- cost per defined daily dose
- generic prescribing rates

4.3.2.4 Audit Commission type categories

The Optimise software was also used to analyse changes in types of drug category where the Audit Commission suggested that general practices might be able to control prescribing costs (Audit Commission, 1994). The categories are listed below and a more detailed explanation is given further in section 4.3.6:

- combination products
- modified/sustained release products
- drugs of limited therapeutic value
- drugs that could be bought over the counter (OTC)
- new and expensive drugs
- topical NSAIDs
- expensive hospital-initiated drugs

4.3.3 Denominator used for the analyses

The results of analyses presented in Chapter 3 used the denominator of ASTRO-PU for changes in overall costs and STAR-PU for changes in chapters and subchapters of the BNF. However, the objective of this Chapter is to present results that make clear comparisons between different therapeutic groups and "indicators" to determine where exactly changes in cost came from. Therefore, most of the data are presented in terms of costs (or defined daily doses) per 1000 patients. Given that the focus was on changes within the two groups of practices between two years, it is doubtful whether accounting for demographic changes (in terms of age and sex) would have made an appreciable difference to the results.

4.3.4 Generic Optimise and Cost Optimise

One of the strengths of the Optimise software is its ability to calculate potential savings that could have been made if:

- brand-named drugs were substituted with generic drugs where it would make a difference to costs (this is termed "Generic Optimise")
- brand-named drugs were substituted with generic drugs (where generics were cheaper) and brand-named drugs were used in place of generics (or another brand) where this brand-named drug was cheaper (this is termed "Cost Optimise")

Changes in potential savings through generic substitution were examined for the two groups of practices between the two years. Where the intervention or control practices reduced the potential savings they could have made, this implies that they stopped using some of the more expensive preparations. It is likely that in most cases this was because they made lower-cost substitutions, and this has been demonstrated in some cases. However, in other cases the practices may have made substitutions with more expensive drugs that were still within patent (where a lower cost alternative may not have been available).

It was desirable to be able to separate the potential savings that could be made through generic substitution and those that could be made through using brand-named drugs that were cheaper than generics (or other equivalent brands). It was possible to obtain the latter figure by subtracting the Generic Optimise figure from the Cost Optimise figure. This has been called "Lower-cost brand Optimise". In this context, it is worth pointing out that generic preparations are not always cheaper than brands. For example, when the tariff generic, co-amilofruse became available, several of the brand-named versions of the drug were cheaper than the price set for the generic in the Drug Tariff. In other cases, there may be differences in costs for chemically equivalent brand-named drugs (where a generic is not available). In order to identify brand-named preparations that are cheaper than either a generic or an equivalent brand, it is necessary to have detailed knowledge of prices (and changes in prices) in the Drug Tariff.

4.3.5 Specific generic changes

Using the Optimise software, it was possible to identify the drugs where the greatest changes in costs occurred between 1995/6 and 1996/7 for both intervention practices and controls. Analysis was then done to identify the switches between brand-named drugs and generics that might have had the greatest impact on costs.

4.3.6 Selection of drugs for Audit Commission type categories

In developing prescribing indicators, the Audit Commission took selected drugs within different categories. For example, "drugs of limited therapeutic value", "modified release preparations" and "combination products" contained a selection of the drugs and preparations that contributed most to cost in these areas. It is understandable that the Audit Commission did not use a comprehensive list of drugs within each category as this would have been very time consuming and it would have made data extraction from the PPA database more complicated. However, Avery et al (2000) produced a set of categories which were similar, but more comprehensive than those used by the Audit

Commission by carefully going through the BNF (Joint Formulary Committee, 1996) and selecting out all relevant drugs from chapters 1 to 6, 8 and 10. The choice of drugs was validated by showing the categories to a group of academic GPs and pharmacists. The latter were paid to check carefully all entries and to highlight any possible omissions. The categories were mutually exclusive so that there was no "double-counting" of drugs. For example, "drugs of limited therapeutic value" that could be bought OTC, were put within the OTC category.

Enigma Medical Systems then wrote software to identify these different categories of drug, and the software was checked to ensure that all relevant drugs had been included in the different categories. Although the software was designed for use as part of an NHS Prescribing Research Initiative project (Avery et al. 2000b), permission to use the software to analyse the Doncaster data was sought from the Principle Investigator and granted.

A detailed explanation of the different categories is given below.

Combination Products

Preparations containing two or more drugs, excluding:

- those in which clinically important components cannot be prescribed separately:
  - dopa-decarboxylase inhibitors with dopaminergic drugs used in parkinsonism
  - clavulanic acid in co-amoxiclav
  - sulphamethoxazole in co-trimoxazole
- those in which components are in a dose that could not be prescribed separately but where OTC equivalents are available e.g. co-codamol, migraleve. (These preparations are included in the "OTC" section)
- Lisinopril and Quinapril preparations (where the combination product was as cheap as the ACE inhibitor prescribed alone)

Modified/Sustained Release Preparations

All modified release (MR) preparations listed in the BNF with the exception of:

- Adalat MR preparations (because MR preparations are indicated for the treatment of hypertension)
- Diltiazem and Felodipine preparations (because no "short-acting" equivalent was available)
- Products where the BNF gave a justification for the use of a modified release preparation:
  - theophylline preparations (because the BNF notes that "the use of rapid-release oral theophylline preparations has declined because of the high incidence of side-effects associated with absorption")
  - lithium preparations (because the BNF notes "once daily administration is preferred when plasma concentrations (have been) stabilised")
  - modified release morphine salts (because the BNF recognises the advantages of these preparations - page 12 BNF).
  - carbamazepine preparations (because the BNF notes "use of modified release tablets (Tegretol Retard) also significantly lessens the incidence of dose-related side-effects")
  - dopaminergic drugs used in parkinsonism (because the BNF notes "modified release preparations may help with "end-of-dose" deterioration or nocturnal immobility and rigidity")

Drugs of Limited Therapeutic Value

Drugs for which the BNF makes comments suggesting that they are of limited clinical value. The following drugs and preparations are excluded:

- those for which similar preparations could be bought over the counter (these appear in the OTC section)
- topical NSAIDs (these appear in their own section)

Over the Counter Products

Drugs and preparations for which an equivalent could be bought over the counter excluding:

- enemas
- nitrates
- topical NSAIDs (these appear in their own section)

Topical NSAIDs

All topical NSAIDs listed in section 10.3.2 of the BNF.

New and Expensive Drugs

Increasing use of relatively new and expensive products may have an important influence on the control of prescribing costs. This section lists:

- Therapeutic groups that showed important increases (more than 20% per year) in prescribing costs across the Trent region between financial years 1994/5 and 1995/6:
  - proton pump inhibitors (PPIs) (BNF 1.3.5)
  - lipid-lowering drugs (LLDs) (BNF 2.12)
  - Selective serotonin re-uptake inhibitors (SSRIs) (BNF 4.3.3)
  - Oestrogens and hormone replacement therapy (HRT) (BNF 6.4.1.1)

- A selection of drugs (not included in the above therapeutic groups) that showed important increases in prescribing costs across the Trent region between financial years 1994/5 and 1995/6:
  - long acting beta-2 stimulants (salmeterol and eformoterol preparations)
  - fluticasone preparations
  - sumatriptan preparations

Expensive Hospital Initiated Drugs (1)

Drugs that would almost certainly be initiated in secondary care used for malignant disease and immunosuppression (BNF chapter 8).

Expensive Hospital Initiated Drugs (2)

Drugs that would almost certainly be initiated in secondary care that would be likely to cost over £30 per week at adult dose (according to prices listed in the BNF, March 1996).

4.3.7 Quality of prescribing

It is recognised that the use of PACT data to assess quality of prescribing has many limitations (McGavock, 2001). The main problem is that the data cannot be related to individual prescribing decisions (Cantrill, Sibbald and Buetow, 1998). Thus, while certain prescribing patterns might suggest either good or poor prescribing, it is not possible to make a firm judgement on the basis of PACT data. Analysing changes in costs is not a particularly good way to assess quality of prescribing, especially where there are variations in cost per unit volume. However, due to the time and financial constraints imposed by the project it was not possible to visit each of the eight individual practices to carry out detailed analyses of prescribing quality. For this reason, analysis of Level 3 PACT data was used as a proxy measure of prescribing quality to address the following questions:

1. Did intervention practices increase their prescribing in areas where this might be necessary to give patients the drugs that they need?

    - inhaled corticosteroids
    - lipid-lowering drugs
    - hormone replacement therapy

2. Did intervention practices control or decrease their prescribing in areas where it has been suggested that GPs may "overprescribe"?

   - drugs of limited therapeutic value
   - antimicrobial agents
   - NSAIDs

3. Did intervention practices control prescribing costs in areas where it has been suggested that savings might be made without detriment to patient care?

   - selected generic substitutions
   - reductions in use of selected combination products
   - reductions in use of selected modified release products

The ways in which information was obtained to give a proxy assessment of prescribing quality are outlined in the relevant sections of the methods and results. In the discussion (Chapter 6), this information is drawn together to give a view on whether practices that controlled costs managed to maintain quality.

4.3.8 Analysis

All calculations of variables were done using Microsoft Excel (versions 95 and 97). As mentioned in section 4.3.1, changes in prescribing patterns were based on combined data for each of the two groups.

Due to the variation in the magnitude of the figures presented in the tables, results have been presented to a minimum of one significant figure. The concept of one significant figure was chosen on the basis that percentage changes of any smaller magnitude were not likely to be important. It is hoped that this allows for easy reading of the figures while at the same time permitting small changes in variables to be presented. For the purposes of this chapter, Year 1 refers to the year October 1995 to September 1996 and Year 2 refers to October 1996 to September 1997.

Chapter 3 demonstrated that there were statistically significant differences in costs between intervention practices and controls in terms of overall prescribing costs and prescribing costs in chapters 1 and 5 of the BNF. Since the aim of this Chapter was to explore in detail the types of changes taking place, no statistical analyses were carried out.

4.4 RESULTS

A considerable amount of information is presented in the results section therefore a brief summary has been given below on the content of each subsection:

- **4.4.1:** refers to the denominator used in the analyses
- **4.4.2:** validation of Optimise data against PACTline data
- **4.4.3:** information on overall prescribing variables (and how they changed between 1995/6 and 1996/7) based on Optimise analysis of Level 3 PACT data for combined BNF chapters 1 to 6, 8 and 10:

  - costs (£) per 1000 patients
  - units (tablets or 5mL quantities of liquid) per 1000 patients
  - Generic Optimise: missed opportunity for making generic savings per 1000 patients
  - "Lower-cost brand Optimise": missed opportunity for making savings by using brand-named drugs that were cheaper than either the generic preparation or an equivalent brand (per 1000 patients)

- **4.4.4:** information on prescribing variables based on Audit Commission type categories (and how they changed between 1995/6 and 1996/7) based on Optimise analysis of Level 3 PACT data for combined BNF chapters 1 to 6, 8 and 10:

  - combination products
  - modified/sustained release products
  - drugs of limited therapeutic value
  - drugs that could be bought over the counter (OTC)

- new and expensive drugs
- topical NSAIDs
- expensive hospital initiated drugs

- **4.4.5:** information on prescribing costs in BNF chapters 1 to 6, 8 and 10 (and how they changed between 1995/6 and 1996/7) based on Optimise analysis of Level 3 PACT data

- **4.4.6:** information on how exactly the two groups of practices changed their prescribing patterns within selected therapeutic groups between 1995/6 and 1996/7 (based on Optimise analysis of Level 3 PACT data). The therapeutic groups were chosen on the basis of important differences having been found between the two groups (demonstrated in section 4.4.6)

- **4.4.7:** information on how practices changed their prescribing patterns for drugs where they had reduced costs for certain brand-named preparations

- **4.4.8:** information on quality of prescribing

Details of the study population can be found in section 3.4.1.

4.4.1 Denominator used for analyses

Table 4.1 shows the total numbers of patients in each group for the two years of the study. Analyses were based on combined data for each of the two groups using "per 1000 patients" as the denominator.

Table 4.1. Total patient numbers for intervention and control practices for 1995/6 and 1996/7

Group	Total number of patients	
	Sept to Aug 1995/6 Year 1	Sept to Aug 1996/7 Year 2
Intervention practices	59 777	59 695
Control practices	63 676	62 891

4.4.2 Validation of Optimise data against PACTline data

Doncaster Health Authority was requested to order level 3 PACT catalogues from the PPA for the financial years:

- September 1995 to August 1996
- September 1996 to August 1997

The PPA was unable to provide catalogues for the exact dates requested. However, catalogues were provided for the following dates:

- October 1995 to September 1996
- October 1996 to September 1997

Costs assigned using Optimise were compared with costs assigned by the PPA (PACTline data). Differences of less than five per cent were found within each of the BNF chapters and, overall, only very minor differences were found (less than one per cent), despite the discrepancy in dates and different methods of assigning costs (Tables 4.2 to 4.3).

Table 4.2. Validation of Optimise data against PACTline data for intervention practices

BNF Chapter	Total Net Ingredient Cost (£)							
	Year 1				Year 2			
	PACTline data	Optimise data	Difference	% Difference	PACTline data	Optimise data	Difference	% Difference
Chapter 1: Gastro-intestinal system	985 104	982 466	-2 638	- 0.3	990 654	991 112	458	0.05
Chapter 2: Cardiovascular system	1 048 583	1 052 609	4 026	0.4	1 120 226	1 107 686	-12 540	-1.1
Chapter 3: Respiratory system	890 978	900 065	9 087	1.0	907 309	903 287	-4 022	0.4
Chapter 4: Central nervous system	809 329	806 062	-3 267	-0.4	957 649	974 987	17 338	1.8
Chapter 5: Infections	358 649	349 811	-8 838	-2.5	305 411	305 802	391	0.1
Chapter 6: Endocrine system	401 165	406 266	5 101	1.3	428 475	442 208	13 733	3.2
Chapter 10: Musculoskeletal and joint diseases	358 332	356 160	-2 172	-0.6	343 212	341 098	-2 114	-0.6
TOTALS	**4 852 140**	**4 853 439**	**1 299**	**0.03**	**5 052 936**	**5 066 180**	**13 244**	**0.3**

Table 4.3. Validation of Optimise data against PACTline data for control practices

BNF Chapter	Total Net Ingredient Cost (£)							
	Year 1				Year 2			
	PACTline data	Optimise data	Difference	% Difference	PACTline data	Optimise data	Difference	% Difference
Chapter 1: Gastro-intestinal system	1 059 067	1 062 573	3 506	0.3	1 136 893	1 132 840	-4 053	-0.4
Chapter 2: Cardiovascular system	1 269 819	1 267 397	-2 422	-0.2	1 379 090	1 382 002	2 912	0.2
Chapter 3: Respiratory system	920 113	888 544	-31 569	-3.4	981 575	983 296	1 721	0.2
Chapter 4: Central nervous system	831 696	836 693	4 997	0.6	982 352	993 341	10 989	1.1
Chapter 5: Infections	374 604	372 861	-1 743	-0.5	361 934	366 553	4 619	1.3
Chapter 6: Endocrine system	419 534	429 664	10 130	2.4	444 395	445 381	986	0.2
Chapter 10: Musculoskeletal and joint diseases	352 483	346 664	-5 819	1.6	363 885	355 121	-8 764	-2.4
TOTALS	**5 227 316**	**5 204 396**	**-22 920**	**-0.4**	**5 650 124**	**5 658 534**	**8 410**	**0.1**

4.4.3 Changes in overall prescribing variables

Table 4.4 shows the changes in overall prescribing variables for combined data for intervention practices and controls for Chapters 1 to 6, 8 and 10 of the BNF. It can be seen that the percentage increase in total costs per 1000 patients for the control practices was almost twice that for the intervention practices. Although the percentage increase in the number of units (a unit = one tablet or 5mL of a liquid) per 1000 patients was similar in both groups, the percentage change in total cost per unit for the control practices was almost three times that of the intervention practices. This is despite the fact that both groups of practices had similar baseline figures.

As mentioned in section 4.3.4, one of the strengths of the Optimise software was its ability to calculate potential savings that the practices might have made in each year if they had prescribed generic preparations instead of the brand-named preparations that they did prescribe (Generic Optimise). From Table 4.4 it can be seen that intervention practices had the potential to make savings of £1 271 per 1000 patients by switching to generic preparations. They succeeded in making savings of £507 per 1000 patients (40%), implying that either they made generic switches or that they stopped prescribing some of these drugs altogether. By contrast, the control practices, which started with greater potential for making generic savings, actually increased their potential savings by three per cent.

Cost Optimise is the potential savings that practices might have made in each year if brand-named drugs were substituted with generic drugs (where generics were cheaper) and brand-named drugs were used in place of generics (or another brand) where this brand-named drug was cheaper. It can be seen that having started from a similar baseline, intervention practices succeeded in making savings of £775 per 1000 patients (30.41%) compared to £47 per 1000 patients for control practices.

As mentioned previously, it was also desirable to calculate potential savings that could be made if practices prescribed brand-named drugs that were either cheaper than a generic (or an equivalent brand). This was termed "Lower-cost brand Optimise" and it can be seen that intervention practices reduced their potential savings by almost threefold compared to controls (21.0% and 7.3% respectively).

Table 4.4. Optimise analysis of changes in overall prescribing variables

Variable	Combined data for intervention practices				Combined data for control practices			
	Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
Total costs (£) per 1000 patients	82 079	86 867	4 788	5.8	82 693	92 026	9 333	11.3
Total units per 1000 patients	566 245	582 579	16 334	2.9	559 399	574 501	15 101	2.7
Total cost/unit (pence)	0.145	0.149	0.004	2.8	0.148	0.160	0.012	8.1
Generic Optimise (£) per 1000 patients	1 271	764	-507	-39.9	1 482	1 521	39	2.6
Cost Optimise (£) per 1000 patients	2 546	1 772	-774	-30.4	2 655	2 608	-47	-1.8
Lower-cost brand Optimise (£) per 1000 patients	1 275	1 008	-267	-20.9	1 173	1 087	-86	-7.3

4.4.4 Optimise analysis of Audit Commission type categories

In this subsection, results of analysis of changes in cost for "Audit Commission type categories" are presented. These categories have been explained in detail in section 4.3.6. However, it is worth restating that the categories are mutually exclusive. Abbreviations for the categories have been used and a key has been provided to explain these abbreviations. Results are for combined data.

Table 4.5 shows the changes in costs for intervention practices and controls for the categories studied. The categories are set out in order of increasing magnitude of total costs per 1000 patients for intervention practices in Year 1. It can be seen that intervention practices appeared to reduce costs for:

- modified/sustained release preparations
- drugs of limited therapeutic value
- topical NSAIDs

Intervention practices appeared to restrict the rise in costs compared with controls for:

- drugs that can be bought over-the-counter
- new and expensive drugs

Relative to controls, intervention practices increased costs for:

- combination products
- expensive hospital initiated drugs (1) (chapter 8 of the BNF)
- expensive hospital initiated drugs (2) (costing >£30 per week)

From the results it can also be seen that "new and expensive" drugs accounted for the majority of overall costs. Both intervention and control practices increased their costs for this category and it was the category where there were the greatest differences between the two groups of practices in terms of changes in costs.

Table 4.5. Optimise analysis of prescribing indicators: change in total costs (£) per 1000 patients between 1995/6 and 1996/7

Indicator	Total costs (£) per 1000 patients							
	Intervention practices				Control practices			
	Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
EHI (2)	444	549	104	23.5	531	275	-256	-48.2
LTV	510	436	-74	-14.5	374	370	-4	-1.1
EHI (1)	888	1 998	1 110	125.2	959	2 052	1 094	114.1
NSAIDs	1 024	988	-36	-3.5	697	745	48	6.9
OTC	2 880	3 007	127	4.4	2 775	2 919	144	5.2
CP	3 818	3 845	27	0.7	3 749	3 688	-60	-1.6
MSR	4 944	4 701	-243	-4.9	5 670	6 004	334	5.9
N&E	17 346	20 206	2 860	16.5	16 778	21 199	4 421	26.4
OVERALL	**31 853**	**35 729**	**3 876**	**12.2**	**31 533**	**37 253**	**5 720**	**18.1**

Key to table

Abbreviation	Indicator
EHI (2)	expensive hospital initiated drugs (costing >£30 per week, excluding EHI (1))
LTV	drugs of limited therapeutic value
EHI (1)	expensive hospital initiated drugs (chapter 8 of BNF)
NSAIDs	topical non-steroidal anti-inflammatories
OTC	over-the counter products
CP	combination products
MSR	modified/sustained release products
N&E	new and expensive drugs

4.4.4.1 Optimise analysis of new and expensive drugs

Table 4.6 gives a breakdown of the contribution of different types of new and expensive drugs to the overall increase in costs for this drug category. Intervention practices managed to control the increase in costs in certain areas more effectively than the control practices:

- Selected new and expensive drugs (other)
- Proton Pump Inhibitors
- SSRIs

Intervention practices did not restrict their percentage increase in costs more than control practices in the following areas:

- Lipid-lowering drugs
- Oestrogens and HRT

Table 4.6. Optimise analysis of new and expensive drugs: change in total costs (£) per 1000 patients between 1995/6 and 1996/7

Category	Total costs (£) per 1000 patients							
	Intervention practices				Control practices			
	Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
LLD	908	1 787	880	96.9	1 374	2 376	1 003	73.0
OHRT	2 437	2 609	172	7.1	2 512	2 485	-26	-1.0
SSRIs	3 115	3 945	830	26.6	2 313	3 160	847	36.6
Other	4 133	4 498	365	8.8	4 144	5 306	1 162	28.0
PPIs	6 754	7 367	613	9.1	6 436	7 872	1 436	22.3
OVERALL	**17 346**	**20 206**	**2 860**	**16.5**	**16 778**	**21 199**	**4 421**	**26.4**

Key to table

Abbreviation	Indicator
LLD	Lipid-lowering drugs
OHRT	oestrogen and hormone replacement therapy
SSRIs	selective serotonin re-uptake inhibitors
OTHER	other new and expensive drugs: salmeterol, eformeterol, fluticasone and sumatriptan
PPIs	proton pump inhibitors

4.4.5 Changes in costs at BNF chapter level

This section presents data on changes in costs per 1000 patients for BNF subsections for combined data for intervention practices and controls. The following tables give a breakdown of costs per 1000 patients for:

- October 1995 to September 1996 (Year 1)
- October 1996 to September 1997 (Year 2)
- the change between the two years
- the percentage change between the two years

This information is presented for:

- overall prescribing costs for BNF chapters 1to 6, 8 and 10 combined
- prescribing costs for each of the BNF chapters 1 to 6, 8 and 10
- prescribing costs for BNF therapeutic groups within each of the BNF chapters studied

The data are presented in a way that means that it is possible to determine the contribution that costs in different therapeutic groups make to:

- costs in their respective BNF chapters
- overall costs in BNF chapters 1 to 6, 8 and 10

Specific therapeutic groups in which there were the greatest differences in cost changes between intervention and control practices have been highlighted in bold type. Where there were less important differences between the two groups, the results have been given at BNF subchapter level e.g. antacids.

At the end of section 4.4.6, therapeutic groups where there were the greatest differences in changes in costs per 1000 patients have been listed. From this list it was possible to see which were the most important therapeutic groups in terms of cost control.

4.4.5.1 Changes in overall prescribing costs for BNF chapters 1 to 6, 8 and 10

Changes in overall prescribing costs per 1000 patients for BNF chapters 1 to 6, 8 and 10 are given in Table 4.7. It can be seen that intervention practices managed to reduce costs for drugs used for infections and musculoskeletal diseases (chapters 5 and 10 respectively). For chapters 1 to 3 they managed to control costs (compared with controls), although there were greater increases for chapters 4, 6 and 8.

Table 4.7. Changes in costs (£) per 1000 patients for BNF chapters 1 to 6, 8 and 10

BNF Chapter	Total cost (£) per 1000 patients							
	Combined data for intervention practices				Combined data for control practices			
	Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
Chapter 1: Gastro-intestinal system	16 435	16 603	168	1.0	16 687	18 013	1 326	7.9
Chapter 2: Cardiovascular system	17 609	18 556	947	5.4	19 904	21 975	2 071	10.4
Chapter 3: Respiratory system	15 057	15 132	75	0.5	13 954	15 635	1 681	12.1
Chapter 4: Central nervous system	13 484	16 333	2 849	21.1	13 140	15 795	2 655	20.2
Chapter 5: Infections	5 852	5 123	-729	-12.5	5 856	5 828	-27	-0.5
Chapter 6: Endocrine system	6 796	7 408	612	9.0	6 748	7 082	334	4.9
Chapter 8: Malignant disease and immunosuppression	888	1 998	1 110	125.0	962	2 052	1 090	113.4
Chapter 10: Musculoskeletal and joint diseases	5 958	5 714	-244	-4.1	5 444	5 647	203	3.7
TOTALS	**82 079**	**86 867**	**4 788**	**5.8**	**82 693**	**92 026**	**9 333**	**11.3**

4.4.5.2 Chapter 1: gastro-intestinal system

Table 4.8 shows the costs per 1000 patients for gastro-intestinal drugs for October 1995 to September 1996, October 1996 to September 1997 and the change between the two years. It can be seen that intervention practices managed to reduce overall costs for ulcer-healing drugs by controlling increases in costs of proton pump inhibitors whilst at the same time making large reductions in costs for H_2-receptor antagonists. By comparison, control practices had much larger increases in costs for proton pump inhibitors but were not as successful in reducing costs for H_2-receptor antagonists.

Table 4.8. Changes in costs (£) per 1000 patients for gastro-intestinal drugs

BNF Section	Therapeutic Group	Total cost (£) per 1000 patients							
		Combined data for intervention practices				Combined data for control practices			
		Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
1.1	Antacids	691	681	-10	-1.5	666	659	-7	-1.0
1.2	Antispasmodics and other drugs	1 208	1 240	32	2.7	1 045	1 150	105	10.1
1.3.1	**H_2-receptor antagonists**	**5 427**	**4 562**	**-865**	**-15.9**	**6 028**	**5 514**	**-514**	**-8.5**
1.3.2	Selective antimuscarinics	0.0	0.0	0.0	†	0.0	0.0	0.0	†
1.3.3	Chelates and complexes	13	9	-4	-31.6	11	6	-4	-41.7
1.3.4	Prostaglandin analogues	36	41	5	12.7	23	23	1	3.5
1.3.5	**Proton pump inhibitors**	**6 754**	**7 367**	**613**	**9.0**	**6 436**	**7 872**	**1 436**	**22.3**
1.3.6	Other ulcer-healing drugs	7	7	0.0	0.0	27	23	-4	-14.8
1.3	**Ulcer-healing drugs (SUBTOTALS)**	**12 238**	**11 986**	**-252**	**-2.1**	**12 524**	**13 438**	**914**	**7.3**
1.4	Antidiarrhoeal drugs	80	84	4	4.7	99	96	-3	-3.5
1.5	Treatment of chronic diarrhoeas	677	714	36	5.3	679	816	136	20.1
1.6.1	Bulk-forming drugs	393	630	236	60.0	347	473	126	36.3
1.6.2	Stimulant laxatives	424	519	95	22.5	470	539	69	14.7
1.6.3	Faecal softeners	13	3	-10	-80.3	24	2	-22	-93.3
1.6.4	Osmotic laxatives	358	368	10	2.7	354	358	4	1.2
1.6	Laxatives (SUBTOTALS)	1 188	1 519	331	27.9	1 195	1 372	177	14.8
1.7	Preparations for haemorrhoids	203	205	2	0.8	214	220	6	2.8
1.8	Stoma care	0.0	0.0	0.0	†	0.0	2.1	2.1	∞
1.9	Drugs affecting intestinal secretions	150	175	26	17.1	264	260	-4	-1.5
1	**Gastro-intestinal system (TOTALS)**	**16 435**	**16 603**	**168**	**1.0**	**16 687**	**18 013**	**1 326**	**7.9**

∞ denotes infinity † denotes undefined

4.4.5.3 Chapter 2: cardiovascular drugs

Tables 4.9 to 4.10 show the costs per 1000 patients for cardiovascular drugs. Although intervention practices almost doubled their costs for lipid-lowering drugs, they managed to reduce their costs for antihypertensive therapy. It is worth noting that intervention practices were more successful at controlling increases in costs for cerebral vasodilators than controls.

