LEABHARLANN CHOLÁISTE NA TRÍONÓIDE, BAILE ÁTHA CLIATH | TRINITY COLLEGE LIBRARY DUBLIN
Ollscoil Átha Cliath | The University of Dublin

Terms and Conditions of Use of Digitised Theses from Trinity College Library Dublin

Copyright statement

All material supplied by Trinity College Library is protected by copyright (under the Copyright and Related Rights Act, 2000 as amended) and other relevant Intellectual Property Rights. By accessing and using a Digitised Thesis from Trinity College Library you acknowledge that all Intellectual Property Rights in any Works supplied are the sole and exclusive property of the copyright and/or other IPR holder. Specific copyright holders may not be explicitly identified. Use of materials from other sources within a thesis should not be construed as a claim over them.

A non-exclusive, non-transferable licence is hereby granted to those using or reproducing, in whole or in part, the material for valid purposes, providing the copyright owners are acknowledged using the normal conventions. Where specific permission to use material is required, this is identified and such permission must be sought from the copyright holder or agency cited.

Liability statement

By using a Digitised Thesis, I accept that Trinity College Dublin bears no legal responsibility for the accuracy, legality or comprehensiveness of materials contained within the thesis, and that Trinity College Dublin accepts no liability for indirect, consequential, or incidental, damages or losses arising from use of the thesis for whatever reason. Information located in a thesis may be subject to specific use constraints, details of which may not be explicitly described. It is the responsibility of potential and actual users to be aware of such constraints and to abide by them. By making use of material from a digitised thesis, you accept these copyright and disclaimer provisions. Where it is brought to the attention of Trinity College Library that there may be a breach of copyright or other restraint, it is the policy to withdraw or take down access to a thesis while the issue is being resolved.

Access Agreement

By using a Digitised Thesis from Trinity College Library you are bound by the following Terms & Conditions. Please read them carefully.

I have read and I understand the following statement: All material supplied via a Digitised Thesis from Trinity College Library is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of a thesis is not permitted, except that material may be duplicated by you for your research use or for educational purposes in electronic or print form providing the copyright owners are acknowledged using the normal conventions. You must obtain permission for any other use. Electronic or print copies may not be offered, whether for sale or otherwise to anyone. This copy has been supplied on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement.

A Cluster randomised trial of educational interventions to promote rational prescribing in primary care

Submitted for the degree of Doctor of Philosophy

(PhD)

To the University of Dublin (Trinity College)

2008

Corina Naughton RN MSc

TRINITY COLLEGE
05 AUG 2008
LIBRARY DUBLIN
TH681S
8539

Declaration

I declare that except where otherwise stated, this thesis is entirely my own work and has not been submitted to this or any other University as an exercise for any degree award.

I declare this work was carried out by myself in the Department of Pharmacology and Therapeutics, Trinity Centre for Health Sciences, St James Hospital (Dublin) under the supervision of Dr Kathleen Bennett.

I hereby give permission to the library to lend or copy this thesis.

Corina Naughton

Summary

A randomised controlled trial (RCT) was used to evaluate the effectiveness of individualised GP prescribing feedback delivered as a postal bulletin (PB, n=50 practices) compared to PB plus academic detailing visits (AD, n=48 practices), in promoting rational prescribing among a volunteer group of Irish GPs. The background changes in prescribing were examined using a quasi-experimental design, where prescribing practice from participant GPs (n=110) was compared to those GPs who declined to participant in the study i.e. non-participant GPs (NP, n=190).

The aims of the interventions were to: (1) reduce the rate of overall antibiotic prescribing, (2) reduce second line antibiotic prescribing (co-amoxiclav & cephalosporins), (3) promote generic substitution for five targeted drugs and (4) increase prescribing of preventive therapies i.e. antiplatelet, statins and antihypertensive therapy in patients with established cardiovascular disease (CVD) or diabetes.

The interventions consisted of two separate postal bulletins with the associated academic detailing visits over a six month period (March 2005 to August 2005). The academic detailing visits consisted of a ten minute powerpoint presentation reiterating the message in the postal bulletin and discussion with the GP.

The Health Service Executive Primary Care Reimbursement Service (HSE-PCRS) pharmacy claims database was used to generate the prescribing feedback and evaluate the effectiveness of the intervention.

The effect of the intervention was assessed in the short term (one month or three months post intervention) and the long term (twelve months post intervention). Prescribing was compared pre and post intervention.

Differences in the rate or proportional monthly change in antibiotic or generic prescribing post intervention, adjusting for pre-intervention prescribing, was analysed using segmented regression analysis. Multiple

regression was used to analysis differences in the proportion of patients receiving recommended CVD preventive therapies. Confounding factors were adjusted for in the analysis.

In the immediate post intervention period, both randomised groups showed: (i) a significant reduction in the overall prescribing of antibiotics and second line antibiotics in particular, (ii) an increase in substitution of two of the generic drugs targeted and (iii) an increase in the proportion of diabetic patients receiving CVD preventive therapy. Over the twelve month post intervention period only prescribing of CVD preventive therapies increased compared to baseline levels.

There were no significant changes to prescribing between GP practices who received PB alone and those who received AD and PB, either in the immediate or long term post intervention period across the three topic areas examined.

In the comparison between participant and NP GPs the following areas were significantly different from background prescribing practice immediately post intervention: (i) prescribing of second line antibiotics was significantly reduced among participant GPs and (ii) generic substitution of omeprazole and nimesulide was significantly increased among participant GPs. Over the twelve month post intervention period changes to prescribing were not maintained by participant GPs. Prescribing of statins in CVD and diabetic patients and antiplatelet therapy in diabetic patients increased over the twelve month post intervention period, but there was no significant difference between participant and NP GPs.

Conclusion: Postal prescribing feedback with or without academic detailing had a small effect on antibiotic and generic prescribing, and very little effect on prescribing of CVD preventive therapies. The addition of academic detailing did not significantly increase the effectiveness of the intervention.

Acknowledgements

This was a very interesting and stimulating project and I appreciate having been given the opportunity to be involved with it. I have learnt a great deal in my three years in the Department of Therapeutics and Pharmacology.

The project was only made possible by the co-operation of the General Practitioners (GPs) who generously gave their time and support. I would like to thank them for their feedback, letters of encouragement and the warm reception I was given when visiting their practices. In particular I would like to thank Dr Fergus O'Kelly and Dr Kevin O'Doherty for their help in developing and piloting the interventions.

I owe a great deal of gratitude to my Supervisor Dr Kathleen Bennett, Dept Pharmacology & Therapeutics, Trinity Centre for Health Sciences. Dr Bennett was a constant source of guidance, support and encouragement. I would like to thank Professor John Feely and other member of the Department Pharmacology & Therapeutics for their help and feedback including Tom O'Hara and my fellow PhD students Ian Barron and Ifeanyi Okechukwu.

I would also like to thank those people who contributed to developing the intervention or supplying me with additional information to support the project. These include Dr Mary Teeling (NMIC, St James), Dr Lesley Tilson (Pharmacoeconomics Centre, St James), T Rafferty, (Prescribing feedback service in NI), Dr Robert Cunney, a Consultant Microbiologist (Irish Health Protection Surveillance Centre), Professor Colin Bradley, head of the subcommittee on community antimicrobial prescribing which forms part of the Strategy for Antimicrobial Resistance in Ireland (SARI), and Prof Walsh (Dept Cardiology, St James Hospital).

This project was funded by a research grant from the Health Research Board.

Finally I would like to thank my family and friends for their support and encouragement.

Table of contents

Table of Tables 17

Table of Figures 20

Introduction and structure of thesis 22

Chapter 1 25

Background & Aims 25

1.1 Introduction 25

1.2 Rational Prescribing 25

1.3 Why rational prescribing is important 25

1.3.1 Cardiovascular disease prescribing 26

1.3.2 Antimicrobial prescribing 26

1.3.3 Generic prescribing 27

1.4 How rational prescribing is monitored 28

1.4.1 Development of quality prescribing indicators 29

1.4.2 Limitations of quality indicators 32

1.4.3 Prescribing Indicators and pharmacy databases 33

1.4.4 Limitations of pharmacy database 34

1.5 Influences on Prescribing in General practice 36

1.5.1 External influences 36

1.5.2 Internal influences 42

1.6 Barriers to evidence based medicine 44

1.6.1 Nature of the evidence. 44

1.6.2 Practitioner attitude 45

1.6.3 Patient attitude 46

1.6.4 Logistical reasons 46

1.7 Implementation of evidence based practice 47
1.8 Conclusion 47
1.9 Aims 49
1.9.1 Main objectives: 49
1.9.2 Secondary objectives 49
Chapter 2 51
Literature Review 51
2.1 Introduction 51
2.2 Types of interventions 51
2.2.1 Educational material/Guidelines 52
2.2.2 Educational groups/opinion leader 52
2.2.3 Audit and feedback 53
2.2.4 Educational outreach visits 54
2.2.5 Reminders/ computer decision support systems 55
2.2.6 Patient focused interventions 56
2.2.7 Multifaceted approaches 56
2.3 Selection of targeted topics and interventions 57
2.3.1 Antibiotic Prescribing 58
2.3.2 Generic prescribing 67
2.3.3 Prescribing in CVD 71
Chapter 3 79
Methodology 79
3.1 Introduction 79
3.2 Study Design 79
3.2.1 The Randomised controlled trial (RCT) 79

3.2.2 The quasi-experimental design 81
3.2.3 Population selection 83
3.2.4 HSE –PCRS pharmacy claims database 84
3.2.5 GP demographic & practice data 85
3.3 Intervention design and development 86
3.3.1 Topic for prescribing feedback 87
3.3.2 Postal bulletin (PB) design 89
3.3.3 Academic detailing (AD) visit 91
3.4 Statistical methods 95
3.4.1 The Comparison groups 95
3.4.2 Summary statistics 95
3.5 Conclusion 96
Chapter 4 97
Antibiotic Prescribing 97
4.1 Introduction 97
4.2 Background on antimicrobial resistance & antibiotic use 97
4.2.1 Antimicrobial resistance within Ireland 98
4.2.2 Antibiotic use within Ireland 99
4.3 Methods 100
4.3.1 Antibiotic quality prescribing indicators 100
4.3.2 Analysis time points 101
4.3.3 Population selection 101
4.3.4 Statistical analysis 102
4.4 Results: Antibiotic Prescribing PB vs AD 104
4.4.1 Baseline characteristics 104

4.4.2 Baseline Antibiotic Prescribing 107
4.4.3 Immediate effect post intervention: PB vs AD practices ... 108
4.4.4 Long term (12 month) effect post intervention 108
4.4.5 Summary of results 114
4.4.6 Discussion 115
4.5 Results: Antibiotic prescribing, participant vs NP GPs 118
4.5.1 Baseline Characteristics 118
4.5.2 Baseline Prescribing 120
4.5.3 Immediate effect post intervention: Participant vs NP GPs 121
4.5.4 Long term effect post intervention 121
4.5.5 Summary of results 128
4.5.6 Discussion 129
4.6 Study limitations 132
4.6.1 Implementation of the randomised interventions 132
4.6.2 Study design limitations 133
4.6.3 Prescribing database limitations 134
4.7 Summary & Conclusion 135
Chapter 5 137
Generic Prescribing 137
5.1 Introduction 137
5.2 Background generic prescribing 137
5.2.1 Generic prescribing in Europe 138
5.2.2 Generic prescribing in Ireland 138
5.2.3 Incentive to prescribe generically 139

5.3 Methods 140
5.3.1 Generic quality prescribing indicators 140
5.3.2 Analysis time points 141
5.3.3 Population selection 142
5.3.4 Statistical analysis 142
5.4 Results: Generic prescribing PB vs AD 144
5.4.1 Baseline characteristics 144
5.4.2 Baseline prescribing 144
5.4.3 Immediate effect post intervention PB vs AD GP practices 147
5.4.4 Long term effect post intervention 147
5.4.5 Summary of results 152
5.4.6 Discussion 153
5.5 Results: Generic prescribing Participant vs NP GPs 155
5.5.1 Baseline Characteristics 155
5.5.2 Baseline prescribing 155
5.5.3 Immediate effect post intervention: Participant vs NP GPs 158
5.5.4 Long term effect post intervention 158
5.5.5 Summary of results 164
5.5.6 Discussion 165
Chapter 6 169
Generic Cost savings 169
6.1 Introduction 169
6.2 Methodology 169
6.2.1 The cost analysis 169

6.3 Results: Generic prescribing cost savings 172
6.3.1 Expenditure & cost savings across all three drugs 172
6.3.2 Cost savings across individual drugs 174
6.3.3 Summary of results 176
6.4 Results: Generic cost savings: Participant vs NP GPs 177
6.4.1 Expenditure & cost savings across all three drugs 177
6.4.2 Cost savings across individual drugs 178
6.4.3 Summary of results 181
6.4.4. Discussion 182
Chapter 7 185
Cardiovascular disease prescribing 185
7.1 Introduction 185
7.2 Background 185
7.2.1 Cardiovascular disease in Ireland 185
7.3 Methods 187
7.3.1 Quality prescribing indicators for secondary prevention of CVD 187
7.3.2 Analysis time points 189
7.3.3 Population selection 189
7.3.4 Statistical analysis 190
7.4 Results CVD prescribing PB vs AD practices 192
7.4.1 Baseline characteristics 192
7.4.2 Baseline prescribing 192
7.4.3 Immediate effect post intervention PB vs AD practices 194
7.4.4 Long term (12month) effect post intervention 196

7.4.5 Summary of RCT results 199
7.5 Results: CVD prescribing Participant vs NP GPs 200
7.5.1 Baseline characteristics 200
7.5.2 Baseline prescribing 200
7.5.3 Immediate effect post intervention Participant vs NP GPs 202
7.5.4 Long term (12 month) effect post intervention 204
7.5.5 Summary of results 207
7.5.6 Discussion 208
Chapter 8 215
GP evaluation 215
8.1 Introduction 215
8.2 Methods 215
8.3 Statistical analysis 216
8.4 Results 217
8.4.1 Quantitative analysis: Postal prescribing bulletin 217
8.4.4 Summary of results 230
8.4.5 Discussion 231
Chapter 9 235
Cost-effectiveness analysis 235
9.1 Introduction 235
9.2 Background 235
9.3 Methodology 236
9.3.1 Cost 237
9.4 Results 243
9.5 Discussion 246

9.5.1 Associated literature 246
9.5.2 Effectiveness of QI strategies 247
9.5.3 Cost offset 248
9.5.5 Long term benefits/consequences 249
9.5.6 Conclusion 250
Chapter 10 251
Summary, Recommendations, Conclusions 251
10.1 Summary 251
10.1.1 What is already known 251
10.1.2 Methods 251
10.1.3 What this study adds 253
10.2 Limitations/ Lessons learned 256
10.3 Future in Primary Care 258
10.4 Recommendations 259
10.5 Conclusion 261
Appendix one 287
Antibiotic and generic prescribing 287
Postal bulletin & Academic detailing powerpoint slides 287
Appendix two 289
CVD preventive therapies 289
Postal bulletin & Academic detailing powerpoint slides 289
Appendix Three 291
Cost difference between five targeted proprietary drugs and their generic equivalent 291
Appendix Four 292

Questionnaire evaluating first postal bulletin 293

Appendix Five 295

Final questionnaire evaluating postal prescribing feedback 295

Appendix six 297

Questionnaire evaluating academic detailing visits 297

Appendix Seven 299

Article published in Family Practice August 2007 299

List of Abbreviations

AD	Academic detailing
ADR	Adverse drug reaction
APMI	Association of Pharmaceutical Manufacturers of Ireland
ATC	Anatomical Therapeutic Classification
CDSS	Computer Decision Support System
C/E	Cost-effectiveness
CI	Confidence Interval
CHD	Coronary Heart Disease
CVD	Cardiovascular disease
DURQUIM	Drug utilisation research quality indicator meeting
DMA	Drug and Medical appliances
EARSS	European Antimicrobial Resistance Surveillance System
E coli	Escherichia coli
EU	European Union
ERHA	Eastern Regional Health Authority
GP	General Practitioner
HIQA	Health Information and Quality Authority
HSE-PCRS	Health Service Executive –Primary Care Reimbursement Service
ICGP	Irish College of General Practitioners
IDTSS	Indicative Drug Targets Saving Scheme
IHD	Ischemic heart Disease
IPHA	Irish Pharmaceutical Healthcare Authority
IQR	Inter-quartile Range
MRSA	Methicillin-resistant staphylococcus aureus
NI	Northern Ireland
NICE	National Institute for Health and Clinical Excellence
NMIC	National Medicines Information Centre
NP	Non-participant
PACT	Prescribing Analyses and Cost pharmacy data
PB	Postal Bulletin
PVD	Peripheral vascular disease
QOF	Quality and outcomes framework
QPI	Quality Prescribing Indicator
RCT	Randomised controlled trial
ROI	Republic of Ireland
SARI	Strategy for the control of antimicrobial resistance in Ireland
UK	United Kingdom
WHO	World Health Organisation

Table of Tables

Table 1.1 Attributes of indicators 31

Table 2.1 Review of trials targeting antibiotic prescribing 60

Table 2.2 Review of trials targeting generic prescribing 68

Table 2.3 Review of trials targeting CVD preventive prescribing 72

Table 4.1 Characteristics of Postal bulletin (PB) vs Academic detailing (AD) GPs 105

Table 4.2 HSE-PCRS patient population characteristics, PB vs AD practices 106

Table 4.3 Baseline antibiotic prescribing PB vs AD GP practices 107

Table 4.4 Change (β coefficient) in immediate and 12 month antibiotic prescribing post intervention PB vs AD 110

Table 4.5 HSE-PCRS patient population, participant vs non-participant (NP)GPs 119

Table 4.6 Baseline antibiotic prescribing, participant vs NP GPs 120

Table 4.7 Change (β coefficient) in 1 & 12 month antibiotic prescribing post intervention, participant vs NP GPs 123

Table 5.1 Baseline prescribing of 5 drugs targeted for generic substitution, PB vs AD 145

Table 5.2 Baseline proportion of generic prescribing, PB vs AD GP ... 146

Table 5.3 Change (β coefficient) in immediate & 12 month generic prescribing post intervention PB vs AD 148

Table 5.4 Baseline prescribing of 5 drugs targeted for generic substitution, participant vs NP GPs 156

Table 5.5 Baseline proportion of generic prescribing, Participant vs NP GPs 157

Table 5.6 Change (β coefficient) in immediate & 12 month generic prescribing post intervention, participant vs NP GPs..... 159

Table 6.1 Six months aggregated cost savings, PB vs AD GP practices 173

Table 6.2 Individual drug cost savings due to generic substitution, PB vs AD GP practices..... 175

Table 6.3 Six months aggregated cost savings participant v NP GPs.. 177

Table 6.4 Individual drug cost savings due to generic substitution, participant vs NP GPs 180

Table 7.1 Baseline proportion of patients with CVD /diabetes & prescribing of CVD preventive therapy, PB vs AD GP practices ... 193

Table 7.2 Three months post intervention, proportion change in population receiving CVD preventive therapies and differences between PB vs AD 195

Table 7.3 Twelve months post intervention, proportion change in population receiving preventive therapies, and differences between PB vs AD..... 197

Table 7.4 Baseline proportion of patients with CVD/diabetes & prescribing of CVD preventive therapy, participant vs NP GPs..... 201

Table 7.5 Three months post intervention proportion change in population receive CVD preventive therapy and comparison between participant vs NP GPs..... 203

Table 7.6 Twelve months post intervention proportion change in population receiving CVD preventive therapy and comparison between participant vs NP GPs..... 205

Table 8.1 Postal bulletin evaluation questionnaire, PB vs AD GPs 218

Table 8.2 The effect of the AD intervention from a GPs perspective.... 222

Table 9.1 Costs of a national postal prescribing feedback service (1st

year) & comparison with NI service..... 239

Table 9.2 Costs of a national prescribing adviser service (1st year) based on NI model 240

Table of Figures

Figure 3.1 Flowchart of research and randomised trial..... 82

Figure 3.2 Project time frame 94

Figure 4.1 Antibiotic prescribing rates, PB vs AD GP practices..... 111

Figure 4.2 Proportion of penicillin prescriptions, PB vs AD GP practices 112

Figure 4.3 Proportion of co-amoxiclav prescriptions, PB vs AD GP practices 113

Figure 4.4 Antibiotic prescribing rate, participant vs NP GPs 124

Figure 4.5 Proportion of penicillin prescriptions, participant vs NP GPs 125

Figure 4.6 Proportion of co-amoxiclav prescriptions participant vs NP GPs 126

Figure 4.7 Proportion of cephalosporin prescriptions, participant vs NP GPs 127

Figure 5.1 Proportion of generic prescribing for all 5 targeted drugs, PB vs AD GP practices 149

Figure 5.2 Proportion of generic omeprazole prescribing, PB vs AD GP practices 150

Figure 5.3 Proportion of generic nimesulide, PB vs AD GP practices .. 151

Figure 5.4 Proportion of generic prescribing (all 5 drugs), participant vs NP GPs 160

Figure 5.5 Proportion of generic omeprazole prescribing, participant vs NP GPs 161

Figure 5.6 Proportion of generic nimesulide prescribing, participant vs NP GPs 162

Figure 5.7 Proportion of generic pravastatin prescribing, participant vs NP GPs 163

Figure 7.1 Proportion of population receiving preventive CVD therapies, 12 months pre & post intervention 198

Figure 7.2 Proportion of population receiving preventive CVD therapies, 12 months pre & post intervention participant vs NP GPs 206

Figure 9.1 Cost-effectiveness analysis for postal prescribing feedback vs prescriber adviser service 245

Introduction and structure of thesis

This thesis is a detailed description of a randomised controlled trial (RCT) to evaluate the effect of an educational intervention on GP prescribing in one former health board region of Ireland. Specifically the study compared the effectiveness of a multifaceted intervention, academic detailing and postal prescribing feedback, versus postal prescribing feedback alone in promoting rational prescribing among GPs. Three target areas were identified as the focus of the intervention: antibiotic prescribing, generic drug prescribing and prescribing of preventive therapies in cardiovascular disease. The effect of background prescribing in these areas was evaluated using a quasi-experimental study design where the prescribing of participating GPs in the RCT was compared to the prescribing of non-participating GPs.

Structure of Thesis

The study is presented in ten chapters. Chapter 1 gives a background to the present study, detailing the concept of rational prescribing and the development of ways to evaluate and monitor prescribing through quality prescribing indicators. It briefly outlines the influences on GP prescribing including the barriers to implementing evidence based medicine and strategies developed to improve the quality of prescribing. The aims and objectives of the study are also presented in this chapter.

Chapter 2 provides a more in-depth literature review of strategies used to change clinical practice especially prescribing practice in the three areas identified above. Chapter three outlines the population selection, recruitment and randomisation, and the development and implementation of the intervention.

Chapters 4 (antibiotics), 5,6 (generic prescribing) and 7 (CVD prescribing) contain the results of the RCT and quasi-experimental study. The general layout of these chapters is: introduction, topic background,

methods including statistical methods, summary of results and discussion. The results for the RCT are presented first followed by the quasi-experimental study.

Chapter 8 evaluates the study from the GPs perspective while chapter 9 is a cost-effectiveness evaluation of the interventions from the perspective of the Irish Health Service. The costs are based on providing a postal prescribing feedback service compared to a prescribing adviser service plus postal prescribing feedback for all GP practices in the Republic of Ireland (ROI).

Chapter 10 summaries the study findings, draws conclusions and provides recommendations on the effectiveness of these interventions in an Irish health care setting and proposes ideas for future research in this area.

Chapter 1

Background & Aims

1.1 Introduction

This chapter aims to describe rational prescribing, outline its importance and how it is evaluated. There is a review of factors which influence prescribing behaviour especially among general practitioners (GPs). Finally, there is a summary of common behavioural change strategies which have been used to influence practitioner prescribing in other studies.

1.2 Rational Prescribing

Rational prescribing is defined in several ways but the following definition is from the World Health Organisation (WHO) for rational drug use. "Each patient should receive medication appropriate for his/her clinical needs, in doses meeting the related requirements, for an adequate period of time and at the lowest cost to them and the community".[1] Rational prescribing encompasses the concepts of safety, effectiveness, efficiency and cost and has clinical, ethical and economic implications for individuals and society as a whole.

1.3 Why rational prescribing is important

The prescribing of medicines is the most common healthcare intervention in the developed world and has the 'greatest potential to produce health benefit or to cause harm.[2] There is mounting evidence to suggest that aspects of drug prescribing can be inappropriate in terms of the dose, drug or combination of drugs used. One indicator of this is Adverse Drug Reactions (ADRs). ADRs that occur in primary care can result in hospital admissions or emergency room visits. Recent reports

estimate that this can range from 3% to 6% of all hospital admissions, while older age, female gender and multiple drug therapy are factors associated with an increased risk of an ADR.[3-5] There are no data on admission to Irish Hospitals due to ADRs, but under-reporting of ADRs by both hospital and community doctors is recognised.[6]

ADRs are an extreme example of inappropriate drug prescribing but it also applies to under or over treatment of chronic conditions such as cardiovascular disease (CVD), dyspepsia or asthma and these areas are also targeted by rational prescribing initiatives.[7-11]

1.3.1 Cardiovascular disease prescribing

EUROASPIRE II was a comparative study in 15 European countries; its aim was to determine in patients with established coronary heart disease whether the Joint European Societies' recommendations on coronary prevention were being followed in clinical practice (1999-2000). A follow-up study in a subset of 9 countries compared the earlier EUROASPIRE I study with EUROASPIRE II. In EUROASPIRE II, 53-58% of patients had inadequate blood pressure or cholesterol control.[12] In particular, the elderly and women were less likely to receive recommended preventive drug therapies for CVD compared to younger males.[13] Inequalities in prescribing related to gender, age or region were also reported in other studies. [14-16]

1.3.2 Antimicrobial prescribing

Rational prescribing focuses not only on the individual but the wider community. Antimicrobial use and generic drug substitution are two areas that have received widespread attention and are frequently used as international markers of rational prescribing. Ecological studies have shown a strong association between levels of antibiotic use in both community and hospital settings and high levels of antimicrobial resistance and the emergence of life threatening 'super bugs'.[17;18] In a European surveillance study of 26 countries, the Nordic

countries were among the lowest users of community antibiotics in Europe with a corresponding low level of antibiotic resistant infections.[19] In contrast, France had one of the highest rates of community physician antibiotics prescribing matched by the highest level of penicillin resistance pneumonia infections. There is a general consensus among health care agencies that antibiotic use needs to be reduced and the use of newer antibiotics restricted to prevent the emergence of resistance to them.[20-22] The Nordic countries in particular are active in this regard where government legislation has reduced reimbursement for community antibiotics.[23;24] Ireland was placed in the mid-range of antibiotic use compared with other European countries. [25] However, total antibiotic prescribing has increased by 13.4% over the last 3 years, with the largest increase seen in the second line antibiotics penicillin/beta-lactamase inhibitor combinations (amoxicillin/clavulanate) and second generation cephalosporins.[26] The use of these drugs has increased by 18-22% from 1993 to 2002.[25]

1.3.3 Generic prescribing

Generic substitution is the use of less expensive 'off patent' drugs in place of more expensive original branded products and is advocated as one way of containing medical care costs. A generic medicine is a faithful copy of a mature drug which is no longer under patent. Since the 1990s several European countries have introduced legislation or have active policies to promote the use of generic drugs over their equivalent more expensive branded products. There is wide variation across Europe in the use of generics. In France generics account for 3% of total drug volume but up to 70% in the UK.[27;28] In Ireland approximately 22% of all drugs dispensed on the state sponsored community drug payment schemes were either unbranded generics or branded generics. A study by Tilson et al in 2003 estimated that over €21 million could be saved on the Irish community drugs budget if generics were substituted for 30 of the most expensive drugs with a generic equivalent.[29]

In Ireland generic prescribing has been promoted through the Indicative Drug Target Saving Scheme (IDTSS) which allowed GPs to reinvest the savings made through more cost effective prescribing, including generic substitution, towards improving their practice facilities. The scheme showed some initial success but an audit of its effectiveness concluded that there was no sustained cost saving achieved and the scheme was suspended. However, the cost of maintaining the community drug schemes was over €1,092 million in 2004 and this has increased by 15 - 17% annually over the past few years.[30]

CVD, antibiotic and generic prescribing are areas where there is a strong evidence base on best practice and are identified as topics for rational prescribing and modifying prescriber behaviour.

1.4 How rational prescribing is monitored

Rational prescribing is synonymous with quality prescribing and the focus is on how to define and measure effectiveness, safety, appropriateness and cost.[31] Prescribing indicators have been developed for this purpose and are based on measurable elements of prescribing performance for which there is evidence or consensus that they can be used to assess quality, and hence in changing the quality of care provided.[32] Indicators can be applied at individual, institutional or national level.

The development and classification of prescribing indicators is a relatively new area in medicine. Indicators can be categorized in different ways depending on the focus of the stakeholders or researchers. One common classification divides indicators into structure (organizational factors e.g. number of specialists per 1000 population), process (e.g. number of patients prescribed statins) and outcome (mortality and morbidity) indicators.[1] Other classifications are more specific, drug orientated indicators (information on a drug and its characteristics), disease (drug usage related to patient diagnosis) or patient (drugs linked to patient characteristics and outcomes).[1]

Prescribing indicators aim to address both process and outcome aspects of care. But many areas of care are complex with combined organisational, clinical and patient elements. Thus, complex sets of quality indicators, of which prescribing may be one, are required to assess health care services or performance.[33]

1.4.1 Development of quality prescribing indicators

Quality prescribing indicators (QPI) should be based on empirical research which forms the basis of local, national or international guidelines. Indicators are generally as a result of a consensus forum of experts.[34] The DURQUIM conference, in an effort to standardise prescribing indicators, identified 11 attributes of an indicator, in order to help in the development of indicators and assess their overall usefulness in practice. These are summarised in Table 1.1.[1]

The temporality of clinical guidelines and their associated QPI also needs to be recognised. Guidelines and indicators change over time to reflect advances in knowledge and medicine. Shekelle et al reviewed 17 clinical practice guidelines and found that 13 required either minor or major changes to reflect current evidence. [35] They concluded that guidelines should be reassessed for validity every 3 years.[36] A practical example of this is the use of a high level of prescribing of hormone replacement therapy (HRT) as a QPI associated with good practice but recent trials and meta analysis now suggests otherwise.[37;38]

In contrast, international focus on cardiovascular disease (CVD) has resulted in broad consensus in European and American guidelines on prevention of CVD. The quality prescribing indicators in this area are based on large clinical trials evidence and this continues to be strengthened with the publication of new trial data. Two important quality prescribing indicators to emerge from this are: patients with established

CVD or Type II diabetes should be prescribed (i) statin and (ii) antiplatelet therapy.[39]

A more constant and internationally recognised QPI is a low level of antibiotic prescribing and avoidance of second line antibiotic therapy, which has remained a focus of attention for the last 10 -15 years.[40] Prescribing indicators are also concerned with the cost of prescribing. Although not directly related to quality in a clinical sense, it is also important. Therefore, a high level of generic drug prescribing would be considered a useful indicator as a measure of cost containment.

Initially quality prescribing indicators were used at local level to assess individual or group of practitioners e.g. primary care practice or hospital activity, but increasingly QPI are used to benchmark activity against a regional, national or international comparator. They are also used to evaluate the effect of strategies to change practice and prescribing trends over time.

Table 1.1 Attributes of indicators

Attribute	Description
Valid	Meeting the indicators is considered better quality (content/face validity)
	Measure is a good translation of clinical situation (construct /concurrent validity)
Reliable	Data should be complete, accurate, consistent and reproducible
Credible/ communicable	Indicator must be acceptable by assessors and those being assessed
	Outcomes must be understandable and relevant to practice
Objective	Data should be as independent as possible
Available	Data should be collected for routine clinical or organizational reasons
Contextual	Indicators should be context free or important context effects (population size, distribution of age and sex case-mix) should be adjusted for
Comparable	Indicators should refer to Gold standards or other similar data
Repeatable	Indicators should be sensitive to change over time
Remedial	Intervention is possible where improvement needed
Interpretation	Indicators used appropriately in its presentation & interpretation
Suitable	Useful for more than one organisation

Reproduced from DURQUIM report[1]

1.4.2 Limitations of quality indicators

The drive towards evidence based medicine to underpin clinical decisions has precipitated the development of clinical indicators (including prescribing) to monitor the relationship between evidence and practice. However, a criticism of using indicators in this way is that they do not take account of the complexity of the interaction between patient and physician and the diversity of the patient population. By reducing clinical practice to simple technical processes for measurement purposes, it diminishes the individual aspect of care.[41] Many researchers who have developed quality indicators and applied them to real clinical situations advise caution in the interpretation and use of such data to make external quality judgments on individual practitioners or comparison between practices.[42-46]

Persistent concerns undermine the reliability of quality indicators. The lack of complete records is identified as one of the major obstacles to using quality indicators, whether it is handwritten/electronic patient medical records, or prescribing databases without diagnosis information. In order to make a reliable judgement on either overall performance or on management of a single condition comprehensive sets of indicators are required. However, not all indicators may be applicable to every patient with a particular condition, therefore determining the relative contribution of each indicator to the overall evaluation of performance is difficult. In addition, large sample sizes are required to avoid making decisions based on small numbers of patients, but incomplete patient registers and poor levels of computerisation in general practice makes identifying patients with particular conditions difficult. Evaluation of clinical practice at an aggregate level using quality indicators is still in the developmental stage, as is the computer technology within primary care which is required to provide information on which these indicators depend.[47]

1.4.3 Prescribing Indicators and pharmacy databases

The development and application of quality prescribing indicators to pharmacy claim databases have become a common approach to evaluating the quality of clinicians' prescribing.[48;49] The QPI tend to be based on a literature review of current evidence on the management of common medical conditions and the evidence surrounding (a) the most commonly prescribed drugs for that condition and (b) drugs of low therapeutic value. Through consensus of an expert panel, QPIs are derived from the evidence but may be modified to compensate for the limitations of an individual pharmacy database. The acceptability of the indicators is then tested in a wider group of physicians usually based on a Delphi or RAND consultation process.[50-52] Both methods contribute to the internal validity of the indicators. Sets of prescribing indicators derived in this way have been used to assess overall prescribing at individual and aggregated GP practice level. [53-57]

Studies based in different countries, show considerable similarity both in the set of quality prescribing indicators developed and the results when the indicators are applied to the pharmacy databases. The indicators generally include: 1) aspects of disease management e.g. aspirin prescribing in ischaemic cardiovascular conditions, 2) cost in terms of generic prescribing, 3) use of drugs of low therapeutic value e.g. oral nutritional supplements, 4) restriction to narrow range of therapeutic drugs within particular conditions, e.g. high rate of prescribing of atenolol as a percentage of all beta blockers. A consistent finding in many of these studies is the wide prescribing variability across GP practice, indicating a lack of uniform adherence to clinical guidelines. The researchers suggest that such prescribing indicators can be useful in monitoring and detecting changes in prescribing practice.

The versatility of prescribing indicators applied to readily available prescribing databases is now being realised. The range of topics monitored is expanding and recent examples include compliance with

evidence based medicine in paediatric asthma[58], preventive therapy in cardiovascular disease and diabetes,[59-62] over prescribing of antidepressants to children,[63] polypharmacy in the elderly[64;65] and variation in antimicrobial consumption.[66] Other areas using pharmacy databases are adherence and persistence with CVD therapy[67;68], potential for drug–drug interactions[69] and cost savings based on generic substitution.[70]

1.4.4 Limitations of pharmacy database

Quality prescribing indicators applied to pharmacy claims databases have specific limitations. Pharmacy databases are based on utilization of drug therapy, and reflect not only treatment of a condition but also the attitude, knowledge of the prescriber and the compliance of the patient with no reliable way of differentiating between these elements.[71] Prescribing databases are not standardized in the amount or type of data they record and such variation in available data must be assessed prior to applying QPIs developed in other settings. [1] Many pharmacy databases are used for reimbursement purposes and do not contain information on diagnosis or other risk factors such as smoking status. One way to overcome this problem is to use specific or a combination of drug therapy as a surrogate marker of disease. This methodology was first developed by Von Kroff et al and has been used in subsequent studies.[72-74] However, this limits the accuracy of the prescribing indicator to make claims about appropriateness of the drug therapy or dosage for a particular condition.[75] For some conditions only broad disease classifications can be identified e.g. it is not possible to distinguish between diuretics used to treat hypertension or heart failure. Similarly, antiplatelet therapy is the mainstay of treatment for ischemic cardiovascular conditions e.g. ischemic heart disease (IHD), peripheral vascular disease (PVD) and ischemic cerebrovascular conditions and can be used for both primary and secondary prevention of CVD. This

methodology may overestimate the prevalence of CVD using a pharmacy claims database. Also patients receiving non-standard treatment for a condition may have their condition misclassified.

Prescribing databases vary in the extent of patient level data recorded, which restricts their use for epidemiological studies examining age, gender or regional characteristics. Databases which lack a unique individual identifier prohibit linkage with other databases such as mortality or cancer registers and hospital or community GP databases, although this comes with its own ethical and technical difficulties. In other situations prescribing databases may not cover the entire population and are only available on a sub-set of the population, which reduces the generalisibility (external validity) of the findings to the entire population.

1.4.5 Validity of Quality Prescribing Indicator

Internal and external validity are important features in assessing quality prescribing indicators. Internal validity deals with the accuracy and reliability of the data and can be defined under four headings: content (indicator based on scientific evidence), face (consensuses among professional), concurrent (empirical data or gold standard) and construct validity (ability to identify optimal or suboptimal prescribing accurately). Depending on the questions, these various aspects will assume different levels of importance.

External validity adopts a wider view of the situation or clinical problem and aims to be an accurate reflection and measure of what is happening in the population. Applied to single institutions or specific situations internal and external validity can be easy to control but when applied to more complex situations such as regional or international comparisons the quality indicator must take account of the variation in treatment or drug availability for certain conditions within and across countries.[76] Marshall et al used 174 US based health care quality indicators and found commonality in 56.3% of them when applied to a UK general practice setting.[77] In addition, the properties of the different regional or

national pharmacy databases must be taken into consideration. An example is the HSE–Primary Care Reimbursement Service (HSE-PCRS) pharmacy claims database in Ireland. It contains individual patient-level data including age and gender, but it is a means tested scheme for those aged less than 70 years. The scheme covers 30% of the Irish population and over represents the elderly and the poorest section of the community. In contract the Prescribing Analyses and Cost (PACT) pharmacy data in England covers the whole population but does not include demographic data.[78]

1.5 Influences on Prescribing in General practice

The majority of consultations in general practice result in a drug prescription.[79] The rising cost of the community drugs budget combined with an increase in range and complexity in the management of conditions in the community has singled out primary care for special attention in regard to rational prescribing. The factors which influence prescribing are complex and are the subject of academic, pharmaceutical and government interest. These factors are broadly divided into those external to the GP practice such as Government initiatives, formularies, expert opinion, guidelines, protocols in addition to pharmaceutical marketing. Internal influences are more subtle and include patient expectation, the GP's past experience and personal beliefs, dynamics and communication with practice partners and practice resources.[80]

1.5.1 External influences

1.5.1.1 Government legislation/restrictions

External influences on GP prescribing can be graded by their perceived degree of influence. Among the most influential are Government initiatives backed by legislation or forced restriction through national

formularies or failure to fund certain drugs. Physicians recognise these types of interventions as having the most immediate impact on prescribing.[81;82] A particular example of this is generic prescribing Governments in several countries have introduced legislation or policies to promote generic substitution as a means of controlling spending on community drugs budgets. Countries such as Sweden, the UK and the Netherlands report large savings based on compulsory generic prescribing. [83-85] Many observers conclude that direct government intervention is required in order to achieve high levels of generic substitution.[86;87]

1.5.1.2 Incentive schemes

Incentive schemes rather than legislation are increasingly viewed as a more appropriate means of achieving quality and value for health care.[88;89] Early reports of incentive schemes suggest variable results depending on the outcomes measured.[90-92] In primary care, incentive schemes have been used for a number of years for particular public health programmes such as childhood immunisation or screening for cervical cancer, in some countries, where payment is based on the number of patients receiving the intervention. The new GP contracts in the UK, part of the National Service Framework, are an ambitious attempt to link GP payment to treatment targets and quality indicators for the management of many high prevalence chronic conditions. [93] It is still too early to evaluate the long term effectiveness on patient outcomes and overall cost-effectiveness of this strategy.[94] However, the concept that quality of care in general practice can be measured and thus rewarded seems to be acceptable to practitioners whose governing bodies and unions were involved in these contract negotiations.

In Ireland there are relatively few examples of Government led incentive schemes for primary care. An early example was the "Indicative Drug Targets Saving Scheme (IDTSS) (section1.3.2) which was an attempt to curb prescribing costs in general practice through rewarding GP who met

cost targets.[95] The results from the scheme were initially promising with a saving of 13.5 million Irish pounds in the first year and an increasing trend towards generic prescribing. However, the results were not sustained and a review by the Auditor General found that only 5% of GPs made any significant saving over a four year period.[96] The scheme concluded in 2004, without an alternative replacement.

A current national incentive scheme in primary care is the Heartwatch Programme. It started in 2003 and involves just over 20% of GPs nationally. It aims to promote secondary prevention in patients with established cardiovascular disease.[97] Among the markers of improvement in care is an increase in antiplatelet, statin and antihypertensive prescribing. GPs received a fee for recruiting patients into the scheme and a subsequent payment for each Heartwatch related visit (3-4 per year per patient). The second annual report showed a significant increase in prescribing of these preventive therapies and improvement in hypertension and hypercholesterolemia management in this patient population.[98] However, there are currently no plans to extend this programme beyond the 20% of GPs already involved.

In contrast primary care in the UK has a relatively high level of Government sponsored initiatives. This includes GP individualised prescribing feedback based on a national pharmacy claims database, and regular visits from prescribing advisors.[99-101] In addition, the British National Institute for Health and Clinical Excellence (NICE) develops national clinical practice guidelines and evaluates the cost-effectiveness of treatment strategies, including medicines, which are circulated to GPs and other health care practitioners. This ready supply of information and practice guidelines is now linked directly to incentives and performance in the form of the Quality and Outcomes Framework and GP contracts.[99] The basis of these contracts are that GP payment is linked to health care indicators and treatment targets in an effort to improve both effectiveness and efficiency of health care delivery.[102] Initial assessment of this scheme

suggests that this approach can achieve substantial success in terms of quality targets with 75% of targets achieved in the first year.[103] Although there is possible evidence of data manipulation by practices it applied to less than 1% of practices analysed. Another report suggested that the programme positively influenced practices in deprived areas where targets are generally more difficult to achieve.[104] The difficulty with such a programme is the initial high cost implications, where the programme exceeded its 1.8 billion budget in the first year. It is too early to identify the effect of the programme on actual population health outcomes, however the effect on practitioner performance seems positive.[105]

1.5.1.3 Pharmaceutical Industry

The pharmaceutical industry invests a substantial amount of money in marketing aimed at primary and secondary care practitioners. It is estimated that as much as 15-25% of a pharmaceutical company's revenue is spent on promotion. Although physicians rate the influence of such marketing as having a low impact on their prescribing,[106] more objective measures of influences seem to suggest that such marketing, which includes representative visits to the GP's office and provision of free samples, does impact directly on GP prescribing. Prosser et al[107] reported that for many GPs the primary source of information on new drugs was direct contact with pharmaceutical company representative. In addition, there are a number of studies which suggest that free samples lead physicians to prescribe medications that differ from their preferred agents and can increase the cost of drug prescribing.[108-111]

1.5.1.4 Prescribing feedback

Prescribing feedback schemes have been developed in many countries to provide GPs with information on their prescribing practice.[112] These schemes are generally advisory and are based on the simple information deficit model i.e. increasing awareness can change behaviour. [113] The aim is to increase GP awareness of their prescribing, especially cost. Through comparison with their peers, GPs with above average cost or

volume of prescribing will be motivated to change practice. The conclusion from meta-analysis of randomised controlled trials of short term interventions including prescribing feedback is that the provision of information in isolation can have a positive impact on GP knowledge but the changes to prescribing practice are small to moderate. [114]

However, the effect of repeated information over prolonged periods as in the Prescribing Analysis and Cost (PACT) system in the UK or the National Prescribing Service in Australia is difficult to evaluate but reports suggest that the supply of prescribing information is effective, particularly if part of a multifaceted approach to change practice e.g. combined with information from prescribing advisors, interactive peer groups or audit.[115-117]

1.5.1.5 Guidelines

In the last number of years the emphasis on management of many chronic and acute illnesses have been through national or local guidelines which aim to standardise care e.g. hypertension, cardiovascular disease, asthma, diabetes.[118;119] In the UK, guidelines from NICE form the basis of quality prescribing indicators which are used to asses clinical practice. Guidelines in isolation are believed to be ineffective in influencing practice and implementation has been highly variable.[120-122] An evaluation of NICE guidelines in 2004 concluded that guidelines need to be backed by strong professional support, have a stable and convincing evidence base, incur no additional costs and be part of organisations which have developed good implementation and monitoring systems. Above all guidelines need to be clear and reflect the clinical context.[123]

In Ireland, there is no single agency charged with overall responsibility for developing, implementing or monitoring adherence to guidelines. It is anticipated that this may become part of the remit for the newly established Health Information and Quality Authority (HIQA) (www.hiqa.ie). Currently the only Government funded source of

information is the National Medicines Information Centre (NMIC) (www.nmic.ie) which aims to produce evidence based information bulletins on common conditions in general practice and advice to practitioners on individual drug items. However, they do not produce national guidelines against which practice can be benchmarked.