Table 4.9. Changes in costs (£) per 1000 patients for cardiovascular drugs (1)

BNF Section	Therapeutic group	Total cost (£) per 1000 patients							
		Combined data for intervention practices				Combined data for control practices			
		Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
2.1	Positive inotropic drugs	13	28	15	120.4	15	30	16	106.3
2.2.1	Thiazides and related diuretics	85	75	-10	-11.6	83	94	11	13.2
2.2.2	Loop diuretics	133	171	37	28.1	153	203	50	32.5
2.2.3	Potassium-sparing diuretics	81	73	-8	-9.9	38	47	9	23.9
2.2.4	Potassium sparing diuretics and compounds	1 099	873	-226	-20.5	1 179	972	-207	-17.6
2.2.8	Diuretics with potassium	51	45	-6	-12.5	33	27	-6	-17.3
2.2	Diuretics (subtotals)	1 449	1 236	-213	-14.7	1 486	1 343	-143	-9.6
2.3	Anti-arrhythmic drugs	223	242	19	8.5	203	236	34	16.7
2.4	Beta-adrenoceptor blocking drugs	1 741	1 708	-33	-1.9	1 961	1 940	-21	-1.1
2.5.1	Vasodilator antihypertensive drugs	20	22	2	7.7	18	29	11	63.2
2.5.2	Centrally-acting antihypertensive drugs	79	61	-18	-22.4	30	25	-5	-17.7
2.5.3	Adrenergic neurone blocking drugs	12	9	-3	-23.5	1.4	1.1	-0.3	-21.4
2.5.4	**Alpha-adrenoceptor blocking drugs**	**253**	**302**	**49**	**19.4**	**512**	**700**	**188**	**36.7**
2.5.5	**Angiotensin-converting enzyme inhibitors**	**4 245**	**4 044**	**-201**	**-4.7**	**5 289**	**5 390**	**101**	**1.9**
2.5	**Antihypertensive therapy (SUBTOTAL)**	**4 609**	**4 438**	**-171**	**-3.7**	**5 850**	**6 144**	**294**	**5.0**

Table 4.10. Changes in costs (£) per 1000 patients for cardiovascular drugs (2)

BNF Section	Therapeutic group	Total cost (£) per 1000 patients							
		Combined data for intervention practices				Combined data for control practices			
		Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
2.6.1	**Nitrates**	**2 784**	**2 881**	**97**	**3.5**	**3 054**	**3 378**	**324**	**10.6**
2.6.2	Calcium-channel blockers	5 067	5 238	171	3.4	5 210	5 450	240	4.6
2.6.3	**Peripheral vasodilators and related drugs**	**352**	**398**	**46**	**13.1**	**344**	**517**	**173**	**50.3**
2.6.4	Cerebral vasodilators	192	168	-24	-12.6	147	150	3	2.1
2.6.5	Flosequinan	0.0	0.0	0.0	†	0.0	0.0	0.0	†
2.7	Sympathomimetics	0.0	0.0	0.0	†	5	2	-2	-53.6
2.8	Anticoagulants and protamine	89	176	87	97.7	51	169	118	233.8
2.9	Antiplatelet drugs	101	134	32	31.7	90	107	17	18.4
2.10	Fibrinolytic drugs	0.0	0.0	0.0	†	0.0	0.0	0.0	†
2.11	Antifibrinolytic drugs and haemostatics	82	124	42	51.5	115	131	17	14.5
2.12	Lipid-lowering drugs	908	1 787	880	96.9	1 374	2 376	1 003	73.0
2.13	Local sclerosants	0.0	0.0	0.0	†	0.0	0.0	0.0	†
2	**Cardiovascular system (TOTALS)**	**17 609**	**18 556**	**947**	**5.4**	**19 904**	**21 975**	**2 071**	**10.4**

† denotes undefined

4.4.5.4 Chapter 3: respiratory system

Table 4.11 shows the costs per 1000 patients for respiratory drugs for September 1995 to October 1996, September 1996 to October 1997 and the change between the two years. It can be seen that intervention practices managed to reduce costs for adrenoceptor stimulants and in addition made only slight increases in costs for both bronchodilators and corticosteroids in contrast to control practices.

Table 4.11. Changes in costs (£) per 1000 patients for respiratory drugs

BNF Section	Therapeutic group	Total cost (£) per 1000 patients							
		Combined data for intervention practices				Combined data for control practices			
		Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
3.1.1	**Adrenoceptor stimulants**	**4 665**	**4 525**	**-139**	**-3.0**	**4 253**	**4 581**	**328**	**7.7**
3.1.2	Antimuscarinic bronchodilators	1 037	1049	12	1.2	879	883	4	0.4
3.1.3	Theophylline	312	293	-19	-6.1	296	270	-26	-8.7
3.1.4	Compound bronchodilator preparations	92	255	164	178.6	99	200	101	102.0
3.1	**Bronchodilators (SUBTOTAL)**	**6 105**	**6 123**	**18**	**0.3**	**5 527**	**5 935**	**407**	**7.4**
3.2	**Corticosteroids**	**7 490**	**7 500**	**9**	**0.1**	**6 900**	**7 790**	**891**	**12.9**
3.3	Cromoglycate and related therapy	226	165	-61	-27.0	292	179	-113	-38.6
3.4	Allergic disorders	937	1 056	120	12.8	810	957	146	18.1
3.5	Respiratory stimulants and sufractants	0.0	0.0	0.0	†	0.0	0.0	0.0	†
3.6	Oxygen	233	216	-16	-7.1	160	236	76	47.5
3.7	Mucolytics	0.0	14	14	∞	170	453	283	166.7
3.8	Aromatic inhalations	1.1	1.2	0.1	9.1	1.4	1.3	-0.1	-7.1
3.9.1	Cough suppressants	30	26	-4	-13.3	36	36	0.0	0.8
3.9.2	Expectorant, demulcent, and comp preps	6	5	-1	-16.8	14	11	-3	-21.9
3.10	Systemic nasal decongestants	29	26	-3	-9.7	44	38	-6	-14.2
3	**Respiratory system (TOTALS)**	**15 057**	**15 132**	**75**	**0.5**	**13 954**	**15 635**	**1 681**	**12.1**

∞ denotes infinity

† denotes undefined

4.4.5.5 Chapter 4: central nervous system (CNS)

Table 4.12 shows the costs per 1000 patients for CNS drugs for 1995/6, 1996/7 and the change between the two years. It can be seen that the clear majority of the increased costs for both intervention and control practices came from antidepressant drugs and analgesics. "Other antidepressant drugs" (mainly SSRIs) was the most important of these drug groups.

Table 4.12. Changes in costs (£) per 1000 patients for central nervous system (CNS)

BNF Section	Therapeutic group	Total cost (£) per 1000 patients							
		Combined data for intervention practices				Combined data for control practices			
		Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
4.1	Hypnotics and anxiolytics	594	667	73	12.3	601	707	107	17.8
4.2	Drugs used in psychoses and rel.disorders	707	927	220	31.2	620	785	164	26.5
4.3.1	Tricyclic and related antidepressant drugs	983	1 070	87	8.9	1 064	1 157	93	8.7
4.3.2	Monoamine-oxidase inhibitors	15	17	3	18.2	16	22	5	31.9
4.3.3	Compound antidepressant preparations	59	106	46	77.8	30	134	104	351.9
4.3.4	**Other antidepressant drugs (includes SSRIs)**	**3 321**	**4 415**	**1 093**	**32.9**	**2 701**	**3 651**	**950**	**35.2**
4.3	**Antidepressant drugs (SUBTOTAL)**	**4 378**	**5 607**	**1 230**	**28.1**	**3 810**	**4 963**	**1 152**	**30.3**
4.4	Central nervous stimulants	24	55	31	128.9	36	48	12	32.7
4.5	Appetite suppressants	23	14	-9	-38.1	21	21	0	-0.9
4.6	Drugs used in nausea and vertigo	843	867	24	2.8	989	1 005	16	1.6
4.7.1	Non-opioid analgesics	2 783	2 960	177	6.4	2 306	2 497	191	8.3
4.7.2	Opioid analgesics	900	1 348	448	49.8	1 201	1 482	281	23.4
4.7.4	Antimigraine drugs	740	962	223	30.1	1 137	1 344	207	18.2
4.7	**Analgesics (SUBTOTAL)**	**4 423**	**5 271**	**848**	**19.2**	**4 644**	**5 323**	**679**	**14.6**
4.8	Antiepileptics	1 578	1 849	272	17.2	1 628	1 980	352	21.7
4.9	Drugs used in park'ism/related disorders	893	1 045	152	17.0	775	926	151	19.4
4.10	Drugs used in substance dependence	23	31	8	34.9	14	36	22	152.1
4	**Central nervous system (TOTALS)**	**13 484**	**16 333**	**2 849**	**21.1**	**13 140**	**15 795**	**2 655**	**20.2**

4.4.5.6 Chapter 5: infections

Table 4.13 shows the costs per 1000 patients for drugs used to treat infections for September 1995 to October 1996, September 1996 to October 1997 and the change between the two years. It can be seen that the clear majority of the changes in costs came from the highlighted drug groups. Intervention practices managed to reduce costs for all of the highlighted drugs. Control practices managed to reduce costs for the majority of the highlighted drugs but to a lesser extent than the intervention practices.

Table 4.13. Changes in costs (£) per 1000 patients for drugs used to treat infections

BNF Section	Therapeutic group	Total cost (£) per 1000 patients							
		Combined data for intervention practices				Combined data for control practices			
		Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
5.1.1	**Penicillins**	**1 262**	**1 018**	**-243**	**-19.3**	**1 325**	**1 236**	**-89**	**-6.7**
5.1.2	**Cephalosporins, cephamycins and betalactams**	**1 560**	**1 283**	**-276**	**-17.7**	**964**	**883**	**-81**	**-8.4**
5.1.3	**Tetracyclines**	**665**	**513**	**-153**	**-22.9**	**729**	**674**	**-55**	**-7.5**
5.1.4	Aminoglycosides	0.0	0.0	0.0	†	16	47	31	196.1
5.1.5	**Macrolides**	**708**	**697**	**-10**	**-1.5**	**1 043**	**1 161**	**118**	**11.3**
5.1.6	Clindamycin and lincomycin	23	43	20	84.3	1	0.4	-0.4	-40.2
5.1.7	Some other antibiotics	7	64	56	753.1	109	112	3	2.37
5.1.8	Sulphonamides and trimethoprim	53	52	-1	-1.9	86	69	-17	-20.0
5.1.9	Antituberculous drugs	17	29	13	78.5	22	18	-4	-19.2
5.1.10	Antileprotic drugs	1	0	-1	-98.5	2	1	-0.6	-30.3
5.1.11	Metronidazole and tinidazole	29	23	-6	-20.6	40	43	3	7.2
5.1.12	4-quinolones	312	318	5	1.6	431	425	-5	-1.3
5.1.13	Urinary-tract infections	29	22	-7	-22.6	32	28	-5	-14.4
5.1	**Antibacterial drugs (SUBTOTAL)**	**4 665**	**4 063**	**-602**	**-12.9**	**4 799**	**4 697**	**-102**	**-2.1**
5.2	Antifungal drugs	537	543	6	1.1	467	550	83	17.9
5.3	**Antiviral drugs**	**508**	**377**	**-130**	**-25.6**	**443**	**445**	**1**	**0.3**
5.4.1	Antimalarials	130	126	-4	-3.1	118	121	3	2.6
5.4	Antiprotozoal drugs (SUBTOTAL)*	130	127	-3	-2.6	118	121	3	2.4
5.5	Anthelmintics	12	13	1	7.9	28	15	-13	-45.0
5	**Infections (TOTALS)**	**5 852**	**5 123**	**-729**	**-12.5**	**5 856**	**5 828**	**-27**	**-0.5**

*figures for antiprotozoal drugs are almost the same as those for antimalarials because very few antiprotozoal drugs were prescribed which were not antimalarials (and the drugs that were prescribed cost less than £1 per 1000 patients)

† denotes undefined

4.4.5.7 Chapter 6: endocrine system

Table 4.14 shows the costs per 1000 patients for endocrine drugs for September 1995 to October 1996, September 1996 to October 1997 and the change between the two years. It can be seen that drugs used for diabetes had an important impact on increased costs for this BNF chapter for both intervention and control practices. It is worth noting that intervention practices increased costs for subchapter 6.5 which are mainly hospital-initiated drugs, whereas control practices reduced costs for this subchapter. This was probably attributed to a prescription of expensive drugs in one or more patients in the intervention practices.

Table 4.14. Changes in costs (£) per 1000 patients for endocrine drugs

BNF Section	Therapeutic group	Total cost (£) per 1000 patients							
		Combined data for intervention practices				Combined data for control practices			
		Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
6.1.1	Insulin	1 028	1 163	136	13.2	1 052	1 275	223	21.2
6.1.2	Oral antidiabetic drugs	425	484	58	13.7	465	554	89	19.1
6.1.4	Treatment of hypoglycaemia	6	9	2	35.2	11	18	7	64.0
6.1.6	Screening and monitoring agents	813	951	138	17.0	729	797	68	9.4
6.1	**Drugs used in diabetes (SUBTOTAL)**	**2 272**	**2 606**	**334**	**14.7**	**2 257**	**2 644**	**387**	**17.1**
6.2.1	Thyroid hormones	62	74	11	17.8	53	68	15	28.5
6.2.2	Antithyroid drugs	60	68	7	12.2	53	32	-21	-39.5
6.3	Corticosteroids	137	135	-3	-1.9	149	149	0.0	0.3
6.4.1	Female sex hormones	2 686	2 834	147	5.5	2 695	2 718	23	0.8
6.4.2	Male sex hormones and antagonists	521	435	-87	-16.6	378	402	24	6.4
6.4.3	Anabolic steroids	8	8	0	5.3	8	11	3	37.4
6.5	**Hypothalamic and pituitary hormones and antioestrogens**	**562**	**710**	**148**	**26.3**	**745**	**586**	**-159**	**-21.4**
6.6.1	Calcitonin	4	0.0	-4	-100.0	9	2	-7	-80.9
6.6.2	Biphosphonates	306	400	95	31.0	261	321	59	22.8
6.7.1	Bromocriptine and Metergoline	64	49	-15	-23.6	43	66	23	52.7
6.7.2	Danazol and Gestrinone	41	15	-26	-64.6	16	9	-7	-46.1
6.7.3	Metyrapone and trilostane	72	75	3	4.9	81	76	-5	-5.7
6.7	**Other endocrine drugs (SUBTOTAL)**	**177**	**139**	**-38**	**-21.6**	**140**	**150**	**11**	**7.6**
6	**Endocrine system (TOTALS)**	**6 796**	**7 408**	**612**	**9.0**	**6 748**	**7 082**	**334**	**4.9**

4.4.5.8 Chapter 8: malignant disease and immunosuppression

Table 4.15 shows the costs per 1000 patients for drugs used for malignant disease and immunosuppression for September 1995 to October 1996, September 1996 to October 1997 and the change between the two years. It can be seen that the greatest increases in costs were for BNF section 8.3. Given that these drug groups relate to mainly hospital-initiated drugs, it was decided not to look at which particular drugs were responsible for the changes in costs.

Table 4.15. Changes in costs (£) per 1000 patients for drugs used for malignant disease and immunosuppression

BNF Section	Therapeutic group	Total cost (£) per 1000 patients							
		Combined data for intervention practices				Combined data for control practices			
		Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
8.1	Cytotoxic drugs	55	154	99	180.7	87	117	30	32.8
8.2	Drugs affecting the immune response	234	546	311	132.8	350	731	381	108.6
8.3	**Sex hormones and antag in malig disease**	**599**	**1 299**	**700**	**116.9**	**522**	**1 204**	**682**	**130.2**
8	**Malignant disease and immunosuppression (TOTALS)**	**888**	**1 998**	**1 110**	**125.0**	**959**	**2 052**	**1 094**	**114.1**

4.4.5.9 Chapter 10: musculoskeletal and joint diseases

Table 4.16 shows the costs per 1000 patients for drugs used for musculoskeletal and joint diseases for September 1995 to October 1996, September 1996 to October 1997 and the change between the two years. It can be seen that NSAIDs were the most important drug group in terms of overall costs (and changes in costs). Intervention practices showed decreased costs, while control practices showed increased costs.

Table 4.16. Changes in costs (£) per 1000 patients for drugs used for musculoskeletal and joint diseases

BNF Section	Therapeutic group	Total cost (£) per 1000 patients							
		Combined data for intervention practices				Combined data for control practices			
		Year 1	Year 2	Change	% Change	Year 1	Year 2	Change	% Change
10.1.1	**Non-steroidal anti-inflammatory (NSAIDs)**	**4 527**	**4 281**	**-245**	**-5.4**	**4 319**	**4 465**	**146**	**3.4**
10.1.2	Corticosteroids	35	35	1	1.7	43	35	-8	-19.1
10.1.3	Rheumatic disease suppressant drugs	59	58	-1	-1.8	101	97	-4	-3.9
10.1.4	Drugs used in the treatment of gout	121	109	-12	-10.1	139	143	4	2.6
10.1	**Drugs used in rheumatic diseases and gout (SUBTOTAL)**	**4 741**	**4 483**	**-258**	**-5.4**	**4 602**	**4 740**	**138**	**3.0**
10.2	Drugs used in neuromuscular disorders	124	141	17	14.1	87	107	20	22.9
10.3.2	Rubefacients and other topical antirheumatics	1 089	1 086	-3	-0.3	748	799	51	6.9
10.3	Drugs for relief of soft-tissue inflammation (SUBTOTAL)	1 093	1 090	-3	-0.3	755	800	45	6.0
10	**Musculoskeletal and joint diseases (TOTALS)**	**5 958**	**5 714**	**-244**	**-4.1**	**5 444**	**5 647**	**203**	**3.7**

Table 4.17 summarises data from Tables 4.8 to 4.16. It shows the contribution of 20 therapeutic groups to the differences observed in changes in cost per 1000 patients for intervention practices and controls. The list was constructed on the basis of the largest differences seen between the two groups of practices. The therapeutic groups are listed in order of the magnitude of difference in change in costs between the intervention and control practices. It can be seen that just over 80% (£3 177) of the differences seen between the groups came from changes in costs from the "top 10" therapeutic groups. Almost 30% (£1 174) of the changes in costs came from ulcer-healing drugs (proton pump inhibitors and H_2-receptor antagonists) alone. This equates to almost 70% and 26% respectively in terms of differences in costs for all drugs in chapters 1 to 6, 8 and 10 of the BNF.

The way in which the two groups of practices changed their prescribing patterns for these 10 therapeutic groups is explored in detail in section 4.4.6.

Table 4.17. Differences in changes in costs (£) per 1000 patients for selected therapeutic groups for intervention and control practices

BNF Section	Therapeutic groups	Change in costs (£) per 1000 patients between 1995/6 and 1996/7		
		Intervention Practices (A)	Control Practices (B)	A minus B
1.3.5	Proton pump inhibitors (PPIs)	613	1 436	-823
3.1.1	Adrenoceptor stimulants	-139	328	-467
10.1.1	Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)	-245	146	-391
1.3.1	H_2-receptor antagonists	-865	-514	-351
2.5.5	Angiotensin-converting enzyme inhibitors	-201	101	-302
2.6.1	Nitrates	97	324	-227
5.1.2	Cephalosporins, cephamycins and betalactams	-276	-81	-195
5.1.1	Penicillins	-243	-89	-154
2.5.4	Alpha-adrenoceptor blocking drugs	49	188	-139
5.1.5	Macrolides	-10	118	-128
	Subtotal for "top 10"	**-1220**	**1957**	**-3 177**
2.6.3	Peripheral vasodilators and related drugs	46	173	-127
6.4.2	Male sex hormones and antagonists	-87	24	-111
5.1.3	Tetracyclines	-153	-55	-98
6.1.1	Insulin	136	223	-87
4.8.1	Control of epilepsy	272	352	-80
2.6.2	Calcium-channel blockers	171	240	-69
4.3.3	Compound antidepressant preparations	46	104	-58
8.2.1	Cytotoxic immunosuppressants	43	100	-57
10.3.2	Rubefacients and other topical antirheumatics	-3	51	-54
6.7.1	Bromocriptine and metergoline	-15	23	-38
Difference in costs (£) for the above drug groups combined		**-764**	**3 192**	**-3 956**
Total difference in costs (£) for all drugs in chapters 1 to 6, 8 and 10 of BNF		**4 788**	**9 333**	**-4 545**
Percentage of total difference in costs (%) from above drug groups		**-16.0**	**34.2**	**87.0**

4.4.6 Analysis of therapeutic groups where there were the greatest differences in costs between the two groups of practices

As shown in Table 4.17 ten therapeutic groups were responsible for just over 80% of the difference between the two groups in their changes in costs between 1995/6 and 1996/7. This section examines in detail how prescribing patterns changed within these therapeutic groups.

The two factors that determine changes in costs are:

- changes in volume of prescribing
- changes in cost per unit of volume

The contribution of these factors to the changes in costs for the ten therapeutic groups was explored. Tables have been presented in the order that the therapeutic groups appear in the BNF. Changes in volume of prescribing have been presented in terms of defined daily doses (DDDs) per 1000 patients. One of the limitations of using DDDs for this analysis is that it may not be a particularly good measure where appreciable numbers of prescriptions may be given to children in lower doses than the DDD e.g. penicillin antimicrobial agents. This needs to be remembered when interpreting the results. In addition, for a small number of drugs, the concept of a DDD is inappropriate e.g skin preparations such as creams and ointments where the unit of issue is a tube. In these instances, an estimated DDD has used. Tables showing changes in cost per unit of volume have only been included in those cases where there was a change in costs per DDD between the two years for either intervention practices or controls.

Table 4.18. shows where the relevant tables of results can be found for each of the therapeutic groups.

Table 4.18. Index of tables of results of analysis of "top 10" therapeutic groups

BNF Section	Therapeutic Group	Table	Page
1.3.1	H_2-receptor antagonists	4.19 to 4.20	144-145
1.3.5	Proton pump inhibitors (PPIs)	4.21	146
2.5.4	Alpha-adrenoceptor blocking drugs	4.22 to 4.23	148-149
2.5.5	Angiotensin-converting enzyme inhibitors (ACEIs)	4.24 to 4.25	150-151
2.6.1	Nitrates	4.26 to 4.27	152-153
3.1.1	Adrenoceptor stimulants	4.28 to 4.29	156-157
5.1.1	Penicillins	4.30 to 4.31	159-160
5.1.2	Cephalosporins, cephamycins and betalactams	4.32 to 4.33	161-162
5.1.5	Macrolides	4.34 to 4.35	163-164
10.1.1	Non-steroidal anti-inflammatory drugs (NSAIDs)	4.36 to 4.37	166-167
Summary of key findings		**4.51 to 4.52**	**182-183**

4.4.6.1 Changes in prescribing for gastrointestinal drugs

Tables 4.19 and 4.20 show DDDs per 1000 patients and cost per DDD for 1995/6, 1996/7 and the change between the two years for H_2-receptor antagonists.

It can be seen that intervention practices reduced their prescribing volume for H_2-receptor antagonists to a much greater extent than controls. Also, they reduced the cost per DDD to a greater extent, despite having started at a lower base figure. Intervention practices reduced DDDs per 1000 patients for ranitidine, cimetidene, famotidine and algitec, while increasing the volume of nizatidine prescribed. Similar changes were seen for control practices but to a lesser extent.

Table 4.21 shows DDDs per 1000 patients for 1995/6, 1996/7 and the change between the two years for proton pump inhibitors. It can be seen that intervention practices increased the number of proton pump inhibitor DDDs per 1000 patients by 653 (12%). However, this increase was offset by a reduction of 903 in the

number of H_2-receptor antagonist DDDs per 1000 patients (13%). In contrast there were substantial rises in proton pump inhibitor DDDs per 1000 patients for control practices (26%), despite these practices having a smaller reduction for H_2-receptor antagonists (7%).

From Table 4.21 it can be seen that both intervention and control practices substantially increased their use of lansoprazole. Intervention practices, unlike control practices, reduced their overall use of omeprazole preparations. This was achieved by reducing their use of 20mg omeprazole (treatment dose) by 1 352 DDDs per 1000 patients (35%). Overall, there were no changes in costs for intervention or control practices.

It would therefore seem that the main differences in costs for gastro-intestinal drugs arose from differences in prescribing volume and greater use of maintenance doses of omeprazole in intervention practices.

Table 4.19. Change in prescribing volume for H_2-receptor antagonists between 1995/6 and 1996/7

Drug	DDDs per 1000 patients							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Algitec	6	2	-4	-74.1	16	10	-6	-39.3
Cimetidine	1 420	1 214	-206	-14.0	1 436	1 295	-141	-9.8
Famotidine	185	108	-77	-41.5	181	168	-13	-7.2
Nizatidine	719	1 165	446	62.0	591	791	200	33.9
Ranitidine	4 608	3 546	-1 062	-23.0	5 333	4 797	-536	-10.0
OVERALL	**6 938**	**6 035**	**-903**	**-13.0**	**7 557**	**7 062**	**-495**	**-6.6**

Table 4.20. Change in cost (£) per unit of volume for H_2-receptor antagonists between 1995/6 and 1996/7

Drug	Cost (£) per DDD							
	Intervention practices				Controls			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Algitec	0.89	0.84	-0.05	-5.5	0.84	0.86	0.02	2.4
Cimetidine	0.27	0.28	0.01	1.8	0.28	0.29	0.01	3.7
Famotidine	0.96	0.96	0.00	0.0	0.97	0.97	0.00	0.0
Nizatidine	0.75	0.75	0.00	0.0	0.75	0.75	0.00	0.0
Ranitidine	0.94	0.92	-0.02	-2.3	0.94	0.91	-0.03	-2.7
OVERALL	**0.78**	**0.75**	**-0.03**	**-3.7**	**0.80**	**0.78**	**-0.02**	**-2.4**

Table 4.21. Change in prescribing volume for PPIs between 1995/6 and 1996/7

Drug	DDDs per 1000 patients							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Lansoprazole 15mg	75	1 017	941	1 246.8	89	415	325	364.2
Lansoprazole 30mg	851	1 768	917	107.8	936	1 666	730	78.0
Total for lansoprazole	**926**	**2 784**	**1 858**	**200.6**	**1 025**	**2 080**	**1 055**	**103.0**
Omeprazole 10mg	476	560	84	17.6	299	422	123	41.1
Omeprazole 20mg	3 873	2 522	-1 352	-34.9	3 633	3 595	-37	-1.0
Omeprazole 40mg	44	57	13	30.3	139	139	0.6	0.4
Total for omeprazole	**4 393**	**3 138**	**-1 255**	**-28.6**	**4 070**	**4 156**	**86**	**2.1**
Pantoprazole 40mg	0.0	50	50	∞	0.0	203	203	∞
Total for pantoprazole	**0.0**	**50**	**50**	∞	**0.0**	**203**	**203**	∞
OVERALL	**5 319**	**5 973**	**653**	**12.3**	**5 095**	**6 439**	**1 344**	**26.4**

∞ denotes infinity

4.4.6.2 Changes in prescribing for cardiovascular drugs

Changes in prescribing for cardiovascular drugs are presented in Tables 4.22 to 4.27. Details are presented of changes in DDDs per 1000 patients and costs per DDD for different types of drug (and for nitrates, different types of preparation).

Although both groups of practices increased prescribing volume and cost per DDD for alpha-adrenoceptor blocking drugs, intervention practices increased prescribing volume to a lesser extent.

Tables 4.24 and 4.25 show changes in prescribing volume and cost per volume for angiotensin converting enzyme inhibitors (ACEIs). It can be seen that both groups of practices increased prescribing volume, although the percentage increase in DDDs per 1000 patients for intervention practices was twice that for controls. This was offset by a reduction in cost of six pence per DDD.

From Tables 4.26 and 4.27 it can be seen that both intervention and control practices showed an increase in prescribing volume, but decrease in cost per unit volume, for different types of nitrates. Both groups of practices showed reductions in relatively expensive preparations such as glyceryl trinitrate (GTN) patches and sustained release GTN tablets. However, control practices showed a marked rise in the use of modified release isosorbide mononitrate (ISMN), which appeared to be at the expense of the standard isosorbide mononitrate tablets and isosorbide dinitrate (ISDN) preparations. Intervention practices almost doubled their use of GTN spray but reduced the cost per DDD by almost half. Overall, it would seem that intervention practices managed to control the rise in costs of nitrate preparations by reducing the cost per DDD.

It would therefore seem that the main differences in costs for cardiovascular drugs arose from differences in cost per unit volume.

Table 4.22. Change in prescribing volume for alpha-adrenoceptor blocking drugs between 1995/6 and 1996/7

Drug	DDDs per 1000 patients							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Doxazosin	166	251	85	51.1	439	679	240	54.6
Indoramin*	3	1	-2	-63.3	12	3	-9	-76.0
Phenoxybenzamine	3	0.0	-3	-100.0	5	4	-1	-23.1
Phentolam	2	2	0.4	20.2	1	0.0	-1	-100.0
Prazosin	320	267	-54	-16.7	322	294	-28	-8.7
Terazosin	40	46	6	13.9	72	89	18	24.7
OVERALL	**534**	**566**	**32**	**6.0**	**852**	**1 070**	**218**	**25.6**

estimated DDD

Table 4.23. Change in cost (£) per unit of volume for alpha-adrenoceptor blocking drugs between 1995/6 and 1996/7

Drug	Cost (£) per DDD							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Doxazosin	0.89	0.82	-0.07	-7.8	0.88	0.84	-0.04	-4.3
Indoramin*	0.37	0.37	0.00	0.0	0.34	0.37	0.03	8.8
Phenoxybenzamine	2.17	†	†	†	2.17	2.17	0.00	0.0
Phentolam	0.27	0.27	0.00	0.0	0.27	†	†	†
Prazosin	0.19	0.20	0.01	4.9	0.18	0.17	-0.01	-4.5
Terazosin	0.95	0.95	0.00	0.2	0.71	0.76	0.04	6.2
OVERALL	**0.48**	**0.53**	**0.06**	**11.9**	**0.60**	**0.65**	**0.05**	**8.8**

* estimated DDD

† denotes undefined

Table 4.24. Change in prescribing volume for ACEIs between 1995/6 and 1996/7

Drug	DDDs per 1000 patients							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Captopril	3 881	3 148	-733	-18.9	1 991	1 728	-263	-13.2
Cilazapril	5	2	-3	-49.9	288	241	-47	-16.4
Enalapril	3 936	3 990	53	1.4	4 156	3 639	-517	-12.4
Fosinopril	29	103	74	253.2	376	443	67	17.9
Irbesartan	0.0	0.0	0.0	†	0.0	1	1	∞
Lisinopril	2 454	3 429	975	39.7	6 068	7 107	1 039	17.1
Losartan	17	82	65	370.8	181	241	60	33.3
Moexipril	0.0	0.0	0.0	†	0.0	2	2	∞
Perindopril	54	251	197	363.2	276	556	280	101.2
Quinapril	98	169	71	72.8	209	215	6	2.9
Ramipril	372	1 009	637	171.4	340	505	165	48.4
Trandolapril	76	160	83	108.9	253	371	118	46.5
Valsartan	0.0	15	15	∞	0.0	18	18	∞
OVERALL	**10 923**	**12 357**	**1 434**	**13.1**	**14 138**	**15 067**	**928**	**6.6**

∞ denotes infinity
† denotes undefined

Table 4.25. Change in cost (£) per unit of volume for ACEIs between 1995/6 and 1996/7

Drug	Cost (£) per DDD							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Captopril	0.44	0.25	-0.19	-42.54	0.46	0.30	-0.16	-34.54
Cilazapril	0.64	0.60	-0.04	-6.32	0.30	0.30	0.00	-1.41
Enalapril	0.33	0.32	-0.01	-2.95	0.33	0.33	0.00	-1.07
Fosinopril	0.62	0.51	-0.11	-17.76	0.48	0.49	0.01	1.53
Irbesartan	†	†	†	†	†	0.62	0.62	†
Lisinopril	0.41	0.40	-0.01	-2.32	0.36	0.36	0.00	-0.52
Losartan	0.65	0.70	0.05	7.03	0.67	0.70	0.03	4.61
Moexipril	†	†	†	†	†	0.61	0.61	†
Perindopril	0.54	0.53	-0.01	-2.73	0.50	0.50	0.01	1.17
Quinapril	0.34	0.32	-0.01	-3.84	0.44	0.47	0.03	7.20
Ramipril	0.20	0.20	0.00	-1.93	0.20	0.21	0.00	1.29
Trandolapril	0.56	0.51	-0.05	-9.12	0.55	0.51	-0.04	-7.46
Valsartan	0.00	0.57	0.57	∞	†	0.62	0.62	†
OVERALL	**0.39**	**0.33**	**-0.06**	**-15.80**	**0.37**	**0.36**	**-0.02**	**-4.38**

∞ denotes infinity
† denotes undefined

Table 4.26. Change in prescribing volume for nitrates between 1995/6 and 1996/7

Preparation	DDDs per 1000 patients							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
GTN patches	441	433	-8	-1.8	667	572	-96	-14.4
GTN spray	700	1 387	687	98.2	1 265	1 307	42	3.3
GTN tablets (S/R)	248	193	-55	-22.1	167	156	-12	-6.9
GTN tablets (not S/R)	297	263	-35	-11.7	251	219	-32	-12.8
GTN Ointment*	0.0	24	24	∞	14	29	14	102.5
ISDN tablets (S/R)	15	16	0.2	1.8	40	22	-19	-46.3
ISDN tablets (not S/R)	231	160	-71	-30.8	273	230	-43	-15.9
ISMN tablets (S/R)	7 616	8 023	407	5.3	8 502	9 958	1 456	17.1
ISMN tablets (not S/R)	1 554	1 761	207	13.3	1 386	1 127	-258	-18.6
ISMN spray	2	2	0.2	16.4	9	8	-1	-15.6
PTTN	50	39	-11	-21.6	5	4	-2	-31.6
OVERALL	**11 154**	**12 299**	**1 146**	**10.3**	**12 580**	**13 629**	**1 049**	**8.3**

* estimated DDD

∞ denotes infinity

Key to table

GTN	glyceryl trinitrate
ISDN	isosorbide dinitrate
ISMN	isosorbide mononitrate
PTTN	pentaerythritol tetranitrate

Table 4.27. Change in cost (£) per unit of volume for nitrates between 1995/6 and 1996/7

Preparation	Cost (£) per DDD							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
GTN patches	0.43	0.40	-0.03	-6.8	0.40	0.42	0.02	4.3
GTN spray	0.46	0.22	-0.24	-52.2	0.23	0.23	0.00	0.4
GTN tablets (S/R)	0.22	0.21	-0.01	-5.0	0.19	0.19	0.01	3.5
GTN tablets (not S/R)	0.03	0.08	0.04	122.4	0.04	0.08	0.04	99.1
GTN Ointment*	†	0.03	0.03	†	0.01	0.01	0.00	0.0
ISDN tablets (S/R)	0.22	0.21	-0.01	-4.9	0.21	0.20	-0.01	-5.2
ISDN tablets (not S/R)	0.08	0.06	-0.01	-16.2	0.07	0.06	-0.01	-15.8
ISMN tablets (S/R)	0.26	0.27	0.00	0.7	0.27	0.27	0.00	0.0
ISMN tablets (not S/R)	0.11	0.05	-0.06	-52.0	0.11	0.08	-0.03	-24.3
ISMN spray	1.03	1.03	0.00	0.0	1.03	1.03	0.00	0.0
PTTN	0.05	0.05	0.00	0.0	0.19	0.19	0.00	0.00
OVERALL	**0.25**	**0.20**	**-0.05**	**-19.3**	**0.24**	**0.25**	**0.01**	**4.1**

* estimated DDD

† denotes undefined

Key to table

GTN	glyceryl trinitrate
ISDN	isosorbide dinitrate
ISMN	isosorbide mononitrate
PTTN	pentaerythritol tetranitrate

4.4.6.3 Changes in prescribing for respiratory drugs

Changes in prescribing for respiratory drugs are presented in Table 4.28. Details are presented of DDDs per 1000 patients for 1995/6, 1996/7 and the change between the two years for:

- beta-2 adrenoceptor stimulants
- different types of salbutamol preparations

The reason for looking at different types of preparation was because it is recognised that certain drug delivery systems are much more expensive than others.

Beta-2 adrenoceptor stimulants

Table 4.28 shows changes in DDDs per 1000 patients for different beta-2 adrenoceptor stimulants. Salbutamol preparations accounted for the vast majority of prescribing in this therapeutic group, followed by salmeterol and terbutaline.

It can be seen that intervention practices reduced prescribing volume for salbutamol and terbutaline and only slightly increased prescribing volume for salmeterol preparations. However, there was a marked increase in the use of Eformoterol. Control practices also managed to reduce prescribing volume for salbutamol and terbutaline (but to a lesser extent) and, despite increasing their use of salmeterol to a greater extent than intervention practices, managed to reduce their overall volume of prescribing by almost three per cent. In contrast to control practices, intervention practices managed to reduce costs per DDD for salbutamol and salmeterol preparations and overall, reduced their costs per DDD for beta-2 adrenoceptor stimulants by 1 pence.

Different types of salbutamol preparations

Table 4.29 shows changes in prescribing volume salbutamol preparations. It can be seen that intervention practices managed to reduce prescribing volume for the

more expensive breath-actuated and dry powder inhalers to a greater extent than controls and this was reflected in a slight decrease in cost per DDD.

Table 4.28. Change in prescribing volume for adrenoceptor stimulants between 1995/6 and 1996/7

Drug	DDDs per 1000 patients							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Bambuterol	16	15	-1.4	-8.7	7.6	5.4	-2.2	-29.1
Eformoterol*	1 285	5 083	3 797	295.5	277	673	396	143.0
Ephedrine HCl	0.0	0.0	0.0	†	12	20	8.5	72.4
Fenoterol	32	29	-3.0	-9.4	14	14	0.17	1.2
Isoprenaline	157	251	94	59.8	217	301	85	39.0
Orcipren	72	78	6.0	7.8	268	282	14	5.2
Pirbuterol	8.9	8.4	-0.5	-6.1	19	16	-2.9	-15.2
Reproterol*	2.0	2.0	0.0	0.0	0.5	0.00	-0.5	-100.0
Rimiterol	6.3	10	3.7	60.2	5.3	1.8	-3.5	-66.3
Salbutamol	28 736	24 858	-3 878	-13.5	35 380	33 058	-2 322	-6.6
Salmeterol	6 256	6 362	106	1.7	4 907	5 585	679	13.8
Terbutaline	2 054	1 730	-324	-15.8	2 242	2 189	-53	-2.3
OVERALL	**38 625**	**38 426**	**-199**	**-0.5**	**43 349**	**42 145**	**-1 204**	**-2.8**

* estimated DDD

† denotes undefined

Table 4.29. Change in prescribing volume for salbutamol preparations between 1995/6 and 1996/7

Preparation	DDDs per 1000 patients							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Standard aerosol inhaler	10 036	10 473	437	4.4	10 053	10 250	197	2.0
Breath actuated inhaler	375	141	-234	-62.4	148	116	-32	-21.6
Dry powder inhaler	15 443	12 322	-3 121	-20.2	22 542	20 618	-1 924	-8.5
Nebuliser preparation	1 723	954	-770	-44.7	1 591	1 178	-413	-25.9
Oral preparations	1 159	968	-191	-16.5	1 046	897	-149	-14.2
OVERALL	**28 736**	**24 858**	**-3 878**	**-13.5**	**35 380**	**33 058**	**-2 322**	**-6.6**

4.4.6.4 Changes in prescribing for drugs used for infections

Penicillins

Tables 4.30 and 4.31 show DDDs per 1000 patients and cost per DDD for 1995/6, 1996/7 and the change between the two years for penicillins. It can be seen that both intervention and control practices decreased prescribing volume for penicillins, although intervention practices decreased prescribing volume to a slightly lesser extent. However, intervention practices showed a marked reduction in cost per DDD (16%).

Cephalosporins, cephamycins and other beta-lactam antibiotics

Tables 4.32 and 4.33 show DDDs per 1000 patients and cost per DDD for 1995/6, 1996/7 and the change between the two years for cephalosporins and related antimicrobial agents. It can be seen that although intervention practices increased prescribing volume in contrast to control practices, which reduced prescribing volume, there was a substantial reduction in cost per DDD for the intervention practices (14%).

Macrolides

Tables 4.34 and 4.35 show changes in DDDs per 1000 patients and cost per DDD for macrolide antimicrobial agents. It can be seen that intervention practices managed to reduce prescribing volume relative to control practices, and control the rise in costs per DDD for macrolides to a slightly greater extent.

Table 4.30. Change in prescribing volume for penicillin antimicrobial agents between 1995/6 and 1996/7

Drug	DDDs per 1000 patients							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Amoxycillin	1 934	1 934	0.45	0.02	2370	2182	-188	-7.9
Ampicillin	10	19	8.6	82.9	5.6	4.6	-1.0	-18.2
Cloxacillin	0.0	0.0	0.0	†	0.04	0.00	-0.04	-100.0
Co-amoxiclav	312	188	-124	-39.8	226	211	-14	-6.4
Co-fluampicil	29	26	-3	-8.9	24	19	-5.7	-23.5
Fluclox	201	230	29	14.3	240	257	16	6.8
Penicillin	282	272	-10	-3.5	314	327	12	3.9
Pivampic	0.0	0.0	0.0	†	0.44	0.50	0.06	13.9
Ticaricillin	0.3	0.0	-0.3	-100.0	0.0	0.0	0.0	†
OVERALL	**2 768**	**2 669**	**-99**	**-3.6**	**3 181**	**3 000**	**-181**	**-5.7**

† denotes undefined

Table 4.31. Change in cost (£) per unit of volume for penicillin antimicrobial agents between 1995/6 and 1996/7

Drug	Cost (£) per DDD							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Amoxycillin	**0.21**	**0.18**	**-0.03**	**-14.4**	0.25	0.24	-0.02	-7.2
Ampicillin	0.32	0.33	0.01	2.7	0.44	0.55	0.11	24.2
Cloxacillin	†	†	†	†	1.42	n/a	n/a	n/a
Co-amoxiclav	1.69	1.85	0.16	9.8	1.69	1.84	0.15	8.9
Co-fluampicil	2.28	2.21	-0.08	-3.4	2.47	2.44	-0.02	-0.9
Fluclox	0.85	0.85	0.01	0.8	0.87	0.85	-0.01	-1.6
Penicillin	0.23	0.22	-0.01	-6.0	0.23	0.20	-0.02	-10.2
Pivampic	†	†	†	†	0.84	0.84	0.00	0.0
Ticaricillin	63.00	†	†	†	†	†	†	†
OVERALL	**0.46**	**0.38**	**-0.07**	**-15.3**	**0.42**	**0.41**	**-0.01**	**-2.3**

† denotes undefined

Table 4.32. Change in prescribing volume for cephalosporins between 1995/6 and 1996/7

Drug	DDDs per 1000 patients							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Cefaclor	809	868	58	7.2	574	574	-0.02	0.003
Cefadroxil	0.06	0.01	-0.05	-78.5	4.4	5.6	1.2	27.2
Cefixime	67	57	-10	-14.5	27	24	-3.0	-11.0
Cefotaxime	0.3	0.0	-0.3	-100.0	0.7	0.0	-0.7	-100.0
Cefpodoxime	0.9	0.3	-0.6	-66.8	5.0	0.9	-4.1	-81.9
Ceftibufen	12	5.3	-6.7	-56.4	4.2	0.0	-4.2	-100.0
Cefuroxime	151	106	-45	-29.6	25	21	-3.9	-15.6
Cephalexin	290	171	-119	-40.9	111	109	-2.0	-1.8
Cephradine	1330	1208	-122	-9.2	216	161	-55	-25.4
OVERALL	**809**	**868**	**58**	**7.2**	**968**	**897**	**-72**	**-7.4**

Table 4.33. Change in cost (£) per unit of volume for cephalosporins between 1995/6 and 1996/7

Drug	Cost (£) per DDD							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Cefaclor	1.05	0.90	-0.15	-13.9	0.81	0.83	0.02	2.4
Cefadroxil	1.13	2.33	1.20	106.8	1.72	1.53	-0.19	-10.9
Cefixime	2.77	2.85	0.09	3.1	2.89	2.92	0.03	1.2
Cefotaxime	4.17	†	†	†	19.40	†	†	†
Cefpodoxime	2.61	2.83	0.22	8.5	3.70	3.70	0.00	0.0
Ceftibufen	1.35	1.35	0.00	0.2	3.11	†	†	†
Cefuroxime	0.78	0.90	0.11	14.6	1.12	1.24	0.12	10.8
Cephalexin	1.34	1.37	0.03	2.2	0.85	0.87	0.02	2.5
Cephradine	1.17	1.06	-0.11	-9.4	1.13	1.25	0.12	10.7
OVERALL	**1.05**	**0.90**	**-0.15**	**-13.9**	**1.00**	**0.98**	**-0.01**	**-1.1**

† denotes undefined

Table 4.34. Change in prescribing volume for macrolide antimicrobial agents between 1995/6 and 1996/7

Drug	DDDs per 1000 patients							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Azithromycin	4.0	4.6	0.6	16.4	23	20	-3.0	-12.9
Clarithromycin	230	243	13	5.6	353	420	67	18.9
Erythromycin	1 143	1 083	-60	-5.2	1 992	1 987	-4.5	-0.2
OVERALL	**1 377**	**1 331**	**-46**	**-3.4**	**2 368**	**2 427**	**59**	**2.5**

Table 4.35. Change in cost (£) per unit of volume for macrolide antimicrobial agents between 1995/6 and 1996/7

Drug	Cost (£) per DDD							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Azithromycin	2.66	2.62	-0.04	-1.5	2.65	2.66	0.01	0.4
Clarithromycin	1.30	1.34	0.04	3.2	1.19	1.23	0.05	3.9
Erythromycin	0.35	0.33	-0.02	-4.7	0.28	0.30	0.01	5.1
OVERALL	**0.51**	**0.52**	**0.01**	**2.0**	**0.44**	**0.48**	**0.04**	**8.6**

4.4.6.5 Changes in prescribing for musculoskeletal drugs

Oral NSAIDs

Tables 4.36 and 4.37 show changes in DDDs per 1000 patients and cost per DDD for oral NSAIDs. Less commonly used drugs have been grouped together into an "others" category. It can be seen that while intervention practices slightly increased their prescribing volume, control practices showed a very slight reduction. However, intervention practices managed to control or reduce costs per DDD for all of the most commonly used NSAIDs to a greater extent than control practices.

Table 4.36. Change in prescribing volume for specific NSAIDs between 1995/6 and 1996/7

Drug	DDDs per 1000 patients							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Aceclofenac	13	74	61	480.8	127	509	382	301.3
Diclofenac	5 097	5 674	577	11.3	4 824	5 266	442	9.2
Etodolac	41	45	4	9.0	452	346	-106	-23.4
Ibuprofen	3 669	3 822	153	4.2	4 003	3 909	-94	-2.3
Indomethacin	714	627	-87	-12.2	647	631	-16	-2.5
Ketoprofen	491	436	-55	-11.2	593	460	-133	-22.5
Mefenamic acid	5 947	5 203	-744	-12.5	3 594	3 461	-133	-3.7
Meloxicam	0.0	172	172	∞	0.0	510	510	∞
Nabumetone	3 057	3 863	806	26.4	1 243	1 274	31	2.5
Naproxen	4 100	3 926	-174	-4.3	2 516	2 013	-503	-20.0
Piroxicam	503	416	-87	-17.2	464	402	-62	-13.5
Tiaprofenic	723	591	-132	-18.2	552	401	-151	-27.4
Others *	1 028	901	-127	-12.4	1 036	835	-201	-19.4
OVERALL	**25 382**	**25 750**	**368**	**1.5**	**20 051**	**20 016**	**-36**	**-0.18**

* others includes NSAIDs that individually accounted for < 1% of total NSAID DDDs per 1000 patients in either group

∞ denotes infinity

Table 4.37. Change in cost (£) per unit of volume for specific NSAIDs between 1995/6 and 1996/7

Drug	Cost (£) per DDD							
	Intervention practices				Control practices			
	1995/6	1996/7	Change	% Change	1995/6	1996/7	Change	% Change
Aceclofenac	0.50	0.50	0.00	0.0	0.50	0.50	0.00	0.0
Diclofenac	0.34	0.30	-0.04	-10.8	0.35	0.35	0.00	0.0
Etodolac	0.34	0.34	0.00	0.0	0.34	0.34	0.00	0.0
Ibuprofen	0.08	0.07	-0.01	-15.8	0.12	0.11	-0.01	-6.1
Indomethacin	0.20	0.18	-0.02	-9.1	0.18	0.18	0.00	0.0
Ketoprofen	0.42	0.40	-0.02	-4.3	0.42	0.42	0.00	0.2
Mefenamic acid	0.02	0.02	0.00	0.0	0.02	0.02	0.00	-4.6
Meloxicam	†	0.62	†	†	†	0.57	†	†
Nabumetone	0.06	0.06	0.00	0.0	0.06	0.06	0.00	0.0
Naproxen	0.20	0.18	-0.03	-12.6	0.21	0.19	-0.02	-7.85
Piroxicam	0.24	0.24	-0.01	-3.9	0.21	0.22	0.01	6.94
Tiaprofenic	0.57	0.57	0.00	0.0	0.57	0.57	0.00	0.00
Others *	0.43	0.42	-0.01	-1.9	0.46	0.45	-0.01	-2.50
OVERALL	**0.18**	**0.17**	**-0.01**	**-6.1**	**0.22**	**0.22**	**0.007**	**3.3**

* others includes NSAIDs that individually accounted for < 1% of total NSAID DDDs per 1000 patients in either group

† denotes undefined

4.4.7 Changes in potential generic savings

As explained earlier, using Optimise software it is possible to calculate the potential savings that could be made through generic substitution of brand-named products. Section 4.4.3 showed that intervention practices reduced their potential for making generic savings between 1995/6 and 1996/7 by almost 40%, while control practices slightly increased their potential (by almost three per cent). The ways in which a practice could reduce its potential generic savings between two years are as follows:

- substitution of brand-named drugs with generics where these are:
  - available and
  - cheaper that the brand-named product

- prescribing less of the brand-named drug (where a cheaper generic was available)

Therefore, in order to work out how practices changed their potential for making generic saving, it was important to explore the changes in detail.

This section presents:

- changes in potential generic savings for intervention and control practices (Tables 4.38 to 4.39):

  - listing top 20 changes in potential generic savings between 1995/6 and 1996/7
  - showing totals for these "top 20" changes in potential generic savings
  - showing totals for other changes in potential generic savings
  - showing "grand totals" for changes in potential generic savings

- changes in prescribing volume for drugs where there was a decrease in costs for specific brand-named preparations (Tables 4.40 to 4.49):

  - changes in volume for specific brand-named preparations from the list of "top 20" changes in intervention practices
  - changes in volume for other brand-named preparations of the same drug (equivalent formulation and dose)
  - changes in volume for generic preparations of the same drug (equivalent formulation and dose)

From this information it was possible to identify how the practices managed to change their potentials for making generic savings and the key findings for intervention practices are summarised in Table 4.53.

4.4.7.1 Changes in potential generic savings

Table 4.38 shows a list of the brand-named drugs where there was the greatest change in potential for making generic savings between 1995/6 and 1996/7 for intervention practices. It can be seen that the "top 10" changes were particularly marked and were responsible for 84% of the total change in potential generic savings.

It should be noted that the potential for making generic savings was slightly greater in 1996/7 than 1995/6 for brand-named preparations outside the "top 20". This was a result of either an increase in volume for these brands, or an increase in cost per unit volume of the brands (without a substantial reduction in overall volume).

Table 4.38. Changes in potential generic savings* for intervention practices between 1995/6 and 1996/7 (with details of "top 20" savings)

Brand-named preparations	Potential generic saving per 1000 patients (£)		
	1995/6	1996/7	Change
Becloforte inhaler 250mcg (200 metered doses)	142	47	-96
Becotide 100 inhaler (100mcg) 200 metered dose	125	51	-74
Ventolin inhaler (200 metered doses)	82	23	-59
Voltarol tablets 50mg	78	22	-55
Adalat tablets (10mg)	31	0	-31
Nitrolingual spray 400mcg (200 metered dose)	29	4	-25
Colofac tablets (135mg)	40	15	-24
Voltarol tablets (25mg)	26	3	-23
Triludan tablets (60mg)	28	10	-18
Tagamet tablets (400mg)	23	6	-18
Subtotal for "top 10"	**604**	**181**	**-423**
Zyloric 300 tablets (300mg)	26	9	-16
Moduretic tablets	27	11	-16
Frumil tablets	31	18	-14
Stemetil tablets (5mg)	22	9	-13
Ponstan Forte tablets (500mg)	27	15	-13
Amoxil SF paediatric suspension (125/5ml)	14	2	-13
Tenormin (LS) tablets (50mg)	24	14	-10
Prothiaden tablets (75mg)	19	9	-10
Amoxil capsules 250mg	15	4	-10
Minocin 50 tablets (50mg)	16	6	-10
Totals for "top 20"	**826**	**277**	**-548**
Totals for other potential generic savings (= 175 preparations)	**445**	**487**	**42**
Grand total for potential generic savings	**1 271**	**764**	**-506**

* a potential generic saving is the amount of money that could have been saved if a brand-named preparation had been prescribed generically. A reduction in potential generic savings suggests that a practice has either made generic switches, or that it has stopped prescribing a drug. An increase in potential generic savings suggests that a practice has increased costs for a brand-named preparation. Reasons for this increase may be:

a) increased cost per tablet

b) increased volume of prescribing of the brand-named preparation.

Table 4.39 shows a list of the brand-named drugs where there was the greatest change in potential for making generics savings between 1995/6 and 1996/7 for control practices. With the exception of Becloforte, there was considerable overlap between the list of "top 20" changes for intervention and control practices, although the magnitude of the changes was less for controls.

Once again it should be noted that the potential for making generic savings was slightly greater in 1996/7 than 1995/6 for brand-named preparations outside the "top 20" for the reasons explained at the beginning of section 4.4.7.1.

Table 4.39. Changes in potential generic savings* for control practices between 1995/6 and 1996/7 (with details of "top 20" savings)

Brand-named preparations	Potential generic saving per 1000 patients (£)		
	1995/6	1996/7	Change
Becotide 100 inhaler (100mcg) 200 metered dose	71	44	-27
Adalat tab (10mg)	27	0	-27
Ventolin inhaler (200 metered doses)	64	39	-26
Nordox capsules (100mg) compliance pack	22	2	-20
Frumil tablets	48	29	-19
Nitrolingual spray (400mcg) 200 metered dose	23	4	-18
Tagamet tablets (400mg)	47	32	-15
Triludan tablets (60mg)	24	11	-14
Amoxil capsules (250mg)	78	67	-11
Amoxil capsules (500mg)	54	44	-10
Subtotals for "top 10"	**458**	**272**	**-187**
Floxapen capsules (250mg)	25	15	-10
Amoxil SF paediatric suspension (125/5ml)	37	28	-9
Erythroped granules for suspension (250mg/5ml)	43	36	-8
Colofac tablets (135mg)	41	34	-7
Voltarol tablets 50mg	82	75	-7
Volraman tablets (50mg)	10	3	-7
Minocin 50 tablets (50mg)	12	6	-6
Moduretic tablets	35	29	-6
Hypovase tablets (5mg)	4	-2	-6
Epilim 200 tablets E/C (200mg)	11	5	-5
Totals for "top 20"	**759**	**499**	**-260**
Totals for other potential generic savings (= 189 preparations)	**723**	**1022**	**299**
Grand total for potential generic savings	**1 482**	**1521**	**39**

* a potential generic saving is the amount of money that could have been saved if a brand-named preparation had been prescribed generically. A reduction in potential generic savings suggests that a practice has either made generic switches, or that it has stopped prescribing a drug. An increase in potential generic savings suggests that a practice has increased costs for a brand-named preparation. Reasons for this increase may be:

a) increased cost per tablet

b) increased volume of prescribing of the brand-named preparation.

4.4.7.2 Changes in prescribing volume for specific brand-named preparations

Tables 4.40 to 4.49 show changes in prescribing volume for the "top 10" drugs where there were reductions in costs of a brand-named preparation between 1995/6 and 1996/7 for intervention practices (Table 4.38). As explained above, it was possible to see whether practices changed prescribing volume for these preparations. Also, it was possible to see whether there were changes in brand-named or generic drugs of the same dose and formulation.

Table 4.40 shows that intervention practices switched from Becloforte inhalers to a mixture of alternative brand-named inhalers (mainly Beclazone) and generic inhalers. Control practices switched mainly from generic inhalers to Becloforte and alternative brand-named inhalers. Table 4.41 shows a similar picture for beclomethasone 100mcg inhalers in the intervention practices, although control practices did manage to control their use of Becotide 100, switching mainly to other brand-named inhalers.

Table 4.40. Change in volume of beclomethasone 250mcg inhalers (200 metered doses)

Preparation type	Inhalers per 1000 patients			
	1995/6	1996/7	Change	% Change
Intervention practices				
Becloforte inhaler	28	9	-19	-67.8
Other brand-named inhalers	1	4	3	295.6
Generic inhalers	14	21	7	48.9
TOTAL	**43**	**34**	**-9**	**-21.0**
Control practices				
Becloforte inhaler	17	21	3	18.1
Other brand-named inhalers	10	14	4	39.3
Generic inhalers	23	16	-7	-30.6
TOTAL	**50**	**51**	**1**	**2.1**

Table 4.41. Change in volume of beclomethasone 100mcg inhalers (200 metered doses)

Preparation type	Inhalers per 1000 patients			
	1995/6	1996/7	Change	% Change
Intervention practices				
Becotide inhaler	60	24	-36	-59.9
Other brand-named inhalers	6	10	4	65.8
Generic inhalers	44	57	13	29.4
TOTAL	**110**	**91**	**-19**	**-17.3**
Control practices				
Becotide inhaler	34	21	-13	-38.3
Other brand-named inhalers	11	17	6	53.9
Generic inhalers	40	40	-0.5	-1.2
TOTAL	**85**	**78**	**-7**	**-8.8**

Table 4.42 shows that for intervention practices, reductions in the prescribing of Ventolin were mainly substituted by increases in alternative brand-named inhalers, namely Salamol Easi-breathe. Control practices mainly switched from Ventolin to generic inhalers.

Table 4.42. Change in volume of salbutamol 100mcg inhalers (200 metered doses)

Preparation type	Inhalers per 1000 patients			
	1995/6	1996/7	Change	% Change
Intervention practices				
Ventolin inhalers	142	46	-96	-67.7
Other brand-named inhalers	4	63	59	1 474.1
Generic inhalers	236	242	6	2.4
TOTAL	**382**	**351**	**-31**	**-8.1**
Control practices				
Ventolin inhalers	111	77	-34	-30.6
Other brand-named inhalers	75	75	0.3	0.4
Generic inhalers	193	219	26	13.5
TOTAL	**379**	**371**	**-8**	**-2.1**

Tables 4.43 and 4.44 show that generic substitution was the major factor in reducing potential generic savings for Volterol 50mg and Volterol 25mg tablets in the intervention practices.

Table 4.43. Change in volume of diclofenac 50mg tablets

Preparation type	Tablets per 1000 patients			
	1995/6	1996/7	Change	% Change
Intervention practices				
Voltarol 50mg tab	631	226	-405	-64.2
Other brand-named preparations	1.5	2.3	0.8	53.3
Generic preparations	2 193	4 342	2 149	98.0
TOTAL	**2 826**	**4 570**	**1 745**	**61.7**
Control practices				
Voltarol 50mg tab	664	757	93	14.0
Other brand-named preparations	99	39	-60	-60.9
Generic preparations	1 599	2 194	595	37.2
TOTAL	**2 362**	**2 990**	**628**	**26.5**

Table 4.44. Change in volume of diclofenac 25mg tablets

Preparation type	Tablets per 1000 patients			
	1995/6	1996/7	Change	% Change
Intervention practices				
Voltarol 25mg tab	436	70	-366	-83.9
Other brand-named preparations	0.0	0.0	0.00	†
Generic preparations	886	1 259	373	42.1
TOTAL	**1 322**	**1 329**	**7**	**0.5**
Control practices				
Voltarol 25mg tab	173	147	-26	-15.2
Other brand-named preparations	1.3	0.00	-1.3	-100.0
Generic preparations	988	1 193	205	20.8
TOTAL	**1 162**	**1 340**	**178**	**15.3**

† denotes undefined

Table 4.45 shows that there was an overall reduction in prescribing volume of nifedipine 10mg tablets for both groups of practices. Intervention practices appeared to switch from generic nifedipine to "other brand-named preparations", specifically Tensipine.

Table 4.45. Change in volume of nifedipine 10mg tablets

Preparation type	Tablets per 1000 patients			
	1995/6	1996/7	Change	% Change
Intervention practices				
Adalat 10mg tab	997	618	-379	-38.0
Other brand-named preparations	0.9	364	363	40 366.7
Generic preparations	1 102	605	-497	-45.1
TOTAL	**2 100**	**1 587**	**-513**	**-24.5**
Control practices				
Adalat 10mg tab	880	743	-137	-15.5
Other brand-named preparations	0.0	1.3	1.3	∞
Generic preparations	1 536	1 157	-379	-24.7
TOTAL	**2 416**	**1 901**	**-515**	**-21.3**

∞ denotes infinity

Table 4.46 shows that there was no real reduction in prescribing volume for GTN spray in intervention practices, and that switches were being made from Nitrolingual spray to a mixture of other brand-named products and generics.