1.5.1.6 Clinical Audit

Clinical audit may be defined as a quality improvement process that seeks to improve patient care and outcomes through the systematic review of care against explicit criteria and the implementation of change.[124] A particular driver of clinical audit is the emphasis by government and the public on clinical governance and professional accountability. Clinical audit has become one of the most consistently used tools to improve patient care and organisational structure. It is also widely used to provide evidence of implementing clinical governance.[124;125]

Audit activity can be internal, conducted by practitioners within an individual practice, or external whereby a third party examines the practice data and compares it to either a set standard or other comparison group such as GPs within the same region. The literature rarely differentiates between the effect of audit and feedback and the results of various meta-analysis continue to favour audit and feedback as effective activities particularly in relation to prescribing behaviour.[126;127]

1.5.1.7 Professional education/Academic detailing

The role of continued professional development and education has been recognised as important in maintaining and improving quality in healthcare. The format this takes has an effect on GP practice. Meta-analysis evaluation of professional education suggest that formal structured courses or interactive workshops in specific aspects of care can have a moderate to large effect on practice while written educational

material, didactic lectures or conferences in isolation do not appear to be effective in changing physician performance.[128-130]

Academic detailing or educational outreach visits are individually focused and aim to make broad educational messages applicable to the individual practice or GP by utilising patient profiling.

1.5.1.8 Reminders / Computer Decision Support Systems

Increasing levels of computerisation within primary care and development of sophisticated software can impact on GP daily practice. Manual or automated prompts at the point of decision making are generally reported as having an impact across a wide area of practice such as immunisation, CVD risk management and prescribing of medication including avoidance of drug interactions and generic substitution.[131] Computer Decision Support Systems (CDSS) actively guide clinical decisions, their effectiveness is more variable[132] while requiring greater levels of training and financial resourcing.[133;134]

1.5.2 Internal influences

Internal influences on prescribing are also well documented but are more difficult to quantify. Paramount among these factors is the physician's own personal and professional experience.

1.5.2.1 GP experience

Armstrong at al[135] described how external factors such as information and professional influence combined with the GP's own experience can be internalised and in turn influence the GP's willingness and ability to change his prescribing practice. Three models of change are discussed:

The accumulation model of change is based on the gradual accumulation of cues which depends on two factors - the weight of evidence in a certain direction through articles, talks, consultants' letters etc and the second is confidence and trust in another professionals' advice.

The challenge model of change is more rapid and generally stems from a critical event, or a particularly negative or positive experience with a drug which left a lasting impression on the practitioner. This generally concerns only a small number of drug items.

The Continuity model of change describes a pre-existing preparedness to change, i.e. the change made sense to the GP because of his own personal view and general attitude to change or there was a particular cost advantage which supplemented the therapeutic reason to change practice.

Armstrong et al[136] concluded that although there was evidence of some change in prescribing this was against a stable background of 'non-change' despite the daily contact with external change agents (section 1.5.1).

1.5.2.1 Patient influence

Strongly related to GP experience is the relationship between the GP and the patient. This is a complex interaction which depends on not just the immediate illness which necessitated the consultation but the patients past experience with illness and the medical profession, their attitude to health and their personal relationship with a particular GP. The patient's social, educational and economic circumstances can also influence a decision to prescribe.[137;138] Prescribing of antibiotics illustrates many of these factors. If patients visit a GP with an infection they generally have the expectation of receiving an antibiotic and they may be disappointed and dissatisfied with the care they received and this in turn can undermine the confidence in that particular GP.[139] In Britain and France efforts to reduce antibiotic prescribing have included national media campaigns aimed at informing the public about safer use of antibiotics and both countries have observed a reduction in GP antibiotic prescribing.[140]

GPs view of their individual patients modifies how and when they apply the evidence[141] for example a patient who lives in poor housing

conditions, or who smokes may be more likely to receive an antibiotic than someone from a wealthier background or non-smoker because the GP perceives the first patient as having a higher risk of developing complications. Also, the decision not to prescribe an antibiotic requires a longer consultation period due to providing the patient with an explanation and additional reassurance.[142]

The decision to persist with a particular new prescribing strategy very often depends on the feedback from patients. If patients dislike the therapy, then the GP is likely to return to their former prescribing habits regardless of the evidence.[143] Patients can also refuse to take medication in which case recommended guidelines cannot be implemented.

1.6 Barriers to evidence based medicine

Some of the influences which play a role in forming a GPs prescribing decision have been reviewed, but these influences taken one step further can be regarded as barriers. Research on barriers to change have tried to identify why evidence based medicine fails to be consistently transferred into clinical practice.[144] Common themes emerge from these studies which can be broadly summarised under four headings: nature of the evidence, practitioner attitude, patient attitude and logistics.

1.6.1 Nature of the evidence.

The rapid change in medicine and emphasis on evidence based practice has resulted in a vast amount of literature advocating best practice for an ever increasing range of clinical conditions. One study estimated that a doctor would have to read 20 articles per day all year round to maintain present knowledge.[145] The trend towards systematic reviews and guidelines aims to summarise this evidence, despite this, contrasting views and treatment strategies still emerge, e.g. for the management of CVD currently there are at least three different sets of guidelines the North American, the European and British guidelines, all broadly similar

but advocating slightly different targets for risk factors e.g. blood pressure.

The complexity of the change required will impact on its uptake. A change which is simple or for which there is scepticism about the current practice may be quickly adopted e.g. cessation of myringotomy for otitis media. In contrast, changes which are complex requiring additional resources, interdisciplinary collaboration and for which there is conflicting views about predicted benefits will be slow to be adopted[146] e.g. the role of statins in primary prevention or in the elderly.[147]

1.6.2 Practitioner attitude

In addition to the volume and complexity of the change practitioners and especially GPs need to have the time and skills to assess the quality and strength of the evidence and the confidence to persuade both colleagues and patients of the value of a new intervention. Instead, many GPs adopt a conservative approach and prefer to wait and assess the durability of the evidence. They need to be convinced of the lack of harm, efficacy and safety of a therapy including a transparent risk benefit profile before initiating prescribing. Many qualitative studies find that GPs are not opposed to change[148;149] but recent experience with evidence which has not stood the test of time e.g. guideline advocating hormone replacement therapy or therapies which were proved unsafe e.g. Cox II inhibitors has increased caution among practitioners in adopting new practices.

Even in areas where GPs accept the evidence there are barriers to implementing best practice. These often centre on an individual patient basis where there is uncertainty about diagnosis or the appropriateness of the therapy for that individual[150;151] e.g. prescribing warfarin in a patient with a history of falls or antiplatelet therapy for a patient with a history of gastrointestinal (GI) ulcers. GPs often find themselves as the mediators between specialists in secondary care and the patient. A patient who experiences side effects due to medication or is finding it difficult to

mange their polypharmacy is more likely to turn to their GP for help rather than the specialist who prescribed the original therapy.

1.6.3 Patient attitude

As mentioned already patients themselves can be the barrier to implementing evidence based practice. Patients can refuse to accept medical advice and recommendations. Doctors may try to influence patients decisions but there is the risk of damaging the patient doctor relationship or the patient not returning for subsequent follow-up if they feel their free will is compromised or they are not been listened too.[152] This is often reported by GPs as a difficulty in refusing to prescribe antibiotics. [153]

Patients' personal circumstances can play a part in a GPs willingness to prescribe new therapies. A patient who already has a poor compliance record with existing therapy is unlikely to be receptive to initiating more therapy, whilst a patient with cognitive impairment, due to ageing or other neurological conditions, may find complex drug regimes difficult to manage.

1.6.4 Logistical reasons

Time and resources are frequently identified as barriers to implementing evidence based medicine. The majority of disease management guidelines call for improved diagnosis and recognition of conditions which require additional diagnostic tools e.g. echocardiogram for heart failure. Difficulties in accessing these tests can impair a GP's ability to manage these patients. Once a diagnosis has been confirmed, the majority of chronic conditions are now managed by multiple drug therapy which incur not only drug costs but also increased surveillance costs. If practices do not have clinics in place to facilitate such monitoring e.g warfarin clinics, a GP may be reluctant to have too many patients which require this level of care.[154-156] Uptake of new therapies by patients often requires time to persuade them of the benefits and GPs frequently identify

insufficient time for this process. Finally, but perhaps most importantly, the lack of reimbursement for this 'extra work' (patient monitoring, follow-up, measuring biophysical markers, documentation etc) is recognised as a barrier to implementing best practice.[157]

1.7 Implementation of evidence based practice

Recognition of the barriers to implementing evidence based practices has prompted the development of strategies to improve their dissemination and implementation. The development of these strategies mirror the growing insight into the difficulties encountered in promoting rational prescribing and evidence based medicine as a whole. The early phase of the evidence based medicine movement adopted simple models of information giving. These included the unsolicited distribution of educational materials and guidelines or didactic educational meetings or conferences, this progressed towards more individualised audit and feedback but the lack of consistent success has prompted a move towards more sophisticated social marketing approaches utilised by the pharmaceutical industry itself. A key aspect of this is one to one educational outreach visits and adopting a multifaceted approach including patient targeted strategies and use of computer technology in the guise of computer assisted treatment plans and decision supports.[158]

Grol et al [159] identified 18 types of interventions used for the transfer of evidence into practice which have been evaluated by randomised control trials (RCT) and systematic reviews. The authors drew some general conclusions: a) change is possible when a well designed intervention is used, b) most interventions had some effect, c) no intervention is superior for all change in all settings, d) interventions that target specific obstacles to change may be more effective than non-focused interventions.

1.8 Conclusion

Rational prescribing is embedded in the concept of evidence based medicine. The underlying principle of rational prescribing is that the prescribing of drug therapy for a condition is based on sound evidence for the overall management of that condition and that appropriate use of the therapy has a measurable clinical outcome.

This evidence supports the development of quality prescribing indicators based on drug therapy which are measurable in large populations and reproducible in different settings. It provides some insight into aspects of clinical practice, safety of patient care and resource utilisation.

Similar to other areas of evidence based medicine rational prescribing needs to be promoted through well designed interventions, part of developing such interventions is an understanding of the influences and barriers to adopting rational prescribing and evidence based medicine.

1.9 Aims

Overall the purpose of this study was to evaluate the effectiveness of promoting rational prescribing by Irish GPs by means of a randomised educational intervention.

1.9.1 Main objectives:

- To review existing literature on audit and feedback and educational outreach visit as a means of changing GP prescribing.
- In the randomised study to evaluate the effectiveness of prescribing feedback via postal bulletin (PB) compared to academic detailing (AD), postal bulletin and educational outreach visit, on GP prescribing for target drug therapies.
- To compare the effect of GP participation in a prescribing feedback project with non-participation (NP) GPs on prescribing of target drug therapies.

Target Drug therapies: Antibiotics, generic prescribing and preventive therapies in CVD and diabetes.

1.9.2 Secondary objectives

- To assess the usefulness of such feedback from a GP perspective.
- To evaluate the suitability of the HSE-primary Care Reimbursement Service prescribing database to generate prescribing feedback and monitor prescribing trends.
- To conduct an economic analysis of providing prescribing feedback to GPs.

Chapter 2

Literature Review

2.1 Introduction

In chapter one, the types of interventions which have previously been developed and evaluated over the last number of years to promote evidence based medicine were described. In this chapter, I will explore in greater depth the interventions which target rational prescribing, especially in relation to the drug therapies which are the main focus of the study intervention i.e. prescribing of antibiotics, generics and preventive therapies (e.g. antiplatelet and statins) in cardiovascular disease and diabetes.

2.2 Types of interventions

The interventions are discussed from the perspective of proven effectiveness in trials or meta-analysis, their potential adaptability to an Irish primary care setting and in relation to the drug therapies which are the subject of the proposed intervention.

Trials and meta-analysis were identified using PubMed, Embase and the Cochrane database. Randomised controlled trials (RCTs), controlled trials, controlled before and after studies and interrupted time series studies reported in the English language were considered. The key word search was based on the criteria published by Jamtvedt et al [114] and included: prescribing, feedback, audit, academic detailing, outreach visits, guidelines, generics, antibiotics, statins, cardiovascular therapy, preventative therapy, general practice, community out-patient combined with methodological terms: clinical trial, randomised, randomised controlled trial, control trial, meta-analysis, systematic review.

Inclusion/exclusion criteria

Trials had to be based in primary care with a principal objective to change practice including prescribing of drugs. There was a particular interest in trials published in the last 6 years as previous studies have largely been evaluated as part of published meta-analysis.

The criteria on which the quality of a study was assessed were similar to those used by the Cochrane collaboration when reviewing topics in this area.[127;160;161] The quality measures used included: population selection, follow-up of professionals or patients, baseline measurements, reliable outcome measures, protection against contamination, in addition, the method of randomisation was assessed for RCTs.

2.2.1 Educational material/Guidelines

Very few interventions now employ guidelines or educational material alone. More recent trials include this material as part of a multifaceted approach. The move away from passive distribution of guidelines or educational material is based on meta-analysis of trials that found little or no effect.[127;162] In addition, review of the effectiveness of NICE guidelines has found their uptake and impact variable and dependant upon many local issues which this type of intervention does not address.[163-166]

At present, within the Irish primary care setting, the majority of guidelines or recommendations for best practice are produced by the Irish College of General Practitioners (ICGP) but there is no commitment to update these recommendations and the distribution is unpredictable. In developing any intervention, the use of succinct, easily readable guidelines on the target topics was seen as providing an important background on which to base practice recommendations.

2.2.2 Educational groups/opinion leader

Educational groups and use of opinion leader remains a popular method

of influencing prescribing. Meta-analysis of trials used to evaluate these tools suggest that change is possible depending on the type of educational tool applied.[167] It is generally felt that didactic lectures, while they may increase physician knowledge, have little effect on practice. In contrast, interactive continuing medical education (CME) sessions which incorporate practice skills can influence professional practice and some health care outcomes.[168;169]

The use of opinion leaders to influence practice is not widely employed. A meta-analysis by O'Brien e al reported a mixed effect on practice. [170] Identifying the opinion leader, standardising the information and replication in different settings may be difficult. Also opinion leaders are generally only specialists in one topic so different leaders are required depending on the clinical topic. Grimshaw et al concluded that opinion leaders are unlikely to be an effective general strategy across all settings and professional groups.[171]

In the context of this project the ability to organise small group teaching sessions with or without opinion leaders was viewed as prohibitively expensive. It was also felt that fewer GPs would be willing to participate in this type of project as they would have to arrange cover in their own practice which would have cost implications.

2.2.3 Audit and feedback

Individual GP or practice audit and feedback has become a consistent feature of most interventions to improve overall and particularly prescribing behaviour.[172] Audit and feedback have been used as either a single strand intervention or as part of a multifaceted approach. The effectiveness of audit and feedback has been widely evaluated in reviews and meta-analysis. Grindrod et al conducted a systematic search for systematic reviews on interventions that impact on health practitioners and identified 34 high quality reviews of which 14 concerned audit and feedback.[173] He concluded that audit and feedback demonstrated consistent effectiveness with 12 of the reviews showing positive

effects.[174] However, Jamtvedt et al, as part of the Cochrane Collaboration, conducted a meta-analysis on trials from 1996 to 2001 and a second update including trials up to 2004. Their conclusions remain largely the same, there is considerable variability regarding the effectiveness of audit and feedback ranging from negative to large positive effects.[114;127]

Several authors have tried to identify factors which can explain the variation in the results. These include level of baseline prescribing, physician motivation, the clinical topic targeted and the intensiveness of the intervention.[127;127;175;176]

Despite its variable effects the use of individualised prescribing audit and feedback was viewed as both a potentially effective and pragmatic option for an intervention to change prescribing behaviour within Irish primary care. There is no routine provision of this information to GPs and it was felt that GPs would be more receptive to changing their practice if they had an overview of their current prescribing patterns.

2.2.4 Educational outreach visits

Educational outreach visits are increasingly being used, generally as part of multifaceted approaches to change professional practice.[172] A review by O'Brien et al of studies up to 1997 concluded that outreach visits, especially if combined with social marketing techniques utilised by the pharmaceutical industry (high quality graphical educational material, repetition of message, follow up visits etc), seemed to be a promising approach.[161;172] Since then the majority of interventions have employed some aspect of outreach visiting. As it is frequently part of a multifaceted approach it is difficult to separate out the effects of outreach visits from the other aspects of the intervention. Four out of five systematic reviews supported the use of outreach visits.[177]

Incorporating outreach visits into multifaceted interventions mimics the marketing strategies of the pharmaceutical industry, who have long since

recognised the value of face to face contact in delivering their marketing message. McGettigen et al[178] and Prosser [179] both reported on the influence of one to one visits by pharmaceutical representatives on physician behaviour and advocated adoption of this methodology to influence clinical practice.

GPs in the Irish health care system are accustomed to receiving visits on their practice premises from pharmaceutical industry representatives. Adopting a similar approach for the rational prescribing feedback project was considered a means of maximising the effect of the intervention. It also recognises the fact that any intervention to change practice needs to take account of other influences which compete for the GPs attention.

2.2.5 Reminders/ computer decision support systems

Initially reminders were in the form of postal letters but the increased level of computerisation within primary care has lead to the development of real time automated reminders and clinical decision supports. These have been particularly effective in increasing appropriate ordering of diagnostic tests, preventive screening and vaccination.[180] The effects can be small and variable when applied across a variety of clinical disease and healthcare settings and many trials report under utilisation of the systems or that physicians ignore the prompts.[181;182] As information systems develop and separate databases are linked, there is a move towards providing more patient specific information which may prove more consistently effective as the practitioners need for patient specific information is met. [183]

A recent survey identified that over 89% of Irish practices who participated in the study used computers, and approximately 70% had computerised patient records.[184] However, the true level of computerisation within Irish primary care may be lower than this and there is no standard primary care computer package used across practices. Therefore developing CDSS which are compatible with a range

of operating systems would be difficult and require significant financial resources.[185]

2.2.6 Patient focused interventions

Patient education is increasingly recognised as a strategy to improve both healthcare outcomes and practitioner performance. Education can focus on particular patient subgroups or be the focus of mass media campaigns, as in those used to reduce antibiotic prescribing in the UK and France.

Patient education alone generally produces an increase in knowledge but has little impact on clinical therapeutic targets e.g. blood pressure or cholesterol.[186] In contrast, multifaceted interventions that included patient education were generally more effective than multifaceted interventions which excluded this element.[187;188]

In this study, the GP was the primary focus. The inclusion of patient education as part of the multifaceted intervention would not allow you to distinguish the effects of the intervention targeted at physicians (audit and academic detailing) and those targeted at patients.

2.2.7 Multifaceted approaches

Multifaceted interventions are those using two or more of the above interventions. Increasingly, the move is towards multifaceted approaches rather than single strand interventions. The combinations of interventions that are used vary but many include educational outreach visits. In 9 out of 11 (82%) systematic reviews multifaceted interventions were reported to be more successful than single interventions.[189] But a review by Grinshaw et al identified 13 multifaceted studies and found a median effect size of 6% (range - 4% to 17.4%) similar in magnitude to audit and feedback alone with a median effect 7% (range 1.3% to 16%).[190] The review also identified the absence of an expected dose-response curve associated with the increasing number of components in an intervention.

A multifaceted approach was viewed as a pragmatic option within the Irish Healthcare setting. Combining interventions aimed at the GP level offered the opportunity of evaluating the effect of single versus multiple stand interventions in changing practice and to identify the relative contribution of each including cost-effectiveness.

2.3 Selection of targeted topics and interventions

It was decided to target three drug therapies in the intervention: antibiotics, generics and preventative therapies in CVD and diabetes.

These topics were selected for several reasons: (1) a review of the international and national literature suggested there was evidence of inappropriate prescribing in these areas (sections 1.3.1-1.3.3),

(2) GPs involved in the study identified these areas as particularly relevant to their practice and on which they would like prescribing feedback, (3) pharmacy claims databases in other countries have been used to provide prescribing feedback on these topics and used to evaluate the effects of interventions to change practice (sections 2.3.1-2.3.3) and (4) aspects of these topics have previously been successfully examined using the Irish pharmacy claims databases.[26;191;192]

The next step was to identify which interventions have previously been used to target these specific areas to change practice. Many previous reviews have focused on the intervention rather than the clinical area. The meta-analysis combined trials across a wide range of clinical topics and from primary and secondary care settings. In the following review trials are grouped according to the target drug groups that are the subject of the intervention and only include trials based in primary care. The reason for omitting trials from secondary care settings is that the organisational culture, environmental influences and even patient attitudes are likely to be very different.

The trials which are reviewed in this section are those that have used guideline, audit and feedback or educational outreach visits as either single strand or as part of a multifaceted approach to changing prescribing behaviour. These types of interventions are among the most widely used internationally and it was anticipated they could be adapted and utilised within the Irish health care setting.

Each review is given by therapeutics class chosen for the intervention study: antibiotics prescribing, generic prescribing and prescribing in CVD.

2.3.1 Antibiotic Prescribing

Interventions targeting antibiotic prescribing are among the most intensive and widely publicised. The reasons relate both to individual patient safety and the wider public health concern over increasing resistance to antimicrobial therapy. A recent meta-analysis by the Cochrane collaboration [193] identified 39 studies from 1966-2000 using a variety of approaches to improve antibiotic prescribing. The authors drew the following conclusions:

1) Printed educational materials , audit and feedback resulted in little or no change
2) Interactive education was more effective than didactic lectures
3) Educational outreach visits and physician reminders produced mixed results
4) Patient based interventions e.g. delayed prescriptions, reduced antibiotic prescribing without increasing co-morbidity
5) Multifaceted interventions combining physician, patient and public interventions were the most successful.

The authors concluded that the success of an intervention depends not only on the quality of the intervention itself but also the characteristics of the community and physicians it is applied to. Therefore, not all interventions will work equally well in all settings and identification of and

addressing local barriers is particularly important to the success of an intervention.

Table 2.1 contains a short review of studies from 2000-2006 targeting antibiotic prescribing, it excludes studies identified in the meta-analysis by Arnold et al[193]. Studies are reviewed under target behaviour, intervention, analysis, absolute effect and study conclusions.

Table 2.1 Review of trials targeting antibiotic prescribing

Author &Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
Mandryk J 2006[194] Australia	1) ↓ antibiotic (a/b) use 2) ↑ preference for first line a/b	Time series analysis National ongoing GP and public education strategy (primarily statistical methods paper, classification of intervention groups unclear)	Before and after time series analysis using national pharmacy claims database 1) rate of a/b prescribing per GP per 1000 consultations per month 2) proportion of each a/b as a subgroup of nine most common a/b	Not reported	↓in median rates of antibiotic prescribing over time period No association between national programme and decrease in prescribing Significant ↑in first line over second line a/b
Rautakorpi U 2006[195] Finland	↑ adherence to national a/b guidelines	5 year follow up study 2 groups, A) intervention: 30 healthcare centres, guidelines, multifaceted (MF) physician & patient education B) control: 20 healthcare centres guidelines only	Logistic regression, mixed effect model, % of times first line a/b prescribed	3 out of 5 infections treated showed significant changes in a/b selection e.g. bronchitis OR1.32 95% CI (1.06-1.65)	No decrease in overall antibiotic rate, ↑in first line over second line a/b

Author &Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
Samore M 2005[196] US	1) ↓community a/b use based on pharmacy data 2) Diagnosis-specific antimicrobial use based on patient chart review	Clustered RCT, 2 yr follow up 334 GPs,407,460 patients 3 Intervention groups A) Community education programme B) MF (GP Community education + clinical decision support tools education +feedback) C) Control group no intervention	Pharmacy data analysed using Multilevel poisson regression based on number of a/b prescriptions/month (1st level),community population size (2nd level) Patient chart-multilevel logistic regression	1st year non significant changes 2nd year A ↑1% a/b B ↓10% a/b* C ↑ 6% a/b *significant ↓ compared to group A/C	Multifaceted intervention achieved significant reduction in overall antibiotic use Improved appropriateness of antibiotic selection
Gonzales R 2005 US[197]	1)↓ a/b use in adults & children	Non-randomised control trial 3 groups A) 7 intervention practices, patients received postal educational material B) 2 control groups (427 practices	Pharmacy database analysis Mixed effects model controlling for clustering	↓ 24% a/b in adults No change in a/b prescribing for children	Patient education reduced adult but not antibiotic prescribing in children

Author &Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
Welschen I 2004[198] Netherlands	↓ a/b prescriptions/ number of consultations (patient charts) ↓a/b prescribing rate (pharmacy claims data)	Clustered RCT, 3 mth follow up,89 GPs, 2 Groups A) MF intervention(n=42) (group education, prescribing feedback, repeat contact, pt education material B) Control group, (n=47) no intervention	Mean difference in change in a/b prescribing from baseline (independent t test) Multilevel model adjusting for clustering (patient level data)	Post intervention mean differences in antibiotic prescribing over 3 months ↓10.7% (95% CI -20.3, -1)	Intensive multifaceted intervention achieved short term reduction in antibiotic prescribing
Doyne et al 2004[199] US	↓a/b rate (pharmacy claims data)	RCT 12 mth follow up 11 practices, 2 grps A) MF (n=6) (guidelines, seminar, local experts, AD, pt education) B) control grp (n=5) (guidelines & postal prescribing feedback)	Time series analysis	0.04% lower a/b in MF group (NS), ↑penicillin use in MF (NS) (p value not reported)	No difference between intensive academic detailing & education Vs prescribing feedback and guidelines
Richards D 2003[200] New Zealand	Promote first line a/b over second line a/b (↑ erythromycin/ amoxicillin, ↓co-amoxiclav) Identify duration of effect	RCT 24 month follow up GPs n=160, 3 groups A) MF, (n=52) (practice educational groups, + audit, & feedback, a/d, educational bulletins) 2 Control grps: B) voluntary GPs (n=25), C) non-participant GPs n=83), (prescribing audit &feedback, a/d, educational bulletins)	Standardized prescribing ratios (SPR)	SPR 1.40(95% CI1.11-1.81) ↑ in Erythromycin SPR 0.83 (95% CI 0.74-0.91) changes lasted 9 months ↓ in co-amoxiclav Change evident at 24 months post intervention	Clinical practice education groups as an addition to ongoing audit feedback etc had an immediate effect on type of antibiotic selected This effect remained significant for co-amoxiclav at 24 months follow up

Author &Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
Sondergaad J 2003[201] Denmark	↓a/bc prescription rate ↑ prescriptions for narrow spectrum (first line) a/b	RCT,12 month follow up, N=299 GPs A) MF: n=155 GPS (91 practices) (postal feedback on prescribing a/b, a/b guidelines) B) control grp n=144 GPS (90 practices), (a/b guidelines)	Difference in prescribing rates at 3, 6, 9, 12 months post intervention compared to pre-intervention Crude prescribing rates not adjusted for population structure	NS ↓ in rate of overall a/b (-0.6 (95% CI -2.8 1.6) NS ↑ narrow spectrum a/b (0.02 95%CI -0.01,0.05)	postal prescribing feedback had no additional impact on antibiotic prescribing above guidelines alone
Flottorp S 2002[202] Norway	↓ rates a/b antibiotic use ↓Laboratory testing ↓Telephone consultations	Pre/post study, 142 General practices 72 practices -Urinary tract infection (UTI) guidelines 70 practices-Sore throat guidelines (acted as controls for each other) Both received MF (Patient education computer decision support & reminders, GP Interactive courses, Increased telephone consultation fee)	Data collected during 8 mth intervention Hierarchical Logistic regression	3% reduction in antibiotic use for sore throats (p=0.03) 5% reduction in Lab tests for UTI (p=0.046) No significant difference in telephone consultations	Passively delivered complex interventions targeted at individual barriers to change had little effect on changing practice

Author &Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
Hennessy 2002 US[203]	↓ rates a/b antibiotic use ↓ penicillin non-susceptible strains (resistance)	Controlled intervention trial Population based analysis Initial intervention Region A: MF physician & patient education Vs no intervention Regions B&C Expanded intervention MF education all 3 regions comparison with pre-intervention data	Data collection over 3 yrs Generalized linear models	Initial intervention ↓31% reduction a/b expanded study: ↓35% reduction a/b No change in prevalence of penicillin non-susceptible strains	Multifaceted intervention was successful in reducing antibiotic use. This reduction had no effect on prevalence of antimicrobial resistance
Belongia E US 2001[204]	↓ number of prescriptions /clinician (pharmacy data) ↓a/b antibiotic use (children records) ↓ prevalence of penicillin non-susceptible s. pneumoniae (PNP) among children	Non-randomised controlled community intervention (2 communities) A) MF , 133 clinicians, (433 children) (parent, childcare workers education, community lectures, practice a/d, guidelines) B) Control arm , 52 clinicians (231 children),no intervention	Wilcoxon rank sum for pharmacy data Multivariate logistic regression for PNP prevalence (adjusted for clustering)	↓21% a/b sales in intervention arm No change in antimicrobial prescribing among children in intervention are No change in PNP prevalence.	Reduction in sales of antibiotics No change in prescribing practice at individual patient level No change in PNP prevalence

Author &Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
Ilett F K 2000[205] Australia	↓a/b prescribing rate ↑ rate of recommended (first line) a/b	RCT,112 GPs random allocation A) MF n=56 GPs (a/d, a/b guidelines (no prescribing feedback) B) Control group n=56 GPs (no intervention)	3 month pre and post intervention comparison Within and between group comparison Wilcoxon 2-sided rank sum test	↑ a/b prescribing both groups (not adjusted for seasonality) ↑ in recommended antibiotics in grp A	Academic detailing modified prescribing patterns with an associated decrease in cost

a/b = antibiotic, MF=multifaceted, pt=patient, grp=group, ↓=decrease, ↑=increase

2.3.1.1 Summary of trial results

Many of the studies reviewed employed more complex intervention than the studies in the meta-analysis by Arnold & Straus yet the effects, although statistically significant in the larger studies, still only report a modest effect size of approximately 10% reduction in antibiotic prescribing.[193] Many of the interventions did not achieve an overall reduction in antibiotic prescribing but did influence the type of antibiotic used.

The conclusions of the authors in the meta-analysis remain valid.[193] Complex multilevel interventions are generally more effective than single strand interventions but the change in practice remains small. The long term effects of the interventions and effect on patient outcomes and antimicrobial resistance needs to be evaluated.

2.3.2 Generic prescribing

Studies reporting interventions aimed at generic prescribing are much fewer in number than for antibiotic prescribing. The studies in the literature tend to report the effect of national or regional policies aimed at increasing generic substitution. An example of this is a study by Andersson et al [66] who evaluated the effect of a policy by the Swedish governments to introduce compulsory generic substitution by pharmacists, resulting in 60% of potential cost savings within the first 12 months of the policy change. Similarly Roberts et al [146] reported on a regional incentive scheme aimed at cost containment which resulted in increased generic substitution for 10 targeted drugs.

A systematic review of trials providing costing information to general practitioners concluded that computerised feedback on drug costs can increase generic prescribing and that academic detailing can affect prescribing of targeted drugs but the effects are short lived.[147]

Table 2.2 contains a short review of trials that targeted generic prescribing directly or indirectly though cost containment measures.

Table 2.2 Review of trials targeting generic prescribing

Author, Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
Rodgers S 1999[148]48 UK	↑Savings in drug budget ↑Increased generic prescribing	Control Trial A) MF, 8 practices (Intensive input from pharmacy prescribing advisor + prescribing feedback B)Control 8 practices (matched on 6 variables) no intervention	Mann –Whitney U-test	Grp A) Significantly lower expenditure on drugs budget compared to control 2) ↑3.28% generic prescribing (p=0.025)	Pharmacy advisers effective in controlling prescribing expenditure
Roberts SJ 1997[146]46 UK	↑ generic prescribing ↑therapeutic equivalent substitution 10 targeted drugs	Pre-post study, Regional incentive scheme Comparison of 499 practices pre and post prescribing rates	Wilcoxon rank sum test	↑20-30% in generic prescribing No increase in therapeutic equivalent No estimate of cost	Incentive scheme seems to have increased generic substitution.

Author &Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
Wadland WC 2005[149]49 US	↑ generic prescribing	Control trial A) MF Intervention,24 family medicine residents (prescribing feedback & training sessions) B)Control: Physicians in community practice, (no intervention)	Linear change in proportion of generic prescribing over 3 time periods	↑5-10% in generic prescribing for intervention group compared to 2% for control (significant difference)	Prescribing feedback combined with education can result in improved cost effective prescribing
Valles JA 2003 [150]50 Spain	↑ % of patients accepting a generic substitution ↑ % of generic prescribing	RCT A) MF Intervention, 8 GP practices, (pts n=4620) (patient interview, education material, GP education) Control: 19 GP practices (no intervention)	Chi-square test	↑8% patient acceptance of generic substitution ↑3% in generic prescribing in intervention group compared to control	Patient education resulted in increased acceptability of generic substation and increased generic prescribing
Walker J 2002 [151]51 UK	↓ prescribing budget ↑ generic prescribing	Control Trial A) MF, 9 GP practices (36 GPS) (pharmaceutical adviser, practice comparison feedback, review meetings recommendations) b) Control, 9 practices (44GPs) no intervention	Mann –Whitney U-test	↓ rate of increase in drugs budget compare to control NS change in overall generic prescribing, but ↓variation in generic prescribing rates in participating practices	intervention resulted in cost containment partly achieved by increased generic prescribing

MF=multifaceted, pt=patient, grp=group, ↓=decrease, ↑=increase, NS=non-significant

2.3.2.1 Summary of Trials

In two of the trials that reported a significant increase in generic prescribing, the pharmacists involved in the intervention were allowed to make the generic substitution, so the increase in generic prescribing was not as a direct result of a change in the GP prescribing behaviour.

It is difficult to draw firm conclusions regarding the effectiveness of prescribing feedback on GPs willingness to prescribe generically. In addition, there is considerable variation across countries regarding government support and the provision of incentives for generic substitution. Therefore, it is likely that the effectiveness of interventions to increase generic prescribing may be influenced by the country in which the study is conducted. For example, the UK studies were trying to increase generic prescribing from a baseline of 50-60%, whereas in the Spanish study the generic prescribing baseline was less than 1% and the researchers had a very limited range of generic alternative available for substitution.

2.3.3 Prescribing in CVD

Prescribing in cardiovascular disease (CVD) including hypertension is perhaps the most widely reported and consistently targeted of the three topic areas involved in this review. Several authors have described the 'care gap' in CVD in relation to the slow and variable adoption of evidence based medicine into regular practice both in hospitals and the community.[11;152-154]

Since the early nineties there has been a proliferation in interventions aimed at closing this gap. Systematic reviews and meta-analysis have drawn similar conclusions to those evaluating antibiotic prescribing.[155-158] Interventions using multifaceted approaches, especially academic detailing, more consistently report positive effects compared to single strand interventions, but the effect size can be small. Measurement of outcomes in CVD trials often include process outcomes (e.g. increase in prescribing of CVD preventive medicines, measuring and recording patient risk factors) and patient level outcomes such as a reduction in patient blood pressure and cholesterol.

In the following table the most recent and relevant trials in the context of the interventions used in this study have been identified. Some of the earlier trials informed the design and development of the intervention used in this study.

Table 2.3 Review of trials targeting CVD preventive prescribing

Author, Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
Fretheim A 2006[159] Norway	↑ prescribing of thiazide ↑ CVD risk assessment ↑ pts achieving target B/P & cholesterol targets (9 other secondary outcomes)	Cluster RCT 146 practices (6179 pts),2 groups A) MF (AD visit, audit & feedback, electronic reminders, pt information, follow up telephone B) Control group (no intervention)	Mixed effects linear regression	↑ 9.3% thiazides (<p<0.001) ↑ 2.6 CVD risk assessment(p=0.39) -0.3 treatment targets (p=0.33)	MF intervention achieved significant effect in one out of 12 CVD indicators
Horn F 2006[160] Australia	↑ prescribing of thiazide ↑ prescribing of β blockers	Before and after study National prescribing education strategy MF, No baseline comparison group	Time series analysis	↑1.3 per 1000 consultations thiazide above baseline ↑ 8% in β blockers	National GP education strategy seems to improve prescribing for hypertension
Schuster RJ 2006[161] US	↓ pt cholesterol ↓ pt B/P (separate studies)	Pre post study 165 physicians 2 settings (1364 pts),2 intervention groups per setting A) MF (physician education, AD visits, baseline pt clinical details,	Not identified	↓9% in cholesterol level ↓4% B/P level	Physician AD including baseline pt clinical data improved pt clinical outcomes

Author, Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
		national guidelines) B) MF intervention plus pt education material)			
Roumie C 2006[131] US	↑ Pts with B/P <140/90mmhg	Cluster RCT 3 groups,10 clinics (182 practitioners, 1341 Pts) 1) Email link to national hypertension guidelines 2) Email guideline link plus electronic specific pt alerts 3) Email, pts alerts +education letter to individual patients	Logistic regression controlling for clustering	Group 3 B/P<140mmhg OR 1.26 (95%CI 1-1.58)	Addition of patient education to electronic patient alerts and guidelines resulted in a marginal improvement in B/P control
Mitchell E 2005[162] UK	↑ Pts with B/P <160/90 ↑ B/P recording ↑ prescribing of antihypertensives	Cluster RCT,52 GP practices (30,345 pts) 3 groups, patient clinical information feedback A) aggregated practice audit data B) Audit plus individual pt risk identification C) control no intervention	Pt level analysis Logistic regression mixed effects model	Practice improved in all groups including control Group2 pt with B/P<160 = OR 1.70 (95% CI 1.09-2.7)	Patient specific identification & feedback improved practice more than aggregated audit feedback

Author, Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
Herbert CP 2004[163] Canada	↑ prescribing of thiazide	RCT,4 groups,200 GPs A) individualised prescribing feedback (grp meetings) 2) educational module C) both D) control grp (no intervention)	Pt level analysis (Clustering not controlled) before and after analysis	1) ↑6.5% prescribing feedback 2) ↑6.8% education 3) ↑11.8 combined (all above changes in control)	Combining prescribing feedback plus education & grp discussion most effective in changing practice
New JP 2004[164] UK	↑ pt achieving cholesterol target ↑ pt achieving B/P target	RCT 44 practices (10,303 pts) 2 groups A) Nurse led outreach visit for hypertension (guidelines, education, list of target pts) B) Nurse led outreach visit for hyperlipidaemia (as above) Acted as control for each other	Multilevel logistic regression	Pt Cholesterol OR 1.04 (95% CI 0.88-1.23) Pt B/P OR 1.01 (0.80-1.27)	Nurse led outreach no effect on patient clinical outcomes
Omstein S 2004[165] US	↑ adherence to 21 quality indicators	RCT 20 Practices (87,291 pts) 2 groups (no control group) A) Postal Practice guidelines & quarterly performance reports	Generalised mixed effects models Wilcoxon rank sum test	Statistically significant within group improvements but no statistical differences between groups.	Regular performance feedback can improve adherence to clinical practice Academic detailing had no significant effect over feedback

Author, Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
		B) Above Plus academic detailing (quarterly)& educational meetings			alone
Simon S 2004[166] US	↑ prescribing of thiazide / β blockers ↓ pt B/P	Cluster RCT 3 practice sites (689 prescribers 9820 pts) 3 groups A) group academic detailing B) Individual AD 3) control group (mailed guidelines)	Pt level analysis Logistic regression adjusting for clustering	Group AD OR 1.4 (95%CI 1.11-1.76) Individual AD OR1.30 (95% 0.95,1.79) NS diff between grps No ↓in pt B/P ↓prescribing 2nd year post intervention	AD improved antihypertensive prescribing compared to mailed guidelines. Effects declines over time No improvement in pt measures
Baker R 2003[167] UK	↑ adherence to angina guidelines ↑ adherence to asthmas guidelines	Cluster RCT,3 grps, 81 GP practices A) Condition guidelines B) Prioritised guidelines C) Guidelines plus GP postal feedback	Patient data Multilevel models		No significant change in practice between groups Postal feedback had no additional impact over guidelines.
Frijing BD 2003[168] N'lands	↑ compliance CVD performance indicators	Cluster RCT, 2 grs,124 GP practices (185 GPs) A) MF (feedback, 7 outreach visits, GP education B) No intervention	Recorded decisions Multilevel logistic regression	5 out of 12 indicators significantly improved no change to prescribing indicators	Intensive intervention only had small effect on GP clinical decisions

Author, Year & Country	Targeted behaviour	Intervention	Analysis	Absolute change	Study Conclusion
Goff D 2003[156] US	↑ prescribing of statins, β blockers Ace inhibitors in pts with CVD	Cluster RCT,2 grps,131 practices (>700 pts) A) Mailed CVD guidelines, prescribing feedback (annually for 3 yrs), + identification of individual patients) B) no intervention	Pt level analysis Clustering controlled for Logistic regression	No significant differences between groups in prescribing of individual drugs	Central mailed prescribing feedback had no effect on prescribing practice
Langham J 2002[169] UK	↑ CVD risk factor recording ↑ aspirin, lipid lowering anti-hypertensive prescribing ↓in pt cholesterol & B/P	Cluster RCT, 4 grps,17 practices (974 pts) A) pt register computer training B) accessing evidence based information C) Both D) Control (no intervention)	Two sample weighted t test Clustering not controlled for	No change in practice between groups A & B Significant in improvement in group C for cholesterol (22%) recording and prescribing of lipid lowering drugs (4%)	

B/P=blood pressure, grp=group, MF=multifaceted, pts=patients, ↑increase, ↓ decrease, NS=non-significant, ACE=angiotensin converting enzyme

2.3.3.1 Summary of trials

The development, implementation and evaluation of interventions to improve CVD management have changed over the last number of years. Similar to interventions targeting antibiotic prescribing, the interventions published in medical journals have become more sophisticated and resource intensive. Increasingly multifaceted interventions combine outreach visits with audit, reminders, physician and patient education. There is also an increased awareness of local barriers to change and there is an effort to tailor interventions to address these barriers.[170]

Evaluation of the effects of these interventions has become more complex with two or more primary outcomes measured, including process (change in prescribing or data recording) and biophysical measures such as patient blood pressure or cholesterol. Studies rarely report positive results for all measured outcomes and, in particular, patient biophysical measures often do not mirror positive changes in process outcomes.

Cost analysis is also becoming an important aspect of recent trials, but often the benefit or consequence of the intervention quoted in the cost-effectiveness analysis are changes in choice of drug e.g. thiazides from more expensive newer antihypertensives rather than patient outcomes such as a reduction in blood pressure or clinical events avoided (myocardial infarction). [171;172]

Chapter 3

Methodology

3.1 Introduction

This chapter covers two areas. The first part describes the research study designs used to achieve the objectives set out in chapter one, explaining the sample size calculation, randomisation and population selection. The second part of the chapter describes the design, development and piloting of the interventions (postal bulletin and academic detailing visits) used to provide prescribing feedback to GP practices.

3.2 Study Design

To achieve the objectives of the project two study designs were adopted: a randomised controlled trial (RCT) and a quasi-experimental study. The RCT was used to evaluate the effectiveness of individualised postal prescribing feedback compared to academic detailing which included a one to one outreach visit and postal prescribing feedback. The quasi-experimental study evaluated the effect of prescribing feedback among participant GPs compared to a group of GPs not involved in the study (non-participant (NP) GPs). Ethical approval for the project was granted in 2004 by the Irish College of General Practitioners (ICGP)

3.2.1 The Randomised controlled trial (RCT)

Three hundred GPs in the Eastern Regional Health Authority (ERHA) in Ireland were invited to participate in the study (see selection criteria below). Approximately one third of GPs (n=110) agreed to participate and gave written consent to receive prescribing feedback. The intention was to deliver the intervention at the practice level, thus participant GP practices were randomised to receive individualised prescribing feedback

using either (1) postal bulletin alone (n=50 practices) or (2) postal bulletin with academic detailing (n=48 practices) (see fig 3.1).

RCTs are generally regarded as the gold standard in establishing causation and allow for control of confounding variables which may be responsible for the results obtained.[173;174] Randomisation ensures that the intervention groups differ only in their intervention allocation (bulletin or academic detailing) and the play of chance.[173] A criticism of RCTs is that the level of manipulation required can overwhelm the intervention applied and make the intervention unrepresentative of what is intended in practice. There is also the concern that important outcomes can be missed if not part of the original analysis plan. Systematic reviews of interventions to change prescriber behaviour report that non-randomised studies are more likely to report positive effects of the intervention compared to RCTs.[119;133] This variation means it is important to be aware of the strengths and limitations of both randomised and non-randomised study designs.

3.2.1.1 Sample size calculation

The sample size was calculated for the randomised study and was based on demonstrating a 25% improvement in appropriate prescribing e.g. 25% increase in generic prescribing, with a power of 80% and statistical significance of 5%, (two sided) between the randomised groups, allowing for clustering of GPs within practices (cluster size=2, Intra class correlation coefficient (ICC)=0.1). For this, a sample of 26 GP practices (52 GPs) per arm was required. (http://www.abdn.ac.uk/hsru/epp/cluster.shtml).[175]

On analysing the positive replies from GPs it was apparent that not all GPs in multi-partner practices had agreed to participate, and only 10 multi-partner practices (n=22 GP) agreed to fully participated in the study. Two practices had 3 GPs and the remaining eight practices consisted of 2 GPs. Thus in the majority of practices the GP cluster was 1. As this would make the study under powered, the number of practices in each

arm was increased to compensate for this (if the GP cluster=1 then the minimum number of GPs/practices would be 48 per arm)

3.2.1.2 Randomisation

The individual GP practice was the unit of randomisation and all GPs working in the same practice or within the same building were randomised to the same intervention. The randomisation was performed using a simple four block randomisation plan (www.randomization.com). As the ERHA includes both the largest urban centre in Ireland and smaller semi-urban areas the randomisation was also stratified. GP practices within the same post area code in Dublin city or by practice area if outside Dublin city were grouped within the four block randomisation. This was to ensure a balanced distribution of practitioners working in deprived and non-deprived areas and urban and semi-urban areas.

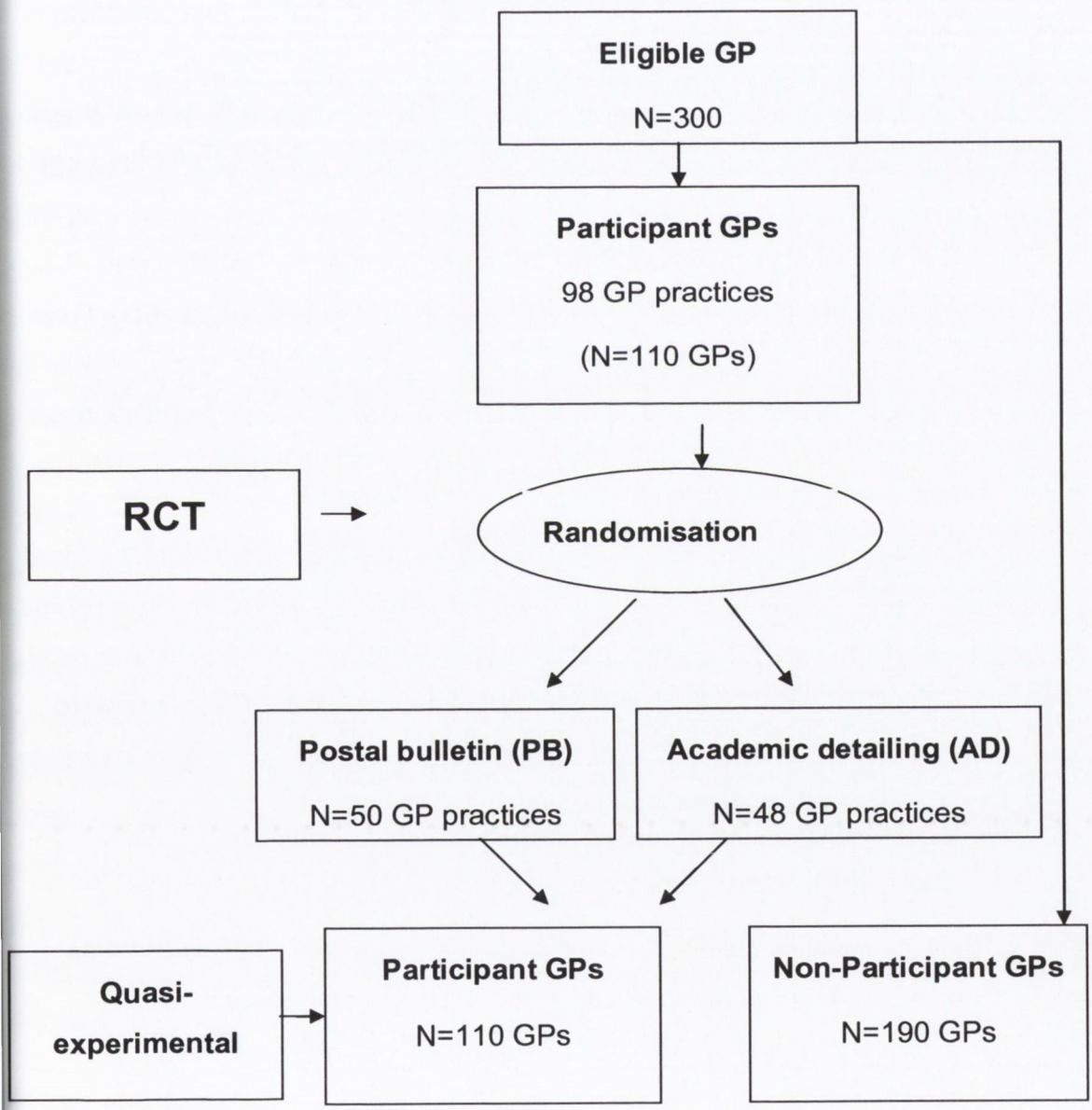
3.2.2 The quasi-experimental design

The quasi-experimental design involved non-randomised GPs. It was a comparison between those GPs who participated (n=110) in the randomised study and those GPs who declined to participate (N=190). These GPs formed the baseline comparison group and are referred to as non-participant GPs (NP) (see fig 3.1).

The comparison of randomised and non-randomised GPs allows for the most efficient use of all available data, but this has limitations. The lack of randomisation means it is difficult to claim a causal effect of the intervention (prescribing feedback) over no feedback. [173;174] The reason for any difference may not be related to the intervention but other independent factors. In this case the volunteer status of the GPs must be recognised, i.e. GPs who were willing to participate in the study may be inherently different from those who declined. However, the use of the non-participant GP data allows: 1) adjustment for baseline prescribing activity, 2) investigation of differences in participant and non-participant

GPs in terms of their prescribing and 3) underlying changes in prescribing due to independent factors such as drug alerts, pharmaceutical promotion of a product which may not be detected in the RCT.

Figure 3.1 Flowchart of research and randomised trial



3.2.3 Population selection

The study was carried out in the ERHA, because it is the largest and most densely populated area in Ireland with the highest concentration of GPs. The study intention was to utilise an existing prescribing database to generate the individualised GP prescribing feedback information and evaluate the effect of the intervention. The largest and most complete prescribing database in Ireland is the Health Service Executive Primary Care Reimbursement Services (HSE-PCRS) pharmacy claims database. The HSE-PCRS is a means tested health care scheme for all those aged less than 70 years but all those aged 70 years or older are eligible for the scheme without restriction. The scheme provides free health care including medicines to 30% (n=1.15 million) of the Irish population. Over 80% of GPs in Ireland participate in the scheme, but with considerable variation in the size of their registered HSE-PCRS patient populations.

3.2.3.1 Selection criteria

In order to avoid generating prescribing feedback based on small patient populations it was decided to invite GPs with: (1) a minimum HSE-PCRS patient panel of 500 patients and (2) at least 12 months prescribing data on the HSE-PCRS pharmacy claims database (2003-2004). Therefore 300 (46%) eligible GPs out of a possible 652 in the ERHA were invited to participate in the randomised study.

3.2.3.2 Ethical considerations

Ethical approval for the study was obtained from the ICGP in 2004 as previously mentioned. Only GPs who gave written consent were randomised to an intervention and provided with individualised prescribing feedback. The confidentiality of individual GP data was maintained throughout and not shared with other GPs or any group external to the study. Data analysis and results were at the aggregated intervention group level with no individual GP data recognisable.

Prescribing data from non-participant GPs (GPs who were invited to participate but who declined) were also analysed and presented at the aggregated group level (no individual GP data recognisable), which is similar to other research studies using the HSE-PCRS database. All GPs involved in the HSE-PCRS scheme are aware that the database can be used for research purposes.

3.2.4 HSE –PCRS pharmacy claims database

The HSE-PCRS pharmacy claims database captures over 65% of prescribing in primary care in Ireland. The database includes a unique patient identification number with both the registered doctor number (doctor who the patient is registered with) and the prescribing doctor number (the doctor who wrote the prescription for the drug). Thus each prescription can be linked to the patient and their registered GP and the GP who prescribed the drugs. The database contains some patient demographic information including gender, age categorised into 10 age bands (A=0-4, B=5-11, C=12-15, etc) and health board in which the patient is resident. Also, full details of all drugs prescribed, including strength, quantity and cost are recorded and the drugs are coded using the WHO Anatomical Therapeutic Chemical (ATC) classification system.[176] The main purpose of the ATC classification system is for drug classification and is used for presentation of drug utilisation statistics. The system is used to avoid duplicate counting or misclassification of drugs, which could occur if relying on the drug name only. The national pharmacy claims database is used primarily for reimbursement purposes and community pharmacists receive payment based on the prescription data they electronically (in most cases) submit, ensuring a high degree of accuracy and consistency in the database.

3.2.4.1 Limitations of database

Despite its usefulness in research studies the database has some limitations.

- The database does not contain information on patient diagnosis, instead specific drug therapy or combinations of drug therapy are used as surrogate markers of disease (see section 1.4.4).[31;80]
- The population covered by the HSE PCRS over represents the elderly, the very young and the most socio-economically disadvantaged. This reduces generalisability to the national population.
- There is no information on area of patient residency other than health board, therefore controlling for deprivation or urban rural locations is difficult.
- There is no linkage of the database to other outcomes databases such as mortality, hospital admissions or cancer registries.

3.2.5 GP demographic & practice data

The HSE-PCRS provided information on GP age and HSE-PCRS patient panel size (including age and gender structure) on all eligible GPs for the study period 2004 and 2005. This data was at the individual GP level as it is normally used to calculate individual GP reimbursement and no further details were available on non-participant GPs.

Additional information was collected from participant GPs through telephone interview. This information was divided into (a) demographic information: GP age and gender, (b) professional characteristics: years practicing as a GP, additional education (Irish college of General practitioners courses/ other courses), number of surgery sessions and number of hours per week worked and (c) practice characteristics: number of full time/part time/trainee GPs in the practice, proportion of the GP patient population that are HSE-PCRS registered patients, practice nurse employed and whether the practice was computerised. This information was used to assess the comparability of baseline characteristics in the randomised groups.

3.3 Intervention design and development

The literature on developing interventions to change physician behaviour identified the importance of recognising and understanding the perspective of the participants receiving the intervention. Veninga et al[177] identified seven pre-requisites for changing behaviour in general practice, these are :

"a) Awareness that a problem may exist in ones practice

b) Understanding what causes the problem

c) Acknowledging individuals doubts about new ways of managing a problem

d) Recognition that social forces may accelerate acceptance of the new change in practice

e) Identification of barriers to implementing new changes in practice

f) Identifying and implementing ways of overcoming barriers."

Only GPs who volunteered to participate in the study received prescribing feedback which suggested that these GPs were inherently interested in gaining greater insight into their prescribing practice and identifying potential problems. The intervention needed to acknowledge the barriers to changing practice and identify practical approaches to overcoming these barriers while respecting the autonomy and experience of GPs and the realities of daily clinical practice.

3.3.1 Topic for prescribing feedback

The first step was to identify topics which were important to GPs and that would encourage their continued involvement with the study. Participant GPs were given the opportunity to identify which topics they would like to receive prescribing feedback on. Only 34% (37/110) identified a topic. Among this group, 32% (12/37) identified cardiovascular disease (CVD) including hypertension and diabetes, a further 25% (8/37) identified drug budgeting and a small number (10%) identified antibiotic prescribing. Other areas of interest were prescribing in the elderly, pregnancy and respiratory conditions. The type of topics that could be targeted was restricted by the lack of diagnosis data on the database e.g. pregnancy could not reliably be identified on the database.

From the literature review it became evident that three areas in particular, antibiotic, generic prescribing (which is an aspect of drug budgeting) and preventive therapies in CVD and diabetes, were amenable to prescribing feedback using a pharmacy claims database and had shown positive results using similar study designs (section 2.31-2.3.3).

Having decided there would be 3 separate topic areas, the next decision was on the number of separate bulletins and associated academic detailing visits there would need to be. The duration of funding for the project and the time lag in receiving monthly pharmacy database files (4-6 months) were the limiting factors in deciding on whether follow up bulletins and visits would be possible.

Taking these factors into consideration it was decided to produce two separate bulletins with a three month lag time between each bulletin (the academic detailing visits were conducted as close to these as possible). However, due to time constraints it was not possible to revisit the topics and provide follow up bulletins or visits.

The topic for the first bulletin was antibiotic and generic prescribing, while the second bulletin covered prescribing of preventative therapies in CVD and diabetes.

3.3.2 Postal bulletin (PB) design

Prior to designing the bulletin, examples of educational material and types/formats of prescribing feedback data were identified. Within Ireland the only regular non-commercial source of information to GPs are bimonthly postal bulletins produced by the National Medicines Information Centre (NMIC) of Ireland (www.nmic.ie). These bulletins contain educational material on common conditions and drugs but do not include individualised prescribing information. The best examples of individualised GP prescribing feedback are the PACT data in the UK or the Prescribing Feedback Service in Northern Ireland (NI), part of the Central Service Agency (CSA) (formerly COMPASS). The researcher visited the Prescribing Feedback Unit in NI to examine and gain insight into how they generate and present individualised prescribing feedback to GPs.

In designing the postal bulletin key design principles were considered, these were to:[178]

1) Provide evidence based material to underpin quality prescribing indicators

2) Restrict to 3 key messages per topic

3) Repeat key messages

4) Individualise the prescribing feedback as much as possible

5) Include comparison with a peer group to facilitate benchmarking

6) Use graphical representation of individualised data

7) Keep the bulletin short (4 pages, single sided print)

8) Avoid long paragraphs

9) Use bullet points

10) Use 2-3 primary colours

The data presented in each bulletin was at the individual GP level not the practice level. This was because we did not have permission from all GPs in multi-partner practices to utilise their data for feedback. The multi-partner practices that did fully participate requested, and were provided with, both individual and practice level data.

Within the individual topic areas the most up-to-date evidence available from national and international sources was provided. To ensure the information was locally applicable and acceptable to GPs local experts in each field were identified and approved the information provided. In preparing information on antibiotic prescribing both Dr Robert Cunney, a Consultant Microbiologist at the Irish Health Protection Surveillance Centre (www.ndsc.ie) and Professor Colin Bradley, head of the subcommittee on community antimicrobial prescribing, which forms part of the Strategy for Antimicrobial Resistance in Ireland (SARI) (www.ndsc.ie) reviewed the first bulletin. With regard to generic prescribing Dr L Tilson from the National Centre for Pharmacoeconomics (www.ncpe.ie) was contacted, while CVD information was reviewed by Prof J Feely (Dept of Pharmacology & Therapeutics) and Prof M Walsh (Dept of Cardiology, St James Hospital, Dublin).

Once each bulletin was designed it was piloted in a local GP practice with 2 GPs (Dr F O'Kelly and Dr K O'Doherty) who commented on design, content and presentation. The bulletins were further revised using their suggestions. Following the first bulletin, GPs were also given a questionnaire to evaluate the bulletin in terms of relevance, clarity and usefulness. These suggestions from GPs were incorporated into the preparation of the second bulletin. Both bulletins took three to four months from original design to producing 110 individualised prescribing feedback bulletins. GP prescribing data was analysed using SAS, then imported into Microsoft (MS) Excel to produce graphs, the final bulletin was prepared in MS word (see appendix 1 & 2).

3.3.3 Academic detailing (AD) visit

The work by Soumerai et al was influential in developing the academic detailing arm of the study. [179] They identified key characteristics of successful academic detailing interventions which included:

a) Conducting pre-intervention interviews to investigate baseline knowledge and motivation

b) Focusing on specific categories of practitioners as well as opinion leaders

c) Defining educational and behavioural objectives

d) Establishing credibility through respected organisation, unbiased source of information

e) Stimulating active GP participation, using concise graphic educational material

f) Highlighting and repeating the essential message

g) Providing positive reinforcement of improved practice in follow-up visits

As many elements as possible were incorporated into the intervention, but inevitably there were trade offs. Pre-intervention interviews were not conducted with practitioners. This was partly due to time constraints within the research project, but also this extra dimension to the study would have required additional time commitments from the GPs. Other studies have identified time pressures as one of the major factors in GPs withdrawing from research studies.[179;180]

Practitioners within the intervention were a well defined group; all were GPs active within clinical practice with HSE-PCRS patient lists and within the same health board. There was no attempt to identify opinion leaders which may have had an influence on individual GPs. Within the postal bulletin and academic detailing visits desirable changes to practice were

identified but specific individual GP targets were not set. As this was the first time GPs received this type of information it was felt that a didactic approach would be counter productive until GPs trust and confidence in the project and with the researcher was established. The academic detailing visit reinforced the information received in the bulletin and the researcher conducting the visit tried to engage the GP in a discussion of how these changes could be implemented. Finally the four-six month delay in receiving prescribing data from the HSE-PCRS pharmacy database meant that follow-up feedback and visits was not possible within the study project time frame.

3.3.3.1 Format of academic detailing visit

Following distribution of the postal bulletins to all GPs, appointments with those GPs randomised to the academic detailing arm were made to visit them in their own practice. GPs were asked to allocate 15-20 minutes for the visit but at a time and place which was convenient to them.

Visits were deliberately kept short to ensure they could be incorporated into the GPs normal working day, as there was no opportunity to provide locum cover to release the GPs for a longer duration. This was also an attempt to maintain GPs interest in the project and limit GPs withdrawing from the study due to time pressures.[161]

As far as possible all visits were completed within four-six weeks of distributing the postal bulletins to maximise the effect of the bulletin. Each visit was conducted by the study research co-ordinator in order to ensure the consistency of the information given. The visit duration ranged from 15-40 minutes with the majority of the visits concluded within 30 minutes. Each visit consisted of a 10 minute PowerPoint presentation which utilised the individualised prescribing feedback which the GP had received in the postal bulletin prior to the visit. However, there was additional evidence based information supporting the proposed changes to practice. Again, prior to conducting the GP visits the PowerPoint presentation was tested in the pilot GP surgery.

The presentation was intended to be interactive and the GP was encouraged to ask questions during the presentation. Following the presentation the GP was encouraged to question the information supplied and identify whether or not they agreed with the suggestions, obstacles to implementing changes and how such obstacles could be overcome.

Following each visit the researcher maintained a diary recording how well the message was received, the reaction of the GP and any insightful comments or suggestions the GP made during the visit. The bulletins and academic detailing visits were also formally evaluated by the GPs using structured questionnaires (see chapter 8 for more details).

Figure 3.2 Project time frame

Oct 2004	Initial literature review, visit compass NI.
Nov 2004	Invitation letters sent to 300 GPs. Identify topics of interest.
Jan 2005	98 GP practices (110 GPs) gave written consent. Practices Randomised: 50 Postal bulletin,48 Academic detailing.
Feb 2005	Pilot 1st postal bulletins (PB)(antibiotics & generics).
Mar 2005	Distribute 1st PB & 1st PB evaluation questionnaires Academic detailing visits (AD).
April 2005	Final AD visits, Analysis PB questionnaires & GP AD feedback.
June 2005	Pilot 2nd postal bulletins (preventive therapies CVD & diabetes) Distribute 2nd PB & PB evaluation questionnaires.
July 2005	AD visits and visits evaluation questionnaires handed out
Aug 2005	AD visits completed. Questionnaire reminders sent out
Sept 2005	GP thank you letters sent
July 2007	Summary of study evaluation sent to all participant GPs

3.4 Statistical methods

A broad description of the statistical methods used in this study is presented here but within each of the three topic chapters more specific statistical methods are described.

3.4.1 The Comparison groups

In the RCT, the GP practice was the unit of randomisation and analysis. Academic detailing (AD) practices (n=48) were compared to those practices who received postal bulletin (PB) only (n=50). The postal bulletin practices were considered the baseline group. An intention to treat analysis was assumed throughout (one GP declined the academic detailing visit associated with the postal bulletin they received).

In the quasi-experimental design the individual GP was the unit of analysis as there was no information on which GPs worked in the same practice and for some multi-partner practices not all GPs participated in the study. Thus, in the quasi-experimental design participant GPs (n=110) (GPs in the randomised groups) were compared to non-participant (NP) GPs (n=190) i.e. those GPs who declined to participate in the study. The NP GPs were the baseline comparison group in this analysis.

3.4.2 Summary statistics

Difference in GP characteristics and patient population size and structure was assessed using two tailed t test for continuous variables, or chi square tests for categorical variables. Data from the evaluation questionnaires was also evaluated using the same methods. The mean standard deviation (SD) or actual number and percentage are presented. Significance at $p<0.05$ is assumed. SAS (V9) software was used for analysis (SAS institute Cary NC).

Regression methods were used to analyse the effect of the intervention in the three topic areas and more specific details are supplied in the individual chapters.

3.5 Conclusion

The dual study design (RCT & quasi-experimental) allowed for the most efficient use of available information including control of factors which may have influenced the results obtained in the study, such as background prescribing among non-participant GPs.

The design and development of the interventions (postal bulletin and academic detailing visits) took account of the available literature in this area with a view to ensuring practitioner's acceptance of the interventions.

Chapter 4

Antibiotic Prescribing

4.1 Introduction

The first of the topics dealt with in the intervention study was antibiotic prescribing. This chapter provides background on antimicrobial resistance and antibiotic use, particularly within Irish health care and evaluates the effect of prescribing feedback on antibiotic prescribing among the randomised postal bulletin only and academic detailing GP practices. In addition, participant GPs were compared to non-participant (NP) GPs. This chapter details the antibiotic quality prescribing indicators and analysis strategy used. The results are presented in two parts. Firstly the RCT is presented followed by the quasi experimental study. Finally, there is a discussion on the main findings and how they relate to the current literature.

4.2 Background on antimicrobial resistance & antibiotic use

Antimicrobial resistance, to many human pathogenic bacteria, is increasing and is recognised as a significant global health problem.[17;181;182] In 2001, the World Health Organisation (WHO) published a global strategy for containment of antimicrobial resistance.[183] The report emphasised the rapidity with which antimicrobial resistance was developing on a world wide scale. Conditions such as acute respiratory infections, diarrhoeal diseases, measles, malaria, AIDS and tuberculosis account for 85% of mortality from infectious diseases, yet in some cases there is nearly 100% resistance to first line antimicrobial therapy.[183] Antimicrobial resistance is the natural response to antibiotic

use and relies on constant drug development to counterbalance the emergence of resistant organisms. However, since the early 90s it was realised that the pace of new drug development could not match that of the emergence of antimicrobial resistance. This has contributed to the current situation, in which there are no effective treatments for some multi-resistant organisms, resulting in high mortality, morbidity and significant health care cost.[181;183]

Increased antibiotic use, especially inappropriate prescribing for minor conditions, is the key driver behind resistance. The emphasis on managing microbial resistance has shifted from new drug development to more judicious use of current therapies, which is often termed 'antimicrobial stewardship'.[184] This is a multifaceted approach and encompasses the key elements of the WHO strategy which includes education of patients, general public, prescribers and dispensers, surveillance and if necessary regulation. In terms of prescriber behaviour the major focus is on reducing and eventually eliminating inappropriate antibiotic prescribing for minor illness such as uncomplicated respiratory tract infections or otitis media and preserving the effectiveness of new generation antibiotics (e.g. second & third generation cephalosporins, quinolones or combination antibiotics) through their restricted use to situations where first line antibiotics have failed. However, the major controversy facing this approach is that there is very little evidence to suggest that reducing antibiotic prescribing can reverse or significantly slow resistance.[19;143;185]

4.2.1 Antimicrobial resistance within Ireland

In Ireland the problem of antimicrobial resistance is accelerating more rapidly than in many other European countries.[186] Monitoring by the European Antimicrobial Resistance Surveillance System (EARSS), reports that Ireland, with a 42% proportion of methicillin-resistant staphylococcus aureus (MRSA), has one of the highest proportions of MRSA in Europe.[186] Increasing resistance among other potentially life

threatening pathogens is also reported, such as Escherichia coli (E coli), where resistance has increased by between 6% to 12% in less than 3 years, while infections caused by other multi-drug resistance strains of bacteria are also increasing. [186;187]

4.2.2 Antibiotic use within Ireland

Ireland's relatively high antimicrobial use, ninth out of twenty five European countries in 2003, is believed to be a primary contributing factor to growing resistance.[17;188] Yet community antibiotic consumption continues to increase in Ireland. [24;188;189] The rise in antibiotic prescribing is primarily driven by use of second line combination antibiotics e.g. co-amoxiclav and second generation cephalosporins.[23] There is little research into why this increase has taken place but one factor may be, at least until recently, the lack of a coherent national approach to reducing antimicrobial usage. Ireland does not have national guidelines on community antibiotic usage. There is no restriction on antibiotic use as in some Nordic countries[19] and there is no public education on the risks of antimicrobial misuse (i.e. failing to complete a course of prescribed antibiotics, self medicating with antibiotics etc) . Such national campaigns in Belgium and France are believed to have contributed to the drop in antibiotic use in these countries.[109] Some of these factors may be addressed by the expert panel established to develop a Strategy for the control of Antimicrobial Resistance in Ireland (SARI).[190] The WHO strategy for control of antimicrobial resistance advised ongoing prescribing feedback and education of GPs in relation to antibiotic prescribing. [183] This is currently provided to UK GPs, who are consistently amongst the lowest community antibiotic prescribers in Europe, but in contrast no such information is provided to Irish GPs.[188;191]

4.3 Methods

This section describes how the recommendations on antibiotic prescribing delivered to GPs in the randomised trial evaluating postal bulletin and academic detailing relate to the subsequent evaluation of GP prescribing practice, using quality prescribing indicators applied to a pharmacy claims database. It then details the specific statistical methods used to analyse the effect of the intervention in the (i) RCT where academic detailing practices (AD) are compared to postal bulletin (PB) only practices and (ii) the quasi-experimental study where participant and NP GPs are compared.

4.3.1 Antibiotic quality prescribing indicators

In terms of evaluating changes in prescribing practice and comparing group differences we identified three outcomes for the subsequent data analysis:

1) A reduction in overall antibiotic prescribing (ATC code J01)
2) An increase in the use of first line antibiotic prescribing (narrow and broad spectrum penicillin, J01CA,E,F) as a proportion of all antibiotics prescribed.
3) A reduction in the use of second line antibiotic (co-amoxiclav (J01CR02) or cephalosporins (J01DA)) as a proportion of all antibiotics prescribed.

The prescribing of other antibiotics was also examined to detect any rebound increase in prescribing associated with a decrease in the targeted drugs.

These outcomes were primarily based on the recommendations contained in the original prescribing feedback bulletins and academic

detailing visits but also on outcomes used in similar studies (see table 2.1). In the original prescribing feedback, information provided to GPs focused on: (a) a low rate of overall antibiotic prescribing where individual GPs were benchmarked against the ERHA average, (b) a higher rate of first line antibiotic use e.g. penicillin compared to second line antibiotics such as cephalosporins and combination antibiotics e.g. co-amoxiclav and (c) avoidance of new generation antibiotics e.g. second & third generation cephalosporins (cefaclor).

The data analysis concerns the first two recommendations. Prescribing data on individual antibiotics was not analysed as the number of prescriptions per GP was too small and analysis would be subject to considerable variability (random error).

4.3.2 Analysis time points

The immediate and long term effects of the interventions were measured. The immediate effect measured the level change from the month immediately prior to the intervention, February 2005, compared to the month immediately post intervention, April 2005.

The long term measure of effect was the trend in monthly data for 12 months post intervention compared to baseline monthly date for 12 months pre-intervention. The twelve month analysis post intervention period was April 2005-March 2006 compared to pre-intervention March 2004–February 2005. The bulletin was distributed and the majority of the visits were conducted in March 2005, this month was excluded from the analysis.

4.3.3 Population selection

All GP practices (n=98) in the RCT or individual GPs (n=300) in the quasi experimental study who were invited to participate in the prescribing feedback project were included in the analysis. No restriction on the minimum number of monthly prescriptions was applied to either

comparison group. All patient age groups (including children) were included in the data.

4.3.4 Statistical analysis

Baseline GP characteristics are described elsewhere (see section 3.4.2).

Differences in the baseline antibiotic prescribing rate or proportion of first and second line antibiotics was compared between randomised or participant/NP groups using Wilcoxon rank sum test for non-parametric data. The median rate (per 1000 patients/practice) or percentage of antibiotic prescribed, inter-quartile range (IQR) and the associated p values are presented. Significance at $p<0.05$ is assumed. SAS (V9) was used for the analysis.

4.3.4.1 Outcome measures

The outcome measures for the antibiotic prescribing indicators were calculated in two ways:

1) Overall antibiotic prescribing rate per 1000 patients was calculated as the total number of antibiotic prescriptions per month per practice in the randomised trial or per GP in the quasi experimental study with the corresponding registered HSE-PCRS patient population used as the denominator.
2) The proportion of first or second line antibiotics was calculated as the total number of prescriptions for the antibiotic (e.g. penicillin) as a proportion of the total number of antibiotics prescribed per practice or per GP per month.

The median monthly rate or proportion of antibiotics prescribed was calculated for each of the comparison groups (randomised bulletin and academic detailing GP practices or participant and NP GPs)

4.3.4.2 Segmented regression analysis

Segmented regression analysis of interrupted time series was used to examine both within group and between group changes in prescribing in the post intervention period compared to the pre-intervention period. This method measures the level i.e. a sudden change in prescribing pattern immediately after the intervention and trend i.e. the monthly rate of change of antibiotic prescribing (slope) post intervention compared to the pre-intervention slope.[192] In the analysis there were 24 monthly intervals, 12 pre-intervention and 12 post intervention. The interval during the intervention period (March 2005) was excluded.

Antibiotic prescribing is subject to seasonal variation, with a peak in prescribing occurring in late winter and early spring. Seasonal variation was controlled for by generating a term for season with four categories, (summer was the baseline category) and this was included in the regression analysis.

The within group model compares changes within the randomised or non-randomised groups and included a constant term, a term for baseline prescribing (linear trend), season and terms to estimate change in level and trend. The β coefficient (regression) and 95% Confidence Intervals (CI) are presented.

The between group model compares changes between the randomised (PB vs AD) practices or non-randomised (participant vs NP) GPs and includes the above terms in addition to a term to indicate study group and interaction terms (group by baseline trend, group by change in level, and group by change in trend) to determine whether there were significant changes in level and trend between the groups adjusting for the other variables in the model.[134;193] A separate model was generated for each antibiotic. The p values presented are for the level and trend interaction terms and are based on the pooled SE of the comparison groups. The analysis was performed using SAS PROC REG (SAS institute Cary NC).

4.4 Results: Antibiotic Prescribing PB vs AD

This section describes the baseline characteristics and pre-intervention prescribing of the randomised groups. The results of the immediate and long term effects of the intervention at practice level are presented. Graphs depicting monthly trends in prescribing for the main antibiotic subgroups are used to provide a visual image of the effect of the intervention.

4.4.1 Baseline characteristics

The individual GP characteristics (age, gender, years qualified and extra training) in the randomised groups were similar. The majority of GPs had over 20 years experience, although only 20% (22/110) had undertaken formal educational courses since qualifying (table 4.1). Most GPs worked in multi-partner practices, but there was a significantly higher proportion of single handed practices in the PB group (p=0.01), while larger practices (≥ 5 GPs) was more common in the academic detailing group. Over 70% of practices employed practice nurses and 80% had some level of computerisation.

The proportion of public (HSE-PCRS) to private patients was similar between the groups. Also there was no significant difference between the groups in the actual number of HSE-PCRS patients per practice; PB practices had a median of 833 patients per practice (IQR 624-1051) compared to 866 patients per practice (IQR 652-1317) in the AD group (p=0.27). The age and gender structure of the populations in both groups was also similar (table 4.2)

Table 4.1 Characteristics of Postal bulletin (PB) vs Academic detailing (AD) GPs

		Postal bulletin (PB)		Academic detailing (AD)	
		N (n=55 GPs)	%	N (n=55 GPS)	%
Gender	Male	43	78	48	87
	Female	12	22	7	13
Age	Mean (SD)	50	7.6	51	6.8
Years Qualified as GP	5-10 years	5	9	1	2
	10-15	6	11	6	11
	15-20	14	25	12	22
	>20	29	55	35	65
Extra Training	No	46	86	42	78
	Yes	8	14	12	21
GPs per practice	1	14	26	9	17*
	2-4	32	59	23	43
	≥5	8	15	22	41
Proportion HSE-PCRS patients	≤25%	4	7	7	13
	25-50	18	33	25	46
	50-75	15	27	12	22
	>75%	16	29	10	18
Practice Nurse	Yes	41	76	45	84
	No	13	24	9	16
Computerised	Yes	48	89	43	80
	No	6	11	11	20

Information in this table is based on individual GP details, *p<0.05 between group comparison

Table 4.2 HSE-PCRS patient population characteristics, PB vs AD practices

		PB		AD	
		50 GP practices		48 GP practices	
		Mean %	SD	Mean %	SD
Age	0-15 yrs	26	9	22	10
	16-64 yrs	44	9	42	10
	≥65 yrs	31	17	36	19
Gender	Male	43	4	42	4

Information in this table was obtained from the HSE-PCRS and relates to practice data. Mean % of practice patient population, $p>0.05$ for all variables

4.4.2 Baseline Antibiotic Prescribing

Overall the antibiotic prescribing rate between the randomised groups was similar in the twelve months prior to the intervention. However, there were significant differences between the groups in the type of antibiotic prescribed. GPs in PB practices were significantly more likely to prescribe penicillin while those in AD practices were significantly more likely to prescribe second line antibiotics. Baseline prescribing for other antibiotics including macrolides was not statistically different between the groups. Baseline differences are adjusted for in subsequent analysis.

Table 4.3 Baseline antibiotic prescribing PB vs AD GP practices

	PB practices n=48		AD practices n=50		Wilcoxon rank sum test
	Median Rate	**IQR**	**Median Rate**	**IQR**	**p value**
All antibiotics (median rate/1000 patient /per month)	113	108-123	106	100-116	0.23
% of all antibiotic prescriptions/GP/month	**Median %**	**IQR**	**Median %**	**IQR**	
Penicillin	34	33-34	30	29-31	0.002
Co-amoxiclav	24	23-26	26	25-28	0.006
Cephalosporins	9	8-10	11	10-11	0.002
Macrolides	12	11-13	12	11-12	0.17
Other antibiotics	17	16-19	17	16-18	0.71

4.4.3 Immediate effect post intervention: PB vs AD practices

Immediately post intervention there was no significant difference in the overall antibiotic prescribing rate between the randomised groups (p=0.26) (figure 4.1). Both randomised groups decreased their prescribing from the immediate pre-intervention (Feb 2005) to the post intervention period (April 2005), but this decrease may be expected due to the normal seasonal variation in antibiotic prescribing (table 4.4).

There was a significant difference in the prescribing of first line antibiotics between the randomised groups. Both groups increased prescribing of penicillin (figure 4.2), but the AD practices significantly increased prescribing by 5% compared to 2 % in the PB practices (p=0.04) (table 4.4). Co-amoxiclav and cephalosporin prescribing decreased in both groups post intervention, but there were no significant differences between the groups.

Prescribing of other antibiotics was also similar between the groups, with both groups having significantly increased prescribing of other antibiotics, namely trimethoprim, immediately post intervention.

4.4.4 Long term (12 month) effect post intervention

Over the twelve months post intervention period there was no significant difference between PB and AD practices in their rate of antibiotic prescribing (table 4.4).

Similarly, there were no significant difference in the pattern of first or second line antibiotic prescribing between the groups, adjusting for baseline prescribing and seasonality. After the initial increase in penicillin prescribing there was a tendency in both groups to return to pre-intervention baseline levels (figure 4.2). A similar pattern was seen with co-amoxiclav prescribing with a non-significant monthly trend towards increased prescribing in both groups (figure 4.3). There was no

significant difference between the groups in cephalosporin or other antibiotic prescribing (table 4.4).

Table 4.4 Change (β coefficient) in immediate and 12 month antibiotic prescribing post intervention PB vs AD

Drug	Immediate response			Long term (12 month trend)		
	PB (n=50)	AD (n=48)	Group difference	PB (N=50)	AD (n=48)	Group difference
	β^1 (95% CI)	β^1 (95% CI)	p value[2]	β^1 (95% CI)	β^1 (95% CI)	p value[2]
All antibiotics (rate)	- 0.02 (-0.04, -0.001)	-0.02 (-0.03, -0.001)	0.26	0.002 (-0.001, 0.004)	0.001 (-0.001, 0.003)	0.33
Penicillin (proportion)	0.02 (0.002, 0.05)	0.05 (0.01, 0.09)	0.04	-0.003 (-0.005, -0.001)	-0.001 (-0.004, 0.002)	0.67
Co-amoxiclav (proportion)	-0.03 (-0.05, -0.01)	-0.3 (-0.05, -0.01)	0.58	0.002 (-0.001, 0.005)	0.0003 (-0.002, 0.003)	0.62
Cephalosporins (proportion)	-0.02 (-0.03, -0.007)	-0.02 (-0.03, -0.003)	0.70	0.001 (-0.0004, 0.002)	0.001 (-0.001, 0.003)	0.86
Other antibiotics (proportion)	0.05 (0.02, 0.07)	0.03 (0.01, 0.05)	0.19	-0.001 (-0.004, 0.001)	-0.002 (-0.004, 0.001)	0.92

[1] β coefficient= change per month in rate or proportion of prescriptions, [2] p value based on pooled SE for both groups,

Figure 4.1 Antibiotic prescribing rates, PB vs AD GP practices

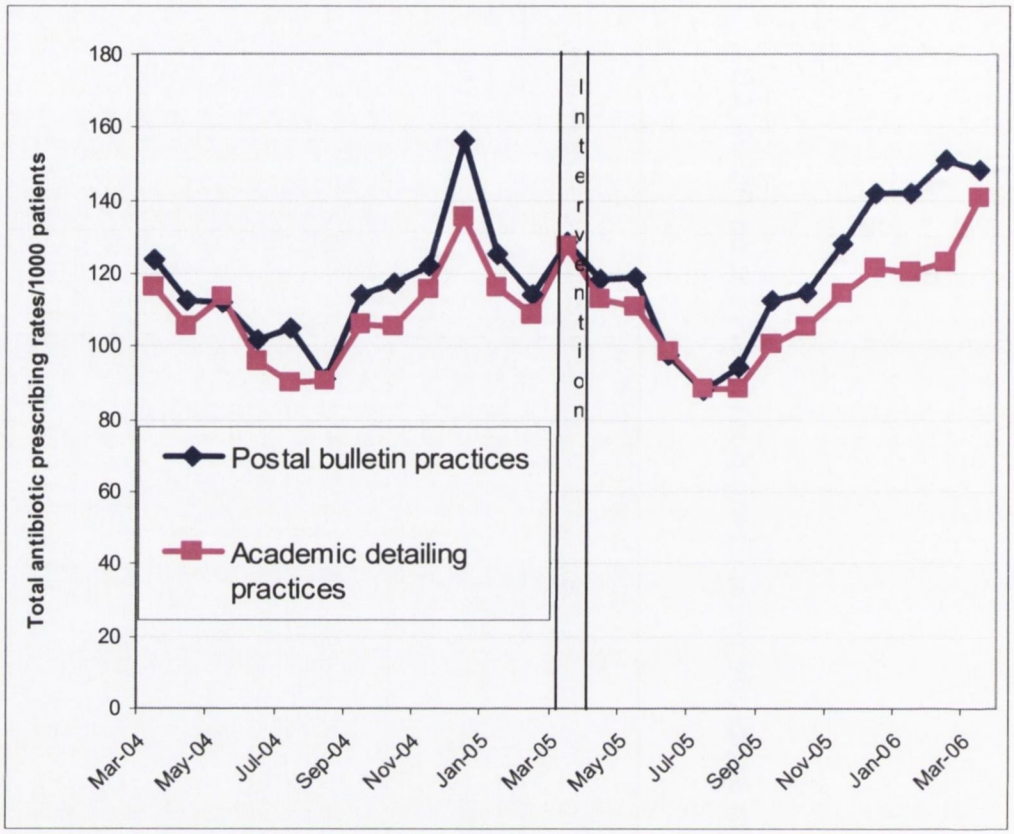


Figure 4.1 depicts total antibiotic prescribing rates per month for 12 months pre-intervention and post intervention in the PB and AD practices. The graph shows the seasonal pattern in antibiotic prescribing with a decrease in the summer months followed by an increase in autumn and reaching a peak in late winter and early spring. The graph indicates the similarity between the groups in their overall antibiotic prescribing both pre and post intervention. Antibiotic prescribing had started to decrease prior to the intervention so the immediate effect of the intervention was not significantly different to that expected due to seasonal changes in antibiotic prescribing. The trend over the twelve month post intervention period closely matches pre-intervention prescribing trends in both groups.

Figure 4.2 Proportion of penicillin prescriptions, PB vs AD GP practices

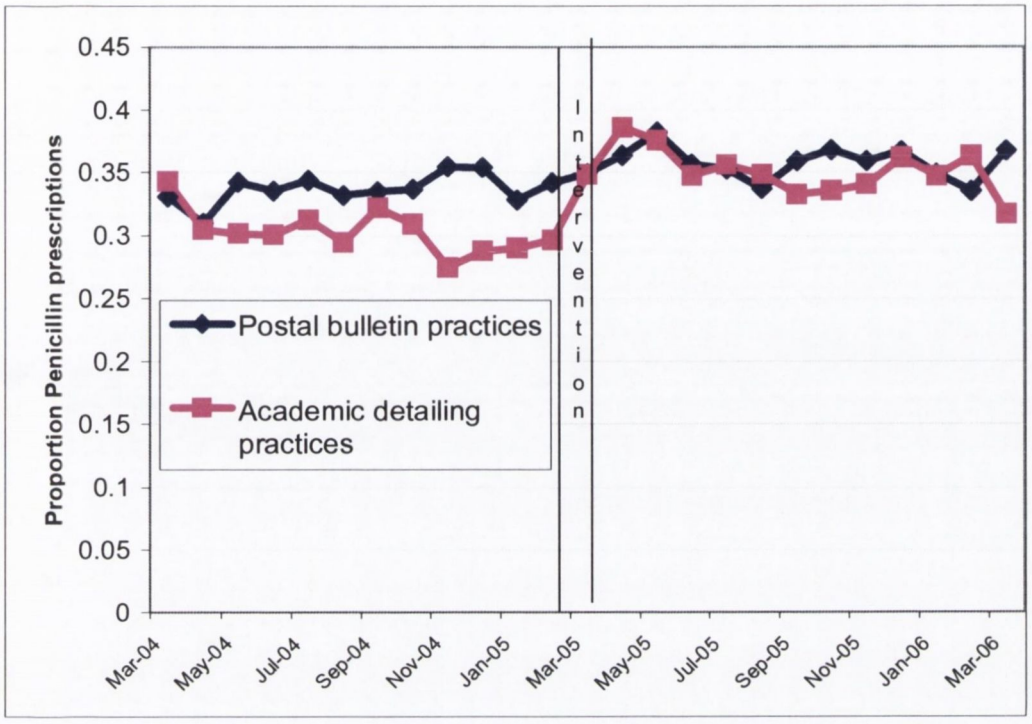


Figure 4.2 depicts the level of penicillin prescriptions as a proportion of all antibiotics per month for both the randomised groups. Pre-intervention AD practices had lower levels of penicillin prescribing compared to PB. Immediately post intervention both groups increased penicillin prescribing but AD practices had a significantly greater increase. However, within three months of the antibiotic intervention ceasing prescribing had declined in both groups and was not significantly different from pre-intervention levels.

Figure 4.3 Proportion of co-amoxiclav prescriptions, PB vs AD GP practices

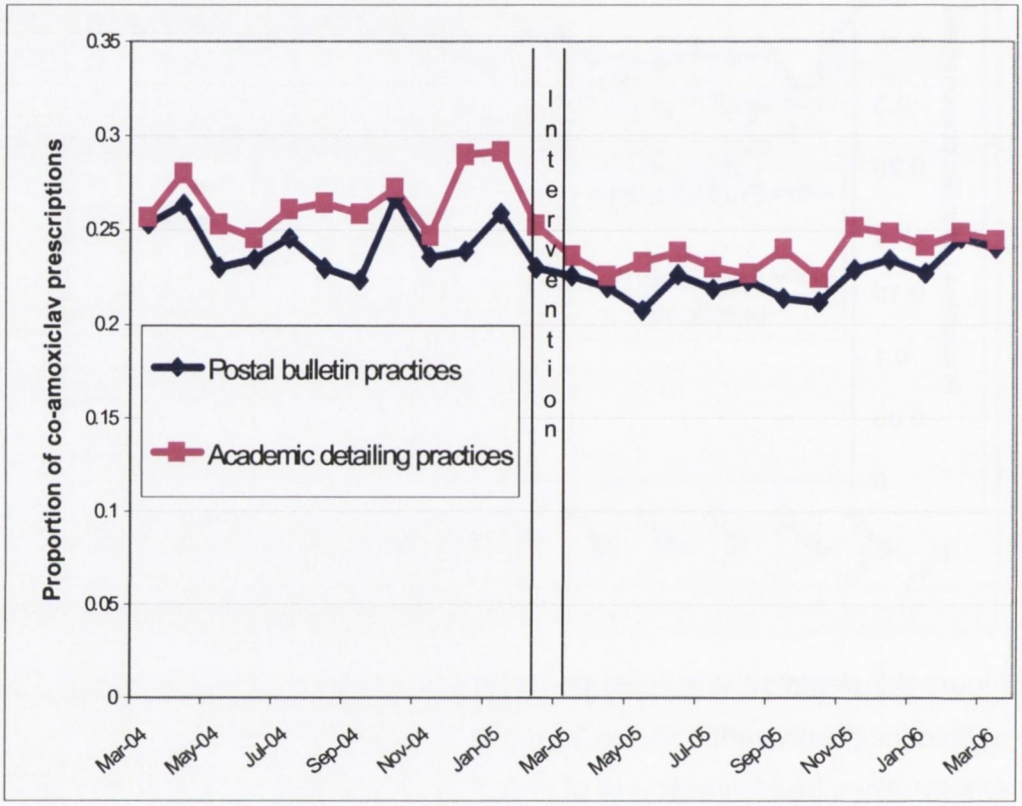


Figure 4.3 depicts the level of co-amoxiclav prescriptions as a proportion of all antibiotics per month for both the randomised groups. Pre-intervention PB practices had significantly lower levels of co-amoxiclav prescribing than AD practices. Immediately post intervention both groups decreased co-amoxiclav prescribing. Over the twelve month post intervention period prescribing in both groups did not change significantly but there was a tendency for prescribing to return to pre-intervention levels, especially towards the end of the twelve month period.