Table 4.46. Change in volume of glyceryl trinitrate 400mcg spray (200 metered doses)

Preparation type	Aerosol sprays per 1000 patients			
	1995/6	1996/7	Change	% Change
Intervention practices				
Nitrolingual spray	43	20	-23	-54.4
Other brand-named preparations	10	24	14	145.5
Generic preparations	34	43	9	24.4
TOTAL	**87**	**87**	**0.0**	**0.0**
Control practices				
Nitrolingual spray	39	38	-1	-1.3
Other brand-named preparations	19	20	1	3.6
Generic preparations	21	23	2	11.0
TOTAL	**79**	**81**	**2**	**2.7**

Table 4.47 shows that both intervention and control practices reduced their use of Colofac 135mg tablets by switching to generic preparations.

Table 4.47. Change in volume of mebeverine hydrochloride 135mg tablets

Preparation type	Tablets per 1000 patients			
	1995/6	1996/7	Change	% Change
Intervention practices				
Colofac 135mg	1 672	690	-982	-58.7
Other brand-named preparations	0.0	0.0	0.0	†
Generic preparations	1 387	2 463	1 076	77.6
TOTAL	**3 059**	**3 153**	**94**	**3.1**
Control practices				
Colofac 135mg	1 714	1 499	-215	-12.6
Other brand-named preparations	0.0	0.0	0.0	†
Generic preparations	1 049	1 531	482	46.0
TOTAL	**2 763**	**3 030**	**267**	**9.7**

† denotes undefined

Table 4.48 shows that both intervention and control practices reduced their prescribing volume for Terfenadine 60mg by substantially reducing prescribing of Triludan 60mg tablets as well as reducing other brand-named and generic preparations.

Table 4.48. Change in volume of Terfenadine 60mg tablets

Preparation type	Tablets per 1000 patients			
	1995/6	1996/7	Change	% Change
Intervention practices				
Triludan 60mg tablets	863	285	-578	-67.0
Other brand-named preparations	1	0.0	-1	-100.0
Generic preparations	821	741	-80	-9.7
TOTAL	**1 685**	**1 026**	**-659**	**-39.1**
Control practices				
Triludan 60mg tablets	758	3 14	-444	-58.5
Other brand-named preparations	11	0.0	-11	-100.0
Generic preparations	1 259	776	-483	-38.3
TOTAL	**2 028**	**1 090**	**-938**	**-46.2**

Table 4.49 shows that the major factor in reducing potential generic savings for Tagamet was an overall reduction in prescribing volume.

Table 4.49. Change in volume of cimetidine 400mg tablets

Preparation type	Tablets per 1000 patients			
	1995/6	1996/7	Change	% Change
Intervention practices				
Tagamet 400mg tablets	90	22	-68	-75.3
Other brand-named preparations	0.0	0.0	0.0	†
Generic preparations	2 366	2 122	-244	-10.3
TOTAL	**2 456**	**2 144**	**-312**	**-12.7**
Control practices				
Tagamet 400mg tablets	183	125	-58	-31.3
Other brand-named preparations	2	1	-1	-44.4
Generic preparations	2 381	2 172	-209	-8.8
TOTAL	**2 566**	**2 298**	**-268**	**-10.4**

† denotes undefined

4.4.8 Quality of prescribing

As mentioned in section 4.3.7, analysis of Level 3 PACT data was used as a proxy measure for prescribing quality. From Table 4.50 it can be seen that intervention practices increased their prescribing costs per 1000 patients for lipid-lowering drugs, inhaled corticosteroids and hormone replacement therapy, which implies that they did not try to cut back on the prescribing of these drugs. They decreased their prescribing costs for drugs of limited therapeutic value, antimicrobial agents and NSAIDs, areas where it has been suggested that GPs may "over-prescribe" (Audit Commission, 1994). They also managed to reduce prescribing costs for selected modified release products and potential generic savings, and control the rise in costs for selected combination products, which implies that the practices were reducing prescribing costs in areas where it has been suggested that savings might be made without detriment to patient care (Audit Commission, 1994).

Table 4.50. Analysis of changes in prescribing costs for intervention practices as a proxy measure for prescribing quality.

Therapeutic Group	Total cost (£) per 1000 patients				
	Year 1	Year 2	Change	% change	Table*
Has prescribing increased for:					
Lipid-lowering drugs	908	1 787	880	96.9	4.10
Inhaled corticosteroids	7 490	7 500	9.1	0.1	4.11
Hormone replacement therapy	2 437	2 609	172	7.1	4.6
Has prescribing been controlled or decreased for:					
Drugs of limited therapeutic value	510	436	-74	-14.5	4.5
Antimicrobial agents	4 665	4 063	-602	-12.9	4.13
NSAIDs	4 527	4 281	-245	-5.4	4.16
Has prescribing been controlled or decreased for:					
Potential generic savings	1 271	764	-507	-39.9	4.4
Combination products	3 818	3 845	27	0.7	4.5
Modified release products	4 944	4 701	-243	-4.9	4.5

*This column gives the table in which further details can be found, including comparisons with controls

4.5 SUMMARY OF MAIN FINDINGS

4.5.1 Changes in overall prescribing variables

The percentage increase in total costs per 1000 patients for the control practices was almost twice that for the intervention practices. Although the percentage increase in the number of units (a unit = one tablet or 5mL of a liquid) per 1000 patients was similar in both groups, the percentage change in total cost per unit for the control practices was almost three times that of the intervention practices. This is despite the fact that both groups of practices had similar baseline figures.

Intervention practices had the potential to make savings of almost £1 271 per 1000 patients by switching to generic preparations. They succeeded in making savings of just over £507 per 1000 patients (almost 40%), implying that either they made generic switches or that they stopped prescribing some brand-named drugs altogether. By contrast, the control practices, which started with greater potential for making generic savings, actually increased their potential for making savings by almost three per cent.

4.5.2 Audit Commission type categories

Intervention practices appeared to make savings relative to controls for modified/sustained release preparations, drugs of limited therapeutic value and topical NSAIDs. Relative savings were not apparent for drugs that could be bought over the counter or combination products.

"New and expensive" drugs accounted for the majority of overall costs. Both intervention and control practices increased their costs for this category and it was the category where there were the greatest differences between the two groups of practices in terms of changes in costs. Intervention practices managed to control the increase in costs in certain areas more effectively than the control practices for selected new and expensive drugs, proton pump inhibitors and

SSRIs. Intervention practices did not restrict their increase in costs more than control practices for lipid-lowering drugs or oestrogens and HRT.

4.5.3 Changes in costs at BNF chapter level

Intervention practices managed to reduce costs per 1000 patients for drugs used to treat infections and musculoskeletal diseases (chapters 5 and 10 respectively). For chapters 1 to 3 they managed to control costs (compared with controls), although there were greater increases for chapters 4, 6 and 8.

It was found that ten therapeutic groups were responsible for just over 80% of the difference between the two groups in terms of their changes in costs between 1995/6 and 1996/7. Almost 30% (£1174) of the changes in costs came from ulcer-healing drugs (proton pump inhibitors and H_2-receptor antagonists) alone. This was equivalent to almost 70% and 26% respectively in terms of differences in costs for all drugs in chapters 1 to 6, 8 and 10 of the BNF.

4.5.4 Analysis of therapeutic groups where there were the greatest differences in costs between the two groups of practices

A summary of how intervention and control practices changed their prescribing patterns in the "top 10" specific therapeutic groups is shown in Tables 4.51 to 4.52.

Table 4.51. Summary of how intervention and control practices changed prescribing patterns in specific therapeutic groups for chapters 1 and 2 of the BNF

Therapeutic Group	Intervention practices	Control practices
Chapter 1: Gastro-intestinal system		
• Proton pump inhibitors • H_2-receptor antagonists	• Offset increases in prescribing of PPIs with reductions in H_2-receptor antagonists • Reduced overall costs relative to controls due to differences in prescribing volume	• Substantial increases in prescribing of PPIs accompanied by smaller reductions in H_2-receptor antagonists
Chapter 2: Cardiovascular system		
• Adrenoceptor blocking drugs • Nitrates • Angiotensin-Converting Enzyme Inhibitors	• Increased prescribing volume and costs for adrenoceptor blocking drugs. However, the increase in volume was less than the increase for controls • Increased prescribing for ACEIs and nitrates to greater extent than controls but this was offset by a reduction in costs per DDD • Increased prescribing for expensive GTN preparations but reduced cost of GTN spray per DDD by almost half • Overall managed to control the rise in costs by reducing the cost per DDD	• Increased prescribing volume and costs for adrenoceptor blocking drugs • Increased prescribing volume for ACEIs but managed to reduce costs (to a lesser extent than intervention practices) • Increased prescribing volume and costs for nitrates • Reduced prescribing for expensive GTN preparations • Particularly large increases in ISMN m/r

Table 4.52. Summary of how intervention and control practices changed prescribing patterns in specific therapeutic groups for chapters 3, 5 and 10 of the BNF

Therapeutic Group	Intervention practices	Control practices
Chapter 3: Respiratory system		
• Beta-2 Adrenoceptor Stimulants	• Reduction in prescribing volume of adrenoceptor stimulants • Reduction in the more expensive breath-actuated and dry-powder inhalers	• Substantial decrease in prescribing of adrenoceptor stimulants but without such marked reductions in the more expensive breath-actuated and dry powder inhalers as intervention practices
Chapter 5: Infections		
• Penicillins • Cephalosporins, cephamycins and other beta-lactam antibiotics • Macrolides	• Decrease in prescribing volume for penicillins and substantially reduced costs per DDD • Increase in prescribing volume but marked reduction in cost per DDD for cephalosporins • Reduction in prescribing volume for macrolides • Controlled rise in costs for macrolides relative to controls • Overall managed to control the rise in costs by reducing prescribing volume coupled with reducing costs per DDD	• Reduction in prescribing for penicillins • Reduction in prescribing volume and reduction in cost per DDD for cephalosporins to a greater extent than intervention practices • Increase in volume and cost per DDD for macrolide antimicrobial agents
Chapter 10: Musculoskeletal and joint diseases		
• NSAIDs	• Increase in prescribing of NSAIDs. • Controlled or reduced cost per DDD to a greater extent than controls	• Small decrease in prescribing for NSAIDs • No change in costs

4.5.5 Changes in potential generic savings

Table 4.53 gives an overview of how intervention practices reduced their potential for making generic savings from certain brand-named drugs between 1995/6 and 1996/7. It can be seen that generic substitution was the most important factor for Volterol 50mg, Colofac and Volterol 25mg. It was also an important factor for Becloforte and Becotide 100, but to a lesser extent.

Reduction in overall prescribing volume (for the brand-named drug and all equivalent preparations) was the most important factor for Adalat 10mg, Triludan 60mg and Tagamet 400mg.

Table 4.53. Summary of factors involved in reducing potential generic savings for certain brand-named preparations for intervention practices

Brand-named preparations	Influence of different factors on change in volume of selected brand-named preparations		
	Generic substitution	Substitution with equivalent brands	Reduction in volume for all equivalent preparations
Becloforte inhaler 250mcg (200 metered doses)	++	+	++
Becotide 100 inhaler 100mcg (200 metered doses)	++	+	++
Ventolin inhaler (200 metered doses)	+	+++	++
Voltarol tablets 50mg	+++	0	0
Adalat tablets 10mg	0	+++	+++
Nitrolingual spray 400mcg (200 metered dose)	+	++	0
Colofac tablets 135mg	+++	0	0
Voltarol tablets 25mg	+++	0	0
Triludan tablets 60mg	*	0	+++
Tagamet tablets 400mg	*	0	+++

Importance of influence of different factors:

+++ very important
++ moderate importance
+ minimal importance
0 no importance
* reduced generic prescribing, but by less than the reduction in brand-named prescribing. Therefore, proportion of drugs prescribed generically increased

4.5.6 Quality of prescribing

In order to give an impression of whether quality of prescribing had been maintained or improved in the intervention practices, the following questions were explored using the results of the analysis of Level 3 PACT data. A summary of the answers is given below:

1. Did intervention practices increase their prescribing in areas where this might be necessary to give patients the drugs that they need?

    - inhaled corticosteroids: Yes
    - lipid-lowering drugs: Yes
    - hormone replacement therapy: Yes

2. Did intervention practices control or decrease their prescribing in areas where it has been suggested that GPs may "over-prescribe"?

    - drugs of limited therapeutic value: Yes
    - antimicrobial agents: Yes
    - NSAIDs: Yes

3. Did intervention practices control or decrease prescribing costs in areas where it has been suggested that savings might be made without detriment to patient care?

    - selected generic substitutions: Yes
    - reductions in use of selected combination products: Yes
    - reductions in use of selected modified release products: Yes

CHAPTER 5

PATIENT SATISFACTION WITH MEDICATION CHANGE

5.1 INTRODUCTION

As shown in Chapters 3 and 4, the employment of dedicated pharmacists to support GP activity within the intervention practices helped to control the rise in prescribing costs over the study period. To achieve this outcome, a number of medication changes were made, particularly the switching of brand-named drugs to generics. It was felt to be important to assess patient satisfaction with medication change in the intervention practices, given that most of the changes were made for reasons of cost-control whereby patients might not expect to receive direct benefits.

5.1.1 Rationale for the study

The results of the study conducted by Dowell, Snadden and Dunbar (1995) showed that 44% of patients undergoing prescribing change in a practice that had reduced its prescribing costs were "slightly unhappy" or "very unhappy". These results are important, as levels of patient satisfaction have been linked to adherence to medication (Horne, Hankins and Jenkins, 2001). Given the results of this study, and the increase in pharmacist intervention in general practice (Bond et al. 1995; Mason, 1996; Speak, 1996; Corbett, 1995; Wells, 1997; Bradley, 1996; Macgregor et al. 1996; Burton, Duffas and Williams, 1995), my own study set out to assess patient satisfaction with medication change where a pharmacist was employed to support GPs' prescribing activity.

5.2 OBJECTIVES

The objectives of the study were to:

- explore patients' satisfaction with changes in their medication
- identify levels of satisfaction in relation to the way in which the change was carried out

5.3. METHODS

5.3.1 Study design

A postal questionnaire survey was developed to assess the views of patients who had undergone a change in their medication in practices where a pharmacist was employed to support GPs' prescribing activity. Issues relating to levels of satisfaction with how the change was communicated were explored and the questionnaire was similar to the one used by Dowell, Snadden and Dunbar (1995). Although interviews or focus groups with patients might have yielded "richer" data, the use of a questionnaire for gauging levels of satisfaction is widely acknowledged (Hall and Dornan, 1988a; Hall and Dornan, 1988b; Baker and Streatfield, 1995; Poulton, 1996; Largey and O'Neill, 1996) and enabled a wider sample of patients to be reached within the time and financial constraints of the study (Bowling, 1997).

5.3.2 Study population

5.3.2.1 Selection of study practices

Due to the success of the Doncaster Prescriber Support Project, the five pharmacists continued to be employed in the 8 intervention practices for a second year and the scheme was rolled out to a further 11 practices, receiving input from an additional six pharmacists between September 1997 and August 1998.

This study was conducted in the second year of the Doncaster Prescriber Support Project and all 11 pharmacists working with 19 practices were asked to take part. Three pharmacists declined the invitation due to workload commitments. The remaining eight pharmacists (working with 13 practices) were therefore recruited to help administer the questionnaire. The median list size (interquartile range) for these practices was 7 390 (3 848 to 8 925). The median (interquartile range) Townsend scores (Townsend, Phillimore and Beattie, 1988) were 2.88 (1.93 to

4.41). The practices included 52 GPs (median four), of whom two were single handers. Six of the practices were fund holding and one was dispensing. Permission to conduct the survey was requested and granted from the lead GP from each practice (Appendix 5.1)

5.3.2.2 Identification of subjects

Each pharmacist was requested to print off anonymised lists of patients who underwent a change in medication, during the period 1 October 1997 to 31 January 1998, where the aim was to rationalise prescribing. These changes included generic substitution or substitution with a cheaper brand, changing to lower cost inhaler devices or brands, therapeutic substitution and reduction/discontinuation of dose. To reduce the possibility of selection bias, the lists were sent to a third party at Doncaster Health Authority where a systematic sampling technique (with random start point) was used to choose a sample of up to 25 patients per practice (Bowling, 1997). This number was decided upon after consultation with the pharmacists regarding the number and types of changes taking place. For each practice, the third party was asked to count up the number of patients who underwent a change in medication in the specified time period (1October 1997 to 31 January 1998) and divide by 25 i.e. the number of questionnaires to be sent, to give the sampling fraction. This was then used to select the sample. For example, if the number of patients who underwent a change in medication was 100, in order to select a sample of 25 patients a one in four sampling fraction would be used. The sampling would then start at a random point between one and four.

The pharmacists were then notified which patients were to receive the questionnaires. Two of the practices could not identify 25 patients who had undergone a change in medication in the above time period. In these cases, all the patients who had undergone a medication change were sent a questionnaire. For one practice, this was 22 patients and for the other 19 patients. From the 13 practices a total of 316 patients were identified for the survey.

5.3.2.3 Exclusion criteria

It was important that the potential respondents could read and write English, as no provision had been made for alternative languages. To avoid any confusion, it was also important that patients had only undergone one change in medication in the time period specified. Therefore, the pharmacists were asked to exclude patients known to be non-English speaking and those who had undergone more than one change of medication in the study period. For practical reasons (including consenting issues), the pharmacists were also asked to exclude patients with severe mental illness, cognitive impairment and those aged under 18 years old.

5.3.3 Questionnaire design

In developing the questionnaire, the previous survey conducted by Dowell, Snadden and Dunbar (1995) and the comments of pharmacists and GPs involved in the Doncaster Prescriber Support project were taken into account. In addition, five patients were interviewed to assess their views on medication change and to pilot an early version of the questionnaire.

5.3.3.1 Patient interviews

In order to explore the issues surrounding patient medication change, semi-structured face-to-face interviews were conducted between June 1997 and July 1997 with five patients from two of the study practices. According to Britten (1995), semi-structured interviews are "conducted on the basis of a loose structure consisting of open-ended questions that define the area to be explored, at least initially, and from which the interviewer or interviewee may diverge in order to pursue an idea in more detail." In the same paper, Britten (1995) goes on to comment on the importance of the setting of the interview, recommending that it is preferable to interview people at home. For this reason, all the interviews were conducted in interviewees' homes at their convenience. To reduce

interviewer bias, all interviews were carried out by the researcher and it was made explicit that the researcher was not medically trained or connected in any way to the interviewees' general practice (Bowling, 1997). It was intended that the interviews would last approximately one hour and the mean duration was one hour and nine minutes, ranging from 45 minutes to one hour and 35 minutes. To ensure accuracy of the data, all interviews were audio-taped with full permission of the interviewees and later transcribed verbatim by the researcher.

Selection of patients

A purposive sampling technique was used whereby practice pharmacists were requested to select up to 20 patients (ten patients from each of the two practices) who had recently (within the last three months) undergone a change in their medication and forward a letter on behalf of the researcher requesting an interview (Appendix 5.2). This method of sampling is not designed to be representative, "rather to identify specific groups of people who either possess the characteristics or live in circumstances relevant to the social phenomenen being studied" (Mays and Pope, 1995). It was requested that the sample be as diverse as possible in terms of the age and sex of the patients and the types of changes in medication. Of the 20 patients invited for interview, five agreed to take part. The age, sex and type of change in medication for the interviewees are shown in Table 5.1 below.

Table 5.1. Characteristics of interviewees

Patient Number	Age	Sex	Type of medication change
1	61	Male	Adalat Retard to Tensipine
2	38	Female	Nifedipine to Tensipine
3	40	Male	Zantac to Lansoprazole
4	60	Male	Atrovent nebuliser solution to Ipratropium Steri-Nebs
5	65	Male	Adalat Retard to Tensipine

Interview schedule

An interview schedule was developed to facilitate the interviews. The schedule, shown in Appendix 5.3, consisted mainly of open-ended questions concentrating on the key areas to be explored namely:

- background information
  - demographic data
  - knowledge of condition
  - past/current medication
- change in medication
  - patients' perceptions of why the change was offered
  - reasons for accepting/refusing medication change
- patients' perceptions of how change was handled
  - how the change was handled
  - opportunity to discuss concerns
  - adequate information
- how things could be improved

The questions were ordered in the above way so as to put interviewees at ease (Britten, 1995) and to let them become accustomed to the tape recorder. Assurances were given that the data would be treated confidentially and that no-one from their GP practice would receive any feedback from the interview.

Data analysis

Each tape was transcribed verbatim and a content analysis (a procedure for the categorisation of verbal or behavioural data, for purposes of classification, summarisation and tabulation) was done to identify the emergent themes (Bowling, 1997). A summary of the key is shown below.

Figure 5.1. Summary of key findings from the patient interviews

1. There was a lack of understanding/confusion over the need for medication change
2. Several patients were suspicions of cost-cutting which they perceived could be to the detriment of patient care
3. Concern was often expressed over (real or potential) side effects of the new medication
4. The need for improved communication regarding the change in medication was often expressed
5. So too was the need for increased opportunity/time to discuss concerns over changes to medication and raise questions
6. There was a strong desire to be involved in the decision making process

From these findings, three main hypotheses were formulated. The first hypothesis was that satisfaction with the manner in which the respondent found out about the change in treatment would be positively correlated with:

- information being conveyed in a personal manner
- information being provided on why the change had been suggested
- the respondent perceiving themselves as having a choice with respect to the suggested change
- the respondent having an opportunity to ask questions about the proposed change in treatment

The second hypothesis, based on evidence from the literature (Hjortdahl and Laerum, 1992; Freeman and Richards, 1993; Baker and Streatfield, 1995; Largey and O'Neill, 1996; Freeman and Hjortdahl 1997) was that satisfaction might be related to a number of patient characteristics such as:

- age
- sex
- how long they had been with the same practice

- how often they saw the same GP when visiting the practice
- whether they paid for their prescriptions

The third hypothesis was that satisfaction with a new treatment might also be related to some or all of the above factors.

5.3.3.2 Objectives of the questionnaire

In order to test the hypotheses, a questionnaire was designed which aimed to:

1. Determine patients' levels of satisfaction with:

    - medication change and
    - how they found out about the medication change

2. Determine whether patients' levels of satisfaction were associated with:

    - the different ways in which they found out about the change
    - whether they felt that they had a choice about the change in medication
    - whether they were able to ask questions
    - any problems encountered with the new medication
    - their characteristics:
        - age
        - sex
        - how long they had been with the same practice
        - how often they saw the same GP when visiting the practice
        - whether they paid for their prescriptions

3. Determine whether patients' levels of satisfaction were significantly associated with the ways in which they found out about the medication change (when controlling for the other factors).

4. Obtain patients' comments on their medication changes.

5.3.3.3 Development of questions relating to satisfaction

Two questions were used to assess satisfaction:

- Question 5: "In general, how satisfied are you with the way you found out about the change in your treatment?"
- Question 10: "In general, how satisfied are you with your new treatment?"

Respondents were asked to give their views on a 5-point ordinal Likert scale (Likert, 1932) with possible responses across the range:

- "very satisfied"
- "satisfied"
- "neither satisfied nor dissatisfied"
- "dissatisfied"
- "very dissatisfied"

Responses were coded in descending order of satisfaction:

- 5 = "very dissatisfied"
- 1 = "very satisfied"

Likert scales are used extensively for this type of questioning in health services research due to their ease of administration, analysis and interpretation (Bowling, 1997). They have been employed in a number of patient satisfaction surveys in general practice (Baker, 1990; Grogan et al. 1995; McKinley et al. 1997). According to Bowling (1997), one of the potential limitations with using this type of scale is that "many respondents will opt for the middle response category and prefer to avoid a decision at either end of the response scales." However, as can be seen from the results, this did not appear to be the case.

5.3.3.4 Development of remaining questions

Other questions were developed, based on the current literature at the time (Hall and Dornan, 1990; Lewis, 1994; Stewart, 1995; Largey and O'Neill, 1996), covering topics believed to be associated with levels of satisfaction, namely:

- the type of medication change
- how patients found out about the medication change
- whether patients went through with the medication change
- patients' characteristics, including whether they paid for their prescriptions
- how long patients had been with their current GP surgery and the extent to which they saw the same GP when visiting the surgery

5.3.3.5 Questionnaire format

The format of the questionnaire was carefully considered in line with well recognised general principles which have been summarised by McColl et al. (2001). It was short, commercially printed on pale yellow paper, was easy to complete with clear unambiguous questions and was of direct relevance to the practice patients. Although it contained predominantly closed questions, respondents were invited to make general comments about their change in medication at the end of the questionnaire. Answers to closed questions were pre-coded for ease of data analysis. The front page of the questionnaire conveyed the fact that the survey was being conducted from the University of Nottingham and that responses to the questionnaire were non-identifiable to the researcher. Although the use of a reference number on the front of the questionnaire meant that responses were identifiable to the pharmacists, reassurances were given that practice staff would not have access to responses and that they would be treated with the utmost confidentiality. A recent systematic review by Edwards et al. (2004) highlighted some of these factors in improving the response rate to questionnaires.

The questionnaire followed a logical sequence (McColl et al. 2001) in that general questions pertaining to changes in medication preceded specific questions and demographic questions were placed at the end. The questionnaire was designed to take no more than ten minutes to complete. The final version of the questionnaire is shown in Appendix 5.4.

5.3.3.6 Piloting the questionnaire

The questionnaire was piloted on the five patients who agreed to take part in the face-to face interviews. All five patients replied to the questionnaire and a brief telephone discussion took place with each respondent within one week of receiving the questionnaire to ask for feedback on the questions, the design of the questionnaire and the covering letter. This process, known as cognitive pretesting (McColl et al. 2001), involved taking the respondents through the steps of completing the questionnaire (from opening the envelope and reading the instructions) and asking them questions about every aspect of the process, what they were thinking while answering the questions, and their opinion of the format and layout of both the questionnaire and covering letter. Notes were made during the telephone conversations which were to be used to make modifications. In summary, all five patients found the questionnaire easy to read, unambiguous, and quick to complete and only minor changes to the wording of the instructions and the layout of the questionnaire were made.

5.3.4 Survey administration

In order to increase potential response rate, the practice pharmacists distributed the questionnaires along with a pre-prepared letter on headed notepaper from the relevant general practice (Edwards et al. 2004) (Appendix 5.5). Questionnaires, instructions (Appendix 5.6), envelopes, labels, and FREEPOST reply envelopes addressed to the researcher were sent to each of the pharmacists.

The questionnaires were non-identifiable to the researcher and this fact was emphasised in the letter to patients and on the first page of the questionnaire. To

allow for the identification of non-responders, a five digit reference number was written on the front each questionnaire. The first two digits referred to each practice (1-13), the middle two digits referred to the patient number (1-25) and the last digit referred to the type of medication change. The last digit was filled in by the pharmacists using the classification codes sent to them as shown in Table 5.2 below.

Table 5.2. Classification for type of change in patient medication

Code	Type of change
1	Generic substitution (including branded generics but not inhalers)
2	Changing to lower cost inhaler devices or brands
3	Substitution of premium price preparations (combination products and modified release products)
4	Discontinuation of drugs (e.g. those of limited therapeutic value or over-the-counter)
5	Other

The pharmacists wrote brief details of patients' medication changes in a box on the first page of each questionnaire. This acted as a reminder to the patient, and it also served to provide information on the types of change that had taken place. On the basis of this information, it was possible to check the codes that the pharmacists had used and a number of new codes were developed to cover other types of medication change (see Table 5.3). The pharmacists then addressed the envelopes, ensuring a copy of the questionnaire, covering letter and FREEPOST reply envelope were enclosed, and distributed them to patients. Each pharmacist was sent a Patient Record Booklet to assist with follow up of non-responders (Appendix 5.7).

The survey was sent out in March 1998, giving sufficient time for patients to have undergone any changes in their medication that had been suggested in October

1997 to January 1998, whilst minimising the potential for recall bias (Bowling, 1997). To maintain patient confidentiality, the replies were sent directly to the Division of General Practice at the University of Nottingham. After one month, the pharmacists were notified of the reference number of non-responders and reminder questionnaires were issued.

5.3.5 Data entry and analysis

All data, with the exception of free text responses, were numerically coded and entered onto a Microsoft Access database by the researcher using the patient reference number as an identifier. Accuracy of data inputting was validated by checking every fifth entry on the database against the associated questionnaire. No inconsistencies were found. Descriptive statistics on the responses were obtained using SPSS (version 8) and responses to open-ended questions were typed into a word processing package (Microsoft Word 95) and a content analysis done to identify emergent themes (Bowling, 1997). Incomplete questionnaires were included in this part of the analysis and therefore the total numbers of patients responding to each question have been indicated in the results section.

Advice on how best to further analyse the data was sought from Dr Ciaran O'Neill, Reader in Health Economics and Policy, University of Ulster. His suggestion was that the data be imported into LIMDEP (version 7) to perform an ordered logistic regression analysis to determine the factors that were associated with different levels of patient satisfaction. It would then be possible to examine the relationship between satisfaction, ranked in an ordinal manner (very satisfied, reasonably satisfied etc) and a range of variables thought to be related to this within the context of a multivariate analysis.