4.4.5 Summary of results

- Academic detailing (AD) practices did not achieve a significant reduction in overall antibiotic prescribing compared to postal bulletin (PB) alone.
- Academic detailing achieved a significant increase in proportion of penicillin prescribed immediately post intervention compared to postal bulletin practices.
- Over the 12 month post intervention period the proportion of penicillin prescribing in both groups was not significantly different from baseline prescribing suggesting a return to baseline practice.
- The proportion of co-amoxiclav and cephalosporin prescribing decreased in both randomised groups immediately post intervention but there was no significant difference between the groups, immediately or at twelve months post intervention.
- There was no significant difference between the groups in prescribing of other antibiotics.

4.4.6 Discussion

Antibiotic prescribing PB vs AD practices

The results showed no significant reduction in the overall rate of antibiotic prescribing between the randomised groups either immediately post intervention or in the long term. However, academic detailing practices achieved a small change in the pattern of antibiotic selection. Immediately post intervention the selection of penicillin, a first line antibiotic, increased by 5% among academic detailing practices compared to a non-significant 2% increase in the postal bulletin only group. However, over the twelve months post intervention period this increase was not maintained by academic detailing practices and there was no significant difference from baseline prescribing practice seen.

Second line antibiotic prescribing (co-amoxiclav and cephalosporins), decreased in both groups immediately post intervention but there was no significant differences between the groups in immediate or long term prescribing.

In this study academic detailing achieved a small change in prescribing practice over postal bulletin alone. Studies using similar approaches with an outreach educational visit, have reported variable results ranging from no effect to similar small effects.[135;138;139;145] A review by Arnold & Straus[133] of interventions to improve antibiotic prescribing practice provides a useful insight into why such interventions have only a small impact on clinical practice. Increasing a practitioner's awareness of a problem through educational lectures, material or audit and feedback will not necessarily provide the practitioner with the tools to change behaviour especially if this involves patient co-operation. In practical terms what is likely to happen is a partial adoption of the recommended practice, as in this study, where GPs did not reduce their overall level of antibiotic prescribing but increased selection of first line antibiotics over second line antibiotics. GP practices in the academic detailing arm of the study showed a greater willingness to adopt first line antibiotic prescribing

compared to bulletin only practices, but the impact of the intervention appears to have deteriorated over time. This may be expected as it is known that physician adherence to recommended guidelines declines with increased time since graduation[133]or in this case since the intervention. However, some studies have reported a sustained change in practice beyond the initial intervention.[140;143;194]

4.4.5.1 Duration of intervention

The short duration of the interventions and the lack of follow up are undoubtedly important factors in the overall small impact of academic detailing over postal bulletin found in this study. Academic detailing relies on building a relationship of confidence and trust between the GP and the prescribing advisor. Also part of the incentive for the GP to change practice is the realisation that their practice is been reviewed and compared to their peers on an ongoing basis.[195] The effectiveness of the interventions may be further improved by providing GPs with specific targets to change practice[196], with patient specific information[197] and data on local area antimicrobial resistance.

The addition of such extra elements moves beyond simple academic detailing into more complex multifaceted interventions. Multifaceted interventions often combine audit, feedback, guidelines, academic detailing and small group workshops for GPs, with public education. This dual targeting of physicians and patient behaviour has produced larger changes in prescribing practice than targeting either group alone especially in relation to antibiotic prescribing.[136;137;198;199]

4.4.5.2 Conclusion

Prescribing feedback using academic detailing had a small additional impact on antibiotic prescribing over postal bullet alone. However the inclusion of academic detailing increases the cost and complexity of delivering prescribing feedback. The effectiveness of both interventions

needs to be evaluated in terms of cost (chapter 9) but more importantly achieving a reduction in antimicrobial resistance.

4.5 Results: Antibiotic prescribing, participant vs NP GPs

This section describes the results of the quasi-experimental study and details the effect of prescribing feedback with or without academic detailing on antibiotic prescribing practice among participant GP compared to those not receiving feedback (NP GPs). Baseline characteristics and prescribing are also compared to examine the comparability of the groups.

4.5.1 Baseline Characteristics

Participant GPs were significantly younger with a mean age of 50 years (SD 7.4) compared to 54 years (SD 8.4) for NP GPs ($p<0.001$). There was no information available on length qualified or extra training for NP GPs. The HSE-PCRS patient population size was similar between the groups; participant GPs had a mean panel size of 908 (SD 304) patients compared to a mean of 872 (SD 331) for NP GPs ($p=0.36$). The age structure of the patient panel was also similar between the groups (table 4.5)

Table 4.5 HSE-PCRS patient population, participant vs non-participant (NP)GPs

		Participant GP n=110		NP GP n=190	
		%	SD	%	SD
Patient age	0-15 yrs	23	11	22	11
	16-64 yrs	42	09	43	10
	≥65 yrs	34	18	36	20
Patient gender	Male	43	4	43	4

p>0.05 for all variables

4.5.2 Baseline Prescribing

In the twelve months prior to the intervention there was no significant difference between participant and NP GPs in their overall antibiotic prescribing rate (table 4.6). Similarly, the proportion of prescriptions of the various antibiotics was not significantly different between the groups prior to the intervention. The exception was for prescriptions for other antibiotics, which was significantly higher among participant GPs, but this was mainly driven by higher prescribing of trimethoprim among participant GPs.

Table 4.6 Baseline antibiotic prescribing, participant vs NP GPs

	Participant GP n=110		**NP GPs n=190**		
	Median Rate	**IQR**	**Median Rate**	**IQR**	**Wilcoxon p value**
All antibiotics (median rate/1000 patient per/month)	110	102-118	116	108-131	0.21
% of all antibiotic prescriptions/GP/month	**Median %**	**IQR**	**Median %**	**IQR**	
Penicillin	32	31-33	31	30-32	0.11
Co-amoxiclav	25	24-26	25	24-27	0.69
Cephalosporins	10	9-10.1	10	9-11	0.34
Macrolides	12	11-12	12	11-12	0.31
Other antibiotics	17	16-18	15	14-16	0.02

4.5.3 Immediate effect post intervention: Participant vs NP GPs

Immediately post intervention there was no significant differences between participant and NP GPs in the overall rate of antibiotic prescribing (p=0.32) (table 4.7). The overall rate of antibiotic prescribing did not change significantly from the pre to the immediate post intervention period in either group (figure 4.4).

However, the pattern of antibiotic prescribing was significantly different between the groups (table 4.7). Participant GPs increased penicillin prescribing by 5% while there was no significant change in penicillin prescribing among NP GPs (p<0.001) (figure 4.5). For second line antibiotic prescribing there was a reverse pattern seen. Participant GPs significantly reduced co-amoxiclav prescribing by 3% (figure 4.6) and cephalosporin prescribing by 2% (figure 4.7), while there was no change in prescribing among NP GPs adjusting for pre-intervention levels. There was no significant difference in the prescribing of other antibiotics between the groups.

4.5.4 Long term effect post intervention

In the twelve month post intervention period there was no significant difference between the groups in their overall rate of antibiotic prescribing (p=0.67) (table 4.7), adjusting for baseline prescribing and seasonality (figure 4.4).

Following the immediate post intervention period penicillin prescribing tended to decrease (0.1% per month) among participant GPs but still remained higher than NP GPs (figure 4.5). However, adjusting for seasonality and pre-intervention prescribing there was no statistically significant difference between the groups (p=0.07). Over the twelve month post intervention period participant GPs' co-amoxiclav prescribing remained significantly lower compared to that of NP GPs (p=0.002). In the latter half of the year prescribing tended to return to pre-intervention

levels with a non-significant 0.2% increase in prescribing per month. There was no significant difference between the groups in cephalosporin or other antibiotic prescribing.

Table 4.7 Change (β coefficient) in 1 & 12 month antibiotic prescribing post intervention, participant vs NP GPs

Drug	Immediate response			Long term (12 month trend)		
	Participant GP (n=110)	NP[1] GP (n=190)	Group difference	Participant GP (N=110)	NP[1] GP (n=190)	Group difference
	β (95% CI)	β (95% CI)	P[3] value	β^2 (95% CI)	β^2 (95% CI)	P[3] value
All antibiotics (rate/GP/month)	- 0.01 (-0.03, 0.002)	-0.02 (-0.04, 0.001)	0.32	0.0001 (-0.001, 0.003)	0.001 (-0.001, 0.004)	0.67
Penicillin (proportion/GP/mth)	0.05 (0.03, 0.07)	-0.002 (-0.02, 0.02)	<0.001	-0.001 (-0.003, 0.001)	0.002 (-0.0002, 0.004)	0.07
Co-amoxiclav (proportion/GP/mth)	-0.03 (-0.05, -0.03)	-0.01 (-0.02, 0.01)	0.03	0.002 (-0.0001, 0.004)	-0.002 (-0.003, 0.00004)	0.002
Cephalosporins (proportion/GP/mth)	-0.02 (-0.03, -0.01)	0.00 (-0.01, 0.01)	0.001	0.00 (-0.001, 0.001)	0.00 (-0.001, 0.001)	0.40
Other Antibiotics (proportion/GP/mth)	0.03 (0.01, 0.04)	0.02 (-0.003, 0.04)	0.60	-0.003 (-0.01, -0.001)	-0.001 (-0.004, 0.002)	0.29

[1] NP=Non-participant GP,[2] β coefficient= change in rate or proportion per month [3] p values based on pooled SE for both groups

Figure 4.4 Antibiotic prescribing rate, participant vs NP GPs

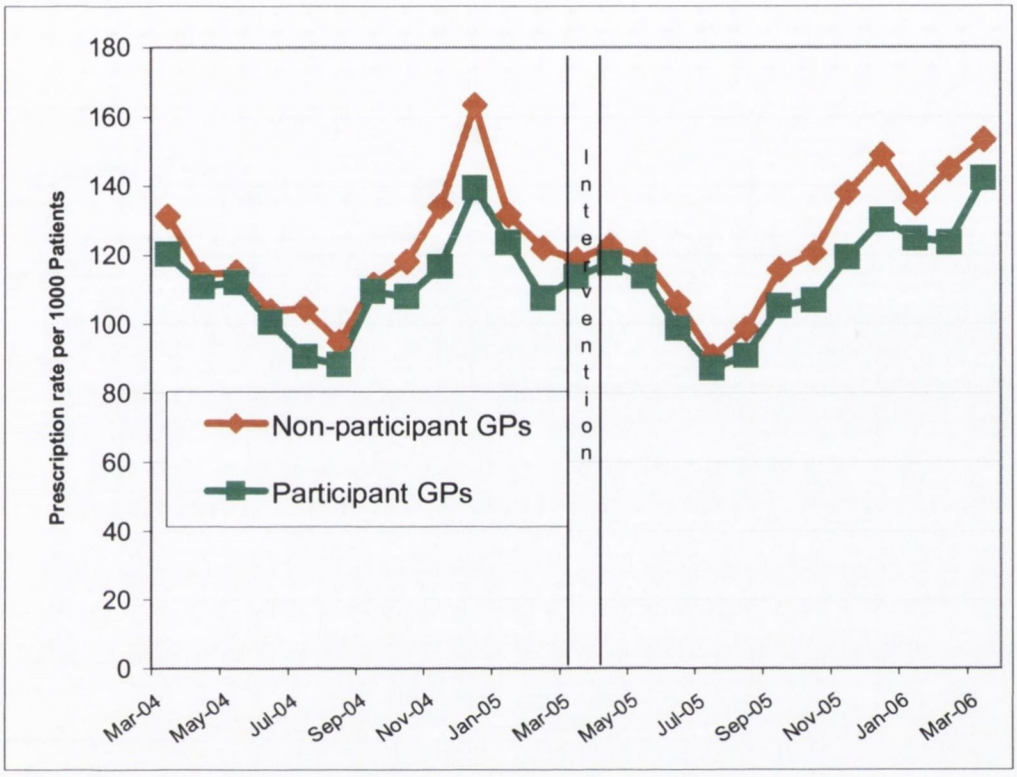


Figure 4.4 shows the monthly total antibiotic prescribing rates for participant and NP GPs. The graph highlights the similarity in pre and post intervention prescribing rates between both groups. Also, the seasonal variation in prescribing is clearly visible.

Figure 4.5 Proportion of penicillin prescriptions, participant vs NP GPs

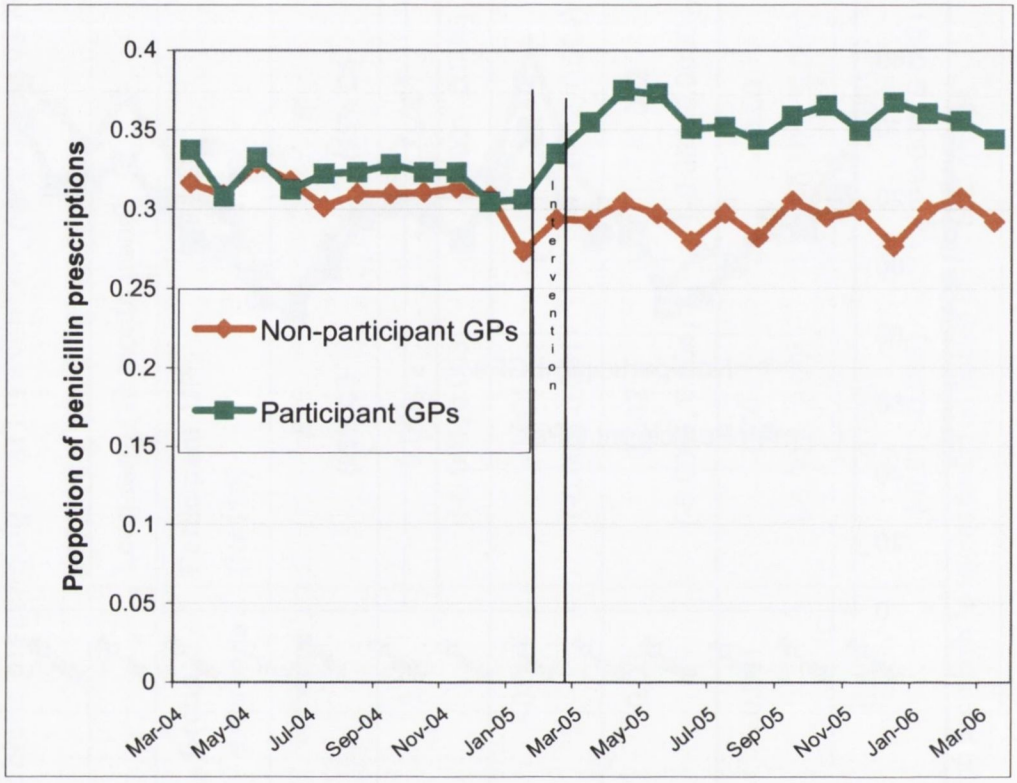


Figure 4.5 shows the proportion of penicillin prescriptions out of the total number of antibiotic prescriptions per month for participant and NP GPs. Pre-intervention there was no significant difference between the groups. The graph shows the increase in proportion of penicillin prescribing immediately post intervention in the participant GP group while prescribing in the NP GPs remained broadly the same in the immediate and 12 month post intervention period. The graph also shows the decline in the proportion of penicillin prescribing among participant GPs over the long term, although prescribing levels remained higher than pre-intervention levels.

Figure 4.6 Proportion of co-amoxiclav prescriptions participant vs NP GPs

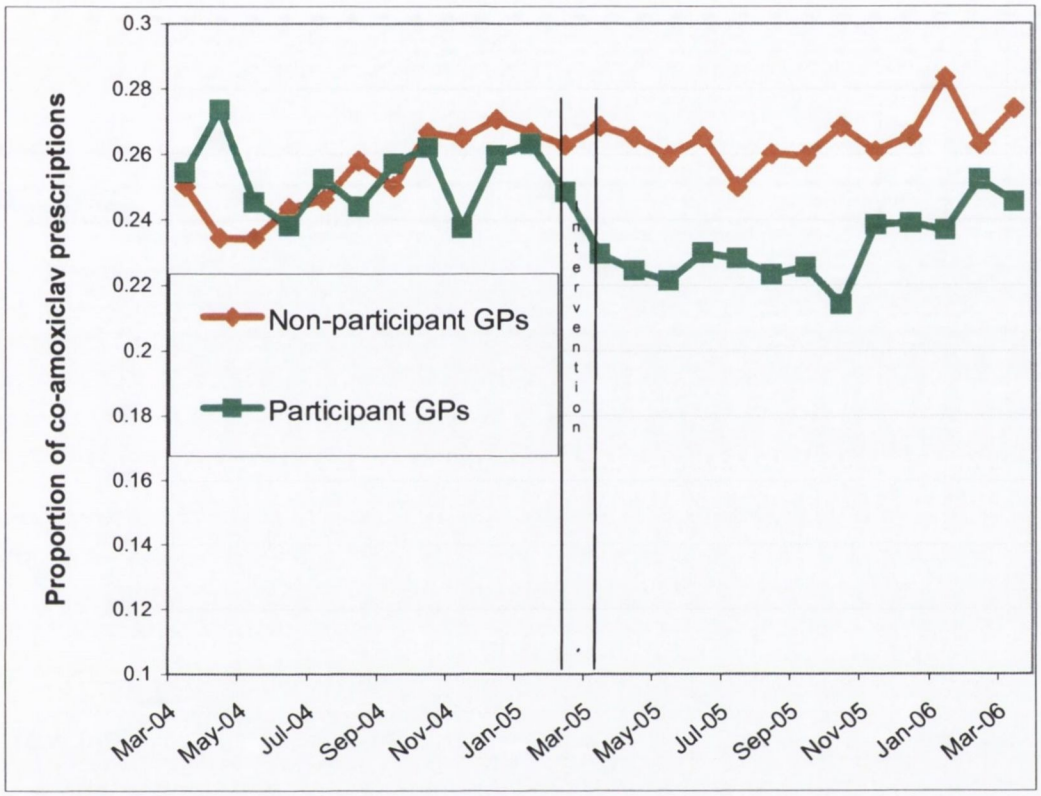


Figure 4.6 shows the proportion of co-amoxiclav prescriptions out of total antibiotic prescriptions per month for participant and NP GPs. Pre-intervention there were similar levels of prescribing in both groups. Immediately post intervention participant GPs decreased the proportion of co-amoxiclav prescribing while NP GP prescribing remained largely the same. Over the long term, participant GPs co-amoxiclav prescribing tended to return to baseline levels.

Figure 4.7 Proportion of cephalosporin prescriptions, participant vs NP GPs

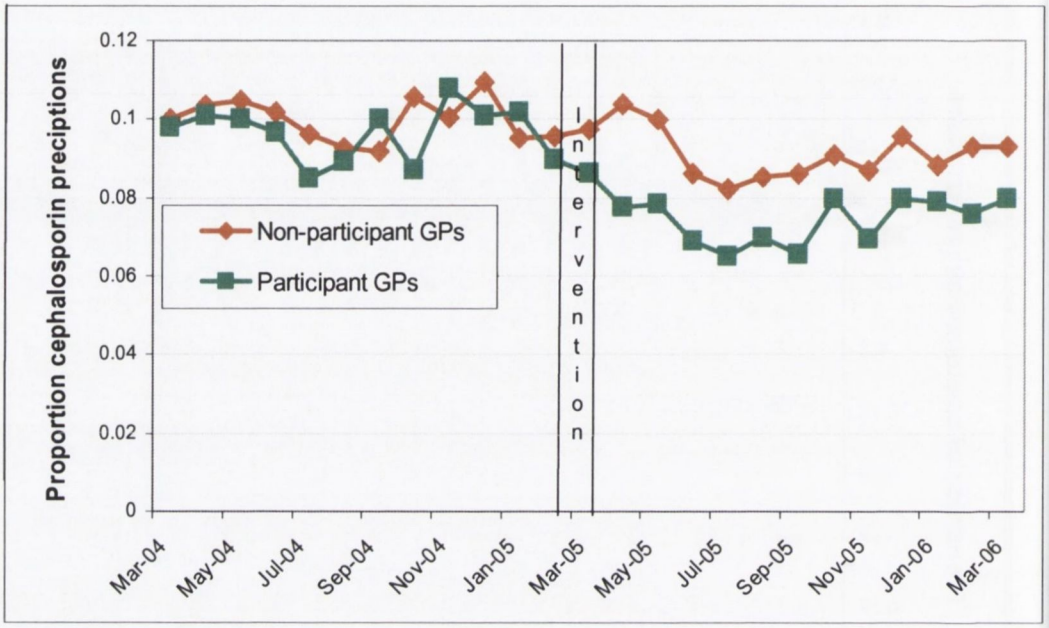


Figure 4.7 shows the proportion of cephalosporin prescriptions for participant and NP GPs. A similar pattern to co-amoxiclav is evident with a decrease among participant GPs immediately post intervention and a tendency to increase prescribing toward the end of the 12 month post intervention period.

4.5.5 Summary of results

- The overall rate of antibiotic prescribing was not significantly different between participant and NP GPs either in the immediate or long term post intervention period.
- The proportion of first line antibiotic prescribing (penicillin) was significantly increased among participant GPs immediately post intervention but over the long term this increased prescribing was not maintained.
- The proportion of second line antibiotics (co-amoxiclav and cephalosporins) were significantly reduced among participant GPs immediately post intervention compared to NP GPs. However, over the long term these changes were not maintained and there was a tendency to return to baseline prescribing.

4.5.6 Discussion

In the quasi-experimental study there was no significant difference in overall antibiotic prescribing between participant and non-participant GPs. However the selection of antibiotics was significantly different between the randomised and non-randomised groups. This study found that supplying prescribing feedback plus or minus academic detailing can significantly alter GP prescribing. However the effect size was small ranging from a 2-5% change in prescribing practice above background activity. Small effect sizes from such interventions have been a consistent finding both in meta-analysis of trials and systematic reviews on this topic. [98;99;133]

4.5.6.1 Barriers to prescribing

An understanding of the barriers to changing prescribing practice can help explain the small change observed in the pattern of antibiotic prescribing and the failure to reduce overall antibiotic prescribing in this and other studies.[139;141;142;145]

Studies identifying the barriers to changing antibiotic prescribing point to a complex interplay of influences beyond accurate clinical knowledge. [200] Antibiotic prescribing seems to be particularly sensitive to patient influence. GPs often describe feeling pressurised by patients into prescribing an antibiotic even if they feel clinically it is not warranted.[106] Older age, other co-morbidities or socio-economic deprivation are also patient factors which influence the decision whether or not to prescribe. [200-203]

Other non-clinical factors associated with higher antibiotic prescribing include GP age, education, single handed or non-training practices.[200;202;203] GPs identify the uncertainty around acute infectious conditions where decisions to prescribe antibiotics are often made empirically in the absence of laboratory tests. Such decisions are influenced by a GPs personal experience and the potential for

deterioration in a patients condition especially in children.[106] Other external influences include the practice in local hospitals, specialist consultants and the pharmaceutical industry.[191;204] GPs are expected to balance the interest of society against the interests of the individual, both in terms of the volume and type of antibiotic they prescribe. However in practice GPs give greater priority to individual patient factors and prescribe the antibiotic which they feel works the most effectively with the best tolerability. [205]

4.5.6.2 Society versus individual need

This present study found that GPs were responsive to changing aspects of their prescribing behaviour through prescribing feedback plus or minus academic detailing. However two key observations are made: (1) the intervention did not influence participant GPs overall volume of antibiotic prescribing and (2) the change in the type of antibiotic selected was not sustained over a twelve month post intervention period. This indicates that the pressure to prescribe either from patients or GPs own anxiety requires more than just the provision of one off individualised GP prescribing information. There is evidence that large scale public education campaigns can play a part in reducing some of this pressure and thus overall antibiotic prescribing.[109;206] Also improvement in the availability of diagnostic procedures within practices resulted in a reduction in antibiotic prescribing.[207]

Individual prescribing feedback plus or minus academic detailing made some GPs aware of their pattern of prescribing and the subsequent reduction in second line antibiotic use may reflect an attempt to balance societal need to control antimicrobial resistance against the individual patients needs. The lack of follow up and intensity of the intervention undoubtedly contributed to a return to baseline practice among participant GPs within twelve months of the intervention ceasing and will be discussed further under study limitations (section 4.6).

4.5.6.3 Intervention contribution to change

The results in this analysis where data from the randomised groups (PB and AD GP practices) was combined and compared to the data from non-participant GPs identified greater differences in the pattern of antibiotic prescribing than in the RCT. This is partly due to the greater power to detect differences with the larger number of GPs in the participant group. The data from non-participant GPs probably reflects underlying baseline practice and the study design used allowed us to examine the relative contribution of postal bulletin versus academic detailing to changes in prescribing practice while also identifying background changes in practice which occurred during the study period. Examining data from the two studies it is apparent that the academic detailing practices contributed to most of the increase seen in penicillin prescribing while reductions in co-amoxiclav and cephalosporin prescribing were equally distributed between the two randomised intervention arms and were only 2-3 % greater than would have occurred if there had been no intervention. This raises questions over the effectiveness and especially cost-effectiveness of the different interventions which will be discussed further in chapter 9.

4.5.6.4 Conclusion

Prescribing feedback plus or minus academic detailing can alter aspects of GP antibiotic prescribing. However, the effect size was small and was not sustained over a prolonged period of time. The key challenge facing the medical and wider community is how to effectively control the spread of antimicrobial resistance whilst providing effective treatment for the individual. Prescribing feedback as part of a multifaceted intervention can be both an effective utilisation of an existing resource and a pragmatic benchmark to help evaluate individual GP practice.

4.6 Study limitations

The study limitations are made explicit at the outset of the presentation of the results to enable the reader to evaluate the data in this and the three subsequent chapters. The limitations are related to the implementation of the intervention, study design including population selection and the prescribing database used to generate and evaluate the prescribing feedback intervention.

4.6.1 Implementation of the randomised interventions

- The interventions were one off, at a single point in time, with no follow up on the particular topic. Several authors have emphasised the importance of sustained feedback whether via postal bulletin or academic detailing to prevent return to baseline practice.[179;195;208]
- Follow up information can allow prescribers to self-audit their practice and monitor changes over time. Also regular contact is one of the key aspects of academic detailing allowing a relationship of trust and confidence to develop between the GP and their adviser.[179;195;208]
- The individual GP prescribing practice was benchmarked against average prescribing practice in the whole region. The consequence of this is that potentially, only below average practitioners were motivated to improve practice. Some authors recommend benchmarking against the top third highest performance. This may over come the problem of 'regression to the mean' and motivate average or above average performers to improving their practice.
- Although individualised GP prescribing feedback was provided and broad recommendations to change practice were made for each participant, individual improvement targets 'achievable benchmarks' were not specified which may have improved individual GP adoption of the recommendations.[196]

- The first bulletin incorporated feedback on antibiotic and generic prescribing. While this catered to the specific GP requests for information on both areas it may have diluted the impact of the intervention for these topics.
- All the academic detailing visits were conducted by a single researcher, this increased the internal validity of the intervention by ensuring its consistency, but external validity was not tested i.e. whether the intervention was reproducible.
- The researcher conducting the visits was not a physician or pharmacist this may have adversely affected how the GPs reacted to the proposed changes in prescribing practice. Schuster et al suggests that a team including a physician delivering the intervention may be more effective than a single physician or researcher.[161]
- Although the researcher worked with GPs to develop the academic detailing arm of the intervention there was no specific training in academic detailing techniques.

4.6.2 Study design limitations

4.6.2.1 RCT

- The RCT allowed for the evaluation of the effectiveness of academic detailing compared to postal bulletin. However the lack of a control group in the RCT meant that the impact of either intervention above baseline activity could not be definitively established.
- Not all GPs in the randomised practices agreed to participate in the study, this meant the individual GP prescribing feedback and not practice level feedback was provided to participants. Also these GPs did not participate in the academic detailing visits. This is likely to reduce the impact of the intervention in these practices. Other

authors have observed that it was easier to achieve change in single handed practices.

- Although it is possible that GPs involved in the intervention may have influenced the practice of their partners, it is equally likely that there is a greater tendency for participant GPs to return to the baseline prescribing pattern of the practice.

4.6.2.2 Quasi-Experimental study

- The lack of randomisation means a causal relationship between the intervention and the change in practice cannot be definitely established.
- The non-participant group included GPs who possibly worked in the same practices as the participant GPs, thus it is possible that these GPs may have been exposed to the intervention through GPs sharing the information. This potentially could have influenced their prescribing and reduced the difference in prescribing seen between the participant and non-participant group.
- GPs in the participant group were a volunteer sample. By virtue of their willingness to participate and receive prescribing feedback they were different from non-participant GPs. Thus, their reaction to receiving this type of intervention may not be generalizable to the whole GP population. Other studies have found that unsolicited information had no effect on prescribing practice. [209;210]

4.6.3 Prescribing database limitations

- The limitations of the HSE-PCRS pharmacy claims database are outlined in chapter 3 section 3.2.4.1. These limitations including the lack of diagnosis and co-morbidity information and the limited population coverage of the database (approximately 30% of the population) which may undermine GPs confidence in the validity and accuracy of the prescribing feedback they received. If this is the case GPs may be unlikely to act on the recommendations made.

4.7 Summary & Conclusion

Inappropriate antibiotic prescribing and antimicrobial resistance are complex problems which are intimately linked and which potentially have significant consequences for public health. Internationally the aim is to reduce antibiotic prescribing and preserve the effectiveness of second line antibiotics through restricting their use to situations where first line antibiotics have failed. Yet changing individual practitioner prescribing behaviour is difficult even when faced with the prospect of widespread antimicrobial resistance and ineffective therapies for what were once, relatively straightforward conditions to manage.

Interventions, such as postal prescribing feedback or academic detailing used in this study, have at best a small, short term impact on prescriber behaviour. Multifaceted interventions which include public education can reduce antibiotic prescribing. However there is no clear evidence that such strategies can reverse antimicrobial resistance, but if achieved on an international scale, it is hoped the increase in antimicrobial resistance can be slowed down.

Ireland has lagged behind many of its European partners in developing and implementing effective strategies for preventing antimicrobial resistance. Recommendations from the WHO advocate prescribing audit and external standard comparisons to maximise effectiveness of guidelines and motivate prescribers to continue and maintain changes to practice. This project identifies a pragmatic method of providing individual GPs or GP practices with information on their antibiotic prescribing which can be benchmarked against their peers. The evidence from this study is that GP practice can be influenced by prescriber feedback. In order to achieve a level of change, which could affect microbial resistance, the intervention to reduce antibiotic prescribing, needs to be more intensive, sustained over time and be part of a multifaceted national approach, possibly under the authority of SARI and in conjunction with the new Health Information and Quality Authority (HIQA).

Chapter 5

Generic Prescribing

5.1 Introduction

The effect of the intervention on generic prescribing is presented in the following two chapters. Chapter five examines changes to prescribing practice while in chapter six there is an evaluation of potential cost savings due to generic substitution.

This chapter outlines the background of generic prescribing particularly in relation to the Irish Health care system. The layout and methods are similar to the previous chapter on antibiotic prescribing and to avoid repetition these common sections are referred to. The results of the randomised and non-randomised studies are presented and are followed by a discussion.

5.2 Background generic prescribing

A generic drug is a faithful copy (bioequivalent) of the original (proprietary) drug manufactured by the innovating pharmaceutical company. Once a drug comes 'off patent' other pharmaceutical companies can manufacture the drug. In this case the drug is either registered under its generic name and is described as a 'pure generic' or it can be registered under an alternative proprietary name and is known as a 'Branded generic' (e.g. the original generic name is pravastatin the equivalent branded generic names include Pravatin^{R} and Pravamel^{R}). Generic drugs are usually cheaper than the original proprietary drug and are promoted as a means of containing rising health care costs especially on the community drugs budget.[211] A high level of generic prescribing is regarded as a good quality prescribing indicator, reflecting a practitioner's awareness and concern for cost saving.[2;212]

5.2.1 Generic prescribing in Europe

The vigour with which generic substitution is pursued is highly variable across European countries and is related to differences in national regulatory systems, national policy, price dynamics and marketing structure.[25;213] Countries such as the UK, Germany and Sweden have achieved high levels of generic diffusion. The latest prescription data from the UK suggests that in 2004, 58% of all drugs were prescribed and dispensed generically (but up to 70% of prescribing is generic). [26] In Germany in 1997 over 53% of drugs were dispensed generically while, in Sweden, in the first year after a policy of generic substitution was introduced, 60% of maximum cost saving was realised.[66;214] These countries have several factors in common: unified national health care systems, specific government legislation or policy to promote either generic or the lowest priced bioequivalent drug substitution and national incentives (e.g. part of QOF linking GP practice to financial reward in UK) or disincentives (drug budget caps in Germany) for practitioners or pharmacists to prescribe or dispense the cheapest available drugs.[213]

In contrast, countries with no active national policy on generic substitution such as France and Spain have traditionally low levels, 3%-7% respectively, of generic market share.[25;213]

5.2.2 Generic prescribing in Ireland

Ireland, similarly has a low level of generic market share despite a Government policy of encouraging generic prescribing.[215] In 2003 generic drugs accounted for 22% of all drugs dispensed on the largest community drug schemes, and only 4% were for the cheapest non-branded generics.[27] The majority of generic drugs available in Ireland are 'branded generics'. Drug pricing for generics is based on a free market system which relies on competition to produce lower drug prices. In addition new agreements in 2006 between the Irish Health Service Executive (HSE), the Irish Pharmaceutical Healthcare Authority (IPHA)[216] and the Association of Pharmaceutical Manufacturers of Ireland

(APMI)[217] ensured that: (1) the price of the original branded product will be cut once its patent has expired (by 20% within the first six months and a further 15% within 22 months) and (2) the equivalent generic must be priced below the off-patent original (proprietary) brand. The IPHA/HSE Agreement also states that pharmacists "will be required to dispense medicines as prescribed"[216] thus they are not authorised to substitute generic products and should dispense the brand prescribed, although, in practice this may happen if a particular generic is not in stock. This agreement did not take effect during the intervention in the RCT.

5.2.3 Incentive to prescribe generically

Unlike some European countries, in Ireland there is no automatic substitution by the pharmacist of the proprietary product for the cheapest available generic. The GP has to prescribe the drug by its generic brand name for a generic to be dispensed. Currently there is no specific government incentive for GPs to prescribe generically or for pharmacists to dispense generically.

In the early nineties there was an attempt to promote cost conscious prescribing, including generic substitution, among GPs through a financial incentive scheme knows as the Indicative Drug Target Saving Scheme (IDTSS) (this was described previously in section 1.3.2). The scheme was suspended after less than 5 years and at the time of this study GPs had not received recent regular feedback on any aspect of their prescribing practice. Thus, although a high level of generic prescribing is regarded as an international quality prescribing indicator, its relative importance within individual countries is likely to be heavily influenced by the political will to promote generic substitution.

5.3 Methods

This section describes how the recommendations on generic prescribing delivered to GPs in the randomised groups relate to the subsequent evaluation of GP prescribing practice using quality prescribing indicators applied to a pharmacy claims database. It details the specific statistical methods used to analyse the effect of the intervention in the RCT and the quasi-experimental study.

5.3.1 Generic quality prescribing indicators

In developing the prescribing feedback on generics five of the top thirty most expensive drugs prescribed on the HSE-PCRS scheme with an available generic equivalent were targeted with the aim of increasing generic substitution. These were: [218] omeprazole (A02BC01), a proton pump inhibitor, pravastatin (C10AA03), a lipid lowering drug, citalopram (N06AB04), an antidepressant, beclomethosone inhalers (R03BA01), an inhaled steroid for respiratory conditions and nimesulide (M01AX17), a non-steroidal anti-inflammatory drug (NSAID).

At the time of this study these drugs were only available as branded generics (no pure generics available). Therefore, in the subsequent analysis and discussion generic refers to these branded generics. No differentiation is made between different brand names, and the comparison is with the proprietary (original) drug.

The quality prescribing indicators used to assess changes to practice were:

(1) An overall increase in the proportion of generic prescribing across all five drugs

(2) An increase in the proportion of generic prescribing for each individual drug

5.3.1.1 Intervention

In the postal bulletin GPs received graphical information on their prescribing rate of these five drugs over the previous 12 months and the proportion of each of these which were prescribed generically. GPs were benchmarked against the ERHA average. GPs were also given an individual cost breakdown based on their expenditure on these drugs in the twelve months prior to the intervention and savings that could be made if the cheapest generic was substituted. For the majority of GPs it was clear that by focusing on just two of these drugs, omeprazole and pravastatin, the majority of cost savings could be realised (appendix 1). Although GPs were given the brand name for the cheapest generic at that time, it was not stipulated in the bulletin or academic detailing visits that GPs should switch to that particular product (see appendix 1).

5.3.1.1 DMA File

In order to identify which version of the drug (generic or proprietary) was dispensed an additional data file was used. This file is the Drug and Medical Appliances (DMA) file, and records the current cost of every individual product brand eligible for reimbursement under the HSE-PCRS scheme. It also records the strength and number of tablets per pack for every drug (allowing calculation of individual tablet cost). It has a 4 category code, DMA class, to identify the type of drug dispensed (1=pure generic, 2 =branded generic, 3=proprietary with equivalent available generic and 4=proprietary with no equivalent generic). The DMA file was linked to the HSE-PCRS pharmacy database using a unique code for each drug/dose combination.

5.3.2 Analysis time points

See chapter 4 section 4.3.2

5.3.3 Population selection

See chapter 4 section 4.3.3

5.3.4 Statistical analysis

Baseline GP characteristics (see chapter 3 section 3.4.2).

5.3.4.1 Baseline prescribing

The volume of prescribing (rate per 1000 patients) of the five individual drugs, as well as the proportion of generic prescribing (over all 5 drugs and the individual drug) in the twelve months prior to the intervention was examined. Differences between the randomised (postal bulletin (PB) v academic detailing (AD)) and non-randomised (participant v NP) groups were tested using Wilcoxon rank sum test for non-parametric data. The median rate or proportion of generic prescribed, inter-quartile range (IQR) and the associated p values are presented.

5.3.4.2 Outcome measures

The outcome measures for the generic prescribing indicators were calculated by:

1) The overall generic prescribing across the five drugs. This was calculated as the total number of generic prescriptions per month per practice in the RCT or per GP in the quasi experimental study as a proportion of the total number of prescriptions (generic and proprietary) for all five drugs per month.

2) The individual level of generic drug prescribing (e.g. pravastatin) was calculated as the number of generic prescriptions as a proportion of all prescriptions for that individual drug per practice (RCT) or per GP (quasi-experimental study) per month.

The median monthly generic proportion was calculated for each of the comparison groups (randomised bulletin and academic detailing GP practices or participant and NP GPs).

5.3.4.2 Segmented regression analysis

See section 4.3.4.2 on segmented regression analysis of interrupted time series.

The same statistical methodology was used in this analysis as for the antibiotic prescribing except seasonality was omitted. Autocorrelation was used to allow for dependency between monthly observations (nlag=1). The five drugs targeted are often prescribed as medium to long term therapy and patients are issued with repeat prescriptions automatically dispensed for a three month period.

Pre-intervention monthly prescribing data for generic pravastatin and citalopram was unstable with median monthly prescribing detected as 0 for some months. This was probably because the generic equivalents for these drugs were only available in the six to twelve months prior to the intervention and had not made a big impact on prescribing. The analysis of these two drugs was restricted to the difference in the post intervention slope between the two groups only. The analysis was performed using SAS PROC AUTOREG (SAS institute Cary NC).

5.4 Results: Generic prescribing PB vs AD

This section describes the pre-intervention prescribing of the randomised groups and presents results of the immediate and long term effects of the intervention at practice level. Graphs depicting monthly trends in prescribing across all five drugs and for those individual drugs with significant changes are also shown.

5.4.1 Baseline characteristics

See section 4.4.1

5.4.2 Baseline prescribing

There was no significant difference between the randomised groups in the overall monthly prescribing rate of the five drugs. Pravastatin and omeprazole were the highest prescribed drugs, followed by beclomethasone. Nimesulide and citalopram were prescribed less frequently (Table 5.1).*

The aggregated generic prescribing data across the five drugs was similar between the randomised groups. However, there were significant differences between the individual drugs. The AD practices had significantly higher baseline levels of generic prescribing for beclomethasone and nimesulide compared to PB practices. As stated earlier there was insufficient pre-intervention prescribing data for generic pravastatin and citalopram to compare prescribing between the groups (Table 5.2).

---

* Nimesulide was withdrawn from the Irish market in May 2007, this was outside the intervention and analysis period for this study and is unlikely to have affected the results reported here.

Table 5.1 Baseline prescribing of 5 drugs targeted for generic substitution, PB vs AD

	PB Practices N=50		AD Practices N=48	
Rate per 1000 population	**Median Rate**	**IQR**	**Median Rate**	**IQR**
Pravastatin	36	21-46	35	25-49
Omeprazole	27	19-37	28	20-37
Beclomethasone inhalers	19	14-26	18	15-28
Nimesulide	11	8-18	14	7-18
Citalopram	12	9-17	14	8-26

All p values>0.05 in above table for group difference

Table 5.2 Baseline proportion of generic prescribing, PB vs AD GP

Insufficient monthly pre-intervention data on generic pravastatin and citalopram

	PB practices (n=50)		AD practices (n=48)		Wilcoxon Rank sum test
Proportion prescribing /GP practice/mth)	**Median proport-ion**	**IQR**	**Median Proport-ion**	**IQR**	**P value**
Five targeted generics	0.22	0.21-0.25	0.23	0.23-0.27	0.19
Omeprazole	0.23	0.15-0.29	0.29	0.22- 0.35	0.14
Beclomethasone inhalers	0.63	0.60-0.67	0.74	0.73- 0.77	<0.001
Nimesulide	0.13	0.11-0.13	0.22	0.19- 0.25	<0.001

5.4.3 Immediate effect post intervention PB vs AD GP practices

Immediately post intervention there was no significant difference in generic prescribing across all five drugs between the randomised groups (Fig 5.1), and no overall significant increase in either group from pre-intervention levels (Table 5.3).

Among the individual drugs only omeprazole showed a significant 5% increase in generic prescribing in the PB group compared to no change from baseline in the AD practices ($p=0.03$) (Fig 5.2). Prescribing of generic nimesulide increased significantly in both groups but there was no significant difference between the groups (Fig 5.3).

5.4.4 Long term effect post intervention

Over the twelve month post intervention period there was no significant change in overall generic prescribing (all 5 drugs) in either group, adjusting for baseline practice (Table 5.4). Similarly, in the individual drugs there was no significant difference between the groups in the proportion of the drugs prescribed generically.

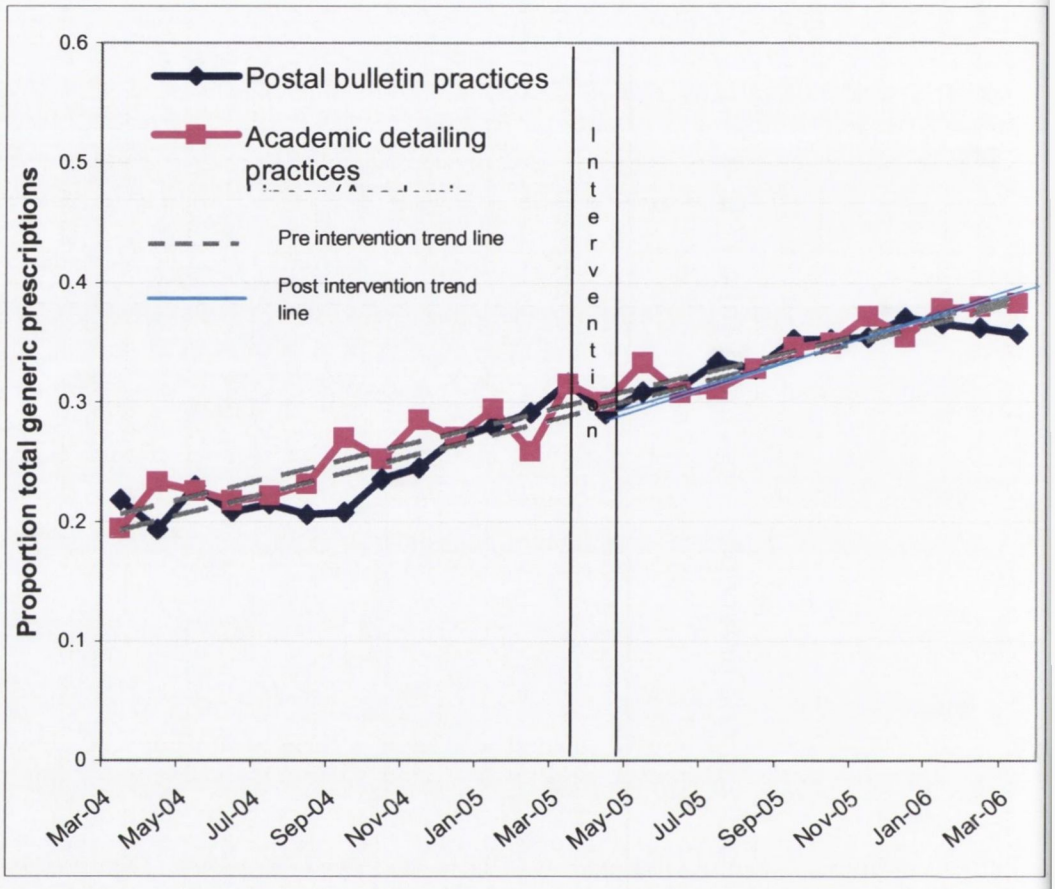
Both groups increased their prescribing of the newly available generic pravastatin over the post intervention period but the change was less than 1% per month in both groups ($p=0.45$).

Table 5.3 Change (β coefficient) in immediate & 12 month generic prescribing post intervention PB vs AD

Drug	Immediate response			Long term (12 month trend)		
	PB[1] Practices (n=50)	AD[2] practices (n=48)	Group difference	PB practices (n=50)	AD practices (n=48)	Group difference
Proportion change/GP/mth	β[3] (95% CI)	β[3] (95% CI)	P[4] value	β[3] (95% CI)	β[2] (95% CI)	P[4] value
All targeted generics	0.01 (-0.02, 0.04)	0.01 (-0.01, 0.03)	0.21	0.00 (-0.01, 0.01)	0.001 (-0.001, 0.003)	0.44
Pravastatin[5]	-	-	-	0.007 (0.004, 0.01)	0.008 (0.006, 0.01)	0.45
Omeprazole	0.05 (0.03, 0.07)	-0.01 (-0.04, 0.03)	0.03	-0.01 (-0.02, -0.009)	-0.01 (-0.01, -0.006)	0.58
Beclomethasone inhalers	-0.04 (-0.08, 0.01)	-0.02 (-0.07, 0.03)	0.75	0.005 (-0.001, 0.01)	-0.001 (-0.01, 0.01)	0.27
Nimesulide	0.14 (0.09, 0.19)	0.11 (0.07, 0.15)	0.33	0.001 (-0.005, 0.006)	0.01 (0.004, 0.02)	0.14
Citalopram[5]	-	-		0.002 (-0.01, 0.01)	-0.002 (-0.01, 0.01)	0.94

[1] PB=postal bulletin, [2] AD = academic detailing group, [3] β coefficient= change per month proportion of prescriptions, [4] p value based on pooled SE for both groups (interaction terms) , [5] Pravastatin & citalopram were excluded from the immediate effect analysis due to insufficient pre-intervention data

Figure 5.1 Proportion of generic prescribing for all 5 targeted drugs, PB vs AD GP practices



This graphs shows the similarity in generic prescribing both in the pre-intervention and post intervention periods. There is a slow gradual increase in generic prescribing over the 24 month period, but the rate of increase is not significantly different from pre-intervention levels in either group, indicated by the over lapping trend lines.

The subsequent graphs presented are only for the individual drugs where there was a significant change in prescribing detected.

Figure 5.2 Proportion of generic omeprazole prescribing, PB vs AD GP practices

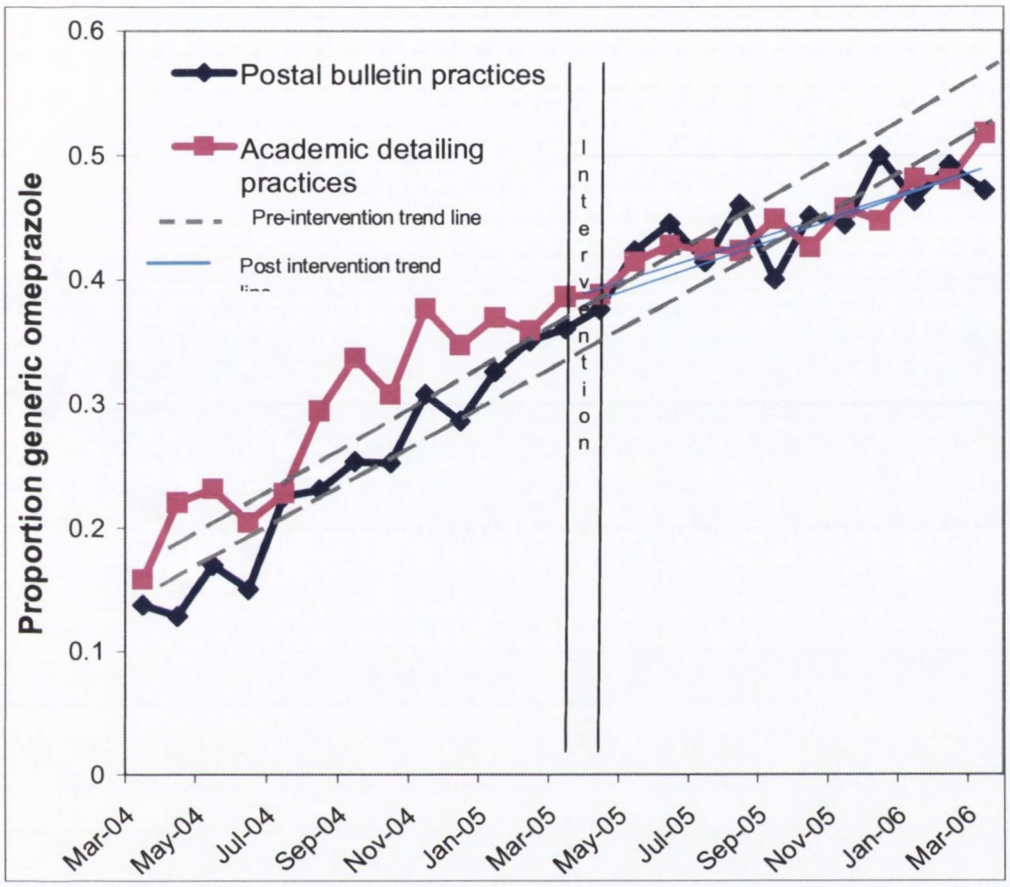


Figure 5.2 shows the proportion of generic omeprazole prescribing in the pre and post intervention periods. The graph shows a small increase among postal bulletin GP practices immediately post intervention but long term this is not maintained and over the course of the twelve month post intervention period, the rate of generic omeprazole prescribing actually decreases compared to the pre-intervention trends in both groups.

Figure 5.3 Proportion of generic nimesulide, PB vs AD GP practices

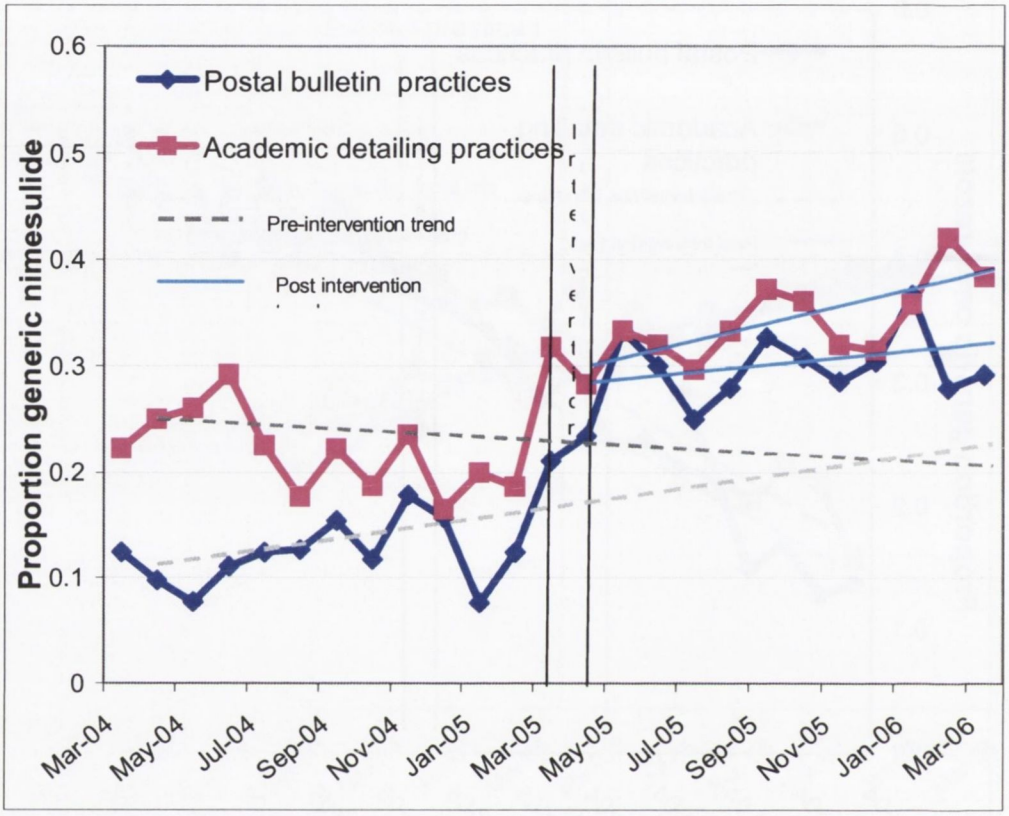


Figure 5.3 shows the proportion of generic nimesulide prescribed pre and post intervention. Compared to the other drugs there is greater monthly variation in the prescribing of nimesulide which is due to the lower overall prescribing of this drug and thus smaller sample size. Immediately post intervention there was a significant increase in generic prescribing.

5.4.5 Summary of results

- Overall, across the five targeted drugs there was no significant increase in generic prescribing or significant difference between postal bulletin and academic detailing practices either immediately or over the twelve month post intervention period, adjusting for pre-intervention generic prescribing.
- Postal bulletin only practices showed significant increases in generic omeprazole prescribing immediately post intervention compared to academic detailing practices but over the long term there was a trend towards a decrease in generic omeprazole prescribing in both groups.
- Generic nimesulide prescribing significantly increased in both groups immediately post intervention.

5.4.6 Discussion

The randomised study found that academic detailing had no real impact on increasing generic prescribing above postal bulletin alone. There was no overall increase in generic prescribing across all five drugs and only small significant increases seen in two out of the five targeted drugs.

5.4.6.1 Impact of academic detailing

The factors which may have contributed to the minimal impact of academic detailing over postal bulletin have already been identified in the discussion and study limitations in chapter 4 (antibiotic prescribing). However, particularly in relation to generic prescribing, GP attitude was a fundamental factor which may have been underestimated in designing the intervention. Although there was no formal evaluation of GPs attitudes towards generic prescribing prior to the intervention, in the initial survey only 7% (8/110) of GPs actively identified cost saving as a topic for the feedback intervention and subsequent contact with GPs through the academic detailing visits, revealed a divided attitude towards generic prescribing compared to antibiotic use. GPs felt it was either a relevant indicator of prescribing quality or they simply did not regard it as a quality issue and felt it should not be part of an intervention to improve rational prescribing. The academic detailing visit followed a set format which did not allow for this diversity in individual attitude to be fully explored. It is possible that a more individual GP centred intervention could have achieved a greater impact. [179] This, is in addition to a sustained and consistent approach to promoting generic prescribing which might have occurred if the prescribing feedback study was more longterm.[112;122]

The diversity of attitudes among Irish GPs to generic prescribing must be viewed in the context of the Irish health care system. Foremost among these factors is the lack of a culture of generic prescribing both in term of community and hospital prescribing practice and lack of a sustained political will to effectively promote generic diffusion through strategies

adopted in other countries e.g. legislation, incentives, feedback and prescribing advisers.[25;66;213]

5.4.6.2 Quality prescribing indicator

The suspension of the community IDTSS scheme may also have impacted on GPs attitude to generic prescribing as a quality indicator. This in part may explain why, although prescribing has increased on the community drug scheme by 6-7% annually, generic prescribing remains static at 22%.[27;28] GPs in other European countries including the UK also question the link between generic prescribing and quality of care, and rarely considered the cost implications of their prescribing as they felt it undermined quality prescribing, their professional judgment and was at variance with individual patient centred care.[68;88] The focus on generic prescribing as a quality prescribing indicator, and not just a cost saving device, may need to be stressed throughout the doctors medical education to gain widespread acceptance.[149]

Other factors that act as barriers to generic substitution include concern over the reliability and quality of generic products on the market, possible legal liabilities associated with their use, patient reluctance to switch drugs, hospital prescribing and a confusing system of drug labelling (branded and unbranded generics).[68;211;213;219;220]

5.4.6.3 Conclusion

Generic prescribing within the Irish health care system is a complex area extending beyond a simple concept of quality of care. The impact of prescribing feedback with or without academic detailing, especially in the absence of financial incentive schemes or legislation, is likely to require a sustained and consistent approach adapted to individual GP attitudes and barriers to change in order to have a real impact on prescribing practice.

5.5 Results: Generic prescribing Participant vs NP GPs

This section describes the results of the quasi-experimental study and details the effect of prescribing feedback with or without academic detailing on generic prescribing practice among participant GP compared NP GPs. Baseline prescribing is also examined to assess the comparability of the groups.

5.5.1 Baseline Characteristics

See section 4.5.1

5.5.2 Baseline prescribing

The baseline median monthly prescribing rate per 1000 patients for the five targeted drugs is shown in table 5.4. The most frequently prescribed drugs in both groups were pravastatin and omeprazole. There was no statistical difference between the groups except for omeprazole which was prescribed more frequently by NP GPs ($p=0.005$).

However, there were baseline differences between the non-randomised groups in the proportion of generic drugs prescribed. Participant GPs had a 6% higher monthly generic prescribing across the five drugs compared to NP GPs ($p<0.001$) (Table 5.5).

There was consistently higher generic prescribing of the three individual drugs examined (insufficient data on generic pravastatin and citalopram).

Table 5.4 Baseline prescribing of 5 drugs targeted for generic substitution, participant vs NP GPs

	Participant GP N=110		NP GP N=190	
Prescribing rate/GP/1000 patients	**Median Rate**	**IQR**	**Median Rate**	**IQR**
Pravastatin	36	22-48	38	22-53
Omeprazole	27	19-37	32	20-48*
Citalopram	13	8-21	17	9-25
Beclomethasone inhalers	20	14-29	19	12-27
Nimesulide	12	7-18	8	4-21

* p=0.005

Table 5.5 Baseline proportion of generic prescribing, Participant vs NP GPs

	Participant GP (n=110)		NP GP (n=190)	
Proportion prescribing/GP/mth	**Median proportion**	**IQR**	**Median proportion**	**IQR**
Five targeted generics	0.23	0.23- 0.27	0.17	0.16-0.19*
Omeprazole	0.27	0.2- 0.32	0.13	0.9 -0.17*
Beclomethasone inhalers	0.71	0.69-0.74	0.59	0.57-0.60*
Nimesulide	0.17	0.17-0.18	0.10	0.9- 0.10*

Insufficient pre-intervention data on pravastatin and citalopram, *p<0.001

5.5.3 Immediate effect post intervention: Participant vs NP GPs

Immediately post intervention participant GPs had a significant 3% increase in generic prescribing across the five targeted drugs compared to no change in prescribing for NP GPs (p=0.03) (Table 5.6), adjusting for baseline prescribing (Fig 5.4). This increase in prescribing was driven by a significant 4% increase in omeprazole (Fig 5.5) and 13% increase in nimesulide (Fig 5.6).There were no significant changes to generic beclomethasone prescribing and there was insufficient pre-intervention data to analyse the individual effects on generic pravastatin or citalopram prescribing.

5.5.4 Long term effect post intervention

Over the twelve month post intervention period there was no significant difference in trend between the participant and NP groups in overall generic drug prescribing (Table 5.6). Only pravastatin showed a significant 1% monthly increase in generic prescribing in the participant GP group compared to 0.5% in the NP GP group (p<0.001) (Fig 5.7). Prescribing of generic omeprazole increased in both groups over the twelve month period, but the rate of increase is smaller compared to the pre-intervention prescribing rate (Fig 5.5).Generic nimesulide prescribing increased by less than 1% per month in both groups over the long term, but there were no significant differences between the groups.

Table 5.6 Change (β coefficient) in immediate & 12 month generic prescribing post intervention, participant vs NP GPs

Drug	Immediate response			Long term (12 month trend)		
	Participant GP (n=110)	NP[1] GP (n=190)	Group difference	Participant GP (N=110)	NP[1] GP (n=190)	Group difference
Proportion change/GP/mth)	β (95% CI)	β (95% CI)	P[3] value	β^2 (95% CI)	β^2 (95% CI)	P[3] value
All targeted generics	0.03 (0.01, 0.05)	0.01 (-0.004, 0.02)	0.03	0.001 (-0.001,0.003)	0.0 (-0.001,0.002)	0.55
Pravastatin[4]	-	-	-	0.01 (0.008, 0.01)	0.006 (0.004, 0.007)	<0.001
Omeprazole	0.04 (0.01, 0.07)	-0.01 (-0.02, 0.0)	0.01	-0.01 (-0.01,-0.008)	-0.006 (-0.01,-0.004)	0.09
Beclomethasone inhalers	-0.02 -0.06, 0.02)	0.02 (0.01, 0.03)	0.25	0.005 (-0.001, 01)	0.0 (-0.001,0.001)	0.13
Nimesulide	0.13 (0.09, 0.17)	0.02 (0.0, 0.04)	0.0002	0.006 (0.0,-0.01)	0.004 (0.002, 0.006)	0.56
Citalopram[4]	-	-	-	0.0 (-0.01, 0.01)	0.002 (-0.01, 0.01)	0.48

[1] NP non-participant, [2]β coefficient= change per month proportion of prescriptions,[3]p value based on pooled SE for both groups in the interaction terms , [4]Pravastatin & citalopram were excluded from the immediate effect analysis due to insufficient pre-intervention data

Figure 5.4 Proportion of generic prescribing (all 5 drugs), participant vs NP GPs

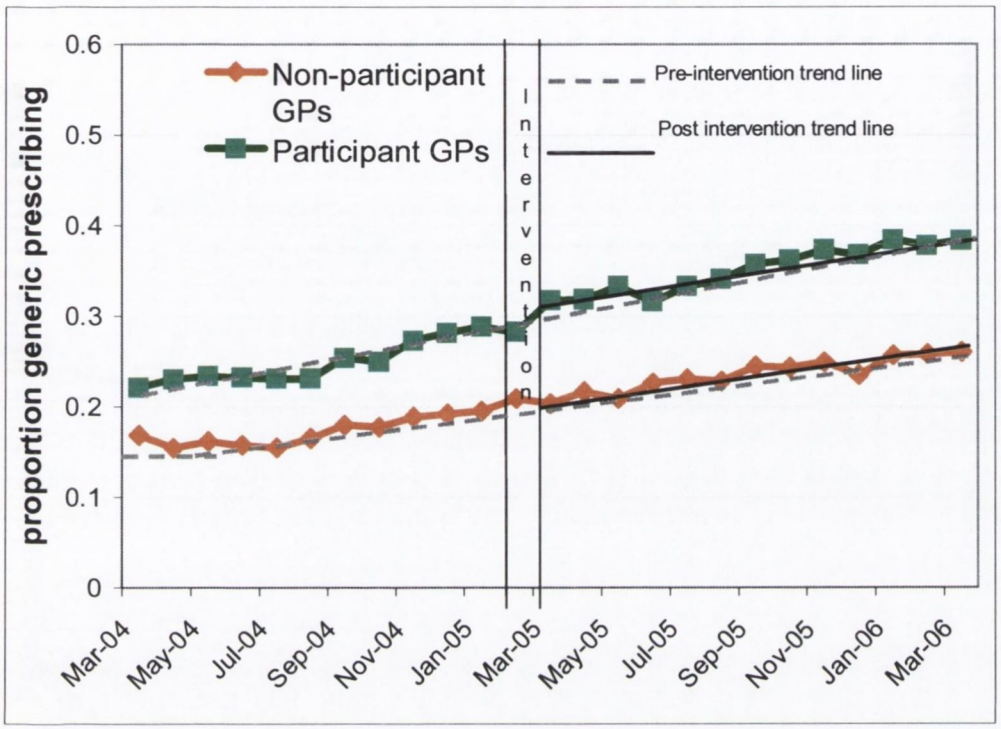


Figure 5.4 shows the pre and post intervention trends in generic prescribing across all five targeted drugs. Pre-intervention participant GPs clearly had a higher proportion of generic prescribing compared to NP GP. Immediately post intervention participant GPs had a small increase in overall prescribing compared to NP GPs but over the twelve month period there was no significant increase in generic prescribing in either group above the pre-intervention trend (overlapping pre and post intervention trend lines).

Figure 5.5 Proportion of generic omeprazole prescribing, participant vs NP GPs

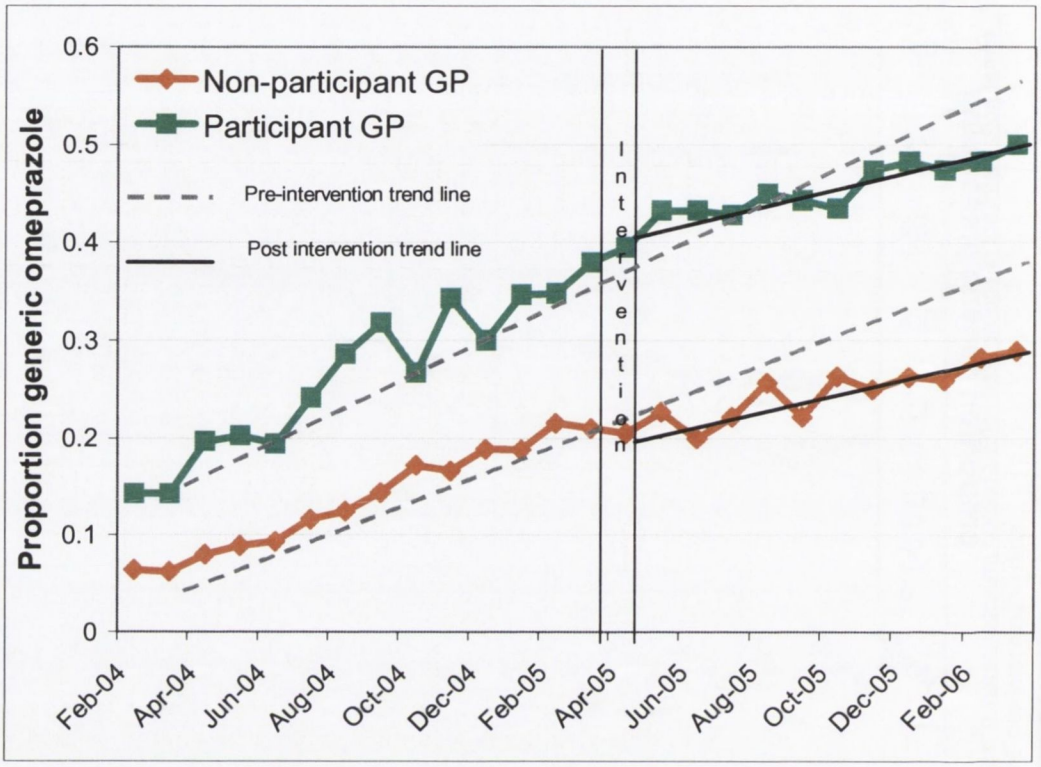


Figure 5.5 shows the pre and post intervention trend in generic omeprazole prescribing. Participant GPs had a higher pre-intervention generic prescribing and immediately post intervention there was an increase in generic omeprazole prescribing among participant GPs compared to no change in NP GPs. However, over the twelve month period the rate of generic omeprazole prescribing slowed down in both groups compared to pre-intervention levels.

Figure 5.6 Proportion of generic nimesulide prescribing, participant vs NP GPs

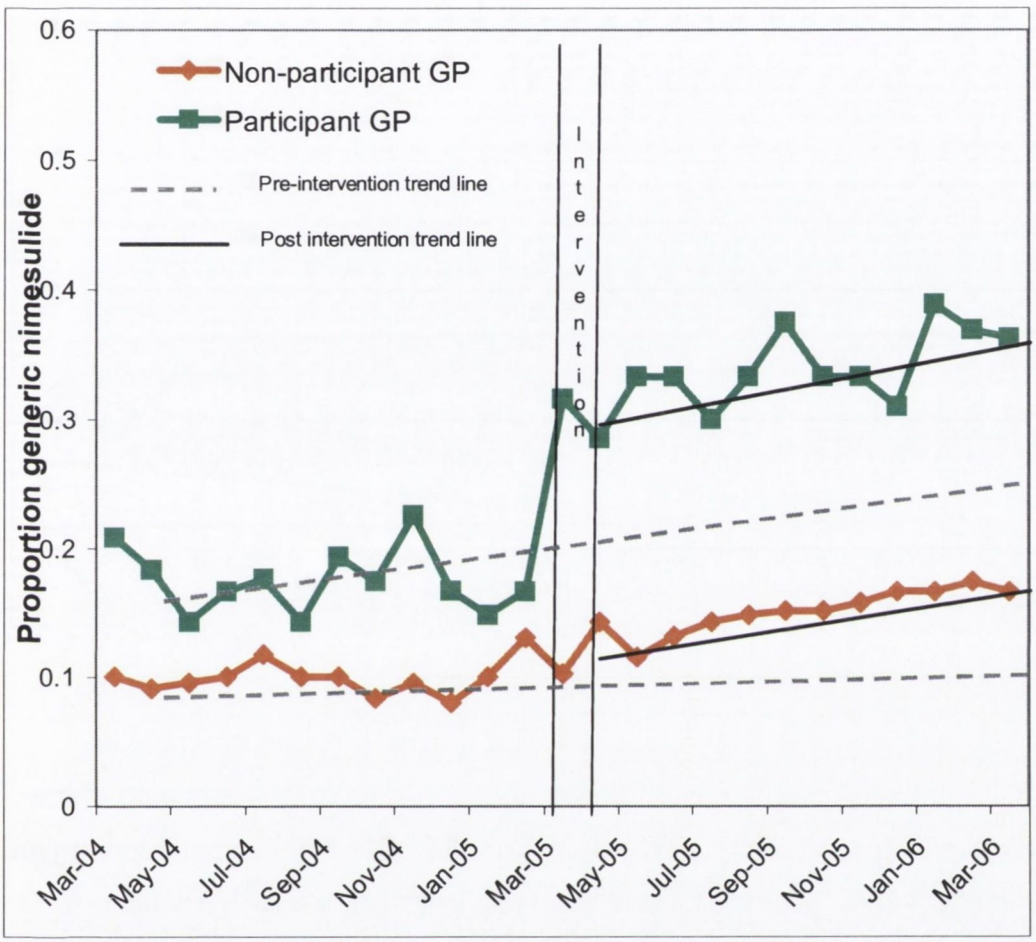


Figure 5.6 shows the pre and post proportion of generic nimesulide prescribing in both non-randomised groups. There is greater fluctuation in monthly prescribing rates of nimesulide compared to nimesulide which is due to a lower volume of overall prescribing. There was a large increase in the proportion of generic nimesulide prescribed among participant GPs in March 2005, during the intervention. This increase was not seen among NP GPs. Over the twelve month post intervention period there was an upward trend in generic prescribing in both groups.

Figure 5.7 Proportion of generic pravastatin prescribing, participant vs NP GPs

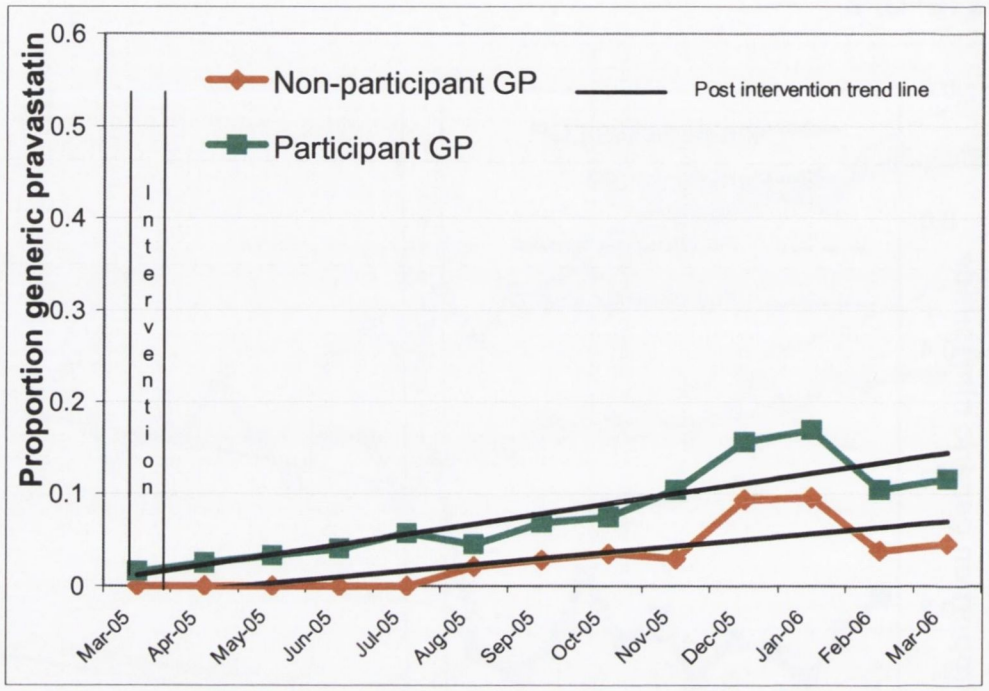


Figure 5.7 shows the post intervention prescribing trend for generic pravastatin in the two groups. Generic pravastatin was available in August 2004 and the graph shows the slow uptake in prescribing of the generic version of the drug in both groups. Immediately post intervention participant GPs started to increase prescribing while NP GPs did not really start prescribing the drug in significant numbers until August 2005. The monthly increase in prescribing remained higher among participant GPs compared to NP GPs at twelve months post intervention, but generic pravastatin still only accounted for 10% of all pravastatin prescribed.

5.5.5 Summary of results

- Immediately post intervention, there was a 3% increase in generic prescribing across all five drugs among participant GPs compared to no change among NP GP, but this was not maintained over the long term
- Participant GPs significantly increased prescribing of generic omeprazole and nimesulide immediately post intervention compared to NP GPs, but there were no significant differences between the groups over the long term.
- Generic pravastatin prescribing increased in both groups over the twelve month post intervention period, but prescribing was significantly higher among participant GPs

5.5.6 Discussion

The quasi-experimental study showed that prescribing feedback either with or without academic detailing significantly increased overall generic prescribing immediately post intervention, but had little impact on long term prescribing compared to a group of non-participant GPs.

The overall increase in generic prescribing of 2% above baseline practice in the NP group is similar to other studies that have evaluated the effect of interventions to promote cost effective prescribing. [148;151]

Despite the factors that mitigate against generic prescribing, as discussed in section 5.4.6 these results show that generic prescribing can be increased, all be it short term, through a prescribing feedback intervention. Several authors have highlighted GPs willingness to prescribe generically and their awareness of cost but have pointed out that this did not necessarily translate into practice. [68;88;195] In a separate survey, of the same Irish GPs as in this study, a high level of generic prescribing was ranked 4th out of 11 other clinical quality indicators, but in practice only 17% of prescribing among this study sample was for generic drugs.[221] This suggests that although GPs may be willing to prescribe generically there are obstacles which prevent them from doing so.

5.5.6.1 Source of information

One of these factors is the information source available to GPs on the different generic drugs or multisource drugs (that is, those with ≥ 1 generic available). In Ireland there is no official, unbiased information provided to GPs on which is the cheapest or most efficacious product available. This lack of information means GPs largely rely on the pharmaceutical industry for information on new products which can act against generic substitution with the least expensive available product.[68;84;88] Therefore, if GPs want to prescribe the least expensive available generic, they need to regularly check which the cheapest option

is and prescribe it using the product name. A previous study reported that GPs were concerned that if they wrote a prescription for the pure generic that a pharmacist may legally dispense the more expensive proprietary product.[222] This tended to encourage prescribing of the more expensive branded generics which could not be substituted. Prescribing feedback could be used to provide unbiased information on the least expensive available generic or branded generic on the market and help balance the marketing forces from pharmaceutical companies which GPs are exposed to. However, amending existing legislation would be required to ensure dispensing of the least expensive product.[222] Prescribing of pravastatin illustrates how the intervention is likely to have influenced the earlier prescribing of the generic version of the drug among participant GPs, who were provided with the name of the cheapest available generic in March 2005. Prescribing of the generic drug increased slowly over the post intervention period, while NP GPs were not really prescribing the drug until August 2005.

5.5.6.2 Feedback vs legislation

The increase in generic substitution seen in this study is likely to reflect the attitude of those GPs who see generic substitution as beneficial to the wider community in terms of cost saving. The stimulus of providing them with the names of the generic alternatives and their potential savings was sufficient to initiate change. The academic detailing visit may have added some extra incentive to those already prepared to change. In contrast, it is likely that many GPs who see generic prescribing as a compromise to individual patient care may not justify cost savings against the potential upset it may cause their patients, in addition to the time taken to gain patient acceptance, review and change prescriptions.[88;222] This group of GPs are unlikely to engage in generic substitution to any great extent without incentives which directly benefit their practice or patients or legislation which takes generic substitution largely out of their control.[214;223]

In countries, such as the UK, with an active policy on generic substitution, the use of prescribing feedback, prescribing advisers and computer software to facilitate automatic generic substitution has achieved over 70% generic prescribing by GPs.

In the absence of political intervention, prescribing feedback, including academic detailing visits, can increase generic substitution, as in this study, but the effect is likely to be small to moderate.[98;99;119]

5.5.6.3 Study limitations

See section 4.6.

5.5.6.4 Conclusion

In Ireland generic prescribing for many GPs is not clearly linked to quality prescribing with evidence of wide variation in willingness to prescribe generically among Irish GPs. These diverse attitudes combined with local barriers, e.g. multiple drug brand names and pharmacists dispensing, needs to be addressed through a combination of legislation and prescribing feedback in order to achieve high levels of generic substitution in the future.

Chapter 6

Generic Cost savings

6.1 Introduction

The substitution of proprietary drugs for their cheaper generic equivalent is one aspect of drug prescribing which can be expected to result in a potential cost saving on drug expenditure. The cost savings achieved through increased generic substitution are presented with an outline of the methodology used to calculate the cost savings.

6.2 Methodology

The cost analysis was restricted to those drugs where there was a significant change in prescribing in the immediate or long term post intervention period, i.e. pravastatin, omeprazole and nimesulide (see chapter 5). The first two drugs, in particular, had the highest pre-intervention levels of prescribing and therefore had the maximum cost savings potential.

6.2.1 The cost analysis

The cost analysis was undertaken using two approaches. The first method has been reported in other studies and takes an overview of cost saving (see Table 2.2). The second approach focuses specifically on savings achieved through starting or switching a patient to a generic drug.

Method 1:

The total drug cost and the drug cost per patient, as a proportion of the total GP patient population receiving that drug over the first six-month post intervention period (April 2005-September 2005) was calculated for

each GP. The aggregated cost across the three drugs is presented. The difference in total cost per GP and cost per patient was compared using the non-parametric Wilcoxon rank sum test, as cost data were not normally distributed, in the separate study designs. Median values, interquartile ranges (IQR) and p values are presented.

Method 2:

The cost saving due to generic substitution in the first six months post intervention was calculated for each of the study groups. In each of the three drugs analysed, the number of patients who either started on the generic equivalent, or who switched from the proprietary drug to the generic equivalent for each month post intervention were identified. Those initiating generics were defined as any patient who received a generic drug post intervention and who had not received any prescriptions for that drug in the previous six months. Generic switchers were defined as any patient who switched from the proprietary to the generic drug post intervention and who had received at least one proprietary prescription for the drug in the previous six months.

For each of the drugs examined there were several branded generic products available therefore the average cost of the generic product for the different drug strengths was calculated (Table 1 in appendix 3). The proprietary and generic drug costs were based on the DMA file for June 2005.

The generic cost was subtracted from the potential proprietary cost for each patient to derive the cost savings made by generic substitution. The total cost saving per GP and the cost saving per patient as a proportion of all patients treated with the drug in each month was calculated for each GP. Although the intervention was at the GP level, it was important to take account of the number of patients treated with the drug in the individual practices as this had a direct bearing on overall cost and

potential cost savings, thus data is presented at both the practice and patient level. The non-parametric Wilcoxon rank sum test was used to compare between groups. The aggregated costs across the three drugs and for the individual drugs are presented with median values, IQR and p values.

Section 6.4.4.1 outlines the value of both approaches to measuring cost and cost savings.

6.3 Results: Generic prescribing cost savings

6.3.1 Expenditure & cost savings across all three drugs

In the six month post intervention period the median expenditure per GP practice across the three drugs was €12,994 (IQR € 8,762, €20,980) for PB practices compared to €13,771 (IQR €8,413, 20,637) for AD practices (p=0.84) (method 1). Breaking this cost down by the number of patients treated, the median cost per patient was €122 (IQR €99, €139) for PB practices compared to €128 (IQR €101,130) for AD practices (p=0.34)

Analysis of change events (starting, or switching to, a generic drug, method 2) across the three drugs over the post intervention six month period, gives the median number of change events in PB practices as 33 (IQR 16 - 52) compared to 34 (IQR 25-55) for AD practices. This resulted in a median cost saving of €197 per GP in the PB practices compared to €217 per GP in the AD practices (p=0.15) (see table 6.1). Overall the total cost saving through generic substitution was €14,560 in the PB group compared to €16,258 in the AD group.

Table 6.1 Six months aggregated cost savings, PB vs AD GP practices

(Data based on patients starting or switching to generic equivalent of a proprietary drug, method 2)

	PB Practices N=50		**AD Practices** N=48		Wilcoxon rank sum test
	Median €	**IQR** €	**Median** €	**IQR** €	**p value** (group difference)
Cost saving per GP practice	197	(107-328)	217	(153-375)	0.15
Cost saving per patient	2.27	(1.68-3.23)	2.28	(1.67-3.10)	0.66

6.3.2 Cost savings across individual drugs

The three individual drugs involved in this analysis were examined in more detail regarding generic substitution. The majority of GP practices in both groups made generic substitutions for each drug and there was no significant difference between the groups.

6.3.2.1 Pravastatin

The total number of generic pravastatin changes in the six month post intervention period, in the PB practices was 233 (median change 1 (IQR 0-6) per practice) while academic detailing practices made 260 changes (median changes 3 (IQR (0-7) per practice (p=0.08). Generic substitution resulted in a total cost saving of €2224 for PB practices compared to €2022 for AD practices. This equated to a median cost savings of approximately €28 per practice over six months or approximately €0.40 per patient treated with pravastatin (Table 6.2).

6.3.2.2 Omeprazole

Generic omeprazole substitutions occurred in a total of 1004 patients, median changes 13 (IQR 8-25) per PB practice compared to a total of 1117 patients, median changes 15 (IQR 11-26) per AD practice (p=0.17). The total cost savings for PB practices was €12,601 compared to €10,816 for AD practices. The PB group achieved a slightly higher median cost saving per GP practice but there was no significant difference between the groups (Table 6.2).

6.3.2.3 Nimesulide

The total number of nimesulide changes in the PB group was 769 (median changes 8 (IQR 2-23) per practice compared to 1085 (median changes 14 (IQR 6-29) per practice) in the AD group (p=0.21).The total cost savings were small, €887 for PB and €1034 for AD practices with no significant differences between the groups (Table 6.2).

Table 6.2 Individual drug cost savings due to generic substitution, PB vs AD GP practices

(Data based on switching or starting a generic equivalent to a proprietary drug, method 2)

	PB practices		AD Practices		Wilcoxon rank sum test
	Median €	**IQR** €	**Median** €	**IQR** €	**p value** (group differences)
Pravastatin					
Cost saving per GP	29	(13-109)	28	(16-69)	0.87
Cost saving per patient	0.48	(0.31-0.75)	0.39	(0.24-0.59)	0.08
Omeprazole					
Cost saving per GP	171	(82-298)	159	(85-265)	0.70
Cost saving per patient	1.54	(0.98-2.09)	1.56	(0.99-2.02)	0.91
Nimesulide					
Cost saving per GP	9.86	(3.38-20.4)	16.5	(9.01-26.5)	0.11
Cost saving per patient	0.27	(0.15-0.51)	0.24	(0.14-0.34)	0.23

6.3.3 Summary of results

- There was no significant difference between the randomised groups in either total expenditure or cost savings due to generic substitution across all three drugs or for the individual drugs examined.
- The greatest savings to be made were for omeprazole substitution followed by pravastatin and nimesulide.

6.4 Results: Generic cost savings: Participant vs NP GPs

6.4.1 Expenditure & cost savings across all three drugs

The total expenditure across the three drugs (omeprazole, pravastatin and nimesulide) was significantly different between participant and NP GPs. Over the six month post intervention period participant GPs spent a median of €13,094 (IQR €8762-20,637) per GP compared to €15,842 (IQR €10,673-22,066) per GP for NP GPs (method 1). This was equivalent to a median of €119 (IQR €101-132) per patient and €125 (IQR €109-149) respectively ($p<0.001$).

In terms of actual generic change events (method 2) participant GPs recorded a median of 33 changes (IQR 21-52) per GP compared to 22 changes (IQR 9-41) per GP in the NP group ($p<0.001$). This resulted in a significant cost saving (median of €215 per GP) for participant GPs compared to NP GPs (median €146) (Table 6.3), of just over €0.61 per patient differences between the groups ($p<0.001$).

Table 6.3 Six months aggregated cost savings participant v NP GPs

(Data based on starting/switching to a generic drug from a proprietary drug, method 2)

	Participant GPs N=110		**NP GPs N=190**		**Wilcoxon rank sum test**
	Median €	**IQR €**	**Median €**	**IQR €**	**p value (group difference)**
Cost saving per GP	215	(131-348)	146	(59-278)	<0.001
Cost saving per patient	2.27	(1.68-3.10)	1.66	(1.01-2.67)	<0.001

6.4.2 Cost savings across individual drugs

Across the individual drugs there were significant differences in the level of generic substitution which is examined in more detail.

6.4.2.1 Pravastatin

The analysis of generic pravastatin substitution activity found that 70% (77/110) of participant GPs made a generic substitution compared to 50% (95/190) of NP GPs (p=0.007). Participant GPs made 493 changes (median=2 (IQR 0-6) per GP) compared to 481 for NP GPs (median=1 (IQR (0-3) per GP) (p<0.001).

This equated to a significant median saving of €28 per participant GP compared to €23 per NP GPs (p=0.02), but in terms of cost saving per patient there was no difference between the groups (p=0.95) (Table 6.4).The total cost saving due to generic substitution in this period for participant GPs was €4,247 compared to €3,944 for NP GPs.

6.4.2.2 Omeprazole

The majority of GPs (over 90%) in both groups made generic omeprazole substitutions. The total number of changes in this period for participant GPs was 2121 (median changes 15 (IQR 10-25) per GP) compared to 2938 (median changes 10 (IQR 4-22) per GP) for NP GPs (p<0.001).

These changes resulted in a median cost saving of €168 per GP in the participant group compared to €129 per GP in the NP group. In terms of patients treated participant GPs made significantly greater savings than NP GPs (p=0.002) (Table 6.4). The total cost savings due to generic substitution for participant GPs was €23,417 compared to €32,772 for NP GPs.

6.4.2.3 Nimesulide

Nimesulide generic substitution were made by 87% of GPs in both groups (participant GPs n=96, NP GPs n=167). Again participant GPs made significantly more changes with a total of 1854 (median changes

11 (IQR 5-24) per GP) compared to 2266 (median changes 5 (IQR 4-22) per GP) for NP GPs (p=0.002).

There was no significant difference between the groups in cost savings due to generic nimesulide substitution (Table 6.4). The total cost saving was €1919 for participant GPs and €4334 for NP GPs.