Ordered logistic regression is an appropriate statistical technique for analysing ordinal data of this type (Largey and O'Neill, 1996). It identifies the independent effects of different factors on satisfaction. The technique produces odds ratios associated with each independent variable and associated p-values. If the odds

ratio for a given characteristic is less than one, it can be interpreted in this context as indicating that a person with that characteristic is more likely to be satisfied than a person without it. If it is greater than one, in this context it can be interpreted as indicating that a person with this characteristic is less likely to be satisfied than a person without this. The p-value associated with the independent variable indicates the probability at which the variable in question is significant. The logistic regression analysis was carried out by Dr Ciaran O'Neill, but the results were interpreted by the researcher. Patients who did not answer all of the questions were excluded from this analysis. Variables used in the multivariate analysis are shown in Appendix 5.8

For the multivariate analysis, data have been presented at the following levels:

- $p<0.1$ (significant at the 90% level of confidence)
- $p<0.05$ (significant at the 95% level of confidence)
- $p<0.01$ (significant at the 99% level of confidence)

5.4 RESULTS

5.4.1 Descriptive analysis

5.4.1.1 Questionnaire response rate

A total of 314 questionnaires (from a potential number of 316) were issued by the pharmacists. Two questionnaires were not issued because one patient had died and another had been admitted to hospital. After the first questionnaire round, 181 patients (58%) responded. After sending out the reminder questionnaires an additional 38 patients (12%) responded giving an overall response rate of 70% (219/314).

5.4.1.2 Demographic characteristics of respondents and non-respondents

Respondents

The mean age of respondents was 64 years (standard deviation: 11.8) and 51 % were female.

Non-respondents

As pointed out by Baker (1990) "Future studies should seek to ...obtain some comparative information for responders and non-responders." For this reason, age, gender and type of medication change of non-respondents was obtained from the pharmacists. The mean age of non-respondents was 63 years (standard deviation: 15.1) and 53% were female.

Using the Independent t-test function in SPSS (version 8) (Puri, 1996), it was found that the difference between the age of respondents and non-respondents was 1.56 years. The 95% confidence interval for this difference was -1.937 to 5.066. Since this interval contains zero, the difference was not statistically significant at the two-tailed 5% level. Using the Chi-square test function in SPSS (Puri, 1996), it was found that there was no significant difference between the observed and expected frequency of males and females in terms of responding to the questionnaire (χ^2=0.123, degrees of freedom = 1, p = 0.725).

5.4.1.3 Types of changes in medication

On the basis of the types of medication changes recorded on the questionnaires, a number of new classification codes were developed as shown in Table 5.3. The corresponding number of respondents and non-respondents with each classification code has also been shown.

Table 5.3. Re-classification for type of change in patient medication

Code	Type of change	Respondents (%)		Non-respondents (%)	
1	Generic substitution or substitution with a cheaper brand (not including inhalers)	90	(41.1)	43	(45.3)
2	Changing to lower cost inhaler devices or brands (including generic substitutions)	5	(2.3)	4	(4.2)
3	Substitution of premium price preparations (combination products and modified release products)	0	(0.0)	2	(2.1)
4	Discontinuation of drugs (e.g. those of limited therapeutic value or over-the-counter)	8	(3.7)	0	(0.0)
5	Reduction of dose	17	(7.8)	12	(12.6)
6	Therapeutic substitution	39	(17.8)	16	(16.8)
7	Unspecified change in medication as a result of medication review	21	(9.6)	7	(7.4)
8	Unspecified change in medication as a result of attending coronary care clinic	18	(8.2)	3	(3.2)
9	Unspecified change in medication as a result of attending acid suppression clinic	17	(7.8)	5	(5.3)
99	Other	4	(1.8)	3	(3.2)
	TOTAL	**219**	**(100.0)**	**95**	**(100)**

It can be seen that the types of changes in medication were similar for both respondents and non-respondents.

5.4.1.4 Responses to questionnaire

Patients first found out about their change in treatment by a variety of methods and these are summarised in Table 5.4.

Table 5.4. Ways in which patients first found out about their change in medication

Method of communication	Responses [a]	(%)
Received a letter from the practice	62	(27.4)
GP discussed change face-to-face	51	(22.6)
Practice pharmacist discussed change face-to-face	46	(20.3)
Told about change when picking up repeat prescription	33	(14.6)
Not told	11	(4.9)
Received a phone call from the practice	9	(4.0)
Unable to remember	3	(1.3)
Other	11	(4.9)
TOTAL	**226**	**(100.0)**

[a] 212 respondents gave a total of 226 responses (7 respondents did not answer this question)

Table 5.5 shows responses to questions relating to patients' perceptions of the process of medication change. It can be seen that nearly 39% (80/206) of patients stated that they were not told why the change was taking place. Sixty-one per cent (127/207) did not perceive that they had a choice with respect to the change and 38% (78/204) felt they were not given the opportunity to ask questions.

Table 5.5. Responses to questions relating to patients' perceptions of the process of medication change

Questions	Responses (%)			
	Yes	No	Can't remember	Total
Were you told why your Doctor wanted to change your treatment?	108 (52.4)	80 (38.8)	18 (8.8)	**206**[a] (100)
Were you given any choice about whether or not your treatment was changed?	66 (31.9)	127 (61.3)	14 (6.8)	**207**[b] (100)
Were you given the chance to ask any questions about the change in your treatment?	112 (54.9)	78 (38.2)	14 (6.9)	**204**[c] (100)

[a] 13 respondents did not answer this question
[b] 12 respondents did not answer this question
[c] 15 respondents did not answer this question

Table 5.6 shows respondents' levels of satisfaction with how they found out about the changes in their medication and with the medication changes themselves. Almost 65% (131/203) of patients were reasonably or very satisfied with the way in which they found out about their medication change and an even greater proportion, 72% (144/199), were reasonably or very satisfied with the new treatment itself.

Table 5.6. Patients' levels of satisfaction with how they found out about the changes in their medication and with the medication changes themselves

	Responses (%)			
	Satisfaction with finding out about the change [a]		Satisfaction with new treatment [b]	
Very satisfied	63	(31.0)	75	(37.7)
Reasonably satisfied	68	(33.5)	69	(34.7)
Neither satisfied or dissatisfied	35	(17.3)	25	(12.6)
Dissatisfied	25	(12.3)	20	(10.0)
Very dissatisfied	12	(5.9)	7	(3.5)
Not applicable	0	(0.0)	3	(1.5)
TOTAL	**203**	**(100.0)**	**199**	**(100.0)**

[a] 16 respondents did not answer this question
[b] 20 respondents did not answer this question

In terms of reported adherence to the medication change, 94% (188/201) of responders said that they had gone along with the change. However, 22% (44/200) experienced problems with the "new" treatment, and of these, 70% (30/43) spoke to their GP about the problems. At the time of the survey, 87% (174/200) of patients reported that they remained on their changed medication.

Descriptive analyses of the results were then undertaken to inform the next stage of the analysis.

5.4.2 Multivariate analysis of attitudinal data

As mentioned previously, a number of studies have demonstrated the link between patient characteristics, such as age and sex, and levels of satisfaction with health care services. The main purpose of using the multivariate analyses was to control for these potential confounding factors when assessing the importance of different methods of informing patients about medication change. However, using these techniques, it was possible to assess the importance of any of the variables considered.

The distribution of responses to a number of questions made it impracticable to examine the relationship between satisfaction and each possible response. For example:

- in relation to Question 16, none of the respondents had been with their GP for less than 6 months and very few for anything less than five years. Therefore, the impact on satisfaction of being with one's GP for more than 5 years was tested against being with them for less than this period
- in relation to Question 17, the categories "never" and "occasionally" were combined
- the age distribution of the sample was reduced to just two categories in the analysis: those 65 years and older, and those under this age

When interpreting the ordered logistic regression analysis it should be recognised that an odds ratio (OR) less than one indicates that the variable was associated with higher satisfaction. The reason for this was because "very satisfied" responses were coded as "1" and "very dissatisfied" responses were coded as "5".

5.4.2.1 Satisfaction with finding out about the change in treatment

Results of the logistic regression analysis (Tables 5.7 to 5.8) showed that satisfaction with the way in which the patients found out about their change in medication was associated with:

- being told of the change by:
  - the practice pharmacist (odds ratio (OR)=0.24)
  - the GP (OR=0.32)
  - a letter from the practice (OR=0.25)
- the patient feeling that:
  - they had a choice about whether their medication was changed (OR=0.17)
  - they had been told why the change in treatment was taking place (OR=0.36)
- the degree to which patients saw the same GP when visiting the surgery
  - respondent *always* saw the same GP (OR=0.17)
  - respondent *often* saw the same GP (OR=0.23)
  - respondent *sometimes* saw the same GP (OR=0.22)
- female gender (OR=0.43)

Satisfaction with the way in which the patient found out about their proposed change in medication was not associated with:

- age (OR=0.58)
- whether the respondent paid for their prescriptions (OR=0.83)
- informing the patient of the change by telephone (OR=0.34)
- length of time the patient had been with the same surgery
  - respondent coming to surgery more than five years (OR=2.75)

5.4.2.2 Satisfaction with the new treatment

From Tables 5.7 to 5.8 it can be seen that satisfaction with the new treatment was associated with:

- the patient feeling that:
  - they had a choice about whether their medication was changed (OR=0.26)
  - they had been told why the change in treatment was taking place (OR=0.48)
- female gender (OR=0.42)

Satisfaction was not associated with:

- Being told of the change by:
  - the practice pharmacist (OR=1.52)
  - letter (OR=0.69)
  - the GP (OR=1.01)
- The degree to which patients saw the same GP when visiting the surgery
  - respondent *always* saw the same GP (OR=1.14)
  - respondent *often* saw the same GP (OR=0.98)
  - respondent *sometimes* saw the same GP (OR=0.73)
- Length of time the patient had been with the same surgery
  - respondent coming to surgery more than five years (OR=1.07)

Table 5.7. Ordered logistic regression analysis of satisfaction with the way in which respondents found out the change in their medication and with the medication changes themselves

Variables	Respondents (%)	Satisfaction with finding out about the change $\chi^2 = 110.80$ n = 171		Satisfaction with new treatment $\chi^2 = 73.45$ n = 164	
		Odds ratio	p-value	Odds ratio	p-value
Constant		159.17	<0.001	3.63	0.07
How the patient was told about the change					
The respondent was informed of the change in treatment by the practice pharmacist	46/226 (20.3)	0.24	<0.001	1.52	0.25
The respondent was informed of the change in treatment by letter	62/226 (27.4)	0.25	<0.001	0.69	0.21
The respondent was informed of the change in treatment by their GP	51/226 (22.6)	0.32	0.01	1.01	0.49
The respondent was informed of the change in treatment by phone	9/226 (4.0)	0.34	0.11	0.44	0.14
The respondent felt they had a choice about whether their treatment was changed	66/207 (31.9)	0.17	<0.001	0.26	<0.001
The respondent was told why there was a change in treatment	108/206 (52.4)	0.36	<0.001	0.48	0.03
The respondent was given the opportunity to ask questions	112/204 (54.9)	0.70	0.20	0.83	0.33

Degree of satisfaction ranked in descending order. Therefore, an odds ratio less than one indicates the variable was associated with higher satisfaction. To calculate the change in probability of being satisfied at a specific level associated with a change in a dependent variable, the beta coefficient from the ordered regression and the associated threshold or μ value must be known. As results here have been converted to odds ratios, in the interests of clarity μ values are not reported.

Table 5.8. Ordered logistic regression analysis of satisfaction with the way in which respondents found out the change in their medication and with the medication changes themselves

		Satisfaction with finding out about the change $\chi^2 = 110.80$ n = 171		Satisfaction with new treatment $\chi^2 = 73.45$ n = 164	
Variables	**Respondents (%)**	**Odds ratio**	**p-value**	**Odds ratio**	**p-value**
Constant		159.17	<0.001	3.63	0.07
Patient characteristics					
The respondent was female	111/216 (50.7)	0.43	<0.001	0.42	0.01
The respondent was over 65	115/216 (53.2)	0.58	0.08	0.93	0.42
The respondent paid for prescriptions	41/214 (19.2)	0.83	0.35	1.08	0.43
The patient in relation to the surgery					
The respondent *always* saw the same GP when visiting the surgery	112/214 (52.3)	0.17	<0.001	1.14	0.42
The respondent *often* saw the same GP when visiting the surgery	65/214 (30.4)	0.23	0.02	0.98	0.49
The respondent *sometimes* saw the same GP when visiting the surgery	21/214 (9.8)	0.22	0.03	0.73	0.36
The respondent had been coming to the surgery for more than five years	187/214 (87.4)	2.75	0.04	1.07	0.44

Degree of satisfaction ranked in descending order. Therefore, an odds ratio less than one indicates the variable was associated with higher satisfaction. To calculate the change in probability of being satisfied at a specific level associated with a change in a dependent variable, the beta coefficient from the ordered regression and the associated threshold or μ value must be known. As results here have been converted to odds ratios, in the interests of clarity μ values are not reported.

5.4.3 Analysis of free-text comments

The questionnaire contained two open-ended questions; Question 11 "If you did not go through with the change in your treatment please explain why" and Question 13 "If there is anything else you would like to add, please write in the space below." A total of 12 patients gave a response to Question 11 and a total of 84 patients gave a response to question 13. Content analysis (Mays and Pope, 1995) was used to draw out the main themes and it should be noted that a single response may have fitted into more than one theme. This process of multiple coding of single items is, according to Bowling (1997), "permissible, as well as often being necessary for analytic coding.....analytic coding requires multiple coding which can be cross-referenced for conceptual and theoretical development."

5.4.3.1 Analysis of responses to Question 11 "If you did not go through with the change in your treatment please explain why"

Four themes were identified from the responses to this question and these are listed below. The number of responses within each theme is given in brackets. Quotations have then been used to illustrate each of the themes.

1. Side effects from the new drug (7)
2. Perception that the tablets were less effective (4)
3. Lack of explanation/understanding about why the change was made (2)
4. Packaging of new drug not acceptable (1)

One of the main reasons cited for not going through with the change in medication was concern over side-effects from the new drug:

> *"As a diabetic indapamide caused me to pass far more water which was at times embarrassing when shopping etc. Also disturbed nights" [Patient 08241, female, aged 83 years]*

"I didn't feel as well on the second tablet as I did on the previous one so my GP put me back onto my original tablets." [Patient 09075, female, aged 68 years]

"I have temporarily stopped because of side effects which may or may not be due to the tablets." [Patient 09095, male, aged 70 years]

"They caused me dizzy spells" [Patient 11222, female, aged 76 years]

There was also a perception that the new tablets were less effective:

"The new tablets did not do the job they were intended to do" [Patient 09235, female, aged 77 years]

"The new treatment was not successful." [Patient 09255, male aged 61 years]

"My symptoms of burning in my throat got worse so I went to my GP who has put me back on Losec for another 6 months." [Patient 03115, female, aged 61 years]

"Trouble came back within a few days, causing me to vomit after every meal." [Patient 10095, female, aged 59]

In two cases, a lack of explanation/understanding about why the change was being made was cited as the reason for refusing to go through with the medication change:

"The only time I used these tablets was when my stomach was bad and it wasn't that often, so really I don't know why they stopped them in the first place, and why they didn't let me know." [Patient 07074, female, aged 64 years]

"Though unhappy I have not been given a full explanation for the reason of change only that it would make no difference in a medical way. It did very much so for several weeks - hence I am back on Tenormin." [Patient 02181, male, aged 67 years]

One patient found the packaging of the new drug unacceptable:

"Tablet supplied loose and liable to disintegrate. Metformin is not supplied in aluminium foil packet which is easier to carry and is

safer. I want to stick to Glucophage and so I had to pay 50p to pharmacist for 84 tablets which is against the principle that a diabetic gets a free prescription. To supply Metformin as loose tablet is a step in retrograde hygienically and financially both to patient and NHS." [Patient 06041, male, aged 73 years]

From this analysis, it can be seen that the reason given for not going through with the change in treatment can be attributed to a number of factors, namely concern about side effects of the new treatment, the belief that the new treatment would not be (or was not as) effective as their existing treatment, and lack of adequate explanation as to why the change was taking place.

5.4.3.2 Analysis of responses to Question 13 "If there is anything else you would like to add, please write in the space below"

As previously mentioned, 84 patients gave a response to this question. In some instances, patients claimed not to have had a change in medication. In these cases, the information given by the pharmacists was verified and it was found that the patients had indeed undergone a change in medication. However, these changes were usually quite minor e.g. a switch from a brand-named preparation to a generic preparation or a move from daily medication to "use when required". A total of 16 themes were identified from the responses to this question and these are shown below. The number of responses within each theme is given in brackets and once again, quotations have been used to illustrate the key themes.

1. Very satisfied with/have complete confidence in their doctor (15)
2. Dissatisfied due to lack of choice/explanation (9)
3. Resistant to changes being implemented by the pharmacist rather than the doctor (2)
4. Suspicious of cost-cutting which could compromise patient care (6)
5. Dissatisfied with method of communication (5)
6. Reassured by pharmacist (4)
7. Unaffected by change due to perception that only the name of the drug had changed (6)
8. Unaware change in medication had taken place (6)

9. Under consultant care (7)
10. Satisfied with change/experienced a real benefit (4)
11. Dissatisfied with change (5)
12. Reverted to their previous regime (4)
13. Experiencing/have experienced side-effects (6)
14. Confusion (real or potential) arising from change in packaging (3)
15. Reduction in dose not as effective (3)
16. General comments of no relevance (6)

Approximately 15 of the 84 respondents (18%) had full confidence in their GP to make any changes in treatment on their behalf:

> *"I have no problems with our doctors Dr [name] and Dr [name]. They have always been very helpful." [Patient 04211, male, aged 64 years]*

> *"I always say the doctor is right to change your treatment if he thinks it's going to be better for you." [Patient 09045, female, aged 77 years]*

> *"My doctor changed my treatment who I have every confidence in." [Patient 06171, female, aged 64 years]*

However, several respondents felt strongly that patients should be consulted and involved in any proposed changes:

> *"...one gets the feeling that most patients are kept very much in the dark about the true purpose of change. Surely, one should have a wider aspect of patient's intelligence and much fuller explanations given before changes take place and indeed possible side effects of theses changes. I raise the question, is it all about cost rather than effect?" [Patient 02181, male, aged 67 years]*

Respondents also felt that they should have a say in whether to accept the proposed treatment:

> *"I suggest that when they change anybody's tablets in the near future that they should tell whoever it concerns that if they don't agree with*

them in any way they should return them to the surgery right away." [Patient 07245, female, aged 90 years]

If not consulted, patients could be confused about changes:

"Since the first change about 3 months ago, my surgery has made another change without any consultation or notification whatsoever. I think patients should always be consulted because it can lead to confusion." [Patient10185, male, aged 56 years]

There were two examples of resistance to change where it was initiated by the pharmacist, rather than a doctor:

"...I do not think a practice pharmacist should interfere with hospital treatment.... The only person who should consider changing your treatment is a doctor." [Patient 01155, female, aged 66 years]

"...It seems the pharmacist is above law and the rule of government..." [Patient 06041, male, aged 73 years]

Patients were not so much concerned about change per se, but rather the manner in which it was conveyed to them:

"...as far as I can recall, I was never consulted by any doctor re: change of programme. The first indication I had was a letter from the pharmacist (of which I didn't know we had one) re new treatment for ulcer." [Patient 01075, male, aged 79]

For some, the change was not communicated at all:

"I found out about the change in my treatment after receiving this form to fill in." [Patient 02161, male, aged 50]

Patients who did not receive a full explanation regarding the change in medication viewed it as a cost-cutting exercise that could compromise patient care:

"I consider that this practice is for health care on the cheap. I am not convinced that generic labelled goods are as good. You only get

what you pay for and cheaper drugs cannot be the same." [Patient 13055, male, 57 years]

"The pharmacist was put back when I told him the only reason for the change was money! And I was right. Luckily Lansoprazole works for me, but no doubt if another cheaper drug comes out, I will be expected to try that. Patient care should not have a price tag on it." [Patient 11165, male, aged 36 years]

"I assumed the change was for economic reasons, as I find the reduction in dosage 20mg to 15mg means the dosage is only effective for approximately 15 hours out of the 24 hour interval." [Patient 03125, male, aged 65 years]

In one case, a patient thought the change was a result of the offer of an incentive from a pharmaceutical company:

"I would have liked an explanation of why the name of my tablets had changed. I have heard that some chemical companies give incentives if Doctors prescribe their products. I was a little concerned of the change of the name of my tablets." [Patient 04111, male, aged 51 years]

There was a perception held by some patients (or their experiences indicated) that where a change resulted in lower dosage, this was not as effective:

"I am not satisfied with the new low dosage as it is not effective." [Patient 15065, male, aged 37 years]

"When I was on 30mg Zoton it was perfect. I had no discomfort whatsoever by taking one a day. But when I had to change to 15mgs I still suffered with heartburn at some time of the day or night. It doesn't seem strong enough in my case to stop the discomfort." [Patient 03055, female, aged 68 years]

The change in medication made no difference to six respondents as they perceived that only the name of the drug had changed (when a branded preparation was changed to a generic preparation):

"Zyloric and Allopurinol are the same thing. No change in treatment only change in tablet name (Zyloric trade name)." [Patient 02251, male, aged 59 years]

"I did not question this change since I already knew that Ponstan Forte and Mefenamic Acid were the same thing" [Patient 06081, female, aged 46 years]

However, in some circumstances, switching to generic preparations resulted in confusion due to the change in packaging of drugs e.g. from strips or blister packs to loose tablets, highlighting the fact that this needs to be considered when making changes to medications:

"My Trandate tablets were in day to day strips so that I always knew whether I had taken them i.e. morning and night. The Labetalol tablets are loose and sometimes I cannot remember whether I have taken one or not and this is very inconvenient." [Patient 08061, female, aged 56 years]

"....Zyloric helped with date/days on blister pack. Sometimes I've forgotten the tablets." [Patient 02111, male, aged 50 years]

A number of patients were pleased with their change in medication and/or experienced a real benefit:

"The best change I ever did." [Patient 01105, female, aged 67]

"Lansoprazole capsules instead of Zantac: less tablets, more beneficial." [Patient 13155, male, aged 69 years]

However, a number reverted to their previous regime:

"I wasn't happy about the change so I changed back to Losec" [Patient 03155, male, aged 82 years]

Although some patients seemed largely unaware and uninformed about the role of the practice pharmacist:

"...Maybe the cost of employing a Practice Pharmacist would be better spent on less cost-cutting of patients' treatment." [Patient 13055, male, aged 57 years]

Others had either been contacted or had made contact with the practice pharmacist regarding their change in medication:

> *"I have now gone back to my original tablets after discussion with the pharmacist." [Patient 09235, female, aged 77 years]*
>
> *"The pharmacist gave me to understand this change is only a brand name change." [Patient 02031, female, aged 66 years]*
>
> *"The pharmacist assures me that cholestyramine is the medical term for Questram..." [Patient 08041, female, aged 77 years]*

To summarise, the results of the free-text comments lend weight to the findings of the survey i.e. the way in which the change in medication was communicated was of importance to respondents. So too was the opportunity to discuss the change and have some degree of choice in whether the change was implemented or not.

5.5 SUMMARY OF MAIN FINDINGS

The patients first found out about their change in treatment by a variety of methods. Fifty-two percent (108/206) of patients were told why the change was taking place, 32% (66/207) perceived that they had a choice with respect to the change and 55% (112/204) were given the opportunity to ask questions. Almost 65% (131/203) of patients were reasonably or very satisfied with the way in which they found out about their medication change, and 72% (144/199) were reasonably or very satisfied with the new treatment itself.

Results of the logistic regression analysis showed that satisfaction with the way in which the patients found out about their change in medication was associated with:

- being told of the change by the practice pharmacist, the GP or by a letter from the practice; and

- the patient feeling that:
  - they had a choice about whether their medication was changed
  - thy had been told why the change in treatment was taking place
  - the degree to which patients saw the same GP when visiting the surgery
  - the patient being female

Satisfaction with the new treatment was associated with:

- the patient feeling that:
  - they had a choice about whether their medication was changed
  - they had been told why the change in treatment was taking place
- the patient being female

Analysis of free-text comments showed that, of the small number of patients who did not go through with their change in medication, the reasons cited included concerns over effectiveness, side-effects and lack of adequate explanation as to why the change was taking place. There was a strong message that the way in which the change was communicated was crucial to the level of satisfaction with the new treatment, with patients wanting more involvement in the decision-making process.

CHAPTER 6

DISCUSSION

6.1 INTRODUCTION

The main aim of this study was to evaluate a pharmacist-led intervention to determine whether this helped general practices to control their prescribing costs. In order to achieve this aim, a series of research questions was devised:

1. Do intervention practices make savings in prescribing costs compared with matched controls?
2. Do any savings cover the costs of the intervention?
3. What changes do intervention practices make in their prescribing patterns compared with matched controls?
4. Is the quality of prescribing maintained on the basis of any changes in prescribing patterns?
5. What are the views of patients on changes made to their medication?

The research questions were addressed in three discrete studies. This final thesis chapter now draws together and discusses the key findings from each of these studies in light of recent literature and policy developments.

6.2 METHODOLOGICAL CONSIDERATIONS

Before embarking on a discussion of the results, it is worth commenting on the methods used in the evaluation (to consider the validity and reliability of the findings) and the practices and pharmacists that were involved in the intervention (to consider the generalisability of the results).

6.2.1 Study design

6.2.1.1 Assessing changes in prescribing costs and patterns of prescribing

Observational studies are widely used in the investigation of changes in prescribing costs (Geoghegan et al. 1998; Bradley, Round and Ramsden, 2000;

Walker and Mathers, 2002). However, the design lends itself to a number of potential biases including:

- secular trend - the outcome may be increasing or decreasing with time; for example, the observations might be increasing before the intervention and could be wrongly attributed to the intervention

- cyclical or seasonal effects – there may be cyclical patterns in the outcome of interest that occur over time. For example, prescribing of certain drugs may vary with the occurrence of seasonal illnesses

- duration of the intervention – the intervention may have an effect for a limited time only, for example a period of four months; data collected yearly would not identify this effect

- random fluctuations – these are short fluctuations with no discernible pattern that can bias intervention effect estimates

To overcome these potential biases, it could be argued that use of an interrupted time series (ITS) analysis may have been a more appropriate method for the analysis of PACTline data than the one used (Shadish, Cook and Campbell, 2002). In ITS design, data are collected at multiple instances over time before and after an intervention (interruption) to detect whether the intervention has an effect significantly greater than the underlying secular trend (Ramsay et al 2004). One of the main advantages of ITS designs is that it allows for the statistical investigation of potential biases in the estimate of the effect of the intervention.

However, all of the potential biases outlined above were recognised and addressed in the design of the study. A control group was used to assess changes in prescribing costs which were reasonably well matched on baseline characteristics. Therefore there was some degree of certainty that the changes observed in the intervention practices were not the result of chance alone or due to natural changes in prescribing patterns. The two year period of data collection allowed for cyclical or seasonal effects and by obtaining changes in prescribing

costs for the Trent Region as a whole and for the ten most similar health authorities in England, it was possible to show that the control practices were not increasing their prescribing costs at an extraordinary rate.

A randomised controlled trial (RCT) would have given a more reliable answer to the question of whether pharmacists working in general practices can help to control prescribing costs and this method has been employed by a number of recent pharmacist-led intervention based studies (Zermansky et al. 2001; Freemantle et al. 2002). However, this was not possible using the approach taken by Doncaster Health Authority who chose to offer the intervention to all practices in Doncaster. As pointed out by Black (1996), although RCTs are viewed as the "gold standard" for measuring the effectiveness of interventions, they are sometimes impossible to do and "well designed observational methods offer an alternative to doing nothing."

6.2.1.2 Patient satisfaction with medication changes

The use of questionnaire surveys to elicit levels of patient satisfaction in general practice is common (Baker and Streatfield, 1995; Dowell, Snadden and Dunbar, 1995) and, given the objectives, was an appropriate methodology for this study. The advantages of postal questionnaire surveys are their low cost and the ability to access a wider sample of patients compared with other methods such as face-to-face interviews (Bowling, 1997). However, the main disadvantage tends to be poor response rate (Edwards et al. 2004). Low response rates have been acknowledged as potential sources of bias upon survey results, making generalisations from the research findings to the wider population difficult (Edwards et al. 2004). This is due to the fact that non-respondents are likely to differ from respondents with respect to important characteristics. For this reason, all the major guidelines to increase response rate were followed (McColl et al. 2001) resulting in an acceptable number of returns (70%). Although non-response bias can affect results, the age and sex distribution of non-respondents was found to be similar to that of respondents (no significant differences). In addition, there were few differences between respondents and non-respondents in

terms of the types of medication changes being made. A second potential source of bias for surveys of this type is the desire for respondents to give a socially acceptable answer. Although it was emphasised that responses to the questionnaire were confidential and anonymised to the researcher, the use of a reference number (for non-response identification) may have led some patients to believe that their responses would be fed back to their general practice and may have influenced their answers. A third type of potential bias is recall bias (Bowling, 1997) which relates to the respondents' selective memory of events, experiences or behaviour. To reduce the likelihood of recall bias, the questionnaires were issued relatively soon after the change in medication.

One of the strengths of the study was that it allowed various factors to be accounted for when assessing patients' levels of satisfaction with medication change. In assessing the importance of different ways of telling patients about medication change it was possible to control for potential confounding factors such as age and gender (Largey and O'Neill, 1996) continuity of care by the same GP (Freeman and Richards, 1993; Freeman and Hjortdahl 1997), and whether the patient paid for their prescriptions. However, social class or patients' levels of educational attainment were not explored. These may have been important confounders as other studies have shown education and income to affect client satisfaction with services (Largey and O'Neill, 1996). Other confounders not taken account of were potential differences in satisfaction associated with the different pharmacists, practices and individual GPs involved in changing patients' medications. Also, the different types of changes in medication were not taken into account. The reason for not including these variables in the multivariate analysis is that there were too many distinct categories to produce meaningful results.

Although the design of the questionnaire was very similar to the one used by Dowell, Snadden and Dunbar (1995), it could have been strengthened by further piloting and testing. Validity and reliability of the questionnaire were not adequately assessed and this is discussed further in section 6.2.3.5.

6.2.2 Study setting

6.2.2.1 Assessing changes in prescribing costs and patterns of prescribing

While the study showed that intervention practices managed to contain their prescribing costs relative to controls, it is important to consider the generalisability of the results to other practices. It is possible that the changes observed were strongly influenced by the characteristics of the volunteer practices, the pharmacists themselves and the input from Doncaster Health Authority.