Table 6.4 Individual drug cost savings due to generic substitution, participant vs NP GPs

(Data based on starting/switching to a generic equivalent of a proprietary drug, method 2)

	Participant GPs		NP GP GPs		Wilcoxon rank sum test
	Median €	IQR €	Median €	IQR €	p value (group difference)
Pravastatin					
Cost saving per GP	28	(15-76)	23	(12-47)	0.02
Cost saving per patient	0.44	(0.29-0.69)	0.42	(0.30-0.68)	0.95
Omeprazole					
Cost saving per GP	168	(85-267)	129	(55-231)	0.01
Cost saving per patient	1.55	(0.99 2.02)	1.18	(0.71-1.90)	0.002
Nimesulide					
Cost saving per GP	13.5	(4.61-26)	15.8	(6.53-39)	0.14
Cost saving per patient	0.25	(0.14-0.42)	0.31	(0.16-0.48)	0.22

6.4.3 Summary of results

- Across all three drugs participant GPs had significantly lower expenditure on individual patient treatment, and this is partly explained by significantly higher levels of generic substitution which resulted in a cost saving per GP of €69 for participant GPs above that of NP GPs.
- This significant cost saving was mainly driven by higher levels of generic omeprazole substitution by participant GPs.
- There was no significant difference between the groups in cost savings for pravastatin or nimesulide.

6.4.4. Discussion

In the previous chapter we identified the similarity in generic prescribing between the postal bulletin and academic detailing practices. In contrast, the aggregated prescribing of generics by participating GPs was significantly different from non-participant GPs. Not surprisingly, there was no significant difference in cost saving between the randomised groups, while a significant cost saving through generic substitution was found between the randomised and non-randomised groups in the first six months post intervention. We chose a six month period for the cost analysis as changes related to the intervention were most likely to have occurred in this early period.

6.4.4.1 Cost saving evaluation

Other studies have examined cost savings by looking at total expenditure per patient or per GP practice and allows comparison with this study.[146;151] However, this method is subject to differences in baseline prescribing rates or patient populations, and changes to prescribing rates during the study period, as found in this study (e.g. the higher expenditure per patient seen in the NP group may be partly explained by higher baseline omeprazole prescribing). The second approach is more sensitive to cost savings achieved through generic prescribing as only generic substitutions events were considered

In this study academic detailing plus postal bulletin did not achieve a significant saving over postal bulletin alone. However, other studies have found that intensive pharmacist led interventions can achieve substantial cost savings.[148;224;225] Participant GPs made significantly more changes to their patients prescriptions than NP GPs across all three drugs especially omeprazole. This resulted in participant GPs having a median cost saving of €69 per GP above NP GPs or approximately €7,590 in total. An overall cost-effectiveness evaluation of the study will be presented in chapter 9.

6.4.4.2 Variation in generic substitution

Among the individual drugs only omeprazole contributed significantly to the overall cost saving, this may be attributed to two reasons (1) there was a greater number of actual generic substitutions for this drug and (2) there was a bigger cost difference between generic and proprietary omeprazole (appendix 3).

GPs were more likely to initiate generic omeprazole than either pravastatin or nimesulide. This may be because omeprazole tends to be prescribed as a shorter term therapy with patients receiving on average 3 prescriptions over the six month period compared to 5 prescriptions for pravastatin. Also pravastatin is likely to be prescribed using repeat prescriptions and thus unless a GP actively reviews the prescription it will not be changed to the generic version of the drug whereas the majority of omeprazole prescriptions were for new patients. Another factor is that generic pravastatin was only available for six months prior to the intervention, so GPs may be less familiar with the generic brand name.

6.4.4.3 Generic cost differences

The cost difference between the generic and proprietary versions of the three drugs may have contributed to the differential prescribing. Based on 2005 cost data the difference between 10 mg of generic and proprietary omeprazole was €8 and for the 20mg and 40mg it was approximately €15. In contrast the cost difference between generic and proprietary pravastatin was €3 for 10mg and €6-€9 for the 20mg and 40mg pravastatin, for nimesulide the cost difference between generic and proprietary nimesulide was less than €2.

Some of the barriers to initiating generic prescribing are patients' unwillingness to switch from a brand of the drug they know and a suspicion that the cheaper alternative may not be as good.[150] GPs may feel that if the individual patient cost saving is not sufficient that it is not worth the potential upset it may cause to their patient or the time and effort it requires to gain acceptance of the generic drug.

6.4.4.4 Targeted prescribing feedback

In this study GPs willingness to prescribe generically seems to be related to the actual drug itself. A drug which results in a high cost saving and which is prescribed as short term therapy was more likely to be substituted that a drug with a small cost saving or indicated for long term treatment. Also from a pragmatic perspective if the prescribing feedback prioritised generic omeprazole substitution we could possibly have increased substitution and realised the same or an even a higher cost saving. The questions which arise from this study are can (1) prescribing feedback continue to achieve a sustained cost saving (2) this saving be increased and (3) prescribing feedback achieve a cost saving among GPs who were not willing to participate in such a project and therefore perhaps are more resistant to change.

6.4.4.5 Conclusion

Prescribing feedback using postal bulletin plus or minus academic detailing had a small effect on generic prescribing resulting in a significant cost saving. This cost saving could be used to offset the cost of a prescribing feedback service. A deeper understanding of GPs motivation to prescribe generically in the context of the health care system may improve the effectiveness of prescribing feedback.

Chapter 7

Cardiovascular disease prescribing

7.1 Introduction

Prescribing preventive therapy in cardiovascular disease (CVD) and diabetes was the subject of the second intervention. This chapter provides background as to why this subject was included as part of a rational prescribing study and how the quality prescribing indicators used to assess GP prescribing relate to the prescribing feedback given to GPs in the postal bulletin and academic detailing visits. The results are presented with a combined discussion for both study designs.

7.2 Background

Ischemic Heart Disease (IHD) and cerebrovascular disease remain the leading cause of death in high income countries, accounting for 27% of all deaths in 2001.[226] However, there has been a steady decline in mortality from these conditions seen since the mid 1980s. In contrast, low to middle income countries have observed a steady increase (16% increase in Eastern Europe and Central Asia).[226] The decline in mortality from CVD is attributed to a combination of improved medical management and lifestyle changes such as a reduction in smoking prevalence.[227] However, there remains considerable variation within and between countries with regard to the implementation of evidence based secondary prevention therapies for cardiovascular disease.[12]

7.2.1 Cardiovascular disease in Ireland

Cardiovascular disease management in Ireland has been a national health priority since the late 1990s when Ireland had the highest mortality from CVD among European Union (EU) member states. [228] However,

similar to other high income countries, mortality from CVD has been steadily decreasing in Ireland from 42% in 1998 to 36% in 2005.[229] Reductions in mortality from coronary heart disease (CHD) have primarily contributed to the reduction in overall CVD mortality, with a 47% reduction between 1985 and 2000.[230] However, uptake of the clinical trial evidence and the guidelines in Ireland have been slow and variable, as in other countries, with studies showing age, gender and regional variation in the prescribing of preventative therapies.[10;13;231] In addition, projections based on epidemiological modelling studies, suggest that if 80% of eligible patients were treated appropriately a further 2280 CHD deaths could have been prevented or postponed in 2000. [232]

7.2.1.1 CVD prevention strategies in Ireland

At present there are few interventions aimed at improving primary care physician prescribing of CVD preventive therapies in Ireland. The exception is the Heartwatch programme aimed at secondary prevention of CVD. It involves 20% of GP practices in Ireland and has enrolled over 13,000 patients. The programme has shown significant improvements in the management of CVD risk factors and improved treatment uptake after only two years.[233] However, it targets only the highest risk population, those with a history of myocardial infarction, coronary artery surgery or percutaneous transluminal coronary angioplasty and a small number of diabetic patients.

Strategies employed in other countries to reduce CVD mortality focus on changing public attitudes to lifestyle and improved treatment at primary care level through increasing uptake of statin, antiplatelet and antihypertensive treatment in patients with established CVD or diabetes. Promoting rational prescribing in CVD disease focuses on these three main drug groups.

7.3 Methods

The Third Joint Task force European guidelines[36] on cardiovascular disease prevention in clinical practice were used as the basis for the prescribing feedback given to GPs in the postal bulletins and academic detailing visits. This section describes how these recommendations relate to the quality prescribing indicators used to assess changes in GP prescribing and to the specific statistical methods used to analyse the effect of the intervention in the RCT and the quasi-experimental study.

7.3.1 Quality prescribing indicators for secondary prevention of CVD

The HSE-PCRS pharmacy database was used to provide GPs with feedback on the prescribing of pharmacological agents used to treat hyperlipidaemia, hypertension and platelet modifying drugs (e.g. aspirin). The focus was on those patients with established CVD and patients with diabetes. The database does not contain information on clinical diagnosis, instead specific drug therapy or combinations of drug therapy are used as surrogate markers of disease.[31;80]

The surrogate markers are: [234]

CVD	-	antiplatelet therapy (aspirin:B01AC04 or clopidogrel:B01AC06) +/- coronary artery vasodilator (nitrates: C01DA or nicorandil:C01DX16)
CHD	-	coronary artery vasodilators
Diabetes	-	insulin and oral hypoglycaemic agents (A10Aor A10B).

The Quality prescribing indicators used to assess changes to prescribing practice were:

1) An increase in the proportion of patients receiving antiplatelet (aspirin/ clopidogrel) or anticoagulants* (warfarin, ATC B01AA03) in those with:

(a) CHD receiving coronary artery vasodilator (nitrates or nicorandil)

(b) diabetic patients

2) An increase in the proportion of patients receiving statin therapy in those with:

(a) established CVD receiving antiplatelet therapy +/-antianginals

(b) diabetic patients

3) An increase in the proportion of patients receiving antihypertensive therapy (C0 2,3,7,8,9) in those with:

(a) established CVD receiving antiplatelet therapy +/-antianginals

(b) diabetic patients

7.3.1.1 Intervention

The postal bulletins contained a brief summary of the European guidelines on CVD prevention including the therapeutic targets for cholesterol and blood pressure in both patients with established CVD and diabetes.

GPs were provided with the number and percentage of their HSE-PCRS registered patients not receiving appropriate therapy for each of the quality prescribing indicators. The data was presented graphically and

---

* Anticoagulants: The guidelines promote antiplatelet therapy in patients with CVD or diabetes. However, this patient group may be on warfarin therapy for another reason, they are regarded as receiving appropriate anticoagulation and are unlikely to receive an additional antiplatelet agents.

patients with established CVD (excludes diabetics) and those with diabetes were treated as separate populations. GPs were benchmarked against average practice in the ERHA.

The academic detailing visit concentrated on the therapeutic targets outlined in the European guideline[36] and the number of patients in each practice who potentially were not receiving appropriate medication. The discussion also focused on the difficulties in implementing the guidelines in clinical practice.

7.3.2 Analysis time points

The CVD data was analysed at three months (immediate effect) and twelve months (long term effect) post intervention. The analysis was adjusted for baseline prescribing in the respective time periods immediately prior to the intervention.

Three months: Post intervention August 2005-October 2005 compared to March-May 2005 pre-intervention.

Twelve months: Post intervention August 2005-July 2006 compared to June 2004-May 2005 pre-intervention.

June and July 2005 were excluded from the analysis as the intervention took place over this time period.

7.3.3 Population selection

GPs or GP practices with less than 25 CVD patients or 10 patients with diabetes were excluded from the analysis to avoid calculations based on small numbers (increasing random error). In the RCT one practice from the PB intervention was excluded from the 3 and 12 month analysis for this reason, while no practices were excluded from the academic detailing group. In the non-randomised study 4 -9 participant GPs were excluded compared to 13-17 NP GPs, in the CVD and diabetes analysis respectively. Analysis was based on intention to treat.

The analysis used the GPs patient registered population aged 45 years or over. In the HSE-PCRS scheme each patient is registered to a particular doctor and while patients may see other doctors in the practice, (i.e. some of the prescribing may be initiated by another doctor), the registered doctor remains responsible for the patients overall care. Using this patient registered population also allowed for a stable population denominator for comparison between different time points.

7.3.4 Statistical analysis

Baseline GP characteristics (see chapter 3 section 3.4.2).

7.3.4.1 Baseline prescribing

The baseline median proportion of patients in each group receiving medication for CVD or diabetes (as a fraction of the adult population aged 45 years and over) in the 12 months pre-intervention period was examined.

In each analysis period (3 and 12 month pre-intervention) the GPs registered patient populations with CVD (excludes patients with diabetes), CHD and diabetes were identified. The proportion of patients in each disease group receiving statin, antiplatelet / anticoagulant (warfarin therapy) or antihypertensive therapy was calculated. Pre-intervention differences between the groups were examined using Wilcoxon rank sum test.

7.3.4.2 Outcome measures

The outcome measure was the proportional increase in prescribing of the CVD preventive therapies from baseline to the post intervention period (3 or 12 month) in patients with CVD or diabetes. Pre-intervention median proportion and the post intervention median proportion increase in the population receiving appropriate therapy are presented.

7.3.4.3 Multivariate linear regression analysis

In the RCT the difference in proportion of patients receiving the preventive therapies between PB vs AD was examined using multivariate linear regression with a random effects component to allow for clustering. Each therapy was analysed in a separate model where PB was the baseline comparison group. Each model was adjusted for baseline prescribing and other confounding factors such as GP participation in the 'Heartwatch' programme and patient population structure (proportion of males and patients aged 70 years or older was calculated for each practice). The same analysis was carried out for the quasi-experimental study but excluded the random effects component (clustering). NP GPs were the baseline comparison group. β coefficients (is the differences in the median proportions of patients receiving therapy between PB vs AD or NP vs participant adjusting for confounding factors), and 95% CI are presented. A 95% CI containing "0" indicates no significant difference between the groups.

7.4 Results CVD prescribing PB vs AD practices

In this section the baseline comparison and the results of the 3 and 12 month effects of the intervention at practice level are presented for those therapies which showed a proportional change from baseline level. Graphs depicting the pre and post intervention proportions of the population receiving CVD preventive therapy are presented.

7.4.1 Baseline characteristics

Only one of the GP practices was excluded from the analysis due to small number of patients, it did not affect the baseline characteristics presented in section 4.4.1.

7.4.2 Baseline prescribing

There was no significant difference between the randomised groups in the baseline proportion of patients receiving medication for CVD or diabetes. Just over 30% of the population aged 45 years and older were receiving CVD medication, while 7% of the population were receiving diabetic related medication in both groups (see table 7.1).

Similarly, there was no significant difference between the groups in the proportion of patients receiving the individual CVD preventive medications (Table 7.1).

There was also no significant difference between the groups in the number of GP practices participating in the Heartwatch programme (PB 35% (17/49) vs AD 44% (21/48)) (p=0.36).

The three month baseline pre-intervention data is not presented. There was a slightly lower proportion of patients detected, as the prescribing was for a shorter period, but again there were no significant differences between the groups.

Table 7.1 Baseline proportion of patients with CVD /diabetes & prescribing of CVD preventive therapy, PB vs AD GP practices

Table based on 12 months of pre-intervention data

	PB practices		AD practices	
	Median proportion	**IQR**	**Median proportion**	**IQR**
CVD population	0.32	(0.26, 0.38)	0.30	(0.23, 0.35)
Anticoagulants[1]	0.96	(0.91, 0.97)	0.97	(0.92, 0.98)
Statins	0.52	(0.46, 0.56)	0.51	(0.47, 0.56)
Antihypertensives[2]	0.81	(0.78, 0.84)	0.79	(0.75, 0.82)
Diabetic population	0.07	(0.05, 0.08)	0.07	(0.05, 0.08)
Anticoagulants[1]	0.75	(0.68, 0.82)	0.79	(0.71, 0.83)
Statins	0.63	(0.57, 0.68)	0.64	(0.54, 0.71)
Antihypertensives[2]	0.84	(0.80, 0.90)	0.86	(0.81, 0.89)

All p values>0.05, [1] aspirin, clopidogrel, warfarin, [2] diuretics, β blockers, agents acting on renin-angiotensin system

7.4.3 Immediate effect post intervention PB vs AD practices

In the three month post intervention period, 27% of the population receiving CVD medication and 7% of patients on diabetic medication were identified in both groups.

In the baseline analysis it was observed that only 3-4% of patients on anti-anginal therapy were not receiving some form of anticoagulant therapy. This group of patients is likely to represent those who refused this therapy or in whom it was contraindicated. It was not expected that GP prescribing could be further improved for this quality prescribing indicator and therefore it was excluded from further analysis.

Table 7.2 shows the median proportional increase in patients receiving CVD preventive therapies compared to the pre-intervention period in both the CVD and the diabetic patient population at three months post intervention. There were minimal prescribing changes observed in the CVD population. In the diabetic population there was an increase in anticoagulants and statin prescribing found within both groups. Only anticoagulant prescribing was significantly different between the groups in this early post intervention period, with PB practices significantly increasing prescribing by 6% compared to 2% in the AD practices. However, PB practices had lower pre-intervention levels of prescribing to start with.

Table 7.2 Three months post intervention, proportion change in population receiving CVD preventive therapies and differences between PB vs AD

	Randomised groups (n= GP practices)	**Pre-interv. median proportion**	**Median change** (from baseline)	**β** (grp diff)	**95% CI**
CVD population					
Statins	PB (n=49)	0.53	0.00		
	AD (n=48)	0.51	0.01	0.001	-0.01, 0.01
Antihypertensi-ves	PB (n=49)	0.81	0	-	-
	AD (n=48)	0.78	0		
Diabetic population					
Statins	PB (n=49)	0.64	0.04		
	AD (n=48)	0.61	0.05	-0.02	-0.05, 0.01
Anti-coagulants	PB (n=49)	0.71	0.06		
	AD (n=48)	0.74	0.02	-0.03	-0.06, -0.001
Antihypertensi-ves	PB (n=49)	0.86	0.00		
	AD (n=48)	0.81	0.02	-0.006	-0.02,0.01

Pre-interv. =pre-intervention, PB is the baseline comparison group, *β* adjusted for confounding factors, group diff= group difference

7.4.4 Long term (12month) effect post intervention

Over the twelve month post intervention period the percentage of patients treated for CVD increased by 2% (PB median 34%, AD median 32%) in each group while those treated for diabetes increased by 1-2% (PB median 9%, AD median 8%) from baseline levels.

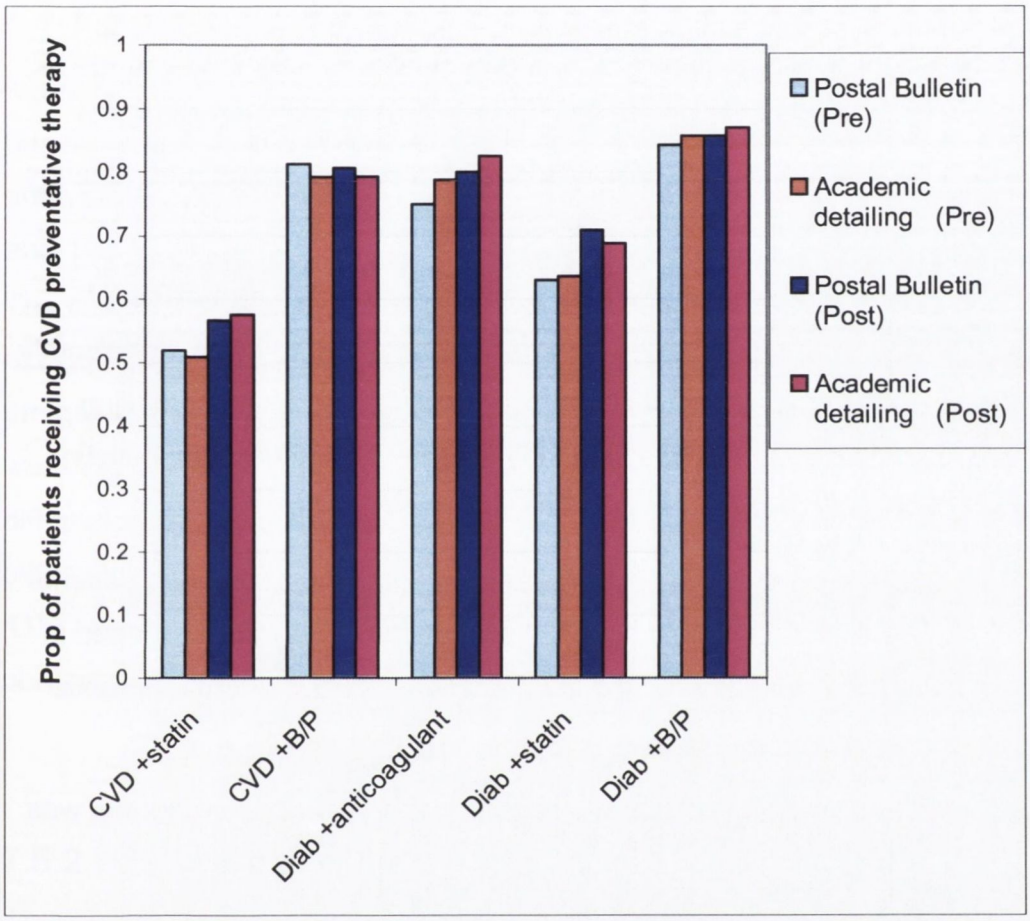
The proportion of patients receiving statin therapy, in both the CVD and diabetic patient populations, had the greatest increase (5%-8%) in prescribing from baseline (Figure 7.1). However, there was no significant difference between the randomised groups (Table 7.3). Similarly there was no significant difference between the groups in prescribing of anticoagulants in diabetic patients or anti-hypertensive agents in either patient population.

Table 7.3 Twelve months post intervention, proportion change in population receiving preventive therapies, and differences between PB vs AD

	Randomised groups (n=GP practices)	**Pre-interv. median proportion**	**Median change** (from baseline)	***β*** (grp diff)	**95% CI**
CVD population					
Statins	PB (n=49)	0.52	0.05		
	AD (n=48)	0.51	0.07	0.01	0.00, 0.03
Anti-hypertensives	PB (n=49)	0.81	0	-	-
	AD (n=48)	0.79	0		
Diabetic Population					
Statins	PB (n=49)	0.63	0.08		
	AD (n=48)	0.63	0.08	-0.01	-0.04, 0.02
Anti-coagulants	PB (n=49)	0.75	0.05		
	AD (n=48)	0.79	0.04	-0.01	-0.04, 0.02
Anti-hypertensives	PB (n=49)	0.84	0.02		
	AD (n=48)	0.86	0.01	-0.01	-0.03,0.01

Pre-interv. =pre-intervention, PB is the baseline comparison group, *β* adjusted for confounding factors, grp diff= group difference

Figure 7.1 Proportion of population receiving preventive CVD therapies, 12 months pre & post intervention



Prop=proportion, B/P=blood pressure lowering agents (Antihypertensives), Diab= diabetics

Figure 7.1 shows the variation in prescribing of CVD preventive therapy across the patient populations. There was an overall increase in the proportion of patients receiving statins or anticoagulants in both randomised groups compared to the pre-intervention period. Antihypertensive therapy prescribing in both patient populations remained relatively unchanged. The figure clearly shows the lack of difference between the two intervention groups.

7.4.5 Summary of RCT results

- At three months post intervention there was very little change in prescribing of CVD preventive therapies in patients with CVD, while small increases in prescribing of anticoagulants and statins were observed in patients with diabetes.
- In the three month post intervention period, the proportion of diabetic patients receiving anticoagulant therapy was significantly higher among postal bulletin compared to academic detailing practices but the baseline level was lower in the postal bulletin group.
- Over the long term, anticoagulant prescribing in diabetic patients and statin prescribing in CVD and diabetic patients increased in both randomised groups but there was no significant difference between the groups.
- The proportion of patients receiving antihypertensive agents was largely unchanged over the course of the study period.

7.5 Results: CVD prescribing Participant vs NP GPs

7.5.1 Baseline characteristics

In the analysis of individual GP data (12 months pre-intervention) in the quasi-experimental study, 106 participant GPs were included in the CVD analysis (2 PB and 2 AD GPs excluded due to small patient numbers) and 100 GPs (3 PB and 6 AD GPs excluded) in the diabetes analysis. The corresponding numbers in the NP group were 177 GPs (13 excluded) and 173 GPs (17 excluded). However, the differences between the groups remained similar to those in section 4.5.1. Participant GPs were significantly younger than NP GPs and there was no statistical difference in patient population structure. There was a significant difference between the GPs participation in the 'Heartwatch' programme, 41% (44/106) of participant GPs were involved in the programme compared to 22% (39/177) of NP GPs ($p<0.001$).

7.5.2 Baseline prescribing

The proportion of patients identified with CVD or diabetes in the non-randomised groups was similar (Table 7.4). The prescribing of CVD preventive therapy was also similar between the groups, except for statin prescribing in CVD. Participant GPs prescribed statin therapy to 51% of their CVD patients compared to 49% in the NP GP group ($p=0.02$), although statistically this difference is significant the clinical difference is small.

Table 7.4 Baseline proportion of patients with CVD/diabetes & prescribing of CVD preventive therapy, participant vs NP GPs

	Participant GP		NP GP	
	Median proportion	**IQR**	**Median proportion**	**IQR**
CVD population	0.31	(0.25, 0.36)	0.32	(0.27, 0.36)
Anticoagulants[1]	0.96	(0.91, 0.97)	0.96	(0.91, 0.98)
Statins	0.51	(0.47, 0.57)	0.49	(0.43, 0.55)*
Antihypertensives[2]	0.80	(0.76, 0.84)	0.80	(0.76, 0.83)
Diabetic population	0.07	(0.06, 0.09)	0.07	(0.06, 0.08)
Anticoagulants[1]	0.78	(0.70, 0.83)	0.76	(0.69, 0.82)
Statins	0.64	(0.56, 0.71)	0.63	(0.55, 0.72)
Antihypertensives[2]	0.85	(0.80, 0.90)	0.84	(0.78, 0.90)

*p=0.02 comparison between groups using Wilcoxon rank sum test

[1] aspirin, clopidogrel, warfarin, [2] (diuretics, β blockers, agents acting on renin-angiotensin system)

7.5.3 Immediate effect post intervention Participant vs NP GPs

In the three month post intervention period 105 participant GPs and 172 NP GPs met the inclusion criteria for the CVD data analysis. This was further reduced to 99 participant GPs and 168 NP GPs for the diabetes data analysis (see section 7.3.3)

Based on prescribing data the prevalence of CVD was between 26-28% of the patient population and 7% of the diabetic population in both groups. In both study groups there were small increases in statin prescribing in the CVD and diabetic patient populations and in anticoagulant prescribing in patients with diabetes. However, there was no significant difference between the non-randomised groups. Prescribing of antihypertensive therapy remained unchanged (Table 7.5).

Table 7.5 Three months post intervention proportion change in population receive CVD preventive therapy and comparison between participant vs NP GPs

	Non-randomised groups (n= individual GPS)	Pre-intervention median proportion	Median change (from baseline)	β (grp diff)	95 % CI
CVD population					
Statins	NP GP (n=172)	0.49	0.03		
	Part GP (n=105)	0.52	0.01	-0.003	-0.01, 0.01
Anti-hypertensives	NP GP (n=172)	0.79	0	-	-
	Part GP (n=105)	0.79	0		
Diabetic population					
Statins	NP GP (n=168)	0.63	0.02		
	Part GP (n=99)	0.64	0.04	0.02	0.00, 0.04*
Anti-coagulants	NP GP (n=168)	0.77	0.01		
	Part GP (n=99)	0.73	0.03	0.003	-0.01,0.02
Anti-hypertensives	NP GP (n=168)	0.84	0.01		
	Part GP (n=99)	0.83	0.01	-0.003	-0.01, 0.01

* significant differences $p<0.05$, Part=participant, NP GPs were the baseline group, β adjusted for confounding factors, (grp diff)= group difference

7.5.4 Long term (12 month) effect post intervention

The twelve months post intervention data analysis was based on 106 participant GPs and 177 NP GPs in the CVD data and 100 participant GPs and 173 NP GPs in the diabetes data analysis (see section 7.5.1).

Patients receiving medication for CVD accounted for 33% of the participant GP population (an increase of 2% from baseline) and 35% of the NP GP population (an increase of 3% from baseline). Patients receiving diabetic therapy accounted for 8% of the adult population in both groups.

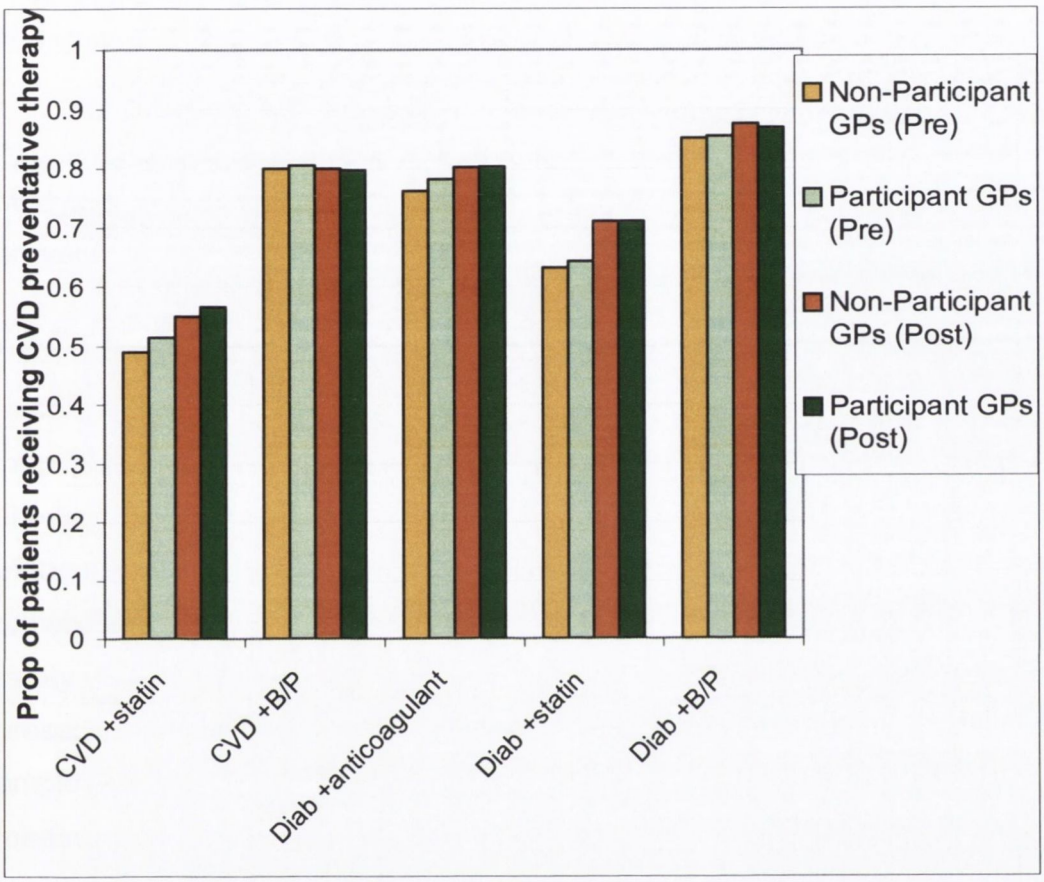
Statin prescribing increased by 6-8% in both groups over the twelve month period, while anticoagulant prescribing in diabetic patients increased by 2-4% and antihypertensive therapy increased by 2% (Figure 7.2). There was no statistically significant difference between the non-randomised groups at twelve months post intervention (Table 7.6).

Table 7.6 Twelve months post intervention proportion change in population receiving CVD preventive therapy and comparison between participant vs NP GPs

	Non-randomised groups (n= individual GPS)	**Pre-intervention median proportion**	**Median change** (from baseline)	***β*** (grp diff)	**95% CI**
CVD population					
Statins	NP GP (n=177)	0.49	0.06		
	Part GP (n=106)	0.51	0.06	0.002	-0.01, 0.01
Anti-hypertensives	NP GP (n=177)	0.80	0	-	-
	Part GP (n=106)	0.81	0		
Diabetic population					
Statins	NP GP (n=173)	0.63	0.08		
	Part GP (n=100)	0.64	0.07	-0.001	-0.02,0.02
Anticoagulants	NP GP (n=173)	0.76	0.04		
	Part GP (n=100)	0.78	0.02	0.01	-0.01,0.03
Anti-hypertensives	NP GP (n=173)	0.85	0.02	-	-
	Part GP (n=100)	0.85	0.02		

Part=participant, NP GPs are the baseline comparison group, ***β*** is adjusted for confounding factors, grp diff= group difference

Figure 7.2 Proportion of population receiving preventive CVD therapies, 12 months pre & post intervention participant vs NP GPs



Prop=proportion, B/P=blood pressure lowering agents (Antihypertensives), Diab= diabetics

Figure 7.7 shows the similarity in both pre and post intervention prescribing of CVD preventive therapies in the non-randomised groups. It also shows the increase in prescribing especially statins and anticoagulants in diabetic patients in both groups.

7.5.5 Summary of results

- Prescribing of CVD preventive therapies, especially statins, increased over the twelve month post intervention period among both participant and non-participant GPs.
- There was no significant difference between the groups in the proportion of patients receiving CVD preventive therapies at three or twelve months post intervention in either the CVD or diabetic patient populations.

7.5.6 Discussion

Prescribing feedback using academic detailing in combination with postal bulletin or postal bulletin alone was not significantly more effective in changing prescribing practice in the management of CVD among Irish GPs compared to standard practice. Approximately 20-40% of patients with CVD or diabetes were not receiving recommended therapy in the study patient population, despite evidence that these therapies can prevent or postpone death from CVD.[36;232]

7.5.6.1 Related literature

In chapter 2 (section 2.3.4), of the 13 studies reviewed that evaluated interventions to change physician practice in relation to CVD, five studies showed no change in physician practice at all.[156;162;164;165;167] While many of the remaining studies only detected a significant improvement in one or two outcomes out of multiple outcomes measured and there were rarely improvements in patient outcomes, such as reduction in blood pressure or cholesterol, observed. The diversity of the interventions employed in these studies, generally multifaceted, and the outcomes measured, means it is difficult to draw direct comparisons with this study. However, even when studies report a positive outcome the effect size was small, and more often related to process outcomes such as improvements in measuring and recording of patient biophysical markers rather than actual improvements in patient biophysical markers or increase in prescribing of CVD preventive therapy.

Meta-analysis and systematic reviews of interventions designed to improve management of chronic disease, specifically CVD, in primary care are limited. However, the broad conclusions suggest that success in achieving improvement in both process and patient outcomes is likely to require attention to physician, patient and organisational factors.[155;158;235]

7.5.6.2 Barriers to changing practice

Several factors may have contributed to the lack of effect of the intervention, including academic detailing, to increasing prescribing of CVD preventive therapies in this study. Changing practice, in line with evidence based medicine, in the management of chronic diseases in primary care where 'clinical problems are presented in complex social and psychological contexts'[152] has proved challenging.[154;231] Experience from clinical trials and qualitative studies have provided insight into why this is the case. In relation to CVD, Majumdar et al classified these barriers into four areas, the evidence, clinician, patient and setting. [231]

Evidence: Although there is a substantial body of evidence relating to CVD, it can be fragmented. GPs tend not to act on evidence from individual studies but wait for a consensus to emerge through guidelines, local specialists and editorials from respected journals.[152] Even then there can be discrepancies between national or local guidelines e.g. therapeutic targets for cholesterol. In this study the latest European therapeutic targets for cholesterol and blood pressure were promoted, but many GPs involved in the 'Heartwatch' programme were using the earlier published European guidelines.[ϒ] Also there is a lack of evidence in clinically relevant subgroups e.g. the elderly or patients with multiple co-morbidities who are often excluded from clinical trials. Short et al observed that generic guidelines often do not take these complex patient conditions into account.[115]

Clinicians: Majumdar et al described a lack of clinician motivation or knowledge, clinical inertia, disagreement with the intervention or

---

[ϒ] Heartwatch used the 2nd joint taskforce European guidelines (1998) based on a cholesterol target <5mmols/l. In 2003 the 3rd Joint taskforce European guidelines lowered total cholesterol targets to <4.5mmols/l for at risk groups.

overemphasis on potential side effects.[231] In addition many GPs describe feeling overwhelmed by the number of clinical guidelines or preventive strategies which should be implemented before ever dealing with their particular patient problem. [231]

Primary care physicians are often described as adopting 'therapeutic conservatism' and wait for specialist to initiate or change patient medication even if therapeutic targets are not reached. [231;236] Similarly GPs can be reluctant to switch therapies in patients whose condition is stable and medication well tolerated.[237]

Patient: The role of the patient has only recently been recognised as an important influence on physician practice especially prescribing. Ultimately patients have to accept the advice of their GP, but even then adherence and persistence with medication cannot be guaranteed.[231;238]

Setting: The influence of organisational factors on the management of chronic disease should not be underestimated. Unlike acute conditions where there is often no need for follow up. The effective management of chronic conditions needs up-to-date patient registers, efficient systems of patient recall, accurate documentation, serial measurement of physiological markers and dedicated time and resources to monitor and run such a service.[239] In recent years it has become more widely accepted to monitor GP performance against set targets and to provide incentives for achieving these targets.[82;231;240] Interventions which have tried to target these local barriers in a pragmatic way often achieved a greater impact than interventions which ignored them.[155;235;237] Fretheim et al emphasised the importance of anticipating and identifying potential barriers at the outset of designing an intervention to change practice.[12;13;241] However, their study failed to show a significant change in all but one of the outcomes measured.[159]

7.5.6.3 Implications for prescribing feedback intervention

Evidence: The guidelines provided in the bulletin, though the most up to date, may have been at variance with other guidelines in general use.

The source of the data is also important in influencing practice, the bulletin was not actively endorsed by local opinion leaders or local GP committees whom may have had more of an influence on GP practice.[152]

The data supplied in the intervention was based on pharmacy data that relies on surrogate markers of disease rather than actual diagnosis. In addition there was no patient clinical information such as cholesterol or blood pressure measurements to assess the appropriateness of the therapy. Some GPs were sceptical as to the accuracy of the information which may have had an impact on the effect of the intervention.

Clinicians: Clinicians are less likely to lack detailed knowledge about CVD , but are more likely to be unconvinced about the applicability of the evidence to certain complex patient groups.[231] The provision of specific patient identification and discussion of individual 'difficult' patient case histories during the academic detailing visits may have increased the impact of this aspect of the intervention.[155;237] As with the other topics covered in the prescribing feedback project the lack of repetition, sustained feedback and personal contact are likely to have contributed to the lack of effect (see section 4.4.5.1).

Patient: The pharmacy data only identified those patients who were currently not dispensed potentially appropriate combination therapy, e.g. antiplatelet agent plus a statin. It did not examine whether these patients were ever initiated on statin therapy and then subsequently discontinued. Similarly, there was no way of identifying whether the patient refused therapy. The role of patient education and interventions aimed at promoting adherence and persistence with chronic medications needs to be considered in conjunction with strategies aimed at physician prescribing. [154;238]

Setting: The impact of local organisational factors was underestimated as an obstacle to effective management of CVD and changing prescribing practice in this study. Many practices could not quickly or easily produce registers of patients with CVD or diabetes and there were

few formal systems in place for patient recall and review. These factors as well as lack of resources, time, personnel and incentives were also identified by Smith et al in an evaluation of a community based diabetes share care scheme in Dublin. [242] The success of the Heartwatch programme in reducing patient CVD risk factors is partly due to its organisational approach, e.g. setting up patient registers, system of recall for enrolled patients, dedicated nurse clinics and financial incentive for GPs. [243]

However, even for the implementation of the 'Heartwatch' programme there was a minimum level of organisational structure required (practice computerisation and employment of a practice nurse) before practices were considered for the programme. Outside of the Heartwatch programme there has been no co-ordinated effort to address these organisation factors.

7.5.6.4 Narrow focus of intervention

As mentioned previously CVD and diabetes are complex medical conditions. The intervention focused on prescribing which GPs may feel undermines the holistic approach, especially lifestyle changes, needed to reduce CVD disease risk factors.[239]

GPs may view smoking cessation as a greater priority, than prescribing more medications, which patients often view as the easy answer to improving their CVD risk.[239] Prescribing feedback even if reinforced by academic detailing visits is likely to be too restrictive an approach to changing practice for chronic conditions.

7.5.6.5 Sensitivity of quality prescribing indicator

Promoting prescribing of preventive CVD therapies is an over simplification of a complex process.[209] Increasing prescribing entails

several steps including patient review, CVD risk evaluation, cholesterol or blood pressure measurement, repeat patient visit, discussion with the patient, lifestyle advise, gaining patient commitment to regular monitoring and finally a decision on whether or not to prescribe. Any or all of these activities are markers of effective CVD management but are not identified on a prescribing database. Prescribing feedback may be a useful audit tool to allow GPs to gauge an aspect of their CVD prevention strategy, but caution must be observed in using it to assess overall quality of practice. [244]

7.5.6.6 Background change in prescribing

A key finding in this study is the background increase in prescribing of preventative therapies i.e. NP GPs increased statin prescribing by 6%-8% in the 'at risk' population. This suggests that Irish GPs are aware of the benefits of CVD preventive therapy and actively prescribe these therapies in their routine practice regardless of prescribing feedback. This relatively high level of background prescribing also had implications for the power of this study to detect a small but significant increase in prescribing between the groups, the original sample size calculation did not anticipate such an increase in background prescribing. This difficulty was also reported by Smith et al .[242]

In the RCT, 44% of practices were also involved in the Heartwatch programme. The most recent Heartwatch report (2003-2005) identified higher general prescribing of preventive therapies in Heartwatch GP registered patients compared to non-Heartwatch GP patients.[233] This is likely to be due to increased GP awareness of CVD prescribing through participation in the Heartwatch programme. The effect of the prescribing feedback intervention over and above this programme may be difficult to detect. Other factors which are likely to have influenced CVD management in primary care are changes in hospital practice, promotion of therapies by the pharmaceutical industry, ongoing education through the ICGP, journal articles etc.

7.5.6.7 Conclusion

In this study prescribing feedback with or without academic detailing had no additional impact on prescribing of CVD preventive therapy compared to no intervention. Findings from other studies suggest that organisational and patient specific factors are as important as physician factors in changing management of chronic diseases. Within the Irish context it is likely that resources are required to be targeted at organisational barriers to achieve a substantial increase in effective management of patients with CVD risk factors. The 'Heartwatch' programme can be used as a template to effectively tackle some of these barriers in a structured chronic disease management approach. Prescribing feedback may be a useful adjunct within such a strategy.

Note:

An interim analysis of the three and six months post intervention effects of prescribing feedback using academic detailing compared to postal bulletin alone was published in Family practice , August 2007 (see appendix 7)

Chapter 8

GP evaluation

8.1 Introduction

Evaluation of the rational prescribing feedback study from the GPs perspective was viewed as an important aspect of the evaluation of the study. Key questions facing the project from the outset were (i) would GPs consent to external review of their prescribing patterns and (ii) would such feedback be acceptable to GPs. In this chapter the views of GPs in both the postal bulletin and academic detailing arm of the study are presented. The results include a combination of quantitative and qualitative data from GPs to highlight issues identified as important to them.

8.2 Methods

The principal method of evaluation was via postal questionnaires. All participant GPs were asked to complete two postal questionnaires evaluating each of the postal bulletins. GPs in the AD arm of the study were asked to complete an additional questionnaire specifically on this aspect of the intervention. The questionnaires evaluating the PB were sent with each of the bulletins to all participant GPs, while the AD questionnaires were given directly to the GPs at the end of their final AD visit. All questionnaires were accompanied by a stamped addressed envelope to facilitate prompt return.

Questionnaires were deliberately short with a maximum of 12 questions. The majority of questions were closed questions evaluated on a three point Likert scale. GPs were also given the opportunity to include free text comments on any aspect of the study. The bulletin questionnaires

were loosely based on an evaluation questionnaire used by the Prescribing Information Unit in NI.

The first questionnaire focused on design aspects of the bulletin including the amount, type, content, layout and clarity of the graphical displays (see appendix 4). GPs were also given the opportunity to identify what they would like to see changed in the second bulletin. The second bulletin also evaluated aspects of the CVD prevention prescribing feedback data. But the focus was on the overall acceptability, value and impact of the RCT on their practice (see appendix 5).

The questionnaire concerning the AD visit aimed to evaluate the content, structure and overall impact of the visits (see appendix 6). Evaluation of the AD visits was further supplemented by the observations recorded by the researcher in the visit diary at the end of each visit. This included the duration of each visit, receptiveness of the GP to the information provided and comments the GP made regarding the actual prescribing feedback presented and the study as a whole.

8.3 Statistical analysis

In evaluating the prescribing feedback sent via postal bulletin the responses from the PB GPs were compared to the AD GPs using descriptive methods. The GP was the unit of analysis, (data was not aggregated at practice level as in the RCT). Chi-squared tests were used to compare the groups and actual numbers and percentages are reported.

Many of the GPs utilised the opportunity to give non-structured feedback. Thematic analysis was used to analyse the text from open ended questions and the observations recorded in the academic detailing visit diary. [245] The replies or comments from the GPs were grouped together into broad themes and described.[245] Verbatim quotes are used to illustrate points made by the GPs.

8.4 Results

8.4.1 Quantitative analysis: Postal prescribing bulletin

There was an overall response rate of 80% (88/110) for the questionnaire evaluating the postal prescribing feedback (PB GPs 82% (45/55), AD 78% (43/55) GPs). There was no significant difference in the responses between the two randomised groups (Table 8.1). All the GPs who returned questionnaires wanted the project to continue, with 95% (84/88) finding the prescribing feedback they received highly relevant to their practice.

The paper bulletin remained the most popular format, with a small number of GPs preferring email or other formats such as CDs. Quarterly feedback (every 3 months) was the most popular time interval for receiving feedback (Table 8.1).

GPs assessment of the impact of the postal prescribing feedback showed that 90% of GPs felt it had some impact on their practice. When asked to identify specific actions or intentions to act, 42% (19/45) of PB GPs identified specific actions (e.g. reduced use of second and third generation cephalosporins) compared to 33% (14/43) of AD GPs. No specific action was identified by 15% (7/45) of PB GPs compared to 23% (10/43) of AD GPs. The remaining 42% (19/45) of PB GPs identified non-specific effects (e.g. increased awareness of rational prescribing) compared to 44% (19/43) of AD GPs. The overall distribution of responses was not significantly different between the groups ($p=0.38$). The majority of GPs (77%) in both groups felt it was important to receive regular prescribing feedback in order for it to have a sustained effect on their practice.

Table 8.1 Postal bulletin evaluation questionnaire, PB vs AD GPs

		PB GPs		AD GPs	
		N	%	N	%
Questionnaires returned		45		43	
Quantity of information provided	Just Right	43	95	37	88
	Too Little	1	2	3	7
	Too much	1	2	2	2
Usefulness graphs	Very useful	36	80	37	88
	Slightly	7	16	5	12
	Not	2	4	0	5
Relevance of information to practice	Very	44	98	40	93
	Slightly	1	2	3	7
Is providing prescribing information to GPs	Very useful	44	98	42	98
	Slightly	1	2	1	2
Is a paper bulletin an effective format	Very Effective	43	96	39	91
	Slightly	2	4	4	9
Future Format preference	Paper	40	90	34	81
	Email	4	9	5	10
	CD/Disc	1	2	3	7
How frequent would you like to receive prescribing feedback	Monthly	7	16	1	2
	2 mths	8	18	4	9
	3 mths	21	47	26	60
	6 /12 mths	9	20	12	28
Did you think the bulletin had an impact on your practice	Yes	40	95	39	93
	No/Don't know	2	5	3	3
The bulletin needs to be repeated		33	77	35	81
Will have a prolonged effect (>12 mths)		9	20	6	14
Don't know/no effect		1	2	2	5

All p values>0.05

8.4.2 Qualitative evaluation of open ended questions

The majority of GPs utilised the opportunity to comment on the study project. Three themes emerged from these comments:

Need for more sophisticated feedback incorporating quality prescribing

The following quotes typify the GPs request for patient centred information to be coupled with international evidence based best practice guidelines.

GPs comments:

' Indicates need for GMS to move from simplistic drug budgeting to *patient specific prescribing'*

'your assessment is the opposite of the IDTSS which takes no account of quality prescribing'

'I am taking the feedback into account consciously. It would help keep me up to date with internationally accepted best practice'

GPs appreciate practical objective help

For many of the GPs a key feature of the postal prescribing feedback was that it facilitated audit and allowed GPs to benchmark their practice against their peers.

GPs comments:

'I do not have a computer and for an outsider to do an audit is very useful, particularly in view of the fact that we GPs are continuously being reprimanded for costly and over prescribing'.

'Repeated bulletins would facilitate audit'

'You cannot beat individualised feedback on prescribing habits to make one reflect on ones own practice'

'Motivate to improve, yardstick to overall performance'

'Great to get objective help'

Need to address individual GP clinical concerns and queries

Broad generic feedback does not address the clinical concerns and doubts of GPs.

There is a need for additional dialogue and the building of a relationship of trust between GPs and those providing the prescribing feedback.

GPs comments:

'Best practice does not yet support use of aspirin in primary prevention, treatments depends on other individual patient risk factors'

'Are statins indicated in all type II diabetics even if cholesterol<4.5mmols?'

'About 10-20% of people cannot take statins, there are deaths from statins

'Aspirin does cause bleeding'

8.4.3 Evaluation of Academic detailing visits

All but one of the practices randomised to the academic detailing arm received both visits (94 visits in total). One practice declined the visit after receiving the postal prescribing feedback because of workload, this GP did not receive the academic detailing questionnaire.

In the questionnaire evaluating the AD visits there was a response rate of 87% (48/55). The vast majority of GPs found the visits very useful (89% (43/48)) and 81% (39/48) indicated they would like to continue receiving the visits in conjunction with the postal bulletins.

The effect of the visit combined with the postal bulletin from the GPs perspective was evaluated using a series of statements. Over 80% of GPs felt they had made some changes to their prescribing as a result of the combined postal bulletin and academic detailing visit (Table 8.2). But similar to the postal bulletin evaluation, 69% felt the visits needed to be repeated to have a sustained effect. The most popular visit frequency was six months suggested by 50% of GPs (24/48), followed by four months for 38% (18/48) of GPs.

GPs were also asked to identify who they felt should conduct the visit; 75% indicating they did not mind who conducted the visit as long as the person was knowledgeable about the topic. A doctor was identified by 21% (10/48) while 4% (2/48) suggested a nurse or pharmacist.

Table 8.2 The effect of the AD intervention from a GPs perspective

Statement (GPs were allowed to select as many statements as they felt applied to them)	Response identified N=48 GPs	%
The visit encouraged me to read bulletin	26	54
Reinforced the bulletin	38	79
Encouraged me to examine aspects of my practice	40	83
Encouraged me to change aspects of my practice	39	81
Had no effect on my prescribing	0	-
Waste of time	1	2

8.4.3.1 Qualitative analysis of academic detailing visits

The qualitative analysis is based on the GP comments in the returned questionnaires and the academic detailing diary maintained by the researcher. The AD visits afforded the opportunity to gain insight into the attitudes of this group of GPs regarding the appropriateness of the topics covered in the intervention, prescribing feedback using academic detailing versus postal bulletins and the barriers they saw as having the greatest impact on their practice. The following common themes emerge from the data:

Topic interest

GPs did not regard the three topics covered with the same degree of interest, in particular, generic prescribing was not regarded as a priority topic by many GPs. Nearly half the GP practices visited admitted that they had little interest in increasing generic prescribing. The reasons mainly centred on lack of incentive.

GPs comments:

'Time consuming no real gain'

'No incentive, government are not willing to tackle problem'

Many GPs were also critical of the Indicative Drug Target Saving scheme (IDTS), and felt that some practices benefited more than others because 'they knew the system better'.

GP comment:

'The IDTSS was not an incentive, very difficult to claim money and the bureaucracy was too time consuming'

The negative impression left by this scheme, to contain community drug expenditure, tainted some GPs attitude towards generic substitution. However, other GPs felt more positive towards increasing generic substitution and took a more altruistic view of cost saving, in that it was of indirect benefit to patients and the wider community and regarded it as a marker of good practice.

GPs' attitude to antibiotic and CVD preventive therapy was less divided and generally more positive. GPs were willing to engage in discussion and identify ways of changing practice. The majority of GPs requested ongoing feedback to help monitor progress in achieving targets related to these topics.

GPs comments:

'GPs need to see how they are performing against quality prescribing indicators and their peers'

'Useful benchmark'

'Helps focus attention'

Obstacles to changing practice

During the course of discussions GPs identified obstacles which they felt impacted on their ability to practice rational prescribing. These obstacles can be grouped under the following headings:

GP Time

Lack of time was a factor identified across all three topic areas. With regard to generics some GPs felt it was not a valuable use of their time to identify and switch patients on repeat prescriptions to the generic equivalent, or the time needed to gain patient acceptance of such a switch.

In relation to antibiotics some GPs felt it quicker and easier to prescribe an antibiotic rather than explain why they were not going to prescribe one. GPs also felt antibiotic prescribing reduced the burden on patients through avoiding repeat visits due to a patient's condition not improving or shortening the duration of the illness, especially if parents had to take time off work to stay at home and look after their sick children.

GPs comments:

'I use a block buster approach (antibiotics), so patients do not have to come back, sure of success'

'Easier to prescribe an antibiotic'

In CVD preventive prescribing GPs complained of a lack of time to identify and target patients at high CVD risk

GPs Comments:

'Quality (CVD) prescribing is very difficult with current workload, GPs are becoming overwhelmed'

'I am a small single handed practice, it is difficult to find time for prevention'

Resources

Adequate resources and time are closely linked as obstacles to changing practice and was identified as a factor in generic drug and CVD prescribing. In particular, computer software within practices was seen as difficult to manipulate and was a barrier to automating generic prescribing and generating disease specific patient registers for conditions such as CVD or diabetes.

GPs comments:

'*Software not conducive to generic prescribing'*

'Identifying patients not on therapies is difficult, generating and updating patient registers needs time and resources'

Many GPs (80%) suggested it would be helpful to receive the actual patient's HSE-PCRS identification number to check against current patient CVD registers in the practice or to generate a register based on this data.

GPs identified specific resources which they felt were required to run effective CVD or diabetes clinics and these included additional consultation rooms, dedicated staff (nurse or doctor) who could operate between several practices, automated patient recall systems, better systems of communication between primary and secondary care.

GP comment:

'Need for specialist GPs to manage diabetics in community, patients are waiting too long for hospital appointments'

Several GPs involved in the 'Heartwatch' programme identified this as having a positive effect on their management of CVD in their overall practice through increased awareness and allocation of dedicated resources.

Incentive

This was already mentioned in relation to generic prescribing but it was also identified as an obstacle to CVD preventive prescribing. GPs described feeling overwhelmed by the number of initiatives they were expected to absorb into their daily practice and felt there should be some form of incentive provided to acknowledge this extra workload.

Clinical factors

Clinical concerns were particularly a factor in relation to antibiotic prescribing. Several GPs expressed concern regarding the potential for a patients' condition to deteriorate or the presence of antibiotic resistance especially in elderly nursing home populations.

GPs comments:

'Difficult not to dispense for fear of missing serious cases, co-amoxiclav commonly used to overcome resistance'

'Fear of patients getting worse, no place to go out of hours'

In CVD prescribing GPs were concerned with polypharmacy especially in elderly patients with the increased risk of drug interactions, side effects and adverse effects on patient compliance. GPs also voiced concerns over the possible link between statins and cancer and the safety of generic drugs.

Patient factors

GPs highlighted the effect patients have on a GPs prescribing practice. This was evident in relation to antibiotic prescribing where many doctors cited patient expectation as one factor behind their antibiotic prescribing.

GP comment:

'Pressures on GPs to prescribe antibiotics, patient expectation, easier to prescribe than explain why not'

In CVD GPs were concerned with patient compliance

GPs comments:

'Difficult to get compliance with multiple therapies'

'If patients have no symptoms then they have no incentive to take statins especially if they experience side effects'

Hospital/specialists practice

GPs felt their practice was strongly influenced by local hospital practice and advice from specialists. This applied to the three areas covered in the intervention.

GPs comments:

'Hospital doctors rarely prescribed the generic version of the drugs thus it is difficult to persuade patients to change from the therapy prescribed by their specialists'

'Hospitals by and large prescribed second generation or combination antibiotics and patients subsequently requested them from their GPs'

'In the past I was too differential to hospital consultants, I waited for them to start treatments (in CVD & diabetes) '

GP practice structure

GPs in multi-partner practices felt it was difficult to control or influence the practice of their colleagues

GP comment:

' We are a large practice, 8 GPs , difficult to persuade all GPs to change and sustain change'

GP knowledge

GPs identified gaps in their knowledge relating to the current targets for cholesterol and blood pressure advocated in the European guidelines. It is likely that some GPs over estimate the level of antibiotic resistance

within the community. GPs also felt it was an impossible task to keep up-to-date with the cheapest generic or when generics became available and relied on the pharmaceutical industry for this information.

GP control over prescribing

GPs felt there were areas of their prescribing that they had little control over. This related to prescribing by specialist practitioners and the dispensing of generic drugs by pharmacists.

GPs comments:

'Pharmacists dispensed whatever they have available'

' Pharmacists should be forced to dispense the cheapest generic'

Researcher's impression of visits

The majority of GPs were receptive to the visits and allocated dedicated time, usually lunch time, for the visit. The average visit length was 20-25 minutes, but some visits lasted up to 40-50 minutes. Occasionally, visits were scheduled between patient appointments, such visits were difficult to conduct due to insufficient time and interruptions.

Initially some GPs felt threatened by the study, particularly by the concept that their prescribing data could be examined and utilised in this way. They wanted reassurance that the data was confidential and was not linked to performance evaluation by external authorities. By the second visit GPs were more trusting and willing to engage. Some GPs suggested ways the visits and feedback could be improved. These included: (1) setting individual GP or practice targets to be achieved within a given time frame, (2) agreeing and formulating definite actions plans with the GP at the end of the visit, (3) providing patient identification details where inappropriate prescribing was identified, (4) repeating the information at regular intervals including changes in practice over time and (5) providing information on all GPs involved in the practice. The short time scale of the intervention and the delay in obtaining HSE-PCRS data meant that these points were not acted upon.

8.4.4 Summary of results

- The majority of GPs who participated in the postal bulletin and academic detailing arms of this study actively identified it as a positive experience and would like to continue receiving prescribing feedback including the academic detailing visits.
- The emphasis on clinically related prescribing and improving practice in these areas was more important to GPs than cost conscious prescribing.
- GPs identified obstacles to quality prescribing and adherence to evidence based medicine, these primarily concerned a lack of time, resources and incentive, which they encountered in their clinical practice within one former Health Board region of Ireland.

8.4.5 Discussion

The evaluation of this project, from a GPs perspective, was as important as the more objective database analysis to identify changes in prescribing. A key aspect of this study was gaining GP acceptance and co-operation in allowing their prescribing data to be utilised in this way and agreeing to meet with an external researcher to discuss aspects of their prescribing and clinical practice.

8.4.5.1 Volunteer Participants

This was a volunteer sample of GPs from the ERHA, and while many aspects of their pre-intervention prescribing practice was similar to their colleagues who declined to participate, it is likely their attitudes to methods of improving and monitoring quality in prescribing may differ. Not surprisingly, many of the GPs involved were suspicious of the study in the beginning and needed reassurance on the confidentiality of the data and its subsequent use.

However these GPs were inherently interested in improving the quality of their prescribing practice and recognised audit including peer comparison as one means of achieving and monitoring this. They appreciated the objective nature of the information provided to them and the opportunity through the academic detailing visits to challenge and question the data. These attitudes have been reported in other studies.[180;246-248]

GPs in both the postal bulletin and academic detailing arm of the study reported increased awareness of the topics covered in the bulletin, however, this had no or only a small effect on clinical prescribing. This gap between awareness and clinical action is a well recognised phenomenon.[110;246] A survey of the GPs involved in this study, prior to the intervention, asked them to rank quality prescribing indicators according to importance to clinical practice.[221] The survey found that prescribing of CVD preventive therapies in diabetes and generics were in the top four rankings while avoidance of second line antibiotics ranked eighth.[221]

However, the data analysis in this study suggests no real changes to prescribing practice in these areas despite prescribing feedback.

The GPs, especially in the academic detailing arm of the study, provided insight into why this may be so. They identified clinical, patient and organisational factors which have an impact on their daily clinical practice. It was not intended to collect this information in a structured way at the outset of the study but it provides valuable insight into barriers faced by GPs in one former Health Board. The obstacles identified by the GPs in this study have been reported in the international literature.[106;112;231;239;246] This underlies the commonality of barriers to changing practice encountered in different healthcare systems and the importance of evaluating strategies employed in other systems within the Irish context.

8.4.5.2 Unsolicited interventions

A clear question which arises from this research is, 'would prescribing feedback and/ or academic detailing visits be acceptable to GPs in the wider community'? There is clinical trial evidence to suggest that unsolicited postal prescribing feedback or academic detailing visits in isolation are ineffective.[209;210;249] However, when such approaches are incorporated into an overall quality improvement strategy driven by government and linked to targets and incentives then the evidence suggest a positive impact on GP overall performance including prescribing.[74;78;91] A key challenge facing any quality improvement strategy is to engage with GPs in a constructive manner and avoid mistrust and fear among practitioners.

8.4.5.3 Conclusions

GPs involved in this study found it worthwhile and felt it had a positive effect on their attitude to quality prescribing and clinical practice. However, they wanted a sustained programme of prescribing feedback which focused on quality prescribing in clinical conditions. These GPs

recognised the role of audit, peer comparison and critical review of their practice as a means of improving and monitoring patient care. Gaining widespread acceptability of such a service would require a combination of GP reassurance and a coherent quality improvement strategy for primary care possibly linked to rewards and incentives.

It is also likely that the new Health Information and Quality Authority (HIQA) will become involved in primary care quality evaluation (www.hiqa.ie). This authority has already awarded funding to the ICGP to develop quality indicators for primary care in Ireland (www.icgp.ie). It is important that prescribing is considered as an aspect of overall quality of practice and patient care.

Chapter 9

Cost-effectiveness analysis

9.1 Introduction

In this chapter a cost evaluation of postal prescribing feedback versus combined academic detailing and postal feedback is presented. A brief background on cost-effectiveness is provided particularly in relation to interventions designed to change clinical practice. The cost-effectiveness analysis is constructed using the criteria outlined by Drummond et al [250] and is followed by a discussion and conclusion.

9.2 Background

The effectiveness of strategies to improve the implementation of evidence based medicine and guidelines have been evaluated extensively over the last ten years. Increasingly, the evaluation of such interventions has extended beyond clinical efficacy to an analysis of cost-effectiveness or cost-benefit from the perspective of the key stakeholders showing Governments, patients, and societies willingness to pay. Health care systems are investing heavily in quality improvement (QI) in terms of efficiency and service provision, but relatively few resources are allocated to initiatives for implementing QI.[251] QI initiatives aimed at changing clinical practice include prescribing feedback, audit, academic detailing visits, reminders, education groups etc. Inevitably, in order to finance such intermediary behavioural change interventions scarce healthcare resources and funding must be diverted from the provision of patient services.

This has led to the application of economic evaluation methodologies to interventions to improve physician adherence to evidence based practice.[251;252] The most common model used is a cost-effectiveness

analysis.[252] This takes into account the full health services cost implications of the change intervention and the consequences in terms of intermediary changes to physician practice. More complex models take patient outcomes e.g. quality life years gained (QALYs) or preferences into account and are termed cost-benefit analysis.[250]

A cost-effectiveness approach to behavioural interventions allows comparison between specific interventions in terms of producing sufficiently large and consistent changes in clinical practice relative to resources consumed thus providing justification of potential expenditure on a given intervention. The ultimate aim of such analysis is to enable objective and informed policy decisions on the appropriate allocation of resources.[250]

9.3 Methodology

The cost-effectiveness analysis was performed using the criteria adopted by Drummond et al.[250] The analysis takes the perspective of the policy maker or funding body i.e. The Department of Health and Children in Ireland. The cost is based on the estimated costs of providing a prescribing feedback service to all GP practices in Ireland (approximately 1200 practices)* rather than the actual costs of this project which was run on a fixed research budget and included only 98 GP practices. The comparison is between a postal prescribing feedback service providing individualised GP practice prescribing feedback versus a feedback service with a combination of prescribing advisers to conduct GP academic detailing visits and individualised prescribing feedback. Further details are described below.

---

* There is no current register of GP practices in Ireland. The number used here is estimated based on the number of GPs in the HSE-PCRS scheme n=2018, the ratio of single handed : partner practices 37:63 and assuming 3 GPs per practice[128]. The estimate is 1170 which was rounded to 1200 for the purpose of this study.

9.3.1 Cost

Salary and material costs for the two interventions are based on 2006 national pay scales and material costs. The costs of the intervention are calculated per GP practice in Ireland (n=1200 GP practices) The costs are estimated for the first year of establishing both types of services, annual running costs thereafter would exclude set up costs and training costs but would have to take account of 5% inflation per annum.

Postal prescribing feedback

The estimated cost of a postal prescribing feedback service is presented in Table 9.1. Initial set up costs and ongoing running costs are calculated based on developing an automated system. The service would rely on automating the data extraction from the HSE-PCRS database, analysis and report generation for individual GP practices. Thus, a small number of staff would be required. These estimated costs are compared to a similar service in Northern Ireland (NI), The Central Services Agency Prescribing Information unit, formally Compass, which provides individual GP practice prescribing feedback, similar to PACT data in the UK, as a postal bulletin.

Prescribing advisers (academic detailing)

The template for this service was based on the prescribing adviser service run in each of the four Primary Care Trusts in NI. This is a pharmacist led service, with 24 senior pharmacists employed to conduct academic detailing visits in 393 GP practices. The ratio of pharmacists to GP practices is an average of 1:16 (range 1:14 to 1:18). The prescribing advisers use the postal feedback GPs received from the Central Service Agency in addition to undertaking independent audits (using GP practice database or patient notes) and aim to provide 3-4 academic detailing visits per practice per year. All information on cost and activity of this service was obtained from personal communication with senior pharmacists involved with the service.

Table 9.2 outlines the projected cost for the first year of a similar service in Ireland, based on two different ratios: (1) using a 1:18 ratio, the maximum pharmacist : GP practice ratio in NI and (2) the ratio used in this RCT, 1:50 (rounded). Both models assume employing senior grade pharmacists. Administration costs are based on NI data (the average cost per pharmacist/year x the number of pharmacists required x 1.5 for a sterling to Euro conversion). Administration costs cover travel expenses, secretarial support, stationary etc. The NI service also includes expenditure on session pharmacists who cover maternity leave, sick leave or holidays. The service in Ireland is calculated with and without session pharmacist cover. In addition a new service would necessitate a training budget. This would include an introduction to academic detailing principles, education on the topics targeted for intervention and use of the main software systems in Irish GP practices to ensure a consistent and standardised service delivered to all practices. It is estimated that a minimum of €250 per pharmacist for 10 days would need to be allocated. The costs per GP practice between NI and a proposed service in the Republic of Ireland (ROI) are presented.

The cost of GP time to participate in the academic detailing sessions was not taken into account in this calculation. Potentially participation in such a scheme would require remuneration at GP locum rates, as reported in other studies.[253] Alternatively on a national level attendance at academic detailing could be incorporated into Continuing Medical Education (CME) and included as part of quality improvement in future GP contracts similar to the UK National Service Framework.

Table 9.1 Costs of a national postal prescribing feedback service (1st year) & comparison with NI service

			€
Running costs	Research Scientist		75,000
	Secretary Support	Half time	20,000
	Computer programmer		60,000
	Stationary/postage/printer cartridges	4 Bulletins/GP practice/year	14,500
	Software licence SAS per annum		4,000
	Accommodation	Based on 20% of annual running costs	23,720
Start up costs	Computer *3 + Microsoft Vista		6,000
	Colour printer (A3)		3,800
	Office furniture		1,500
Total cost first year			**208,319**
Cost per GP practice/year			**174**
NI postal prescribing feedback	*Total running cost 120,000 sterling (*1.5 conversion to €)*		*180,000**
NI Cost per GP practice/year	*NI 393 GP practices*		*458*

All salaries include PRSI and pension contributions, * estimate of cost of NI postal prescribing feedback service was obtained through personal communication.

Table 9.2 Costs of a national prescribing adviser service (1st year) based on NI model

	NI € (actual)		ROI € (proposed)		
Num GP practices		393		1200	1200
Ratio prescribing adviser: GP practice		**1:16** (range 1:14-1:18)		**1:18** (max NI ratio)	**1:50** (RCT ratio)
Number pharmacist prescribing advisers		24		65	24
Total Wages	(NI Average £45,000* 1.5 to convert to euro 67,500 /pharm)	1,620,000	€67,500 2006 pay scales senior pharmacist	4,387,500	1,620,00
Administration costs	£125,000 *1.5	187,500	(£125K/24 pharm)*num Irish pharm*1.5	507,813	187,500
Training			€250*num pharm*10 Days	162,500	60,000
Session pharmacists[1]	£225000* 1.5	337,500	(£225K/24 pharm)*num Irish pharm *1.5	914,062	337,500
Total cost		**2,145,500**	**Total cost** (Excl session pharm)	**5,971,876** **(5,057,813)**	**2,205,000** **(1,867,500)**
Cost/practice/ yr		**5,459**	(Excl session pharm)	**4,976** **(4,217)**	**1,838** **(1,556)**

All salaries include PRSI and pension contributions

Pharm=pharmacists, [1] sessions pharmacists are unlikely to be employed within the first year of a start up service, but the cost is retained as expenditure would be required on computer equipment (laptop for each pharmacist)and other start up costs.

Consequences

The consequences or benefits in this study are defined as the significant change in prescribing practice among the randomised groups adjusted for pre-intervention prescribing. In two of the topics covered a significant change in prescribing practice compared to non-participant GPs was detected. There was a significant reduction in prescribing of second line antibiotics (co-amoxiclav and cephalosporins) and an increase in overall generic prescribing in the immediate post intervention period. The β coefficients calculated for the bulletin only and academic detailing practices in chapters 4 and 5 are used as an estimate of the effect size of the intervention (% change in prescribing in each group above baseline).

Although prescribing of CVD preventive therapies increased in the randomised groups over the intervention period this increase was not significantly different to changes that had occurred in the NP GP group. Therefore, as we could not attribute this change in practice to the intervention we excluded CVD prescribing from a cost-effectiveness evaluation.

Direct patient benefits were not taken into account when identifying possible consequences of the interventions on generic and second line antibiotics. At an individual patient level, for both of these areas, it is difficult to identify direct patient benefits, e.g. reduction of second line antibiotics may slow the emergence of antimicrobial resistance in the population, but use of older potentially less effective antibiotics may slow the individual patients recovery or result in a repeat visit to a GP. The level of GP satisfaction with the interventions was not included as a benefit.

Cost-effectiveness ratio

A cost-effectiveness ratio was calculated based on the cost of the individual intervention per GP practice divided by the average change in prescribing practice for each of the areas covered in the randomised interventions. The intention was to calculate an incremental cost ratio

(academic detailing + postal bulletin-postal bulletin cost)÷(difference in prescribing practice between the randomised groups). However, as there was no significant difference between the randomised groups this was not possible.

9.4 Results

The initial set up and running costs for a postal prescribing feedback service in the first year would be approximately €208,319 or €174/ GP practice (Table 9.1). The cost of a prescribing adviser service is largely driven by the ratio of pharmacists to GP practices employed. Using the maximum ratio employed in NI (1:18) the cost is estimated to be between €5,057,813 to €5,971,876 (with and without session pharmacists) or €4,214 to €4,976 per practice per year. The alternative model using the ratio of personnel to GP practice visits in this study (1:50) greatly reduces the cost of the service with an estimate of €1,867,500 to €2,205,000 or €1,556 to €1,838 per GP practice (Table 9.2). The inclusion of postal prescribing feedback, as in this study, increases the per practice cost for each model by €174.

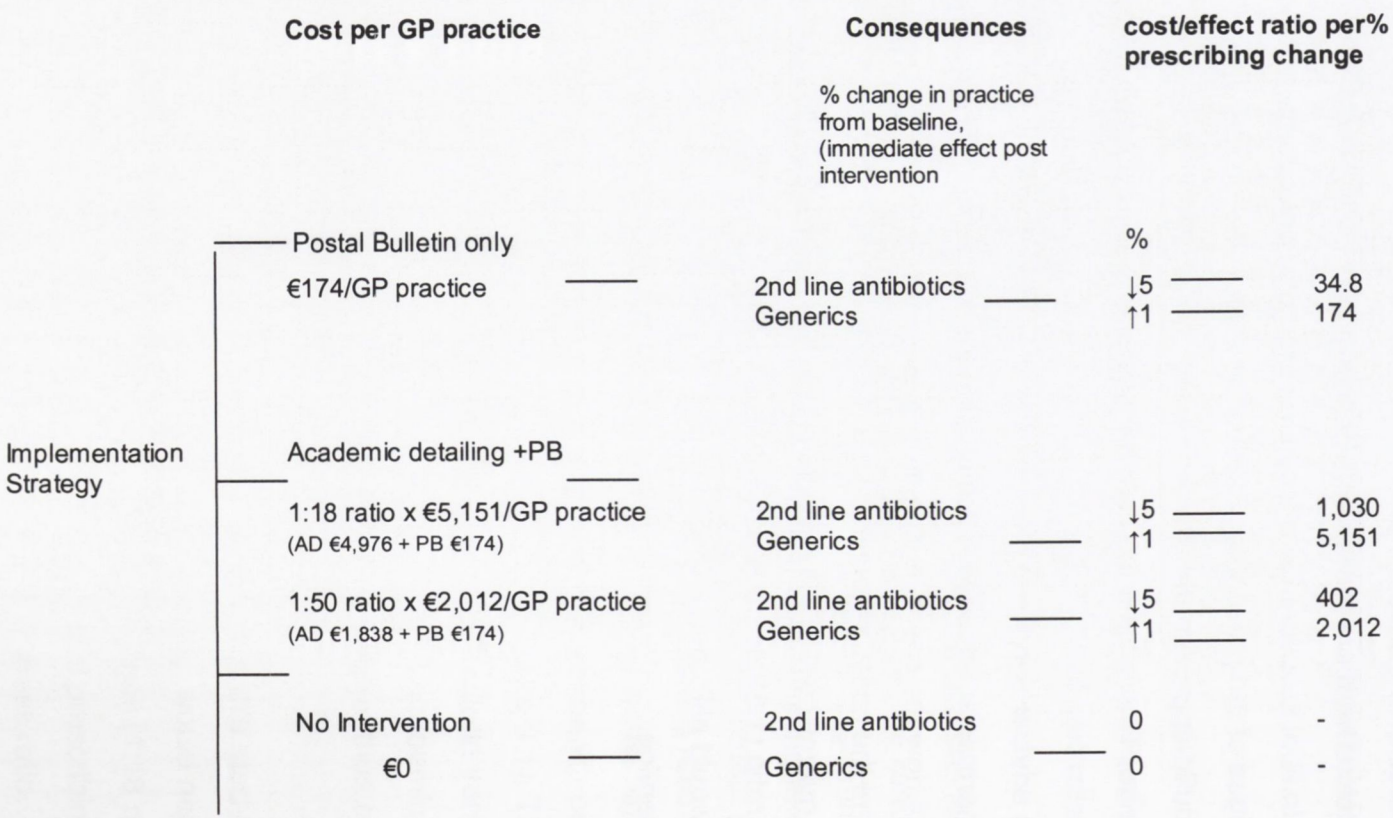
Figure 9.1 shows the cost effectiveness ratios of the two services based on the changes in GP prescribing practice observed in the randomised study (decrease in second line antibiotic and increase in generic drug substitution). The cost- effectiveness of a postal prescribing feedback service ranges from €34 - €174 for a unit of healthcare benefit (1% change in prescribing). In contrast, the cost-effectiveness ratio for a prescriber adviser service plus postal feedback could be as high as €1,030 - €5,151 or as low as €402 - €2,012 per unit of health care gain, depending on number of pharmacists employed (Figure 9.1). The analysis of the randomised study comparing postal bulletin versus academic detailing plus postal bulletin found that the academic detailing did not increase effectiveness over postal bulletin alone, thus an incremental cost ratio could not be calculated.

Based on the consequences or benefits measured in this study, a prescribing adviser service using academic detailing, would need to be at least 12 times (based on 1:50 ratio) and up to 30 times (1:18 ratio) more effective in changing prescribing practice than postal prescribing feedback in order to achieve a similar cost effectiveness ratio.

The baseline comparison for either service in this analysis is the non-participant group. During the immediate post intervention period there was no significant change in either second line antibiotic prescribing or generic substitution among NP GPs. Although there is no intervention cost involved in the NP group prescribing practice remained static.

The comparison with the NI data suggests that the postal prescribing feedback service would be considerably less costly to run on a per practice basis. There are three times as many GP practices in ROI compared to NI. However, it is anticipated that through automating the various stages of the prescribing feedback analysis and report generation it would require approximately the same number of staff to provide a similar service. This means the cost per practice bases could be two and half times less than in NI (Table 9.1). In contrast, the costs of the prescribing adviser service is predominately dictated by the number and grade of pharmacist employed. Presenting the two models gives a clear indication of how the cost-effectiveness is affected by this factor. At a practice level the costs associated with using a 1:18 ratio are similar to NI, but the overall cost of the service is nearly treble that of NI. The alternative ratio (1:50) is obviously much less costly on a per practice basis, but would still cost nearly €2 million more than a postal prescribing feedback service.

Figure 9.1 Cost-effectiveness analysis for postal prescribing feedback vs prescriber adviser service



*Pharmacist : GP practice ratio, academic detailing costs includes session pharmacists costs
↓ decrease in prescribing, ↑ increase in prescribing

9.5 Discussion

The results of the cost-effectiveness analysis indicate that a postal prescribing feedback service is more cost effective than multifaceted interventions involving academic detailing. In this study academic detailing plus postal prescribing feedback was not superior to postal prescribing feedback in changing GP prescribing practice. However, there were significantly greater costs associated with a prescribing adviser service. Both interventions achieved only small improvements in practice compared to no intervention and this contributed to low cost-effectiveness ratios especially for a prescribing adviser service.

9.5.1 Associated literature

In the literature, academic detailing is invariably used as part of a multifaceted intervention. However, there are very few economic evaluations of complex interventions which include academic detailing compared to other less labour intensive interventions, such as postal audit and feedback. Economic evaluations of such multifaceted interventions tend to compare changes in practice to no intervention and even then there are mixed results regarding cost-effectiveness.[253-255] One study which strongly concluded that academic detailing was cost effective focused on promoting eight preventive strategies in primary care and reducing five inappropriate screening strategies.[255] The authors used complex 'down the line' avoidance of health care costs e.g. the cost of treating a women with advanced cancer versus increased mammography screening in their cost /consequence analysis.[255] A study which looked at intermediary process outcomes, e.g. switching to thiazides in the treatment of hypertension, concluded that the quality improvement intervention cost more than twice any cost saving that would be made through drug switching within the first year.[253]

There is considerable variability in the methods used to cost multifaceted interventions, where authors report the actual cost of the intervention as

a research project or scale these up to the costs of a national programme.[256;257] The cost-effectiveness of the quality improvement strategy depends not only on the costs taken into account, but more importantly on the real and projected benefits used to offset the cost of the intervention. Increasingly, models to evaluate the cost-effectiveness of quality implementation strategies use long term projected outcomes e.g. patient life years gained or cost avoidance through disease prevention, as benefits which offset the cost of quality improvement (QI) implementation strategies.[255;257;258]

9.5.2 Effectiveness of QI strategies

These models make key assumptions regarding the effect size of the intervention, background level of activity, duration of effect and the benefits measured. Grimshaw et al estimated that the median effect size of audit and feedback was 7% (range 1.3% to 16%) compared to 6% (-4% to 17.4%) for multifaceted interventions including educational outreach visits.[251] Often an unrealistic change in practice, in this case over 20 fold, is required to make a multifaceted intervention, which includes outreach visit, as cost effective as other strategies which are perceived as less effective but are also less costly. Grimshaw et al suggested that the cost of quality improvement strategies can outweigh their potential benefits and it may be more efficient to adopt less costly but less efficient QI initiatives.[251]

Ultimately, whether an implementation strategy is considered cost effective depends on whether that ratio falls above or below the maximum threshold that the health service is willing to pay.[252] NICE has formalised this threshold and gives a value of £20,000-£30,000 per QALY (€30,000-€45,000).[259] This threshold had been the subject of much debate and any judgment needs to take account of all the evidence surrounding the interventions under review. No such threshold currently exists in Ireland.

In this study the limitations on how the academic detailing arm of the study was conducted have already been identified (section 4.6.1). It is likely that a more intensive visit schedule and regular contact with GPs could have improved the effectiveness of the intervention. The postal audit and feedback aspect of this study also achieved improvements in practice. It is possible that investment in developing an online prescribing feedback service using innovative information delivery techniques would also continue to improve GP prescribing practice with less investment in money and resources.

9.5.3 Cost offset

The justification for diverting funds to an intermediary QI initiative is that the intended changes in practice will delivery health gains which are substantially better than baseline practice. Such QI strategies in themselves are rarely cost effective in simple economic terms. However, the cost of the QI interventions can be offset by process changes in practice. In this study an increase in generic substitution was targeted as a means of 'offsetting' the cost of the intervention. The bulletin only arm of this study achieved a median cost saving of €197 per practice through generic substitution. This saving is actually greater than the projected cost of supplying postal prescribing feedback bulletins to each practice in the first year (€174).

The academic detailing arm of the study achieved a median cost saving of €217 per practice, which would contribute to offsetting 10%-20% of the estimated cost of a prescribing adviser service. There are important underlying assumptions: (1) all the generic substitutions were the result of the intervention (2) the same level of substitution could be achieved in a non-volunteer sample and (3) this level of substitution could be maintained and even increased over time.

Intermediary cost savings were also reported by Hogg et al where a reduction in inappropriate screening contributed to a 34% cost offset of an outreach facilitator service.[255] Rogers et al also concluded that control

on prescribing expenditure could sufficiently cover pharmacist employment costs.[148]

9.5.5 Long term benefits/consequences

Such intermediary cost savings may be useful in offsetting the initial costs of establishing a prescribing feedback service but the real gains are achieved through better practitioner adherence to preventive strategies such as CVD, vaccination, control of antimicrobial prescribing and cancer screening. A postal audit and feedback service can only focus on prescribing but a prescriber adviser service has the flexibility to include other aspects of practitioner adherence to guidelines such as: recording of patient cholesterol or blood pressure, GP/nurse education on patient life style changes, promotion of screening for breast cancer in the appropriate age group, etc. Freemantle et al suggested that 'outcomes such as life years saved were more likely to be an efficient target for scarce implementation resources than that aimed at reducing costs through substitution of one drug for a less expensive alternative'.[173]

In this study prescribing of CVD preventive therapy was not significantly different between the intervention groups and the baseline non-participant group. However, the study was probably under-powered to detect a change in practice with the current background level of increased prescribing observed in the NP group. In Germany, a cost effectiveness model by Gandjour et al, considered the proportion of patients not receiving effective CVD or Stroke prevention treatment and quality adjusted life years gained (QALYs) through effective treatment. Their model assumed a 10% effect size per visit and they concluded that an outreach visit costing €500 per visit with a rate of 3.4 visits would cost €3,407-€5,653 per QALY. The estimated national cost of an outreach visit service was reported as €215- €238 million (approx € 5,358 per GP). However, such outreach services can potentially target several disease groups and increase cost-effectiveness across a wide range of health care priorities.[257] The authors also suggested a scaled down version of a

national prescribing feedback service. By identifying and focusing on those practices that seem to be underperforming, the size of an outreach facilitator service could be reduced, leading to increased cost-effectiveness. But, similar to increasing the ratio of pharmacists : GP practices, this may reduce the impact and effectiveness of a prescribing adviser service.

9.5.6 Conclusion

On the surface, a prescribing adviser or outreach practice facilitator service would appear to deliver poor value for money compared to a less expensive postal prescribing feedback service. The value and cost effectiveness of an outreach service lies in its flexibility to target multiple aspects of national health priorities such as CVD prevention, cancer screening, or reduced antimicrobial resistance through judicious use of antimicrobials. An important aspect to changing practice is up-to-date information on patterns of prescribing but a broader focus on patient specific issues and working to overcome local barriers is likely to be required to achieve long term health care gains. The justification for developing either service, but particularly an outreach visit service, requires a long term view of healthcare and the costs associated with disease events such as stroke, myocardial infarction, cancer, or treatment of multi-resistant infections.

Chapter 10

Summary, Recommendations, Conclusions

10.1 Summary

10.1.1 What is already known

The present study outlines the importance of prescribing in primary care from an individual patient to a societal perspective. Inappropriate or poor prescribing e.g. drug interactions or failure to prescribe appropriate preventative therapy can increase patient mortality and morbidity. On a broader scale, society has to pay for an ever increasing drugs budget, e.g. the cost of the HSE-PCRS scheme has increased by €0.5 million overall in the last five years. The rise in antimicrobial resistances, with its sometimes fatal consequences for patients, is partly related to injudicious prescribing of antibiotics. Until recently, strategies to counteract inappropriate prescribing focused on the individual practitioner and included guidelines, education, audit, academic detailing and multifaceted combinations of these strategies. Quality prescribing indicators were developed to monitor and evaluate the effectiveness of such strategies. Two implementation strategies for quality improvement, audit and feedback, and audit and feedback combined with academic detailing have been shown to be effective in changing GP practice, though not consistently, in the international literature.

10.1.2 Methods

Using a RCT these interventions were evaluated for: (1) effectiveness in changing GP prescribing practice, (2) acceptability to GPs and (3) cost-effectiveness in an Irish primary care setting. GPs not involved in the randomised study were used to identify changes in background prescribing using a quasi-experimental design. Three topics areas, seen as national health care priorities or concerns, were targeted:

(1) prescribing of antibiotics, (2) generic prescribing related to cost containment and (3) prescribing of preventive therapies in CVD and diabetes. One of the key challenges in this study was to produce clinically meaningful and individual GP prescribing feedback data using an available national pharmacy claims database (i.e. HSE-PCRS).

Ninety eight GP practices (110 GPs) from the ERHA participated in the study; 50 practices received postal prescribing feedback and 48 received academic detailing visits plus postal feedback from the researcher. The interventions were implemented over a six month period (March 2005-August 2005) and included two separate postal bulletins (all GP practices) and two visits for GP practices in the academic detailing arm of the study (one GP declined the visits). The GP practice was the unit of randomisation and analysis in the RCT. In the separate quasi-experimental study participant GPs were compared to non-participant GPs (n=190) and the unit of analysis was the individual GP.

The HSE-PCRS prescribing database was used to analyse changes in prescribing practice. The effect of the intervention was assessed in the short term (one month post intervention or 3 months post intervention) and the long term (12 months post intervention). Prescribing in these time periods were compared to prescribing in the corresponding pre-intervention time periods. The months during which the interventions were delivered to practices were excluded from analysis.

Two statistical approaches were adopted to analyse the effect of the intervention depending on the topic area. Difference in the rate or proportional change in antibiotic and generic prescribing was analysed using segmented regression analysis. This method identifies immediate (level) and 12 month post intervention change in practice (post intervention monthly trend (slope) compared to the previous pre-intervention monthly trend).

Multiple regression was used to analysis differences in prescribing for CVD preventive therapies at three and 12 months post intervention (insufficient data for monthly analysis).

Confounding factors such as patient population size and structure, pre-intervention prescribing and GP clustering within practices was adjusted for in all analysis. Specific factors such as seasonality in antibiotic prescribing or participation in the Heartwatch programme in CVD and diabetes analysis was also adjusted for.

10.1.3 What this study adds

The following results summarises the effect of two quality improvement interventions in Irish primary care.

10.1.3.1 Randomised Controlled Trial

- In the immediate post intervention period, both randomised groups showed
  - A significant reduction in the overall prescribing of antibiotics and second line antibiotics in particular.
  - An increase in the proportion of diabetic patients receiving CVD preventive therapy.
  - An increase in substitution of some of the generic drugs targeted (e.g. omeprazole and nimesulide) compared to pre-intervention levels.
- Over the twelve month post intervention period changes to antibiotic and generic prescribing were not maintained by either group.
- There was no significant difference in changes to prescribing between GP practices who received postal prescribing feedback alone and those who received academic detailing

and postal feedback, either in the immediate or long term (12 month) post intervention period across the three topic areas examined.

10.1.3.2 .Quasi-experimental study

- In the comparison between participant and non-participant GPs the following areas were significantly different from background practice immediately post intervention:
  - Prescribing of second line antibiotics (co-amoxiclav and cephalosporins) was significantly reduced among participant GPs.
  - Generic substitution of omeprazole and nimesulide was significantly increased among participant GPs.
- Over the twelve month post intervention period changes to second line antibiotic prescribing was not maintained by participant GPs and only generic substitution for pravastatin was significantly higher among participant GPs compared to NP GPs.
- Prescribing of statins in CVD and diabetic patients and antiplatelet therapy in diabetic patients increased over the twelve month post intervention period, but there was no significant difference between participant and NP GPs.

10.1.3.3 Cost-effectiveness analysis

- The cost of a national postal prescribing feedback service was estimated at €174/GP practice compared to €2,012 to €4,433/GP practice for a pharmacist led prescribing adviser service (depending on pharmacist : GP practice ratio).
- Based on changes to prescribing practice observed in this study a multifaceted intervention using academic detailing needs to be 12-30 times more effective than postal audit and feedback to

achieve a similar cost-effectiveness ratio (depending on pharmacists : GP ratio).

10.1.3.4 General observations

- One third of GPs in the ERHA agreed to receive individual prescribing feedback and allow external review of their prescribing practice including peer comparison.
- There was a high level of satisfaction among GPs who participated in the study, with the majority (80%) actively indicating that they would like to continue to receive postal prescribing feedback, while 81% (39/48) of GPs involved in the academic detailing arm of the study indicated they would like to continue receiving the visits in conjunction with the postal bulletins.
- The evaluation of the randomised groups and NP GPs prescribing data against quality prescribing indicators suggest that improvements could be made across the three topic areas examined.
    - Antibiotics: The rate of overall antibiotic prescribing ranged from 110-116 per 1000 population (eligible GMS population). Second line antibiotics (co-amoxiclav and cephalosporins) account for 35% of antibiotics prescribed.
    - Generics: With the exception of beclomethasone inhalers, there was less than 30% generic prescribing for the remaining drugs targeted in the intervention.
    - CVD preventative therapy: Between 30-50% of eligible patients were potentially not receiving recommended therapy.
        i. There was considerable variability in the prescribing practices in both participant and NP GPs. This is further evidence of the need to monitor and improve quality of prescribing practice.

ii. The HSE-PCRS prescribing database can be used to generate GP prescribing feedback (at individual and practice level). The database can also be used to monitor and evaluate changes to prescribing practice over time.