The practices involved in the project came from a health authority with relatively high prescribing costs. It could therefore be argued that the relative savings made by the intervention practices were not the result of the intervention per se, but due to a phenomenon known as "regression to the mean" (Campbell and Stanley, 1963). This can occur when "respondents are selected (or select themselves) because they had scores that were higher or lower than average" (Shadish, Cook and Campbell, 2002). When such extreme scorers are selected, there is a tendency for them to score less extremely when retested on the original measure and this can easily be mistaken for a treatment effect. Use of a control group and comparison with other practices for the same time period would indicate that it is unlikely that the findings of the study were as a result of regression to the mean, rather than as a result of the intervention. However, it is possible that the scale of the relative "savings" made by the intervention practices would not be replicated in other practices with lower baseline figures.

This was a voluntary project that included interested GPs only. Although intervention and control practices were carefully matched, they differed on the important issue of whether they took up the offer of pharmacist support. It is doubtful whether the results would be replicated in practices that did not want help from a practice-based pharmacist.

It should be recognised that this was a managed project that required considerable input from a committed health authority team. It is possible that the information, training and support that the pharmacists received had a major impact on the success of the project. The pharmacists certainly perceived these things to be important (Davis S. personal communication). However, it is not possible to identify with certainty which aspects of the information, training and support were most important. It is possible that the lack of any of one of these elements might have adversely affected the success of this initiative, making it difficult to replicate in other parts of the country.

There is also the possibility that the pharmacists working in the intervention practices were particularly gifted and that other projects might have had difficulties in attracting people of such high calibre. It should be noted that the pharmacists employed in the project had at least five years' experience and were all considered appropriate to be employed at senior/principal level.

By charting the changes in costs for the study period, it was possible to see that the pharmacist intervention had an almost immediate effect on prescribing costs. According to Wagner (2002), it is usual for the effect of interventions to take time to become manifest. However, the pharmacists involved knew that the project was being evaluated and may have perceived that their jobs were unlikely to continue unless they had achieved some degree of success at controlling costs or improving the quality of prescribing in the study period.

These factors may have increased the motivation of both practices and pharmacists. In other circumstances one might not find such marked changes in prescribing as a result of pharmacist intervention.

6.2.2.2 Patient satisfaction survey

The patient satisfaction survey took place in the second year of the Doncaster project when an additional six pharmacists were employed to work (on a sessional basis) in a further 11 practices. The 13 practices chosen for the survey

were therefore unusual in that they all had the support of a dedicated pharmacist and this factor may well have limited the generalisability of the results. Nevertheless, the survey provided a good opportunity to gauge patients' views on medication change where pharmacists had been involved, and in contrast to the Dowell study took place in more than one practice. The major limitation of the study however, was the fact that no control group was used to measure levels of patient satisfaction undergoing medication changes in practices where no pharmacists were employed. It is therefore difficult to say with any certainty whether the presence of the pharmacists had any bearing on the levels of patient satisfaction with changes in their medication in the study practices.

6.2.3 Validity and reliability of results

The concept of reliability relates to the reproducibility of a study, and validity, relates to the 'truth' (Mays and Pope 1995). Hammersley (1990) interprets validity as "the extent to which an account accurately represents the social phenomenon to which it refers" and reliability as "the degree of consistency with which instances are assigned to the same category by the same observer on different occasion." The validity and reliability of the results are discussed below.

6.2.3.1 Use of PACT data

Although the use of PACT data to assess changes in prescribing costs is common (Wilson et al. 1996; Harris and Scrivener, 1996; Leach and Wakeman, 1999; Bradley, Round and Ramsden, 2000; Avery et al. 2000b; Walker and Mathers, 2002), the validity of the results are dependent upon the validity of the PACT data from which they are derived. It is important to note that PACT data only relates to those drugs dispensed, not those prescribed. The way in which the PACT data were manipulated and analysed deserves comment. All data manipulation was carried out in Microsoft Excel. The figures were then "rounded off" to a minimum of one significant figure on the basis that percentage changes of any smaller magnitude were not likely to be important.

In analysing the Level 3 PACT data, the September 1997 Drug File was used for both the year of the intervention and the previous year. Although this made it possible to assess changes in prescribing behaviour without having to account for inflation in drug costs, a limitation was that the calculated changes in drug costs did not tally exactly with real changes in costs. Therefore accuracy of the data was compromised.

In order to check for accuracy and precision of the data used in the analysis, data obtained from the PPA were compared with data obtained from Enigma Medical Systems and it was found that there was less than five per cent variation between the two which was considered acceptable.

6.2.3.2 Choice of denominator

The use of the item is not a reliable measure of prescribing volume as it does not take the quantity of the drug prescribed into consideration (Bogle and Harris, 1994). For this reason DDDs were used to measure changes in prescribing volume (World Health Organisation, 1978). One of the limitations of using this system is that, for a small number of drugs, the concept of a DDD is inappropriate e.g skin preparations such as creams and ointments where the unit of issue is a tube. Since patients use different quantities depending on the area to be covered, it is not possible to produce a meaningful DDD. Therefore an estimated DDD was used for these drugs which may have affected the accuracy of the data.

A second limitation of the system is the fact that it is based on an adult dose. This presents a problem with drugs used to treat infections where a large number of paediatric doses are given e.g. penicillin antimicrobial agents. Although the net effect was to reduce the overall number of DDDs in this class of drug, the same was true for both intervention and control practices. Since the study was concerned with changes in volume of prescribing, it could be argued that the results are indeed valid.

More recently, a new method for measuring volume has been developed by the Prescribing support unit, the Average Daily Quantity (ADQ). Where as the DDD is defined by international prescribing habits, the ADQ is based upon the prescribing behaviour in England and represents the assumed average maintenance dose per day for a drug used for its main indication in adults. The ADQ, which was not available for use at the time of the study, is now used to more accurately compare the prescribing activity of primary care practitioners in the UK (National Prescribing Centre, 2004).

6.2.3.3 Quality of prescribing

Using PACT data is not a good way to measure quality of prescribing (McGavock, 2001). The main problem is that the data cannot be related to individual prescribing decisions (Cantrill, Sibbald and Buetow, 1998). In order to assess the appropriateness of changes in prescribing, audit of medical records is necessary, an approach increasingly advocated (Woodhead, 2004). Thus, while certain prescribing patterns might suggest either good or poor prescribing, it is not possible to make a firm judgement on the basis of PACT data. Therefore, although the results of this analysis may be reliable, their validity could be questionable.

6.2.3.4. Statistical tests used

In analysing changes at BNF chapter level, a number of statistical tests were done using the Wilcoxon Test to investigate changes in prescribing costs between intervention and control practices. Repeated tests of this type, if uncorrected for the number of tests, can artificially inflate statistical significance. This is known as "Fishing and the Error Rate Problem" (Shadish, Cook and Campbell, 2002). Since correction for the number of tests was not carried out, caution is needed in the interpretation of these results. However, it must be remembered that changes at BNF chapter level were secondary prescribing-related outcome measures; primary-related outcome measures being the changes in overall prescribing variables.

6.2.3.5 Questionnaire design

In designing the questionnaire only five of the twenty patients approached agreed to be interviewed and the sample was not as diverse as hoped for. Although the questionnaire was piloted on these five patients, in hindsight, it is acknowledged that much more extensive piloting (with a more diverse sample of patients) was needed to assess validity and reliability. Due to financial and time constraints, it was not possible to conduct the survey in languages other than English. Therefore the results are unlikely to include views from those patients from non-English speaking backgrounds. However, according to the 2001 census (National Statistics Online, 2004), the percentage of non-white people living in Doncaster is low (2.3%).

6.2.4 Ways the study could have been strengthened

There are a number of ways the study could have been strengthened and these are discussed below.

The collection and analysis of PACTline data for a two year period prior to the intervention would have given greater insight into the growth in costs of both the intervention and control practices. In addition, it would have been interesting to look at trends for at least one more year subsequent to the intervention to see whether relative savings were being maintained by the intervention practices and whether the trend of rising costs continued in the control practices. The benefits of the pharmacist intervention may well have been short-lived, as previous studies have shown a tendency for GPs to revert to old habits after prescribing intervention has ceased (Harris et al. 1985).

The collection of the additional data was considered by the researcher in the second year of the project but was not possible due to a number of reasons. PACTline data for the year September 1994 to August 1995 were not available from the PPA as only the most current two years' worth of data are kept on

computer. In terms of collecting PACTline data for the year September 1997 to August 1998, guidelines on the ethics of using this type of data for research purposes were changing and it was no longer possible to access this data without prior ethical committee approval.

The analysis of PACT data at individual practice level showed that some intervention practices were more successful than others at containing the rise in prescribing costs, relative to controls. The reasons for this were not explored by the researcher but by staff at Doncaster Health Authority who took responsibility for the qualitative aspects of the Prescriber Support Project. This consisted of a series of interviews with the pharmacists and GPs in the intervention practices and analysis of the pharmacists' diaries. The results of this work are mentioned in Appendix 6 but it is acknowledged that my own study could have been strengthened by including some qualitative aspects in its design. This process of "triangulation of methods" (Mays and Pope, 2000) would have illuminated the findings from the quantitative aspects of the study, and given greater insight into the cost-control strategies used by the intervention practices. However, time and financial constraints were the major inhibiting factors.

6.3 COMMENTS ON THE RESULTS OF THE STUDY

The majority of the results presented in Chapter 3 and all of the results presented in Chapter 4 have been presented for combined data for both the intervention practices and matched controls. Therefore, with the exception of changes in overall prescribing costs, it is not possible to see the variations between the two groups of practices. While this information may have been interesting, it would have been extremely time-consuming to process and analyse the data at practice level. Also, this process would have produced hundreds of statistical results and this would have made interpretation of p-values difficult (Shadish, Cook and Campbell, 2002). Instead, the method of presenting data on each of the two groups of practices has some advantages. The most important is that it is possible to see exactly how the groups of practices changed their prescribing costs. For example, in section 4.4.5, costs (and changes in costs) within BNF therapeutic

groups add up to give overall costs for each BNF chapter. In turn, the costs (and changes in costs) for each BNF chapter add up to give overall costs for BNF chapters 1 to 6, 8 and 10. Thus it is possible to see the impact of changes in costs in one therapeutic group on overall prescribing costs.

The results of the study are discussed below in answer to the research questions posed at the start of the project. Policy implications and recommendations arising from the study are also discussed.

6.3.1 Did intervention practices make savings in their prescribing costs?

6.3.1.1 Changes in overall prescribing variables

Compared with their matched controls, the intervention practices made relative savings of more than twice the amount that the project cost in terms of the employment and training of the practice-based pharmacists. Results showed that there was little difference between the two groups of practices in terms of number of items prescribed and that the relative savings were due to a reduction in cost per item. It seems likely that a substantial proportion of these savings were the result of a significant increase in the growth of generic prescribing.

Figures 3.2 to 3.5 show changes in overall prescribing variables at individual practice level. With one exception, all the intervention practices managed to control prescribing costs relative to their matched controls. Although the majority of intervention practices increased the number of items prescribed per ASTRO-PU, in general they were better able to control costs per item and increase generic prescribing compared to controls. The increase in the number of items prescribed in intervention practices may well have been the result of reducing repeat prescribing intervals from 2 monthly to monthly. This would have the effect of dramatically increasing the number of items prescribed without any change in overall prescribing volume and may in part explain how intervention practice 6 (Figure 3.3) showed a greater than 20% increase in items per ASTRO-PU, yet managed to control prescribing costs, relative to matched controls.

6.3.1.2 Changes at BNF chapter level

Statistically significant differences in costs between intervention and control practices were found in chapters 1 (gastro-intestinal system) and 5 (infections).

For combined data, intervention practices showed a reduction in costs for chapters 1, 5 and 10 and showed relatively smaller increases in costs than controls in BNF chapters 2, 3 and 4. Although intervention practices increased their generic prescribing rates by a greater amount than the controls for each of the BNF chapters studied, this did not explain how practices controlled expenditure for gastrointestinal drugs where, at the time of the study, a high proportion of costs came from drugs that were still within patent. This is discussed further in section 6.3.3.3.

Relative to controls, intervention practices increased the number of items prescribed in BNF chapters 2, 3 and 4. These differences were small and once again the results may be spurious as items are not a reliable measure of prescribing volume (Bogle and Harris, 1994).

6.3.2 Did savings cover the cost of the intervention?

The study showed that if the cost growth of the intervention practices had been as great as controls, their total prescribing expenditure would have been around £347 000 higher. Given that the cost of the scheme was £163 000, it is estimated that the project made a net saving of £184 000.

Although the project was successful in making savings, it must be noted that the Prescriber Support Project involved opportunity costs for the Health Authority and the practices. While Health Authority personnel felt that these costs were justified in terms of the benefits of the initiative, Primary Care Trusts would need to be aware of the major commitment required in terms of time and resources to implement such an intervention. Similarly, practices would need to be aware that

working with a practice based pharmacist may reduce the time available for other aspects of practice development.

6.3.3 What changes did intervention practices make in their prescribing patterns compared with matched controls?

6.3.3.1 Changes in overall prescribing variables

The results from the Optimise analysis of changes in overall prescribing variables show similar patterns to the results from the PACTline analysis. However, there were some minor differences. For example, the percentage changes in costs (per 1000 patients) were slightly higher for each group based on the Optimise analysis. This is because cost growth would have been higher in chapters 1 to 6, 8 and 10 of the BNF compared with the other chapters (Department of Health Statistical Bulletin, 2004). Interestingly, the percentage changes in prescribing volume (based on units per 1000 patients or items per ASTRO-PU) were similar even though the unit of volume was different. As with the PACTline analysis it is clear that intervention practices made relative savings by controlling the cost per unit volume.

According to the analysis of PACTline data, intervention practices achieved a significantly higher growth in generic prescribing than controls, despite their median baseline proportion of generics being higher than controls. The results of the Optimise analysis are consistent with these findings. They show that intervention practices had the potential to make savings of £1 271 per 1000 patients by prescribing generically and that they realised 40% of this potential. In contrast, control practices which had a greater potential to make savings (£1 482 per 1000 patients) only realised 2.6% of this potential.

Optimise software makes it possible to identify potential savings by prescribing brand-named preparations that are cheaper than either a generic (or brand-named) equivalent. As mentioned earlier, generics are not always cheaper than brands. For example, when the tariff generic, co-amilofruse became available, several of

the brand-named versions of the drug were cheaper than the price set for the generic in the Drug Tariff. In other cases, there may be differences in costs for chemically equivalent brand-named drugs (where a generic is not available). In order to identify these types of preparations it is necessary to have detailed knowledge of prices (and changes in prices) in the Drug Tariff. The analysis has shown that although both intervention and control practices made savings by switching from generic (or branded) preparations to brand-named products that were cheaper, the extent of savings was much greater for the intervention practices (21% compared with 7% for controls). This is an important finding because making savings through these types of substitution requires a sophisticated approach to cost control.

6.3.3.2 Changes in Audit Commission type categories

New and expensive drugs

Of all the categories examined, "new and expensive drugs" was the most important in terms of overall prescribing costs and changes in costs. The increase in costs for these drugs accounted for 73% of the £3 688 rise in overall costs per 1000 patients for intervention practices and 76% of the £5 384 rise for control practices. Although these proportions are similar, there was a marked difference between the two groups of practices in terms of the actual change in prescribing costs between the two years, with intervention practices being more successful at controlling the rise in costs of these drugs than control practices.

The most important of the new and expensive drugs in terms of percentage increase in costs between the two years for both groups of practices were lipid-lowering drugs. This is not surprising given that, for all practices in England, this section of the BNF (2.12) has shown the largest increase in net ingredient cost for the three consecutive years 2001 to 2003 (Department of Health Statistical Bulletin, 2004). Results showed that intervention practices did not restrict their prescribing of this class of drug; nor did they restrict their prescribing of oestrogens and HRT. However, with a changing clinical evidence base, the

benefits of increased prescribing of HRT may now be questionable (Innovative Health Technologies, 2004). In terms of SSRIs, proton pump inhibitors and selected new and expensive drugs, intervention practices managed to restrict the increase in costs to a greater extent than controls.

Expensive hospital-initiated drugs

Expensive hospital-initiated drugs were included in the analysis as it was considered that they may have contributed to some of the differences in costs observed between the intervention and control practices. Although intervention practices had a marked increase in costs for drugs in chapter 8 of the BNF, the magnitude of the increase was similar for control practices. However, intervention practices had a 24% increase in costs for some hospital-initiated drugs in marked contrast to control practices which had a fortuitous 48% reduction in costs for the same drugs.

Other Audit Commission type categories

In keeping with the results of the Audit Commission Report (1994), intervention practices made savings in prescribing costs for modified/sustained release preparations, drugs of limited therapeutic value and topical NSAIDs. The fact that intervention practices decreased their prescribing costs for these drugs suggests that the pharmacists were making specific interventions in these areas. Savings for intervention practices were not apparent for drugs that could be bought over-the-counter or combination products. However, the rise in costs for these drugs was minimal (4% and 0.7% respectively).

6.3.3.3 Changes in prescribing costs at BNF chapter level

Findings from the Optimise analysis of changes in prescribing costs at BNF chapter level are consistent with those obtained from the PACTline analysis, with the exception of changes in costs for chapter 6 (endocrine system). This is not unexpected as the PACTline data, unlike the Optimise data, were weighted for patient characteristics such as gender, an important factor in this class of drugs.

Overall, intervention practices managed to restrict the rise in costs to a greater extent than control practices for chapters 1 (gastro-intestinal system), 2 (cardiovascular system), and 3 (respiratory system). In contrast to control practices, intervention practices reduced costs for chapter 10 (musculoskeletal and joint diseases) and although both intervention and control practices reduced their costs for chapter 5 (infections), intervention practices did so to a much greater degree.

It is noteworthy that intervention practices managed to control costs for gastro-intestinal drugs at a time when the rise in the use of proton pump inhibitors was having a substantial impact on prescribing costs (Jones et al. 2001). This was achieved by substantially reducing prescribing costs for H_2-receptor antagonists. Also the reduction in costs for drugs used for infections is important given that GPs have been criticised for the volume and cost of the antimicrobial agents that they prescribe (Little et al. 1997; Woodhead, Fleming and Wise, 2004). Similarly, reductions in costs for drugs used for musculoskeletal and joint diseases (mainly NSAIDs) in the intervention practices, would be in keeping with attempts to persuade GPs to reduce their prescribing of NSAIDs for reasons of safety and cost.

6.3.3.4 Changes in prescribing costs for selected therapeutic groups

As shown in Table 4.17, changes in costs for 20 therapeutic groups were responsible for 87% (£3 956) of the difference between the two groups of practices in their changes in costs between 1995/6 and 1996/7. It is worth noting that of the 20 therapeutic groups listed in Table 4.17, the "top 10" were responsible for 80% of the differences seen between the two groups.

Data on changes in prescribing in specific therapeutic groups are shown in section 4.4.6 and a summary of the changes in different therapeutic groups is shown in Tables 4.51 to 4.52. It is not intended to repeat this information in the discussion but rather to focus on the types of changes that occurred in prescribing

patterns (with examples) in order to draw out key strategies that may have been employed by the intervention practices.

Changes in intervention practices

The types of changes that enabled intervention practices to reduce prescribing costs are shown below (with examples):

- reductions in prescribing volume:
  - H_2-receptor antagonists
  - drugs used to treat infections (penicillins and macrolide antimicrobial agents)
  - adrenoceptor stimulants (mainly salbutamol)
- reductions in cost per volume:
  - drugs used to treat infections (penicillins and cephalosporins)
  - ACE inhibitors
- switching to less expensive drugs and preparations:
  - nizatidine instead of ranitidine
  - reduction in use of breath-actuated and dry-powder inhalers
  - relative increase in generic beclomethasone inhalers
- "paying" for new and expensive drugs through reductions in other therapeutic areas:
  - Increase in prescribing of proton pump inhibitors offset by reductions in prescribing of H_2-receptor antagonists

The most important of these factors was the reduction in cost per volume. This is in keeping with the results of the PACTline data which showed that these practices significantly increased their rate of generic prescribing relative to matched controls.

It should be noted that intervention practices did not reduce costs in all therapeutic areas. In some areas they increased costs, but managed to control

these increases to a greater extent than control practices. This was achieved in one of three ways:

- control of prescribing volume:
  - alpha-adrenoceptor blocking drugs
  - proton pump inhibitors
- reductions in cost per volume:
  - nitrates
- switching to less expensive drugs and preparations:
  - use of 10mg omeprazole

Changes in control practices

The types of changes that resulted in control practices increasing their overall prescribing costs included:

- increases in prescribing volume in most therapeutic groups but particularly for cardiovascular and gastro-intestinal drugs (especially PPIs)
- use of more expensive preparations within specific therapeutic groups:
  - isosorbide mononitrate m/r
  - dry powder inhalers
  - clarithromycin
- increases in cost per volume:
  - alpha-adrenoceptor blocking drugs
  - nitrates
  - macrolide antimicrobial agents
- smaller reductions in costs per volume than intervention practice:
  - ACE inhibitors
  - penicillin antimicrobial agents
  - cephalosporins

The most important of these factors was the inability of the control practices to either reduce (or restrict the rise in) costs per unit volume. This is in keeping with

the overall Optimise results which demonstrated that these practices showed only a slight reduction in their potential generic savings (2.6%).

It should be recognised however, that while control practices showed considerable increases in costs between 1995/6 and 1996/7, there were some instances where they managed to reduce costs. For example they reduced costs for chapter 5 (infections) by reducing the volume of prescribing for penicillins and cephalosporins.

Implications of changes in prescribing costs in specific therapeutic groups

On the basis of the findings presented, it is possible that the pharmacists were using strategies to help the intervention practices reduce their prescribing costs. The elements of these possible strategies are outlined below.

Controlling prescribing volume

There are a number of ways in which prescribing volume (per 1000 patients) might fall. These include:

- a decrease in morbidity
- prescribing more appropriately
- minimising drug wastage through improving the monitoring of drugs
- withholding drugs that patients need
- a spurious result due to a fall in list size

Although some of the reductions in prescribing volume for the intervention practices may have been spurious, it is possible that much of the change was as a direct result of specific efforts on the part of the pharmacists. Analysis of the pharmacists diaries by Doncaster Health Authority showed that the pharmacists were using a range of strategies which could account for the changes seen in the analysis of the PACT data and these have been summarised in Appendix 6. However, while the pharmacists may have been responsible for instigating most of the changes that influenced prescribing costs in the intervention practices, it is

likely that the GPs made some independent changes in their day to day prescribing.

Given that the researcher did not have data on morbidity in the study practices, it is not possible to tell whether or not the reductions in prescribing volume were appropriate or not. However, there were reductions in prescribing volume in areas where it has been suggested that there may be benefits from less prescribing e.g antimicrobial agents (Little et al. 1997; Woodhead, Fleming and Wise, 2004). Conversely, there were increases in volume for drugs where it has been suggested that there may be benefits from greater prescribing by GPs e.g. lipid-lowering drugs (Scandinavian Simvastatin Survival Study Group, 1994; Oliver, 1995; Shepherd et al, 1995).

Controlling cost per unit of volume

Practices can control cost per unit of volume by:

- an appropriately cautious use of new and expensive drugs
- an appropriately conservative use of premium price preparations including:
  - combination products
  - modified release products
  - expensive inhaler delivery systems
  - relatively expensive drug choices in different therapeutic groups
- a fortuitous reduction in patients on expensive medications (particularly hospital-initiated drugs)
- failure to prescribe expensive medications that patients may need
- failure to prescribe premium price preparations when they might have considerable benefits over existing medication.

One of the limitations of using PACT data for this type of analysis is that it is not possible to know the reason why a specific drug is prescribed; or whether the changes in cost per unit volume are appropriate or not. However, the findings would suggest that the intervention practices were being appropriately cautious in their use of new and expensive drugs and conservative in their use of premium

price preparations. In addition, the use of therapeutic substitution to reduce costs was evident e.g. the increased use of nizatadine over ranitadine (Dutton, 1996)

6.3.3.5 Changes in potential generic savings

Potential generic savings are the savings that could have been made if a practice had prescribed a brand-named drug generically (where this would have saved money). Therefore a reduction in potential generic savings between two years implies that practices have reduced prescribing volume for the brand-named drugs in question. This analysis makes it possible to say whether these reductions in prescribing volume have been accompanied by increases in prescribing generic (or brand-named) equivalent preparations, or by a general reduction in prescribing volume. This type of analysis is important as it points to the type of strategy that might have been employed by the practices.

Table 4.38 showed that, for intervention practices, there was a substantial reduction in potential generic savings between the two years. Over 80% of this came from reductions in the prescribing of 10 brand-named drugs. This suggests that in order to make sizeable generic savings, it may be important to focus on a small number of brand-named drugs where there is the greatest potential for making savings through generic substitution (Audit Commission, 1994).

Table 4.53 summarises the results of the analysis of how intervention practices reduced prescribing of certain brand-named preparations. It can be seen that for some preparations, generic switching was the most important method. For others, there was an overall reduction in prescribing volume for all equivalent preparations. These results are discussed in more detail below.

Intervention practices reduced their prescribing of certain brand-named inhalers by switching to generics and other brands. There was an overall reduction in prescribing volume for these preparations (when brands and generics were added together). The analysis showed that brand to brand switches were towards Salamol Easi-breathe (salbutamol) and Beclazone (beclomethasone) preparations.

This is in keeping with the fact that these preparations were heavily marketed to GPs during the time of the study.

The generic switches that occurred for Volterol 50mg, Volterol 25mg and Colofac 135mg were quite substantial and would suggest that intervention practices were instituting systematic changes in their prescribing.

For Adalat 10mg, Triludan 60mg and Tagamet 400mg, there were substantial reductions in volume of prescribing. In the case of Adalat 10mg, there was a switch away from generic nifedipine to "other brand-named preparations", specifically Tensipine. These changing in prescribing might well have been attributed to a number of factors. For short acting nifedipine, there were concerns that it might increase the risk of cardiac events. Triludan prescribing was hit massively by highly publicised concerns about potentially life-threatening drug interactions and it is possible that the reduction in Tagamet prescribing was due to generic substitution and the use of PPIs instead of H_2-receptor antagonists.

In the case of Nitrolingual spray, there was no real reduction in prescribing volume in intervention practices and switches were being made to a mixture of other brand-named preparations and generics.

6.3.4 Was the quality of prescribing maintained?

As mentioned in section 4.3.7 there are a number of limitations in the use of PACT data to assess prescribing quality ((McGavock, 2001; Cantrill, Sibbald and Buetow, 1998). However, by using PACT data as a proxy measure of prescribing quality it has been possible to obtain an impression of whether quality of prescribing was maintained or improved in the intervention practices. A list of questions pertaining to quality of prescribing was explored using Level 3 PACT data and the results are discussed below with examples.

Did intervention practices increase their prescribing in areas where this might be necessary to give patients the drugs that they need?

Intervention practices increased their costs (per 1000 patients) for:

- lipid-lowering drugs (97% increase: see Table 4.10)
- inhaled corticosteroids (0.12% increase: see Table 4.11)
- hormone replacement therapy (7.1% increase: see Table 4.6)

Did intervention practices control or decrease their prescribing in areas where it has been suggested that GPs may "over-prescribe"?

Intervention practices reduced their prescribing (per 1000 patients) for:

- drugs of limited therapeutic value (15% decrease: see Table 4.5)
- antimicrobial agents (13% decrease: see Table 4.13)
  - reductions in prescribing volume for penicillin antimicrobial agents (3.6%) and macrolide antimicrobial agents (3.4%)
- NSAIDs (5.4% decrease: see Table 4.16)
  - reductions in prescribing volume seen for Mefenamic acid (13%), Naproxen (4.3%), Indomethacin (12%), Piroxicam (17%), Tiaprofenic (18%) and others (12%) (see Table 4.36)

Did intervention practices control or decrease prescribing costs in areas where it has been suggested that savings might be made without detriment to patient care?

Intervention practices made savings or controlled the rise in costs in the following areas:

- selected generic substitutions (see Table 4.4)
  - reduced their potential for making savings by £507 per 1000 patients (40%)
  - most of these reductions in potential for generic savings came from reductions in the prescribing of 10 brand-named drugs. In many cases there was evidence of generic substitution e.g. Voltarol 50mg and 20mg tablets, Colofac 135mg tablets, Becloforte 250mcg inhaler and Becotide 100mcg inhalers
- selected combination products (see Table 4.5)
  - although practices did not mange to reduce costs for these drugs, they did manage to control the rise in costs which amounted to 0.71%
- selected modified release products (see Table 4.5)
  - overall practices managed to reduce the prescribing of these drugs by 4.9%. In some cases, e.g. the use of ISMN m/r, intervention practices showed a modest increase in prescribing volume (5.3%) compared with controls (17%)

To summarise, on the basis of these findings it would appear that intervention practices:

- increased their prescribing in areas where this might be necessary to give patients the treatment that they need
- decreased their prescribing in areas where it has been suggested that GPs may "over prescribe" (Audit Commission, 1994)
- decreased their prescribing in areas where it has been suggested that savings might be made without detriment to patient care (Audit Commission, 1994)

It is worth repeating that the intervention practices appeared to make relative savings in areas where it is believed that savings *can* be made without detriment to patients. These reductions in costs were partly offset by increases in areas where it has been suggested that GPs may need to increase their prescribing. There was no suggestion of the practices holding back on their prescribing of important classes of drug such as inhaled corticosteroids or lipid-lowering agents.

Although these findings would suggest no major cause for concern, it would have been interesting to have carried out detailed analysis of prescribing quality in the intervention practices. An area for future possible research would be to examine quality of prescribing in general practices and how it changes, as a result of different pharmacist-led interventions.

6.3.5 What were the views of patients on changes made to their medication?

6.3.5.1 Satisfaction with finding out about the change in treatment

The results of the study showed that communication, or lack of it, was extremely important to patients in terms of having their medication changed. Levels of satisfaction were greatest when told about the change face-to-face by either a pharmacist or GP, or being told by a letter. It is likely that some of the patients' dissatisfaction could have been avoided with better communication. These findings are consistent with the findings of the Dowell study (Dowell, Snadden and Dunbar, 1996), the recent study by Little et al. (2004b) and the findings of the systematic literature review by Cox et al. (2004).

Being offered a choice about whether the medication was changed was positively associated with levels of satisfaction; so too was having the opportunity to discuss their concerns with the GP (or pharmacist). This suggests, as found by Little et al. (2004b), that satisfaction can be increased by encouraging patients to raise issues and to discuss symptoms and other health related issues in the consultation.

From analysis of the free-text comments, concerns often centred around real (or potential) side-effects. In addition, for the small number of patients who did not go along with the change in medication, there was the suggestion that initial compliance was associated with satisfaction with the way in which respondents were told about the change in treatment. This association has been found in other studies such as that by Jenkins et al. (2003) which showed that problems in

communication were more likely to lead to poor outcomes in terms of non-adherence.

Satisfaction with the way in which patients found out about their changes in medication was associated with a number of other factors. In common with other studies, women were more likely to be satisfied (Largey and O'Neill, 1996). Also, the degree to which patients saw the same GP when visiting the surgery was an important factor. Increased satisfaction associated with seeing the same GP always (or often) would fit with the literature suggesting that continuity of care is important to patients (Baker and Streatfield, 1995; Freeman and Richards, 1993).

6.3.5.2 Satisfaction with the new treatment

The recently published World Health Organisation report (2003) highlights the need to improve adherence to medications so as to "reduce the global burden of disease". At the time of the survey, 87% of patients confirmed that they remained on their new treatment, despite 22% having experienced problems. Seventy-two percent of responders were either "satisfied" or "very satisfied" with their new treatment, and 14% were either "dissatisfied" or "very dissatisfied" (these figures include patients who decided not to continue with their treatment). These are important findings as they suggest that the vast majority of patients in this study were prepared to go along with the types of prescribing changes mentioned. It is interesting to note that in the study by Jon Dowell and colleagues, (Dowell, Snaden and Dunbar, 1995) only 70% of patients had continued with a prescribing change at the time of their survey. The more favourable results from this study may have been associated with a number of factors including the types of medication change and the communications received by patients. Nevertheless, even on the basis of this study, GPs and pharmacists need to recognise that a significant minority of patients will experience problems with a change in medication and that most of these will seek advice.

Satisfaction with a new treatment was strongly associated with whether patients felt that they had a choice about their change in treatment. This is an important finding because it adds support to the contention that patients should be involved in the decision-making process. The recognition of the need for patient centred consultations is well documented (Royal Pharmaceutical Society, 1997; Richards, 1999; Stevenson et al. 2000; Weiss and Britten, 2003). However, as pointed out by Stevenson et al. (2000) and Jones (2003), the concept of shared decision making does not always translate into practice.

Other aspects of the way in which patients were told about changes in their medication were not so important, although telling patients *why* the change in treatment was taking place seemed to be valuable. Once again, females were more likely to be satisfied than males. Other patient characteristics were not associated with satisfaction with the new treatment. Neither were the length of time the respondent had been with the practice nor how often they saw the same GP when visiting the surgery.

In summary it can be seen that the results of the study are consistent with the body of evidence that suggests that patient satisfaction is positively associated with increasing levels of communication in the consultation and degree of involvement in the decision-making process. The fact that they frequently do not get the information or reassurance they want (Britten et al. 2000) may be attributed to a number of factors e.g. unvoiced agendas in the GP consultation (Barry, 2000), patient expectations, GPs' (sometimes inaccurate) perceptions of their patients, or lack of participation on the part of the patient (Britten et al. 2000). Perhaps practice-based pharmacists, with their knowledge of medications and "well developed interest in, and awareness, of concordance," (White, 2003) would be well-placed to provide such information and assurances.

6.4 POLICY IMPLICATIONS OF THE STUDY

The work presented in this thesis would suggest that the employment of pharmacists in general practice has the potential to reduce GP prescribing costs while maintaining or improving the quality of prescribing. The relative savings made by the intervention practices were largely the result of controlling or reducing costs per unit volume, although controlling or reducing the volume of prescribing had an important part to play, especially in the case of new and expensive drugs (proton pump inhibitors in particular). It would appear that large savings were made from just 10 brand-named drugs by:

- switching to generic preparations (where these were cheaper)
- reducing prescribing volume
- in the case of inhalers, switching to lower cost delivery devices

The implications from this work are that there are a number of quite simple strategies which might help GPs to control prescribing costs in the future. These are:

- making systematic switches from brand-named drugs to generics where this is likely to have an important impact on drug costs.
- having a cautious approach to the introduction of new and expensive drugs (except where there is very clear evidence to support their benefits compared with existing products)
- limiting the use of modified release and combination products by reserving them for patients who really need them
- controlling prescribing volume (without detriment to patients)

Although these strategies could very well be implemented without the need for pharmacist intervention (Tant, 1999), the reason for the success of this project is likely to be the fact that the pharmacists had the time, the detailed knowledge, the motivation and the co-operation required to bring about a change in prescribing patterns. GPs often do not have the necessary time it would take to implement such strategies (Avery, Walker and Murphy, 1997), but are willing to change

prescribing behaviour if there is no detriment to patient care (Avery and Heron, 1997).

6.4.1 Information and support

The information and support offered to the pharmacists involved in the project probably made an important contribution to the success of the initiative. One area where information and training was seen to be particularly important was with regard to the use of PACT data (Davis, S. personal communication). Some of the pharmacists were more experienced than others in dealing with this information and therefore the level of input required from Doncaster Health varied from training in basic skills to more complicated analysis. However, skilled interpretation of prescribing data is essential if pharmacists are to identify priorities for change in their practices (Jones and Kendall, 2004). Future schemes need to pay careful attention to training needs in this area and the provision of appropriate data when it is needed.

6.4.2 Relationships between pharmacists and primary health care teams

The importance of good working relationships between pharmacists and their respective primary health care teams cannot be underestimated. These relationships (in which mutual trust is essential) take time to develop. It is important for pharmacists to find effective ways of communicating with GPs and for managing change with minimum disruption to the practices or patients. The fostering of good working relationships in the intervention practices may have been helped by the time commitment given by each of the pharmacists. It is unlikely that pharmacists working on a sessional basis would have the opportunity to develop such effective working relationships.

6.4.3 Patient involvement

The literature has shown the increasing importance of patient involvement in their medication regimens (Barber 1995; Royal Pharmaceutical Society, 1997; Richards, 1999; Stevenson et al. 2000; Lewin et al. 2004). Levels of satisfaction with health services have been shown to correlate with compliance (Horne, Hankins and Jenkins, 2001). Thus, to improve health outcomes and reduce drug wastage, it is desirable to increase levels of patient satisfaction.

The results of this study showed that communication between patients and health professionals is of paramount importance in terms of patient satisfaction, especially when changes to medications are being made. Recommended strategies to improve communication include:

- informing patients of changes to their medications at all times. Since the findings suggest that patients are as satisfied with a letter as they are with face-to-face contact, then the former may be a more cost-effective way of proposing medication change to patients
- giving patients the opportunity to discuss their medications and the reasons for any changes made
- giving patients the option to refuse a change in medication (if reasonable)
- ensuring patients receive continuity of care

6.4.4 Implications for future work

Although this study was completed some years ago, the policy implications are still relevant today. It could be argued that the scale of the savings seen in the study as a result of increased generic prescribing would no longer be replicated as generic prescribing is now more commonplace than it was then. However it is possible that with an emphasis on the appropriate control of new and expensive drugs and the avoidance of waste, practice-based pharmacists might continue to be able to "pay for themselves". An appropriate model might be to have intensive

input from a pharmacist for one or two years followed by a "maintenance programme" where the pharmacist visits once every week or so.

If large scale recruitment of practice-based pharmacists were attempted then it is unlikely that there would be sufficient numbers of pharmacists to go round. It would certainly not be possible to recruit large numbers of pharmacists with the skills and experience of those employed by the practices in this study. These difficulties might mean that relatively inexperienced pharmacists were employed on a sessional basis in practices. If this were the case then it would be important to assess whether these pharmacists were effective at helping to control prescribing costs (while maintaining or improving quality).

Although there has been much emphasis on prescribing costs in this study, it is important to recognise that the most important role for practice-based pharmacists is likely to be in promoting high quality patient-centred prescribing. There is great potential for the involvement of pharmacists in the reduction of medication-related problems in general practice (Granas and Bates, 1999; Mackie et al. 1999)

It is recognised that there is scope for improving prescribing in primary care (Audit Commission, 2003) and pharmacists are uniquely placed to offer support. It is clear from the pharmacists' diaries (Appendix 6) and from the Optimise analysis that quality issues were addressed by having a pharmacist in the practice. In some instances it seems likely that GPs were addressing quality issues without the direct intervention of the pharmacists. Further research is needed on which models of interaction between pharmacists and GPs are likely to be most effective.

6.5 CONCLUSIONS

This evaluation has shown that the intervention practices made estimated relative savings of £347 000 in its first year of operation. This is more than twice the cost of employing the pharmacists and providing training and support. Relative

savings were achieved by controlling both prescribing volume and cost per unit volume. The important factors associated with cost control were:

- controlling the increased volume of new and expensive drugs (especially proton pump inhibitors and SSRIs)
- reducing the volume and cost of prescribing (especially for drugs used for infections and adrenoceptor stimulants)
- generic substitution of brand-named drugs (where this could significantly reduce prescribing costs)
- reducing costs for modified release preparations
- controlling costs for combination products

The findings suggest that the intervention practices made savings in areas where it is believed that savings can be made without detriment to patients and appeared to maintain or improve the quality of their prescribing. In addition, the findings add support to the contention that patients should be involved in the decision making process. If patients are as satisfied with a letter as they are with face-to-face contact, then the former may be a more cost-effective way of proposing medication change to patients.

On the basis of these findings strategies have been suggested that may help general practices control prescribing costs in the future. Previous work has suggested that the majority of GPs are sympathetic to the idea of controlling prescribing costs where there is no detriment to patients (Avery and Heron, 1997). However the major problem which they face is lack of time (Avery, Walker and Murphy, 1997). Changes in medication can prove to be time consuming, particularly when large numbers of patients' notes need to be reviewed and/or patients need to be invited to specially arranged clinics. Receiving intensive input from pharmacists may not only help to overcome this problem, but also bring additional benefits to both patients and the rest of the primary care team (Wells, 1997).

In the words of Marinker and Reilly (see Ford and Jones, 1995):

> *"Primary care pharmacists, based in practices, could become responsible for the pharmaceutical care of the practice population. They would also effect liaison with community and hospital pharmacists, would undertake domiciliary visits where necessary and would certainly emerge as key players in the primary health care team of the future"*

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APPENDIX 1

SEARCH TERMS USED TO IDENTIFY PEER-REVIEWED LITERATURE

List of search terms used for the literature review

The following Medical Subject Heading (MeSH) terms were used to identify the relevant peer-reviewed literature used in this thesis:

Health care professional/setting:

- ambulatory care
- family practice
- pharmaceutical services
- pharmacists
- primary health care
- primary health care research

Patient/consumer:

- adherence
- communication
- communication barriers
- compliance
- consumer satisfaction
- decision making
- outcome assessment
- patient-centred care
- patient compliance
- patient satisfaction

Prescribing:

- budgets
- cost control
- cost-benefit analysis
- cost sharing
- costs and cost analysis
- drugs, generic
- drug costs
- drug therapy
- drug utilization
- formularies
- health care costs
- health care rationing
- health care reform
- health services research
- prescriptions, drug
- physician's practice patterns
- physician's practice patterns
- quality of health care

APPENDIX 2

TESTS FOR NORMALITY

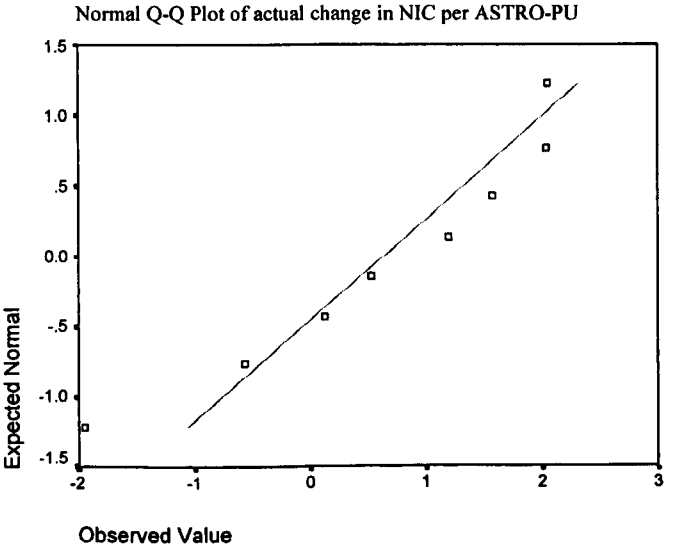
Appendix 2.1: Intervention practices

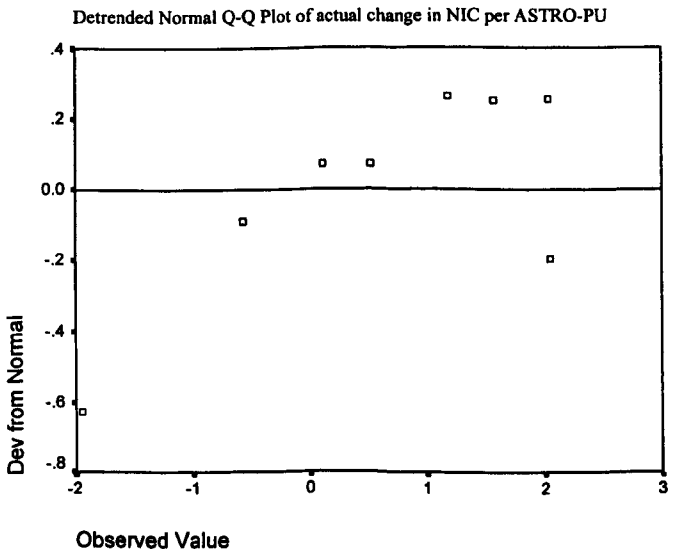
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
actual change in NIC per ASTRO-PU	.157	8	.200*	.922	8	.445
actual change in items per ASTRO-PU	.311	8	.022	.834	8	.065
actual change in NIC per item	.371	8	.002	.662	8	.001
actual change in % generics	.212	8	.200*	.900	8	.291

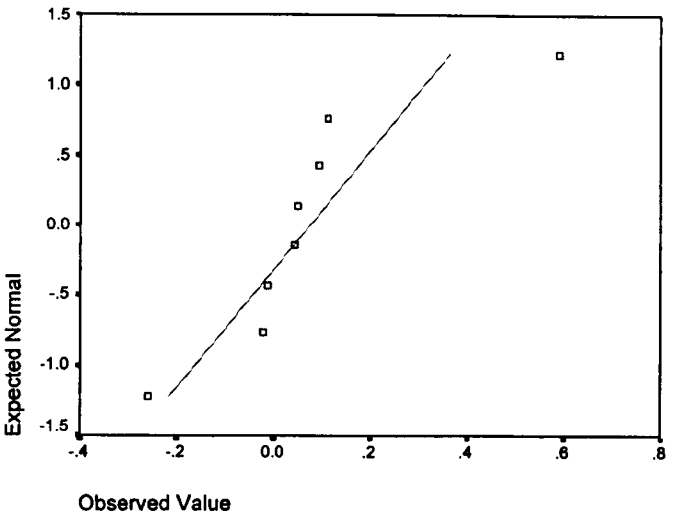
*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

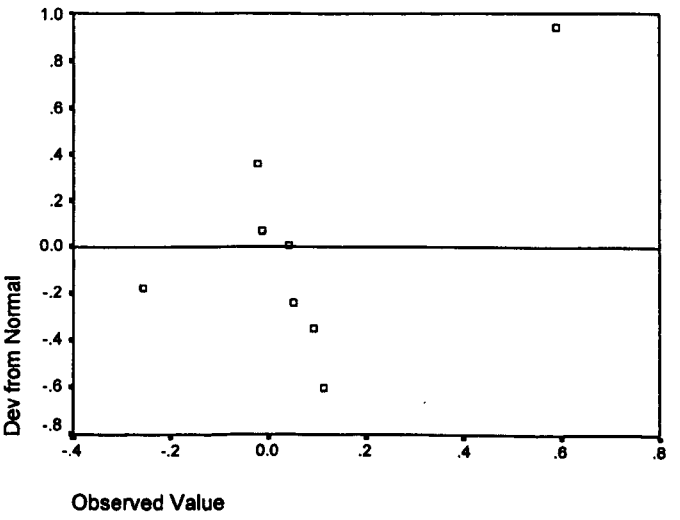




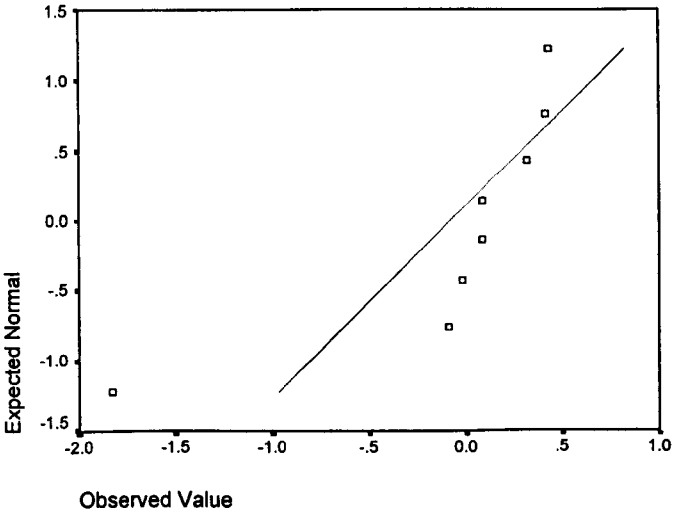
Normal Q-Q Plot of actual change in items per ASTRO-PU



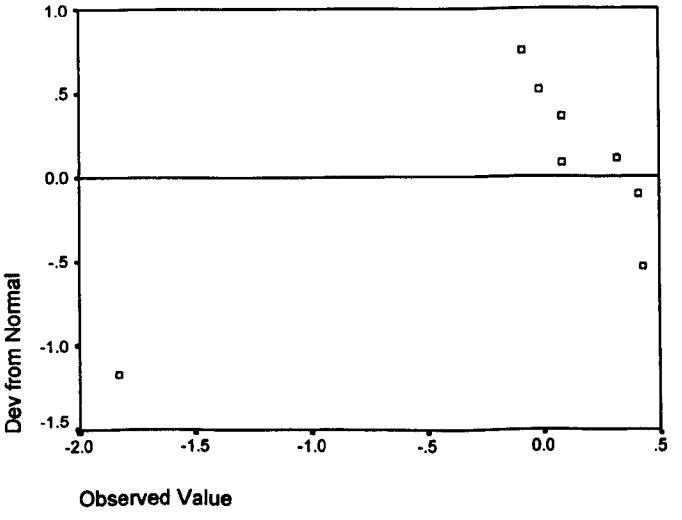
Detrended Normal Q-Q Plot of actual change in items per ASTRO-PU



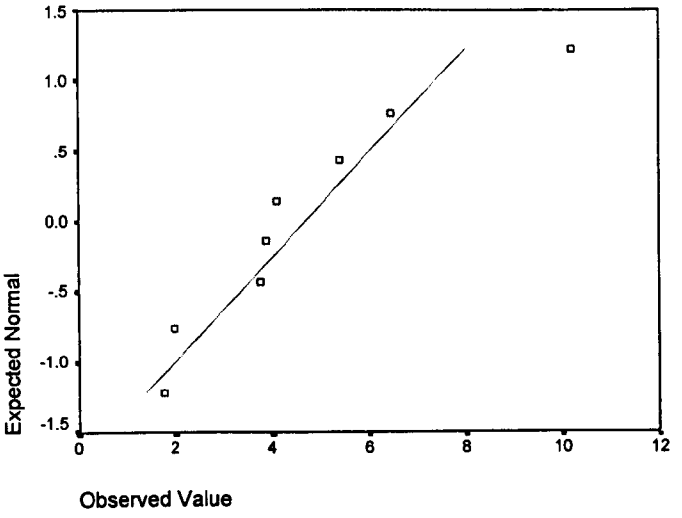
Normal Q-Q Plot of actual change in NIC per item



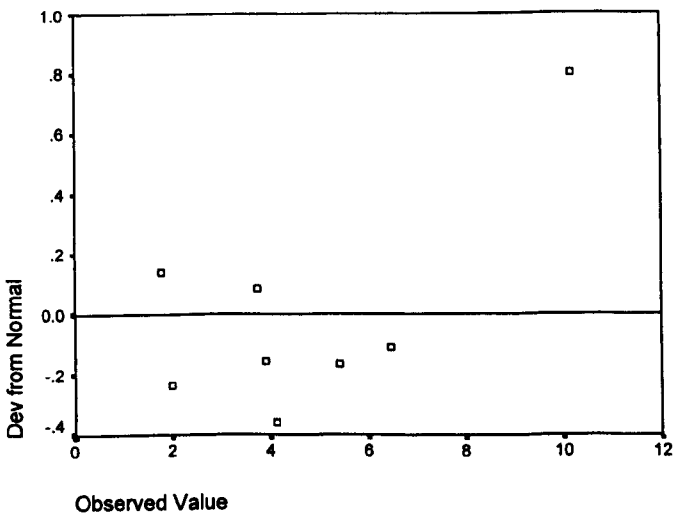
Detrended Normal Q-Q Plot of actual change in NIC per item



Normal Q-Q Plot of actual change in % generics



Detrended Normal Q-Q Plot of actual change in % generics



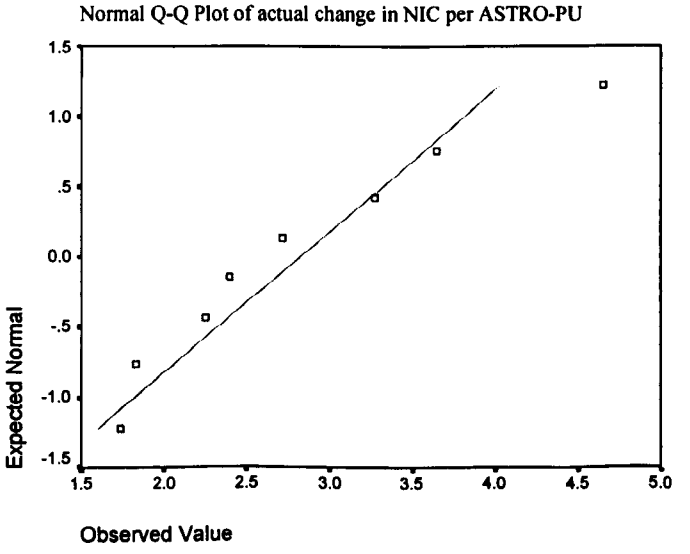
Appendix 2.2: Control practices

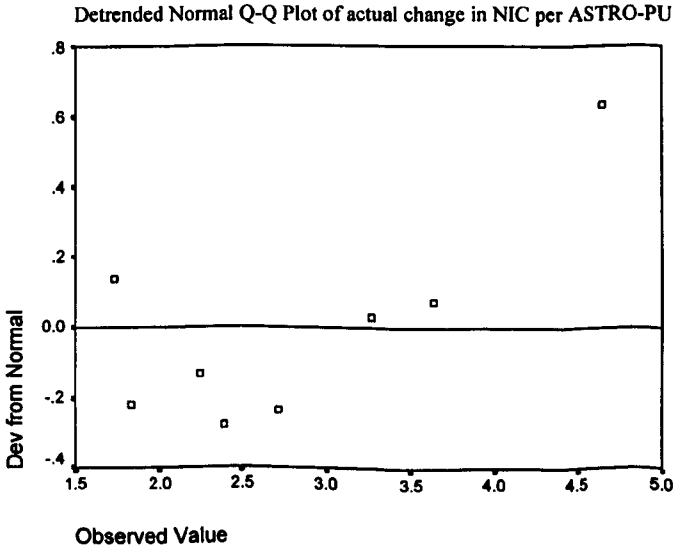
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
actual change in NICper ASTRO-PU	.164	8	.200*	.930	8	.516
actual change in items per ASTRO-PU	.289	8	.047	.895	8	.260
actual change in NIC per item	.279	8	.067	.894	8	.255
actual change in % generics	.192	8	.200*	.933	8	.542

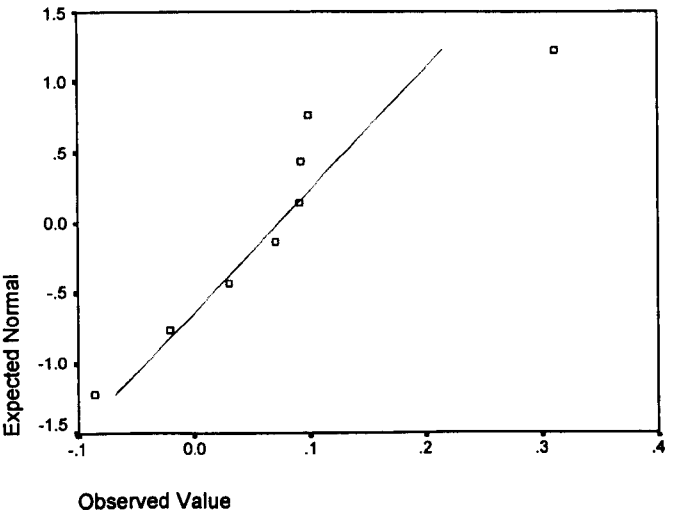
*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

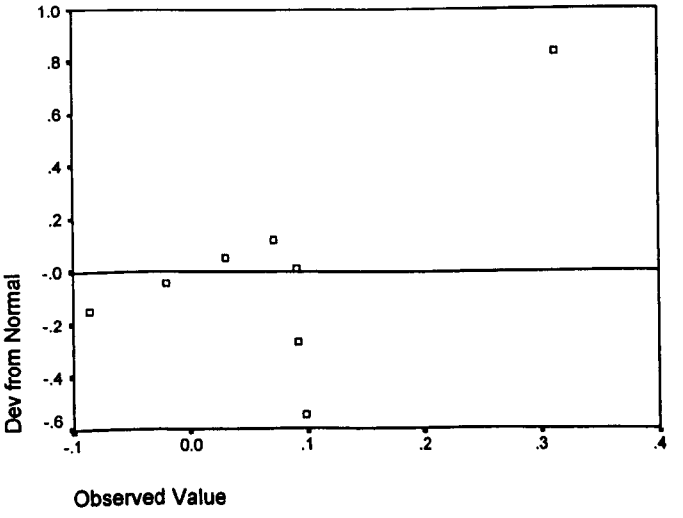




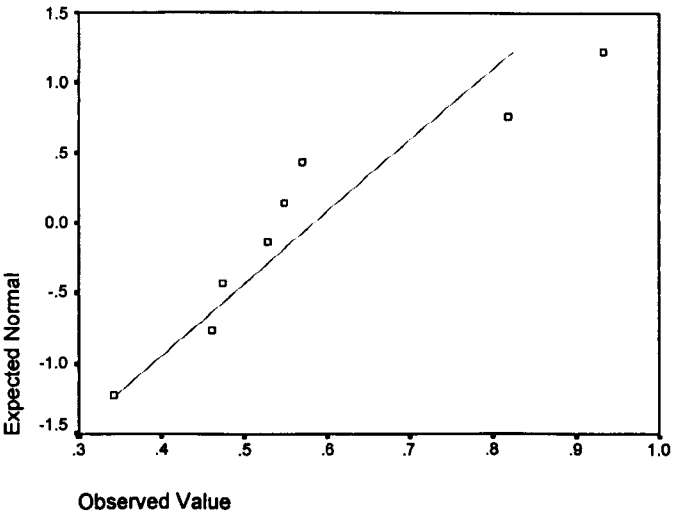
Normal Q-Q Plot of actual change in items per ASTRO-PU



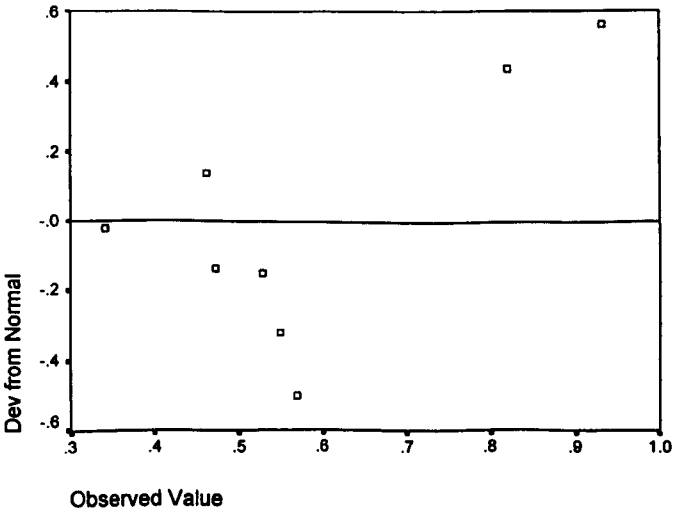
Detrended Normal Q-Q Plot of actual change in items per ASTRO-PU

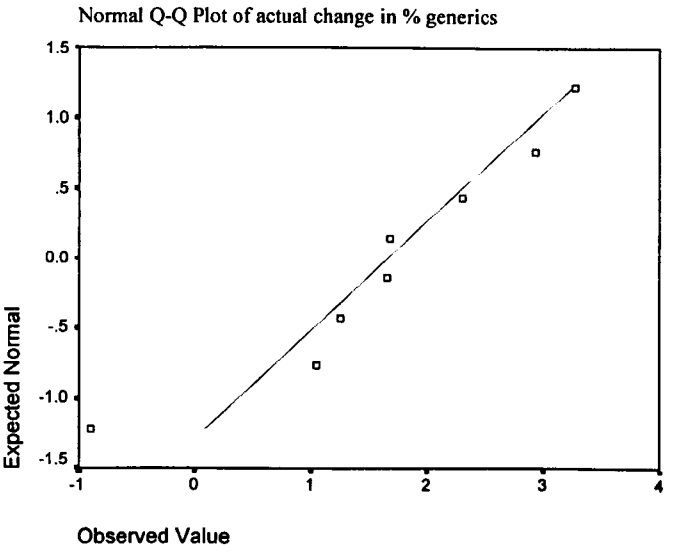


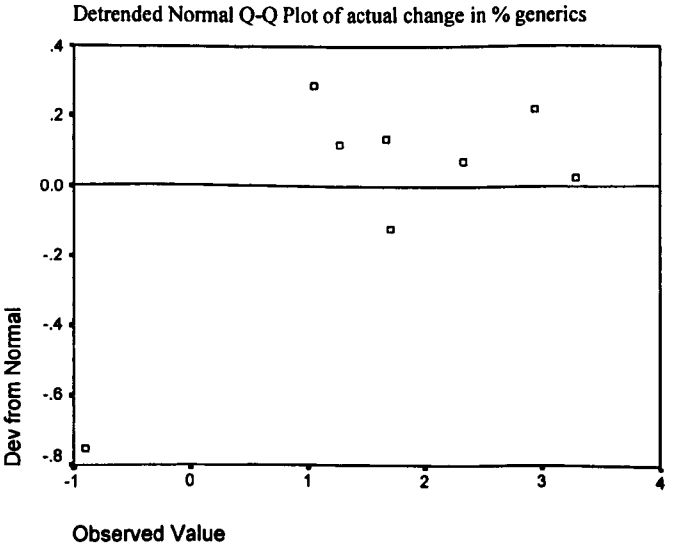
Normal Q-Q Plot of actual change in NIC per item



Detrended Normal Q-Q Plot of actual change in NIC per item




Normal Q-Q Plot of actual change in % generics
Expected Normal
1.5
1.0
.5
0.0
-.5
-1.0
-1.5
-1
0
1
2
3
4
Observed Value


Detrended Normal Q-Q Plot of actual change in % generics
Dev from Normal
.4
.2
0.0
-.2
-.4
-.6
-.8
-1
0
1
2
3
4
Observed Value

APPENDIX 3

CALCULATION OF SAVINGS

Calculation of relative savings

Relative savings were calculated by applying the percentage increase in NIC per ASTRO-PU of control practices to intervention practices for the year September 1995 to August 1996 to give a projected NIC per ASTRO-PU for the year of the intervention. This figure was then multiplied by the mean number of ASTRO-PUs for intervention practices for the period September 1996 to August 1997 to give projected total costs. The actual costs of the intervention practices were then subtracted from the projected costs to give an estimate of the relative savings made. Calculations are shown below:

NIC (£) per ASTRO-PU 1995/6 for intervention practices	= 27.34
Percentage increase NIC per ASTRO-PU (%) for control practices	= 9.17
Projected NIC (£) per ASTRO-PU for intervention practices $[= 27.34 + \frac{(27.34 \times 9.17)}{100}]$	= 29.85
Mean ASTRO-PUs 1996/7 for intervention practices	= 217 033
Projected costs (£) for intervention practices [= 29.85 x 217033]	= 6 478 435
Actual costs (£) for intervention practices	= 6 131 619
Difference between projected and actual cost (£)	**= 346 816**
Cost of the scheme (£)	= 163 000
Net saving (£)	**= 183 816**

APPENDIX 4

CHANGES IN OVERALL PRESCRIBING VARIABLES FOR INDIVIDUAL INTERVENTION PRACTICES AND MATCHED CONTROLS

Appendix 4.1: Changes in overall prescribing variables for individual intervention practices and matched controls (practice pairs 1 to 3) between September 1995 and August 1997

Variable	Intervention practices				Control practices			
	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change
PAIR 1								
NIC (£) per ASTRO-PU	30.18	32.20	2.02	6.7	26.45	29.15	2.70	10.22
Items per ASTRO-PU	3.98	4.02	0.04	1.0	3.48	3.58	0.10	2.80
NIC (£) per item	7.59	8.02	0.43	5.7	7.60	8.15	0.55	7.22
Items prescribed generically (%)	67.08	68.84	1.76	2.62	52.70	53.95	1.26	2.38
PAIR 2								
NIC (£) per ASTRO-PU	25.97	24.04	-1.93	-7.45	26.53	28.90	2.37	8.94
Items per ASTRO-PU	3.53	3.28	-0.26	-7.26	3.04	3.11	0.07	2.26
NIC (£) per item	7.35	7.33	-0.01	-0.20	8.72	9.29	0.57	6.53
Items prescribed generically (%)	53.77	59.18	5.41	10.06	61.16	62.85	1.69	2.76
PAIR 3								
NIC (£) per ASTRO-PU	22.70	23.01	0.30	1.33	28.69	32.33	3.65	12.71
Items per ASTRO-PU	3.38	3.38	0.004	0.11	5.12	5.04	-0.08	-1.66
NIC (£) per item	6.72	6.80	0.08	1.22	5.60	6.42	0.82	14.61
Items prescribed generically (%)	42.18	45.92	3.75	8.89	30.80	29.91	-0.90	-2.91

Appendix 4.2: Changes in overall prescribing variables for individual intervention practices and matched controls (practices pairs 4-6) between September 1995 and August 1997

Variable	Intervention practices				Control practices			
	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change
PAIR 4								
NIC (£) per ASTRO-PU	27.60	29.17	1.56	5.66	24.46	26.30	1.84	7.53
Items per ASTRO-PU	3.69	3.74	0.05	1.36	3.39	3.42	0.03	0.91
NIC (£) per item	7.49	7.80	0.32	4.25	7.22	7.69	0.47	6.56
Items prescribed generically (%)	62.32	64.30	1.98	3.18	48.62	51.89	3.28	6.74
PAIR 5								
NIC (£) per ASTRO-PU	23.27	25.35	2.08	8.92	22.69	24.44	1.75	7.72
Items per ASTRO-PU	3.25	3.35	0.10	3.02	2.77	2.87	0.09	3.41
NIC (£) per item	7.16	7.57	0.41	5.73	8.19	8.53	0.34	4.17
Items prescribed generically (%)	55.93	60.03	4.10	7.33	61.04	62.69	1.66	2.72
PAIR 6								
NIC (£) per ASTRO-PU	24.92	25.45	0.52	2.11	27.46	29.71	2.25	8.21
Items per ASTRO-PU	2.43	3.02	0.59	24.28	2.95	3.04	0.09	3.10
NIC (£) per item	10.25	8.42	-1.83	-17.84	9.30	9.76	0.46	4.96
Items prescribed generically (%)	47.04	57.22	10.18	21.64	64.93	67.87	2.94	4.52

Appendix 4.3: Changes in overall prescribing variables for individual intervention practices and matched controls (practices pairs 7 to 8) between September 1995 and August 1997

Variable	Intervention practices				Control practices			
	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change	Sept to Aug 95/96	Sept to Aug 96/97	Change	% Change
PAIR 7								
NIC (£) per ASTRO-PU	28.68	29.78	1.11	3.85	32.91	36.25	3.34	10.16
Items per ASTRO-PU	3.77	3.87	0.10	2.72	3.72	3.71	-0.01	-0.34
NIC (£) per item	7.61	7.70	0.08	1.10	8.84	9.77	0.93	10.54
Items prescribed generically (%)	59.40	65.87	6.48	10.90	37.94	40.25	2.31	6.10
PAIR 8								
NIC (£) per ASTRO-PU	44.25	44.20	-0.05	-0.11	30.39	35.03	4.64	15.26
Items per ASTRO-PU	5.67	5.72	0.06	0.97	4.59	4.90	0.31	6.75
NIC (£) per item	7.81	7.72	-0.08	-1.07	6.62	7.15	0.53	7.97
Items prescribed generically (%)	54.70	58.59	3.89	7.11	48.43	49.48	1.04	2.15

APPENDIX 5

ADDITIONAL INFORMATION RELATING TO PATIENT SATISFACTION WITH MEDICATION CHANGE

Appendix 5.1: Letter to GPs involved in Doncaster prescribing scheme

(0115) 970 9386

23 February 1998

«Prefix2» «FirstName2» «LastName2»
«Position2»
«OrganizationName»
«Address»
«Address_1»
«City»
«Postal_Code»

Dear «Prefix2» «LastName2»

Evaluation of the Doncaster Prescriber Support Scheme

The Department of General Practice at the University of Nottingham has been asked to be involved in the evaluation of the Doncaster Prescriber Support Scheme. As part of this evaluation we have been working with Sandra Briant, Pharmaceutical Adviser to produce a questionnaire to assess patient satisfaction with changes in their medication. We have piloted this questionnaire with other practices and we have found it to be satisfactory from both the patients' and practices' point of view. We would be grateful if you would have a look at the enclosed letter and questionnaire and give your approval for its use in your practice as part of the evaluation of the Prescriber Support Scheme.

Please note the following:

1 The questionnaire is designed to assess how patients feel about having their medication changed so that any lessons can be learnt for the future. This will be the focus of our analysis: we do *not* plan to judge practices on the basis of the results of the questionnaire.

2 We would like the pharmacist attached to your practice to send out the questionnaires to a sample of patients who have had their medication changed. We believe that it is very important that the questionnaire comes with a (pre-prepared) letter from the practice as this will:

   a) ensure patient confidentiality is maintained
   b) maximise the response rate

3 Envelopes and postage will be provided for the purposes of the survey and we will be able to reimburse the costs of your headed note paper should this be required.

4 When patients return their questionnaires to us we will not know their identities. Therefore, patient confidentiality will be maintained.

If you are willing for this survey to take place in your practice then please fill in the reply slip overleaf and return it to Sarah Rodgers in the postage paid envelope provided.

Yours sincerely

Sarah Rodgers
Research Associate

Tony Avery
Senior Lecturer

.....

Evaluation of the Doncaster Prescriber Support Scheme: Reply Slip

Please tick the appropriate box:

1. I am willing for this survey to take place in my practice ❑
If you have ticked this box please fill in your details below and send this reply slip back using the FREEPOST envelope provided

2. I do not wish for this survey to take place in my practice ❑
If you have ticked this box there is no need to fill in your details below. Please send this reply slip back using the FREEPOST envelope provided

Name: _____

Address or practice stamp): _____

_____

_____

_____

_____

Appendix 5.2: Letter sent to patients on behalf of researcher requesting an interview

Date

Name of patient
Address 1
Address 2
Doncaster
Postcode

Dear *patient*,

In order to improve the service we provide our patients, we wish to look at the way in which changes in prescriptions are being handled at our practice. An important part of this evaluation process is to find out what you think about changes that we have made to your medication in the last few months. To do this, we have asked an independent researcher from the University of Nottingham to conduct interviews with patients, such as yourself. The reason we have chosen someone from outside the practice to undertake this work is so that patients can say what they really think about the changes we have made. Any feedback given to the practice will be done in such a way that individual patients cannot be identified.

If you agree to be interviewed, we would be grateful if you would complete the attached reply sheet and send it in the FREEPOST envelope enclosed. Initially, you will receive a phone call from the Researcher, Sarah Rodgers, who will ask you to suggest a convenient time for the interview and answer any queries you may have. If acceptable, the interview will take place in your own home and will take about one hour.

Sarah would like to tape the interview but only if you are in agreement. This is to make sure that your comments are accurately recorded, since note taking is difficult during discussions. Sarah is the only person who will listen to the tape and once again we would like to stress that anything you say to her will be treated in the strictest confidence. Should you have any queries regarding the interview, please feel free to contact Sarah directly on telephone number (0115) 970 9387 ext. 42022.

We would very much appreciate your support and look forward to receiving your comments.

Yours sincerely,

Signed on behalf of Drs [*name of doctors*]

Appendix 5.3: Doncaster patient interview schedule

A: BACKGROUND

KEY THEMES: Demographic data, knowledge of condition, past/current medication

- How old are you?
- Which practice do you attend?
- How long have you been attending this practice?
- How often do you attend the practice?
- How often do you see your doctor?
- What medication have you been taking?
- Why have you been taking this particular medication?
- How long were you taking it for?
- How has the medication helped you?
- Did it give you any unwanted side-effects?
- Did you always take your medication when you should?
- Do you pay for your prescriptions?

B: CHANGE IN MEDICATION

KEY THEMES: Patients perception of why the change was offered, reasons for accepting/refusing

- When were you offered a change in your medication?
- Do you know why you were offered a change in your medication?
- What were your reasons for accepting/refusing the change?
- How has your prescription been changed?
- How do you feel about this change?
- Do you feel that your new medication has made you feel better/worse/no different?
- Does it give you any unwanted side-effects?
- Do you always take your (new) medication when you should?

C: PATIENTS' PERCEPTION OF HOW CHANGE WAS HANDLED

KEY THEMES: How change was handled, opportunity to discuss concerns, adequate information

- Were you consulted before the change in your medication took place?
- Who was it spoke to you about the change?
- Were you given adequate information?
- Did you have any concerns? What were they?
- Was enough time given to exploring these concerns?
- Are you going to continue taking your new medication?

D: HOW COULD THINGS BE IMPROVED

- Would you say that you feel satisfied with the way the change was handled?
- Do you think that things could be improved? How?

Patient Satisfaction Questionnaire

We are asking for your help in finding out how patients feel about having their treatment changed. To do this, we would like you to spend a few minutes filling in this short questionnaire and sending it to the University of Nottingham in the FREEPOST envelope provided.

Your practice will not see your answers. Only the people dealing with the questionnaires at the University of Nottingham will see your answers and they will not know who you are. This means that you are free to say what you really think!

Your views are very important. *What you say may help improve services to patients in your area and throughout the rest of the country, so please take the time to reply.*

Thank you for your help

Ref ❑❑❑❑❑

ABOUT YOUR CHANGE IN TREATMENT

As you may remember, you recently had the following change in your treatment:

Thinking about this change please answer the following questions by ticking the boxes to give your replies. At the end there is space for you to write comments.

1. How were you **first** told about your change in treatment? (*please tick **one** box*)

My GP discussed it with me face-to-face	❑1
The practice pharmacist discussed it with me face-to-face	❑2
I received a letter from the practice about the change	❑3
I received a phone call from the practice about the change	❑4
I was told about the change when I came to collect a repeat prescription	❑5
I cannot remember	❑6

Other (please give details)7 _____

_____

2. Were you told **why** your Doctor wanted to change your treatment? (*please tick **one** box*)

No	❑1
Yes	❑2
Cannot remember	❑3

3. Were you given any choice about whether or not your treatment was changed? (*please tick **one** box*)

No	❑1
Yes	❑2
Cannot remember	❑3

4. Were you given the chance to ask any questions about the change in your treatment? (*please tick **one** box*)

No	❑1
Yes	❑2
Cannot remember	❑3

5. In general, how satisfied were you with **the way** you found out about the change in your treatment? (*please tick **one** box*)

❑1	❑2	❑3	❑4	❑5
Very Satisfied	Reasonably satisfied	Neither satisfied or dissatisfied	Dissatisfied	Very Dissatisfied

6. Did you go along with the change in your treatment? (*please tick **one** box*)

No	❑1 *now please go to question 11*
Yes	❑2 *now please go to question 7*
Cannot remember	❑3 *now please go to question 12*

7. Did you have any problems with the change in your treatment e.g. side-effects? (*please tick **one** box*)

No	❑1
Yes	❑2
Cannot remember	❑3

8. If you did experience any problems, did you speak to your GP about them? (*please tick **one** box*)

No	❑1
Yes	❑2
Cannot remember	❑3

9. Have you continued with the change in your treatment? (*please tick **one** box*)

No	❑1
Yes	❑2

10. In general, how satisfied were you with your new treatment? (*please tick **one** box*)

❑1	❑2	❑3	❑4	❑5
Very Satisfied	Reasonably satisfied	Neither satisfied or dissatisfied	Dissatisfied	Very Dissatisfied

11. If you **did not** go through with the change in your treatment please explain why.

_____

_____

_____

_____

_____

12. Have you gone through with any other changes in treatment in the last 12 months? (*please tick **one** box*)

No	❑1
Yes	❑2
Cannot remember	❑3

13. If there is anything else you would like to add, please write in the space below.

_____

_____

_____

_____

_____

_____

_____

continued overleaf

ABOUT YOU

Please answer **all** the following questions by ticking the boxes to give your replies.

14. How old are you? (*please give your age in years*) _____

15. Are you male or female? (*please tick **one** box*)

Male ❑1 Female ❑2

16. How long have you been coming to this surgery? (*please tick **one** box*)

❑1	❑2	❑3	❑4	❑5
Less than 6 months	Between 6 months and 1 year	Between 1 year and 3 years	Between 3 years and 5 years	More than 5 years

17. When you visit the surgery, how often do you see the same GP? (*please tick **one** box*)

❑1	❑2	❑3	❑4	❑5
Always	Often	Sometimes	Occasionally	Never

18. Do you have to pay for your prescriptions?

Yes ❑1 No ❑2

Thank you for your help!!!

Don't forget to return this questionnaire in the FREEPOST envelope provided (no stamp required) to:

Sarah Rodgers
Division of General Practice
The Medical School
University Hospital
Nottingham
NG7 2UH

Appendix 5.5: Letter sent to patients by pharmacists on practice-headed paper

Date

Name of patient
Address1
Address2
Doncaster
Postcode

Dear *patient,*

We are asking for your help in finding out how patients feel about having their treatment changed. To do this, we would like you to spend a few minutes filling in a short questionnaire and sending it to the University of Nottingham in the FREEPOST envelope provided.

We will not see your answers. Only the people dealing with the questionnaires at the University of Nottingham will see your answers and they will not know who you are. This means that you are free to say what you really think!

Your views are very important. What you say may help improve services to patients in your area and throughout the rest of the country, so please take the time to reply.

Thank you for your help

Yours sincerely

Practice Pharmacist

Appendix 5.6: Instructions sent to pharmacists regarding survey administration

Date

Name of Pharmacist
Title
Practice
Address 1
Address 2
Doncaster
Postcode

Dear *pharmacist*,

Evaluation of the Doncaster Prescriber Support Scheme

Following our previous letter, we would like to outline a proposed method for administering the Patient Satisfaction Questionnaire:

1. We would like you to send out **25** questionnaires **per practice**

2. We would like you to consider only those patients who underwent a change in their medication between **1 October 1997 and 31 January 1998.**

3. To avoid bias, the questionnaire will need to be sent to a 1 in N sample of patients. It has been decided that a third party should choose the sample and Joanne Etridge has agreed to help. What we would like you to do, is to send details (anonymised if possible) of all patients who have had a change in medication between 1st October 1997 and 31st January 1998. Joanne will then choose the sample and notify you which patients are to be sent the questionnaire.

4 It will be necessary to write brief details of the medication change in the box on the first page of each questionnaire (as a reminder for the patients), and write each patient's name and address on the envelope.

5. A Patient Record booklet (and explanatory notes) has been enclosed to enable you to keep a record of the patients who have been sent a questionnaire. Each questionnaire has an arbitrary reference number on the front and will be used to follow up non-responders. The first 2 digits refer to each practice (1-13), the middle 2 digits refer to the patient number (01-25) and the last digit refers to the type of change. We would be grateful if you could ensure that the patient number on the questionnaire corresponds with the patient number on the Record booklet.

6. Enclosed you will find a classification for the type of change in medication the patient has had. If possible, we would appreciate if you could decide which category the change falls into and enter the number corresponding to this category in the far right-hand box of the reference number on the front page of the questionnaire.

7. When all the questionnaires for each practice have been issued we would appreciate if you could return the reply slip enclosed in a FREEPOST envelope. This will help me to know when the questionnaires have been sent out.

8. Three weeks after the questionnaires have been sent out we will tell you which patients have replied (based on their reference numbers). We will send you another batch of questionnaires to be sent to non-responders with a covering letter.

The appropriate number of questionnaires has been enclosed along with stamped envelopes, labels, FREEPOST envelopes and a copy of a covering letter which will need to be photocopied onto your letterhead paper and signed. We will be able to reimburse the costs of headed note paper should this be required.

We would like to take this opportunity to thank you for your help in administering the Patient Satisfaction Questionnaire and look forward to providing you with feedback on the results. Should you have any queries, please do not hesitate to contact me on the telephone number above.

Yours sincerely,

Sarah Rodgers
Research Associate

Tony Avery
Senior Lecturer

Encl.

Appendix 5.7: Patient Record Booklet and explanatory notes for pharmacists

Explanation of Patient Record

No.	Refers to patient number (1-25)
Name	Name of patient
Ref.	Reference number on front of questionnaire (first 2 digits practice number; middle 2 digits patient number; last digit classification number for type of change)
M/F	Male or female
DoB/Age	Date of birth or age
Change	Actual medication change
Code	Code number for classification for type of change
Date of Change	Date when change in medication took place
Q'aire sent (date)	Date when questionnaire was sent to patient
Reply (Y/N)	Nottingham University to notify you whether patient has replied to initial questionnaire
Reminder sent (date)	Date reminder questionnaire was sent to non-respondents
Reply (Y/N)	Nottingham University to notify you whether patient has replied to reminder questionnaire

I would appreciate if the Patient Record could be returned to Nottingham University after administering the questionnaire. Please detach patient details to maintain anonymity.

Patient Satisfaction Questionnaire
Patient Record

Name of pharmacist:

Practice:

Code Number:

Portion to be retained by pharmacist **Portion to be returned to Nottingham University**

No	Name	Address	Ref.	M/F	DoB/Age	Change	Code	Date of Change	Q'aire sent (date)	Reply (Y/N)	Reminder sent (date)	Reply (Y/N)
1.												
2.												
3.												
4.												
5.												

Explanatory note: a further 4 pages were sent to the pharmacists to allow them to keep information on up to 25 patients

Appendix 5.8: Variables used in the multivariate analysis shown in Tables 5.7 to 5.8

Satisfaction with change in treatment

Dependent variable was "satisfaction with how the respondent found out about the change in treatment":

- Very satisfied = 0
- Satisfied = 1
- Neither satisfied nor dissatisfied = 2
- Dissatisfied = 3
- Very dissatisfied = 4

Independent variables were:

- *The respondent was over 65:* dummy variable =1 if the respondent was over 65 and zero otherwise.

- *The respondent was female:* dummy variable = 1 if the respondent was a female and zero otherwise.

- *The respondent paid for prescriptions:* dummy variable =1 if the respondent paid for their prescriptions and zero otherwise.

- *The respondent had been coming to the surgery for more than 5 years:* dummy variable = 1 if the respondent had been coming to the surgery for more than five years and zero otherwise.

- *The respondent was told why there was a change in treatment:* dummy variable = 1 if the respondent was told why there was a change in treatment and zero otherwise.

- *The respondent was given an opportunity to ask questions:* dummy variable =1 if the respondent was given the opportunity to ask questions and zero otherwise.

- *The respondent felt they had a choice about whether their treatment was changed:* dummy variable = 1 if the respondent felt that they had a choice about whether or not their treatment was changed and zero otherwise.

- *The respondent always seen the same GP the same GP when visiting the surgery:* dummy variable = 1 if the respondent always saw the same GP when visiting the surgery and zero otherwise.

- *The respondent sometimes seen the same GP when visiting the surgery:* dummy variable = 1 if the respondent sometimes saw the same GP when visiting the surgery and zero otherwise.

- *The respondent was informed of the change in treatment by their GP:* dummy variable = 1 if the respondent was informed of the change in treatment by their GP and zero otherwise.

- *The respondent was informed of the change in treatment by the practice pharmacist:* dummy variable = 1 if the respondent was informed of the change in their treatment by the practice pharmacist and zero otherwise.

- *The respondent was informed of the change in treatment by letter:* dummy variable = 1 if the respondent was informed of the change in their treatment by letter and zero otherwise.

- *The respondent was informed of the change in treatment by phone:* dummy variable = 1 if the respondent was informed of the change in their treatment by phone and zero otherwise.

Satisfaction with the new treatment

Dependent variable was "satisfaction with the new treatment":

- Very satisfied = 0
- Satisfied = 1
- Neither satisfied nor dissatisfied = 2
- Dissatisfied = 3
- Very dissatisfied = 4

Independent variables were:

- *The respondent was over 65:* dummy variable =1 if the respondent was over 65 and zero otherwise.

- *The respondent was female:* dummy variable = 1 if the respondent was a female and zero otherwise.

- *The respondent paid for prescriptions:* dummy variable =1 if the respondent paid for their prescriptions and zero otherwise.

- *The respondent had been coming to the surgery for more than 5 years:* dummy variable = 1 if the respondent had been coming to the surgery for more than five years and zero otherwise.

- *The respondent was told why there was a change in treatment:* dummy variable = 1 if the respondent was told why there was a change in treatment and zero otherwise.

- *The respondent was given an opportunity to ask questions:* dummy variable =1 if the respondent was given the opportunity to ask questions and zero otherwise.

- *The respondent felt they had a choice about whether their treatment was changed:* dummy variable = 1 if the respondent felt that they had a choice about whether or not their treatment was changed and zero otherwise.

- *The respondent always seen the same GP the same GP when visiting the surgery:* dummy variable = 1 if the respondent always saw the same GP when visiting the surgery and zero otherwise.

- *The respondent sometimes seen the same GP when visiting the surgery:* dummy variable = 1 if the respondent sometimes saw the same GP when visiting the surgery and zero otherwise.

- *The respondent was informed of the change in treatment by their GP:* dummy variable = 1 if the respondent was informed of the change in treatment by their GP and zero otherwise.

- *The respondent was informed of the change in treatment by the practice pharmacist:* dummy variable = 1 if the respondent was informed of the change in their treatment by the practice pharmacist and zero otherwise.

- *The respondent was informed of the change in treatment by letter:* dummy variable = 1 if the respondent was informed of the change in their treatment by letter and zero otherwise.

- *The respondent was informed of the change in treatment by phone:* dummy variable = 1 if the respondent was informed of the change in their treatment by phone and zero otherwise.

APPENDIX 6

KEY FINDINGS FROM THE ANALYSIS OF THE PHARMACIST DIARIES BY DONCASTER HEALTH AUTHORITY

Actions taken by the pharmacists as recorded in their diaries

As mentioned in the introduction to the thesis, the pharmacists were asked to fill in record sheets to note down any actions that they or their practice took to review or alter prescribing during the course of the study. Doncaster Health Authority personnel analysed these diaries and it can be seen from the types of interventions shown below, that the pharmacists were using a number of strategies which may have accounted for some of the changes seen in the analysis of the PACT data.

1. Repeat prescription review

Repeat prescription review was undertaken in at least five of the practices and interventions included review of patients receiving multiple medications (polypharmacy), 28 day prescribing, incompatible amounts prescribed and ulcer healing drugs.

2. Generic substitution

This took place in at least six of the practices. In many cases the pharmacist identified the areas where greatest savings would be made from switching from brand-named drugs to generics. After discussions with the practice, the pharmacist often made the generic substitutions on the practice computer for patients receiving repeat medication.

3. Nursing and residential home reviews

These took place in at least five of the practices with the emphasis being on review of medication to determine whether prescribing regimes could be rationalised.

4. Formulary review

This took place in at least five of the practices. As a result, several practices agreed to specific therapeutic substitutions:

- Topical NSAIDs changed to Movelat
- PPIs changed to Lansoprazole

- Beconase changed to Nasobec
- Opticrom changed to Haycrom
- Capoten changed to Captopril

5. Gastro-intestinal drugs

Review of these drugs took place in at least six practices with pharmacists tending to set up clinics in order to review patients. The types of changes undertaken were:

- H.pylori eradication (two practices)
- Changing PPIs to lower doses, less expensive preparations or alternative drugs (three practices)
- General review of patients taking ulcer healing drugs (two practices)

6. Cardiovascular disease

Review of these drugs took place in at least five practices. Types of review included:

- lipids audit to maximise treatment of patients with ischaemic heart disease (two practices)
- hypertension clinic audit (one practice): the notes of 862 patients were reviewed by the pharmacist and assessments were made of the most appropriate treatments
- diuretic review (two practices): in both practices a clinic was set up for changing patients' medication (in one of these practices 55 out of 85 patients attended and agreed to change in their medication)
- ACEI review (one practice): 28 out of 55 patients agreed to undergo changes in their medication
- Review of patients taking peripheral vasodilators (one practice): out of 15 patients, two stopped the drug and three agreed to try stopping it
- Aspirin audit (one practice)
- Diltiazem SR changed to Angitil (one practice)
- Natrilix changed to Bendrofluazide (one practice)
- Indapamide changed to Bendrofluazide (one practice)

7. Asthma

Changes were reported in six practices and they included:

- The setting up of a pharmacist run asthma clinic
- Becotide and Ventolin prescribed generically
- Some patients switched from Becotide and Becloforte to an Easi-breathe inhaler
- Dry powder devices switched to Easi-breathe inhalers
- Respirator solutions changed to Sterineb

Some pharmacists commented that changing patients' asthma drugs was a major undertaking because of the numbers involved. In some practices patients were sent letters to inform them of the proposed changes. In one practice over ten per cent of patients asked to be changed back to Ventolin after a switch to Salamol.

8. Other activities

The following took place in at least one of the practices:

- medication review
- review of antidepressant prescribing
- home visits to review medication
- review of monitoring arrangements for patients taking lithium
- medication review of patients taking methotrexate
- identification of high cost drug treatments
- hospital discharge drug checks
- update of diabetic register
- stop smoking clinic
- combination analgesics (Tylex and Solpodol) changed to their separate ingredients

General comments

The following additional points came from the pharmacists' diaries:

- the practice-based pharmacists tended to inform the local community pharmacists about any major changes in their prescribing so that they could order appropriate drugs in some areas whilst reducing stock in other areas.
- many of the interventions were noted to be time consuming particularly where large numbers of patients notes had to be reviewed and/or patients needed to be invited to specially arranged clinics.