10.2 Limitations/ Lessons learned

The limitations of the study have already been identified in the previous chapters, particularly in chapter four. However, there were key factors, which, as the researcher conducting the study and analysing the data I felt had an important impact on the results observed and their interpretation. They are as follows:

- The lack of intensity and follow-up on individual topics is likely to have contributed to the small changes observed in prescribing practice in both intervention groups.
- Specific training in conducting academic detailing visits. Longer and more intensive visits, with specific targets for changing practice may have increased the effectiveness of the intervention.
- The failure to gain consent from all GPs within multi-partner practices to participate in the intervention is also likely to have diluted the effect of the interventions.
- The lack of a randomised control group (no intervention) made the analysis and interpretation of the effect of background changes in practice compared to changes attributable to the intervention more difficult to discern. The inability to control for GP clustering in this group (no information on which NP GPs worked together) and their non-volunteer status meant that comparison with the NP GP group was not an ideal compromise.

- Incomplete understanding of the impact of local barriers, such as level of practice computerisation, lack of disease specific patient registries, and the impact that the attitudes/motivation of the key stakeholders have on the effects of strategies to change practice in line with best available evidence.
- The HSE-PCRS database covers approximately 30% of the Irish population, but captures 65% of prescribing in primary care. However there is the potential that GP attitudes and management of patients who pay privately for their GP visits and medicines may be different from this population. This relationship needs to be investigated more fully, before being confident that the pattern of prescribing observed in the HSE-PCRS prescribing database is representative of all prescribing in primary care.

This was primarily a pragmatic randomised trial conducted within a given time frame and set budget. The lack of follow up is due to the delay in receiving prescribing data from the HSE-PCRS (currently 4-6 months). Also, given the sample size of 98 GP practices willing to participate in the study, randomising the study into 3 groups would have meant that the study would have been underpowered (see section 3.2.1.1). Using a non-randomised control group meant that the randomised study was adequately powered to detect differences in practice between an intervention which can achieve changes in practice but costs 25% of the potentially more effective but more costly intervention. In an environment of tight economic control on healthcare spending it is important to evaluate not only the effectiveness but also the cost-effectiveness of QI implementation strategies.

The lack of detailed prior knowledge of local barriers to changing practice is unlikely to have changed the methods or approaches adopted in these interventions. Resolving many of these barriers requires long term investment in primary care IT, personnel, building and structures as outlined in the 2001 Primary Care strategy.[260] Also, incentivising or

actively rewarding good practice and broader public education may be useful and should be evaluated.

Mason et al[261] in a review of implementation literature up to 2002 felt there were many questions unanswered regarding factors that influence effectiveness and their interplay with strategies to modify practitioner behaviour. The authors observed that "in terms of the process of implementation, routine mechanisms to monitor, feedback and reinforce change should be in place, those delivering the intervention should have appropriate knowledge and skills, and interventions should be adequately funded." In this study the interventions were too short term and were conducted in a health care system with no regular monitoring or feedback to practitioners.

Finally, the use of the HSE-PCRS pharmacy claims database has its limitations. In particular, disease specific quality prescribing indicators and surrogate markers of disease need to be validated in clinical practice. However, over 80% of GP practices in Ireland are involved in the HSE-PCRS scheme and it is the most nationally representative of any primary care database in Ireland. Prescribing feedback services in other countries use similar databases to influence and monitor GP prescribing practice.[63;91]

10.3 Future in Primary Care

Primary care, similar to other areas of health care, is subject both to increased public accountability and quality improvement.[262] In an international context, efforts to improve quality in primary care, including prescribing, has switched from an individual GP focus, e.g. audit and feedback, to comprehensive systematic strategies (external supervision, regulation of medical practice, national system of practice guidelines and standards, effective use of information systems, active professional involvement in quality improvement activity, systematic use of financial and other incentives).[262] In many respects Ireland has lagged behind

many other developed countries in developing a systematic approach to quality improvement in primary care, including monitoring and performance feedback to practitioners. This project focused on just one aspect of primary care, prescribing, but it is estimated that up to 90% of consultations in primary care result in a prescription.[43]

10.4 Recommendations

Based on the results in this research study, including the cost-effectiveness analysis, GP evaluation and a review of the associated national and international literature related to prescribing and quality improvement in primary care, the following recommendations are proposed:

- To develop a national postal prescribing feedback service providing GP practices with individualised information on their prescribing for specific target areas identified as national healthcare priorities and amenable to prescribing feedback.
- The service should be independent and objective with close collaboration between the GP organisations (ICGP), the Department of Health and Children and the HSE including the HSE-PCRS in order to achieve a consensus on areas for prescribing feedback and set performance targets.
- An integrated approach to health information should be adopted, ideally, with the prescribing feedback service linked to the current NMIC, with the aim of providing GP practices with consistent and clear information.
- In the long term, it would seem appropriate that such an information service (prescribing feedback and drug information) would be part of the new Health Information and Quality Authority (HIQA).

- The development of a national prescribing adviser service, using academic detailing principles, should be further evaluated once a background of ongoing prescribing feedback is established. It is likely that the most efficacious and cost effective application of such a service is to extend its remit beyond prescribing and target disease preventive strategies in primary care.
- Initially a prescribing feedback service would rely on postal delivery, but with increased computerisation of GP practices, an online web-based service would replace postal delivery. The aim would be to develop an interactive web-based service, ensuring confidential access, e.g. each GP practice has its own unique password and access only to their data. The service would provide a standardised feedback with individual GP practices benchmarked against the top 10% performance or national targets. In addition the service would allow GPs to conduct their own prescribing audits, identify individual patients within their practice who may not be receiving appropriate treatment, monitor trends over time, question their performance against quality indicators.
- Once the credibility and robustness of the prescribing feedback is established GP performance on quality prescribing indicators could be used as part of a wider quality improvement strategy in primary care linked to targets and incentives, similar to the Quality and Outcomes Framework in the UK[79]
- Prescribing feedback and quality prescribing indicators may be compatible with the aim of HIQA to 'Implement a programme of quality assurance reviews for hospitals, primary care, general practice etc. (www.hiqa.ie).
- Such a service should be subjected to ongoing evaluation by the key stakeholders including GPs, the Department of Health and Children and the HSE.

- In the future, with the focus on integrated health care information and the linkage of key national databases and disease registries, this service could provide GPs with an overview of their patient outcomes. This would facilitate both practice level and national audit linking patient outcomes to prescribing history and disease management.

10.5 Conclusion

Quality improvement and public accountability is likely to become a more prominent feature of primary care in Ireland. This study has used a readily available source of information to provide GPs with an overview of various aspects of their prescribing practice. Participation in the study achieved short term changes in some areas of practice, but the inclusion of academic detailing did not have a significant impact above postal audit and feedback. Prescribing feedback in isolation is unlikely to achieve large scale changes in practice. However, as part of an integrated strategy of quality improvement, which actively targets identified barriers to change, sets performance targets and rewards good practice, prescribing feedback can be a useful tool to initiate change and monitor performance.

Reference List

(1) DURQUIM. A conceptual framework for constructing prescribing quality indicators: a proposal. WHO 2004; publicationrequests@euro.who.int.

(2) Avery AJ. Appropriate prescribing in general practice: development of the indicators. Qual Health Care 1998; 7(3):123.

(3) Hitchen L. Adverse drug reactions result in 250,000 UK admissions a year. BMJ 2006; 332(7550):1109.

(4) Pouyanne P, Haramburu F, Imbs JL, Begaud B. Admissions to hospital caused by adverse drug reactions: cross sectional incidence study. French Pharmacovigilance Centres. BMJ 2000; 320(7241):1036.

(5) Trifiro G, Calogero G, Ippolito FM, Cosentino M, Giuliani R, Conforti A et al. Adverse drug events in emergency department population: a prospective Italian study. Pharmacoepidemiol Drug Saf 2005; 14(5):333-340.

(6) Bradbury F. How important is the role of the physician in the correct use of a drug? An observational cohort study in general practice. Int J Clin Pract Suppl 2004;(144):27-32.

(7) Buetow SA, Sibbald B, Cantrill JA, Halliwell S. Prevalence of potentially inappropriate long term prescribing in general practice in the United Kingdom, 1980-95: systematic literature review. BMJ 1996; 313(7069):1371-1374.

(8) Jones MI, Greenfield SM, Jowett S, Bradley CP, Seal R. Proton pump inhibitors: a study of GPs' prescribing. Fam Pract 2001; 18(3):333-338.

(9) Nolte H, Nepper-Christensen S, Backer V. Unawareness and undertreatment of asthma and allergic rhinitis in a general population. Respir Med 2005.

(10) Bennett KE, Williams D, Feely J. Under-prescribing of cardiovascular therapies for diabetes in primary care. Eur J Clin Pharmacol 2003; 58(12):835-841.

(11) James P, Tan HH, MacAlpine R, Brennan G, Emslie-Smith A, Morris AD. Treatment gap in the use of lipid-lowering drug therapy

in diabetes: a population-based study. Diabet Med 2004; 21(10):1108-1112.

(12) EUROASPIRE Group. Clinical reality of coronary prevention guidelines: a comparison of EUROASPIRE I and II in nine countries. EUROASPIRE I and II Group. European Action on Secondary Prevention by Intervention to Reduce Events. Lancet 2001; 357(9261):995-1001.

(13) Bennett KE, Williams D, Feely J. Inequalities in prescribing of secondary preventative therapies for ischaemic heart disease in Ireland. Ir Med J 2002; 95(6):169-172.

(14) Simpson CR, Hannaford PC, Williams D. Evidence for inequalities in the management of coronary heart disease in Scotland. Heart 2005; 91(5):630-634.

(15) Williams D, Bennett K, Feely J. Evidence for an age and gender bias in the secondary prevention of ischaemic heart disease in primary care. Br J Clin Pharmacol 2003; 55(6):604-608.

(16) Goossens H. European status of resistance in nosocomial infections. Chemotherapy 2005; 51(4):177-181.

(17) Goossens H, Ferech M, Vander SR, Elseviers M. Outpatient antibiotic use in Europe and association with resistance: a cross-national database study. Lancet 2005; 365(9459):579-587.

(18) Finch RG. Antibiotic resistance: a view from the prescriber. Nat Rev Microbiol 2004; 2(12):989-994.

(19) Livermore D. Can better prescribing turn the tide of resistance? Nat Rev Microbiol 2004; 2(1):73-78.

(20) Sheldon AT, Jr. Antibiotic resistance: who is winning the war? Introductory remarks. Int J Toxicol 2003; 22(2):129-130.

(21) Bergan T. Antibiotic usage in Nordic countries. Int J Antimicrob Agents 2001; 18(3):279-282.

(22) Patrick DM, Marra F, Hutchinson J, Monnet DL, Ng H, Bowie WR. Per capita antibiotic consumption: how does a North American jurisdiction compare with Europe? Clin Infect Dis 2004; 39(1):11-17.

(23) Cunney R Oza Ajay. Antibiotic consumption in Ireland 1993 to 2002. EPI-INSIGHT 2004; 5(4):2-3.

(24) National Centre for Pharmacoeconomics. National antibiotic consumption on the GMS scheme. NCPE 2005; www.ncpe.ie (last accessed 14/12/2006).

(25) Garattini L, Tediosi F. A comparative analysis of generics markets in five European countries. Health Policy 2000; 51(3):149-162.

(26) NHS Health and Social Care Information Centre. Prescriptions dispensed in the community statistics for 1994 to 2004: England. NHS Information Centre 2005; www.ic.nhs.uk (accessed 11/11/2006).

(27) Tilson L, Bennett K, Barry M. The potential impact of implementing a system of generic substitution on the community drug schemes in Ireland. Eur J Health Econ 2005; 6(3):267-273.

(28) Health Service Executive. General Medical Service (Payments) Board 2004 Report. HSE 2005; www.gmspb.ie (last accessed 10/02/2007).

(29) Holden J, Wilson R. The quality of prescribing in general practice. Int J Health Care Qual Assur 1996; 9(5):17-23.

(30) Lawrence M OF. Indicators of Quality of Health Care. Eur J Gen Pract 1997; 3:103-108.

(31) Hoven JL, Haaijer-Ruskamp FM, Vander Stichele RH. Indicators of prescribing quality in drug utilisation research: report of a European meeting (DURQUIM, 13-15 May 2004). Eur J Clin Pharmacol 2005; 60(11):831-834.

(32) Campbell SM, Roland MO, Quayle JA, Buetow SA, Shekelle PG. Quality indicators for general practice: which ones can general practitioners and health authority managers agree are important and how useful are they? J Public Health Med 1998; 20(4):414-421.

(33) Shekelle PG, Ortiz E, Rhodes S, Morton SC, Eccles MP, Grimshaw JM et al. Validity of the Agency for Healthcare Research and Quality clinical practice guidelines: how quickly do guidelines become outdated? JAMA 2001; 286(12):1461-1467.

(34) Lawton B, Rose S, McLeod D, Dowell A. Changes in use of hormone replacement therapy after the report from the Women's Health Initiative: cross sectional survey of users. BMJ 2003; 327(7419):845-846.

(35) Williams D, Bennett K, Feely J. The application of prescribing indicators to a primary care prescription database in Ireland. Eur J Clin Pharmacol 2005; 61(2):127-133.

(36) de Backer G., Ambrosioni E, Borch-Johnsen K, Brotons C, Cifkova R, Dallongeville J et al. European guidelines on cardiovascular disease prevention in clinical practice. Third Joint Task Force of European and other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of eight societies and by invited experts). Atherosclerosis 2004; 173(2):381-391.

(37) Finch RG, Metlay JP, Davey PG, Baker LJ. Educational interventions to improve antibiotic use in the community: report from the International Forum on Antibiotic Resistance (IFAR) colloquium, 2002. Lancet Infect Dis 2004; 4(1):44-53.

(38) Campbell SM, Roland MO, Buetow SA. Defining quality of care. Soc Sci Med 2000; 51(11):1611-1625.

(39) Avery AJ, Heron T, Lloyd D, Harris CM, Roberts D. Investigating relationships between a range of potential indicators of general practice prescribing: an observational study. J Clin Pharm Ther 1998; 23(6):441-450.

(40) Cantrill JA, Sibbald B, Buetow S. Indicators of the appropriateness of long-term prescribing in general practice in the United Kingdom: consensus development, face and content validity, feasibility, and reliability. Qual Health Care 1998; 7(3):130-135.

(41) Kirk SA, Campbell SM, Kennell-Webb S, Reeves D, Roland MO, Marshall MN. Assessing the quality of care of multiple conditions in general practice: practical and methodological problems. Qual Saf Health Care 2003; 12(6):421-427.

(42) Morris CJ, Cantrill JA. Preventing drug-related morbidity--the development of quality indicators. J Clin Pharm Ther 2003; 28(4):295-305.

(43) Muijrers PE, Janknegt R, Sijbrandij J, Grol RP, Knottnerus JA. Prescribing indicators. Development and validation of guideline-based prescribing indicators as an instrument to measure the variation in the prescribing behaviour of general practitioners. Eur J Clin Pharmacol 2004; 60(10):739-746.

(44) Andersen M. Is it possible to measure prescribing quality using only prescription data? Basic Clin Pharmacol Toxicol 2006; 98(3):314-319.

(45) Veninga CC, Denig P, Pont LG, Haaijer-Ruskamp FM. Comparison of indicators assessing the quality of drug prescribing for asthma. Health Serv Res 2001; 36(1 Pt 1):143-161.

(46) Campbell SM, Cantrill JA, Roberts D. Prescribing indicators for UK general practice: Delphi consultation study. BMJ 2000; 321(7258):425-428.

(47) Campbell SM, Braspenning J, Hutchinson A, Marshall MN. Research methods used in developing and applying quality indicators in primary care. BMJ 2003; 326(7393):816-819.

(48) Bateman DN, Eccles M, Campbell M, Soutter J, Roberts SJ, Smith JM. Setting standards of prescribing performance in primary care: use of a consensus group of general practitioners and application of standards to practices in the north of England. Br J Gen Pract 1996; 46(402):20-25.

(49) Lloyd DC, Scrivener G. Prescribing at the Primary Care Group level: census data and prescribing indicators. J Clin Pharm Ther 2001; 26(2):93-101.

(50) Marshall MN, Shekelle PG, McGlynn EA, Campbell S, Brook RH, Roland MO. Can health care quality indicators be transferred between countries? Qual Saf Health Care 2003; 12(1):8-12.

(51) de Vries TW, Tobi H, Schirm E, van den BP, Duiverman EJ, de Jong-van den Berg LT. The gap between evidence-based medicine and daily practice in the management of paediatric asthma. A pharmacy-based population study from The Netherlands. Eur J Clin Pharmacol 2006; 62(1):51-55.

(52) Simpson CR, Hannaford PC, Williams D. Evidence for inequalities in the management of coronary heart disease in Scotland. Heart 2005; 91(5):630-634.

(53) Ward PR, Noyce PR, St Leger AS. Exploring the equity of GP practice prescribing rates for selected coronary heart disease drugs: a multiple regression analysis with proxies of healthcare need. Int J Equity Health 2005; 4(1):3.

(54) Bennett K, Teeling M, Feely J. Overprescribing antidepressants to children: pharmacoepidemiological study in primary care. BMJ 2005; 331(7530):1451-1452.

(55) Bjerrum L, Sogaard J, Hallas J, Kragstrup J. Polypharmacy: correlations with sex, age and drug regimen. A prescription database study. Eur J Clin Pharmacol 1998; 54(3):197-202.

(56) Mott DA, Meek PD. Evaluating prescriptions for the elderly: drug/age criteria as a tool to help community pharmacists. J Am Pharm Assoc (Wash) 2000; 40(3):417-424.

(57) Vander Stichele RH, Elseviers MM, Ferech M, Blot S, Goossens H. European surveillance of antimicrobial consumption (ESAC): data collection performance and methodological approach. Br J Clin Pharmacol 2004; 58(4):419-428.

(58) Perreault S, Blais L, Dragomir A, Bouchard MH, Lalonde L, Laurier C et al. Persistence and determinants of statin therapy among middle-aged patients free of cardiovascular disease. Eur J Clin Pharmacol 2005; 61(9):667-674.

(59) Malone DC, Hutchins DS, Haupert H, Hansten P, Duncan B, Van Bergen RC et al. Assessment of potential drug-drug interactions with a prescription claims database. Am J Health Syst Pharm 2005; 62(19):1983-1991.

(60) Korff Von M, War EH, Saunders K. A chronic disease score from automated pharmacy data. J Clin Epidemiol 1992; 45(2):197-203.

(61) Maio V, Yuen E, Rabinowitz C, Louis D, Jimbo M, Donatini A et al. Using pharmacy data to identify those with chronic conditions in Emilia Romagna, Italy. J Health Serv Res Policy 2005; 10(4):232-238.

(62) Percudani M, Barbui C, Fortino I, Petrovich L. Antidepressant drug prescribing among elderly subjects: a population-based study. Int J Geriatr Psychiatry 2005; 20(2):113-118.

(63) Majeed A, Evans N, Head P. What can PACT tell us about prescribing in general practice? BMJ 1997; 315(7121):1515-1519.

(64) Schumock GT, Walton SM, Park HY, Nutescu EA, Blackburn JC, Finley JM et al. Factors that influence prescribing decisions. Ann Pharmacother 2004; 38(4):557-562.

(65) Bloor K, Freemantle N. Lessons from international experience in controlling pharmaceutical expenditure. II: Influencing doctors. BMJ 1996; 312(7045):1525-1527.

(66) Andersson K, Sonesson C, Petzold M, Carlsten A, Lonnroth K. What are the obstacles to generic substitution? An assessment of the behaviour of prescribers, patients and pharmacies during the first year of generic substitution in Sweden. Pharmacoepidemiol Drug Saf 2005; 14(5):341-348.

(67) Tilson L, McGowan B, Bennett K, Barry M. The high cost of medicines in Ireland: Is it time to change the pricing mechanism? Eur J Health Econ 2004; 5(4):341-344.

(68) Paraponaris A, Verger P, Desquins B, Villani P, Bouvenot G, Rochaix L et al. Delivering generics without regulatory incentives?

Empirical evidence from French general practitioners about willingness to prescribe international non-proprietary names. Health Policy 2004; 70(1):23-32.

(69) Epstein AM, Lee TH, Hamel MB. Paying physicians for high-quality care. N Engl J Med 2004; 350(4):406-410.

(70) Grossbart SR. What's the return? Assessing the effect of "pay-for-performance" initiatives on the quality of care delivery. Med Care Res Rev 2006; 63(1 Suppl):29S-48S.

(71) Ashworth M, Lea R, Gray H, Rowlands G, Gravelle H, Majeed A. How are primary care organizations using financial incentives to influence prescribing? J Public Health (Oxf) 2004; 26(1):48-51.

(72) Rosenthal MB, Frank RG, Li Z, Epstein AM. Early experience with pay-for-performance: from concept to practice. JAMA 2005; 294(14):1788-1793.

(73) Shekelle P. New contract for general practitioners. BMJ 2003; 326(7387):457-458.

(74) Rowe JW. Pay-for-performance and accountability: related themes in improving health care. Ann Intern Med 2006; 145(9):695-699.

(75) Fadden L. The impact of the extension of the GMS scheme to cover all persons aged 70 years and over: A case study. ESRI 2004; Working paper no 6 (unpublished thesis) www.esri.ie.

(76) Walley T, Murphy M, Codd M, Johnston Z, Quirke T. Effects of a monetary incentive on primary care prescribing in Ireland: changes in prescribing patterns in one health board 1990-1995. Pharmacoepidemiol Drug Saf 2000; 9(7):591-598.

(77) National Heartwatch Programme. Heartwatch Report. The national programme in General practice for the secondary prevention of cardiovascular disease in Ireland. ICGP 2004; www.icgp.ie/library (last accessed 02/07/2007).

(78) DOHC. Irelands Changing Heart: Second report on implementation of the Cardiovascular Health Strategy. Dublin Department of Health and Children, 2003; http://www.healthpromotion.ie/pdf/Irelands_Changing_Heart.pdf (last accessed 02/06/2007).

(79) Department of Health. Quality and Outcomes Framework (QOF). DOH 2004; www.doh.gov.uk (last accessed 09/05/2007).

(80) Kendall H. Why prescribing data are monitored. The Pharmaceutical Journal 2004; 272:21-22.

(81) Spurgeon P, Hicks C, Field S, Barwell F. The new GMS contract: impact and implications for managing the changes. Health Serv Manage Res 2005; 18(2):75-85.

(82) Doran T, Fullwood C, Gravelle H, Reeves D, Kontopantelis E, Hiroeh U et al. Pay-for-performance programs in family practices in the United Kingdom. N Engl J Med 2006; 355(4):375-384.

(83) Sutton M, McLean G. Determinants of primary medical care quality measured under the new UK contract: cross sectional study. BMJ 2006; 332(7538):389-390.

(84) Prosser H, Almond S, Walley T. Influences on GPs' decision to prescribe new drugs-the importance of who says what. Fam Pract 2003; 20(1):61-68.

(85) Caudill TS, Johnson MS, Rich EC, McKinney WP. Physicians, pharmaceutical sales representatives, and the cost of prescribing. Arch Fam Med 1996; 5(4):201-206.

(86) Chew LD, O'Young TS, Hazlet TK, Bradley KA, Maynard C, Lessler DS. A physician survey of the effect of drug sample availability on physicians' behavior. J Gen Intern Med 2000; 15(7):478-483.

(87) Hall KB, Tett SE, Nissen LM. Perceptions of the influence of prescription medicine samples on prescribing by family physicians. Med Care 2006; 44(4):383-387.

(88) Prosser H, Walley T. A qualitative study of GPs' and PCO stakeholders' views on the importance and influence of cost on prescribing. Soc Sci Med 2005; 60(6):1335-1346.

(89) Sales A, Smith J, Curran G, Kochevar L. Models, strategies, and tools. Theory in implementing evidence-based findings into health care practice. J Gen Intern Med 2006; 21 Suppl 2:S43-S49.

(90) Jamtvedt G, Young JM, Kristoffersen DT, Thomson O'Brien MA, Oxman AD. Audit and feedback: effects on professional practice and health care outcomes. Cochrane Database Syst Rev 2003;(3):CD000259.

(91) Weekes LM, Mackson JM, Fitzgerald M, Phillips SR. National Prescribing Service: creating an implementation arm for national medicines policy. Br J Clin Pharmacol 2005; 59(1):112-116.

(92) Meredith PA. New FDA guidelines on the treatment of hypertension: comparison of different therapeutic classes according to trough/peak blood pressure responses. Arch Mal Coeur Vaiss 1994; 87(11):1423-1429.

(93) Coleman P, Nicholl J. Influence of evidence-based guidance on health policy and clinical practice in England. Qual Health Care 2001; 10(4):229-237.

(94) Sheldon TA, Cullum N, Dawson D, Lankshear A, Lowson K, Watt I et al. What's the evidence that NICE guidance has been implemented? Results from a national evaluation using time series analysis, audit of patients' notes, and interviews. BMJ 2004; 329(7473):999.

(95) Wathen B, Dean T. An evaluation of the impact of NICE guidance on GP prescribing. Br J Gen Pract 2004; 54(499):103-107.

(96) Grimshaw JM, Thomas RE, MacLennan G, Fraser C, Ramsay CR, Vale L et al. Effectiveness and efficiency of guideline dissemination and implementation strategies. Health Technol Assess 2004; 8(6):iii-72.

(97) National Institute for Clinical Excellence. Principles for best practice in clinical audit. NICE 2004; www.nice.org.uk (accessed 14/11/2006).

(98) Grindrod KA, Patel P, Martin JE. What interventions should pharmacists employ to impact health practitioners' prescribing practices? Ann Pharmacother 2006; 40(9):1546-1557.

(99) Jamtvedt G, Young JM, Kristoffersen DT, O'Brien MA, Oxman AD. Audit and feedback: effects on professional practice and health care outcomes. Cochrane Database Syst Rev 2006;(2):CD000259.

(100) Davis D, O'Brien MA, Freemantle N, Wolf FM, Mazmanian P, Taylor-Vaisey A. Impact of formal continuing medical education: do conferences, workshops, rounds, and other traditional continuing education activities change physician behavior or health care outcomes? JAMA 1999; 282(9):867-874.

(101) Freemantle N, Harvey EL, Wolf F, Grimshaw JM, Grilli R, Bero LA. Printed educational materials: effects on professional practice and health care outcomes. Cochrane Database Syst Rev 2000;(2):CD000172.

(102) Thomson O'Brien MA, Freemantle N, Oxman AD, Wolf F, Davis DA, Herrin J. Continuing education meetings and workshops: effects on professional practice and health care outcomes. Cochrane Database Syst Rev 2001;(2):CD003030.

(103) Gross PA, Bates DW. A pragmatic approach to implementing best practices for clinical decision support systems in computerized

provider order entry systems. J Am Med Inform Assoc 2007; 14(1):25-28.

(104) Kuperman GJ, Bobb A, Payne TH, Avery AJ, Gandhi TK, Burns G et al. Medication-related clinical decision support in computerized provider order entry systems: a review. J Am Med Inform Assoc 2007; 14(1):29-40.

(105) Armstrong D, Reyburn H, Jones R. A study of general practitioners' reasons for changing their prescribing behaviour. BMJ 1996; 312(7036):949-952.

(106) Bradley CP. Factors which influence the decision whether or not to prescribe: the dilemma facing general practitioners. Br J Gen Pract 1992; 42(364):454-458.

(107) Barry CA, Bradley CP, Britten N, Stevenson FA, Barber N. Patients' unvoiced agendas in general practice consultations: qualitative study. BMJ 2000; 320(7244):1246-1250.

(108) Weiss MC, Deave T, Peters TJ, Salisbury C. Perceptions of patient expectation for an antibiotic: a comparison of walk-in centre nurses and GPs. Fam Pract 2004; 21(5):492-499.

(109) Goossens H, Guillemot D, Ferech M, Schlemmer B, Costers M, van BM et al. National campaigns to improve antibiotic use. Eur J Clin Pharmacol 2006; 62(5):373-379.

(110) Freeman AC, Sweeney K. Why general practitioners do not implement evidence: qualitative study. BMJ 2001; 323(7321):1100-1102.

(111) Shaneyfelt TM. Building bridges to quality. JAMA 2001; 286(20):2600-2601.

(112) Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. Lancet 2003; 362(9391):1225-1230.

(113) National Institute for Clinical Excellence. TA94 Cardiovascular disease - statins: Guidance. NICE 2006; www.nice.org.uk (last accessed 02/03/2007).

(114) Khunti K, Hearnshaw H, Baker R, Grimshaw G. Heart failure in primary care: qualitative study of current management and perceived obstacles to evidence-based diagnosis and management by general practitioners. Eur J Heart Fail 2002; 4(6):771-777.

(115) Short D, Frischer M, Bashford J, Ashcroft D. Why are eligible patients not prescribed aspirin in primary care? A qualitative study indicating measures for improvement. BMC Fam Pract 2003; 4:9.

(116) Coenen S, Michiels B, Renard D, Denekens J, Van RP. Antibiotic prescribing for acute cough: the effect of perceived patient demand. Br J Gen Pract 2006; 56(524):183-190.

(117) Oswald N, Bateman H. Treating individuals according to evidence: why do primary care practitioners do what they do? J Eval Clin Pract 2000; 6(2):139-148.

(118) Gill PS, Makela M, Vermeulen KM, Freemantle N, Ryan G, Bond C et al. Changing doctor prescribing behaviour. Pharm World Sci 1999; 21(4):158-167.

(119) Thomson O'Brien MA, Oxman AD, Davis DA, Haynes RB, Freemantle N, Harvey EL. Educational outreach visits: effects on professional practice and health care outcomes. Cochrane Database Syst Rev 2000;(2):CD000409.

(120) Thomson O'Brien MA, Oxman AD, Haynes RB, Davis DA, Freemantle N, Harvey EL. Local opinion leaders: effects on professional practice and health care outcomes. Cochrane Database Syst Rev 2000;(2):CD000125.

(121) Grimshaw JM, Eccles MP, Greener J, MacLennan G, Ibbotson T, Kahan JP et al. Is the involvement of opinion leaders in the implementation of research findings a feasible strategy? Implement Sci 2006; 1:3.

(122) Majumdar SR, lipton HL, Soumerai SB. Evaluating and improving physician Prescribing. In: Strom BL, editor. Pharmacoepidemiology. Fourth ed ed. Wiley & Sons Ltd; 2005. 419-438.

(123) Mugford M, Banfield P, O'Hanlon M. Effects of feedback of information on clinical practice: a review. BMJ 1991; 303(6799):398-402.

(124) McGettigan P, Golden J, Fryer J, Chan R, Feely J. Prescribers prefer people: The sources of information used by doctors for prescribing suggest that the medium is more important than the message. Br J Clin Pharmacol 2001; 51(2):184-189.

(125) Schellhase KG, Koepsell TD, Norris TE. Providers' reactions to an automated health maintenance reminder system incorporated into the patient's electronic medical record. J Am Board Fam Pract 2003; 16(4):312-317.

(126) Eccles M, McColl E, Steen N, Rousseau N, Grimshaw J, Parkin D et al. Effect of computerised evidence based guidelines on management of asthma and angina in adults in primary care: cluster randomised controlled trial. BMJ 2002; 325(7370):941.

(127) Lester WT, Grant RW, Barnett GO, Chueh HC. Randomized controlled trial of an informatics-based intervention to increase statin prescription for secondary prevention of coronary disease. J Gen Intern Med 2006; 21(1):22-29.

(128) O'Dowd T, O'Kelly M, O'Kelly F. Structure of General Practice in Ireland 1982-2005. ICGP 2006; www.icgp.ie/library (last accessed 25/01/2007).

(129) Kuperman GJ, Bobb AM, Payne T, Avery AJ, Gandhi TK, Burns G et al. Medication-related Clinical Decision Support in Computerized Provider Order Entry Systems: A Review. J Am Med Inform Assoc 2006.

(130) Lichtman JH, Amatruda J, Yaari S, Cheng S, Smith GL, Mattera JA et al. Clinical trial of an educational intervention to achieve recommended cholesterol levels in patients with coronary artery disease. Am Heart J 2004; 147(3):522-528.

(131) Roumie CL, Elasy TA, Greevy R, Griffin MR, Liu X, Stone WJ et al. Improving blood pressure control through provider education, provider alerts, and patient education: a cluster randomized trial. Ann Intern Med 2006; 145(3):165-175.

(132) Grimshaw J, Eccles M, Tetroe J. Implementing clinical guidelines: current evidence and future implications. J Contin Educ Health Prof 2004; 24 Suppl 1:S31-S37.

(133) Arnold SR, Straus SE. Interventions to improve antibiotic prescribing practices in ambulatory care. Cochrane Database Syst Rev 2005;(4):CD003539.

(134) Mandryk JA, Mackson JM, Horn FE, Wutzke SE, Badcock CA, Hyndman RJ et al. Measuring change in prescription drug utilization in Australia. Pharmacoepidemiol Drug Saf 2006.

(135) Rautakorpi UM, Huikko S, Honkanen P, Klaukka T, Makela M, Palva E et al. The Antimicrobial Treatment Strategies (MIKSTRA) program: a 5-year follow-up of infection-specific antibiotic use in primary health care and the effect of implementation of treatment guidelines. Clin Infect Dis 2006; 42(9):1221-1230.

(136) Samore MH, Bateman K, Alder SC, Hannah E, Donnelly S, Stoddard GJ et al. Clinical decision support and appropriateness

of antimicrobial prescribing: a randomized trial. JAMA 2005; 294(18):2305-2314.

(137) Gonzales R, Corbett KK, Leeman-Castillo BA, Glazner J, Erbacher K, Darr CA et al. The "minimizing antibiotic resistance in Colorado" project: impact of patient education in improving antibiotic use in private office practices. Health Serv Res 2005; 40(1):101-116.

(138) Welschen I, Kuyvenhoven MM, Hoes AW, Verheij TJ. Effectiveness of a multiple intervention to reduce antibiotic prescribing for respiratory tract symptoms in primary care: randomised controlled trial. BMJ 2004; 329(7463):431.

(139) Doyne EO, Alfaro MP, Siegel RM, Atherton HD, Schoettker PJ, Bernier J et al. A randomized controlled trial to change antibiotic prescribing patterns in a community. Arch Pediatr Adolesc Med 2004; 158(6):577-583.

(140) Richards D, Toop L, Graham P. Do clinical practice education groups result in sustained change in GP prescribing? Fam Pract 2003; 20(2):199-206.

(141) Sondergaard J, Andersen M, Stovring H, Kragstrup J. Mailed prescriber feedback in addition to a clinical guideline has no impact: a randomised, controlled trial. Scand J Prim Health Care 2003; 21(1):47-51.

(142) Flottorp S, Oxman AD, Havelsrud K, Treweek S, Herrin J. Cluster randomised controlled trial of tailored interventions to improve the management of urinary tract infections in women and sore throat. BMJ 2002; 325(7360):367.

(143) Hennessy TW, Petersen KM, Bruden D, Parkinson AJ, Hurlburt D, Getty M et al. Changes in antibiotic-prescribing practices and carriage of penicillin-resistant Streptococcus pneumoniae: A controlled intervention trial in rural Alaska. Clin Infect Dis 2002; 34(12):1543-1550.

(144) Belongia EA, Sullivan BJ, Chyou PH, Madagame E, Reed KD, Schwartz B. A community intervention trial to promote judicious antibiotic use and reduce penicillin-resistant Streptococcus pneumoniae carriage in children. Pediatrics 2001; 108(3):575-583.

(145) Ilett KF, Johnson S, Greenhill G, Mullen L, Brockis J, Golledge CL et al. Modification of general practitioner prescribing of antibiotics by use of a therapeutics adviser (academic detailer). Br J Clin Pharmacol 2000; 49(2):168-173.

(146) Roberts SJ, Bateman DN, Smith JM. Prescribing behaviour in general practice: the impact of promoting therapeutically

equivalent cheaper medicines. Br J Gen Pract 1997; 47(414):13-18.

(147) Beilby JJ, Silagy CA. Trials of providing costing information to general practitioners: a systematic review. Med J Aust 1997; 167(2):89-92.

(148) Rodgers S, Avery AJ, Meechan D, Briant S, Geraghty M, Doran K et al. Controlled trial of pharmacist intervention in general practice: the effect on prescribing costs. Br J Gen Pract 1999; 49(446):717-720.

(149) Wadland WC, Farquhar L, Priester F, Oberst K, Weismantel DP. Increasing generic prescribing: a resident educational intervention. Fam Med 2005; 37(4):259-264.

(150) Valles JA, Barreiro M, Cereza G, Ferro JJ, Martinez MJ, Escriba JM et al. A prospective multicenter study of the effect of patient education on acceptability of generic prescribing in general practice. Health Policy 2003; 65(3):269-275.

(151) Walker J, Mathers N. The impact of a general practice group intervention on prescribing costs and patterns. Br J Gen Pract 2002; 52(476):181-186.

(152) Fairhurst K, Huby G. From trial data to practical knowledge: qualitative study of how general practitioners have accessed and used evidence about statin drugs in their management of hypercholesterolaemia. BMJ 1998; 317(7166):1130-1134.

(153) Feely J, Chan R, McManus J, O'Shea B. The influence of hospital-based prescribers on prescribing in general practice. Pharmacoeconomics 1999; 16(2):175-181.

(154) Hobbs F.D.R. What should cardiologists be telling general practitioners/family physicians? European Heart Journal Supplements 2002; 4(F):F54-F59.

(155) Fahey T, Schroeder K, Ebrahim S. Educational and organisational interventions used to improve the management of hypertension in primary care: a systematic review. Br J Gen Pract 2005; 55(520):875-882.

(156) Goff DC, Jr., Gu L, Cantley LK, Sheedy DJ, Cohen SJ. Quality of care for secondary prevention for patients with coronary heart disease: results of the Hastening the Effective Application of Research through Technology (HEART) trial. Am Heart J 2003; 146(6):1045-1051.

(157) Hulscher ME, Wensing M, van der WT, Grol R. Interventions to implement prevention in primary care. Cochrane Database Syst Rev 2001;(1):CD000362.

(158) Weingarten SR, Henning JM, Badamgarav E, Knight K, Hasselblad V, Gano A, Jr. et al. Interventions used in disease management programmes for patients with chronic illness-which ones work? Meta-analysis of published reports. BMJ 2002; 325(7370):925.

(159) Fretheim A, Oxman AD, Havelsrud K, Treweek S, Kristoffersen DT, Bjorndal A. Rational Prescribing in Primary Care (RaPP): A Cluster Randomized Trial of a Tailored Intervention. PLoS Med 2006; 3(6):e134.

(160) Horn FE, Mandryk JA, Mackson JM, Wutzke SE, Weekes LM, Hyndman RJ. Measurement of changes in antihypertensive drug utilisation following primary care educational interventions. Pharmacoepidemiol Drug Saf 2007; 16(3):297-308.

(161) Schuster RJ, Terwoord NA, Tasosa J. Changing physician practice behavior to measure and improve clinical outcomes. Am J Med Qual 2006; 21(6):394-400.

(162) Mitchell E, Sullivan F, Grimshaw JM, Donnan PT, Watt G. Improving management of hypertension in general practice: a randomised controlled trial of feedback derived from electronic patient data. Br J Gen Pract 2005; 55(511):94-101.

(163) Herbert CP, Wright JM, Maclure M, Wakefield J, Dormuth C, Brett-MacLean P et al. Better Prescribing Project: a randomized controlled trial of the impact of case-based educational modules and personal prescribing feedback on prescribing for hypertension in primary care. Fam Pract 2004; 21(5):575-581.

(164) New JP, Mason JM, Freemantle N, Teasdale S, Wong L, Bruce NJ et al. Educational outreach in diabetes to encourage practice nurses to use primary care hypertension and hyperlipidaemia guidelines (EDEN): a randomized controlled trial. Diabet Med 2004; 21(6):599-603.

(165) Ornstein S, Jenkins RG, Nietert PJ, Feifer C, Roylance LF, Nemeth L et al. A multimethod quality improvement intervention to improve preventive cardiovascular care: a cluster randomized trial. Ann Intern Med 2004; 141(7):523-532.

(166) Simon SR, Majumdar SR, Prosser LA, Salem-Schatz S, Warner C, Kleinman K et al. Group versus individual academic detailing to improve the use of antihypertensive medications in primary care: a

cluster-randomized controlled trial. Am J Med 2005; 118(5):521-528.

(167) Baker R, Fraser RC, Stone M, Lambert P, Stevenson K, Shiels C. Randomised controlled trial of the impact of guidelines, prioritized review criteria and feedback on implementation of recommendations for angina and asthma. Br J Gen Pract 2003; 53(489):284-291.

(168) Frijling BD, Lobo CM, Hulscher ME, Akkermans RP, van Drenth BB, Prins A et al. Intensive support to improve clinical decision making in cardiovascular care: a randomised controlled trial in general practice. Qual Saf Health Care 2003; 12(3):181-187.

(169) Langham J, Tucker H, Sloan D, Pettifer J, Thom S, Hemingway H. Secondary prevention of cardiovascular disease: a randomised trial of training in information management, evidence-based medicine, both or neither: the PIER trial. Br J Gen Pract 2002; 52(483):818-824.

(170) Shaw B, Cheater F, Baker R, Gillies C, Hearnshaw H, Flottorp S et al. Tailored interventions to overcome identified barriers to change: effects on professional practice and health care outcomes. Cochrane Database Syst Rev 2005;(3):CD005470.

(171) Simon SR, Rodriguez HP, Majumdar SR, Kleinman K, Warner C, Salem-Schatz S et al. Economic analysis of a randomized trial of academic detailing interventions to improve use of antihypertensive medications. J Clin Hypertens (Greenwich) 2007; 9(1):15-20.

(172) Fretheim A, Aaserud M, Oxman AD. Rational Prescribing in Primary Care (RaPP): Economic Evaluation of an Intervention to Improve Professional Practice. PLoS Med 2006; 3(6):e216.

(173) Freemantle N, Eastaugh J. Using effectiveness studies for prescribing research, part 1. J Clin Pharm Ther 2002; 27(5):383-389.

(174) Strom B. Study designs available for pharmacoepidemiology studies. In: Strom B, Kimmel S, editors. Textbook of pharmacoepidemiology. Wiley; 2006. 13-23.

(175) Campbell MK, Thomson S, Ramsay CR, MacLennan GS, Grimshaw JM. Sample size calculator for cluster randomized trials. Comput Biol Med 2004; 34(2):113-125.

(176) WHO. Anatomical therapeutic chemical (ATC) classification index with defined daily doses (DDDs). WHO 2001; www.who.int/medicines/ (last accessed 08/07/2007).

(177) Veninga CC, Denig P, Zwaagstra R, Haaijer-Ruskamp FM. Improving drug treatment in general practice. J Clin Epidemiol 2000; 53(7):762-772.

(178) Ferguson JJ. Producing prescribing feedback on a national scale-techniques, problems and potential. In: Mc Gavock H, editor. Handbook of drug use research methodolgy. 1st ed. UK Drug Utilisation Research Group; 2001. 113-133.

(179) Soumerai SB, Avorn J. Principles of educational outreach ('academic detailing') to improve clinical decision making. JAMA 1990; 263(4):549-556.

(180) Watkins C, Timm A, Gooberman-Hill R, Harvey I, Haines A, Donovan J. Factors affecting feasibility and acceptability of a practice-based educational intervention to support evidence-based prescribing: a qualitative study. Fam Pract 2004; 21(6):661-669.

(181) Livermore DM. Minimising antibiotic resistance. Lancet Infect Dis 2005; 5(7):450-459.

(182) Paskovaty A, Pflomm JM, Myke N, Seo SK. A multidisciplinary approach to antimicrobial stewardship: evolution into the 21st century. Int J Antimicrob Agents 2005; 25(1):1-10.

(183) WHO. Global strategy for containment of antimicrobial resistance. WHO 2001; www.who.int/drugresistance (last accessed 01/02/2007).

(184) Fishman N. Antimicrobial stewardship. Am J Infect Control 2006; 34(5 Suppl 1):S55-S63.

(185) Wilton P, Smith R, Coast J, Millar M. Strategies to contain the emergence of antimicrobial resistance: a systematic review of effectiveness and cost-effectiveness. J Health Serv Res Policy 2002; 7(2):111-117.

(186) Murchan S, Cunney R. Rise in antimicrobial resistance in invasive isolates of Escherichia coli and Enterococcus faecium in Ireland. Euro Surveill 2006; 11(4):E060413.

(187) Clarke P, Murchan S, Smyth EG, Humphreys H. Antimicrobial susceptibility of invasive isolates of Streptococcus pneumoniae in Ireland. Clin Microbiol Infect 2004; 10(7):657-659.

(188) Ferech M, Coenen S, Malhotra-Kumar S, Dvorakova K, Hendrickx E, Suetens C et al. European Surveillance of Antimicrobial Consumption (ESAC): outpatient antibiotic use in Europe. J Antimicrob Chemother 2006; 58(2):401-407.

(189) National Centre for Pharmacoeconomics. National antibiotic consumption on the GMS scheme. www ncpe ie (accessed 14/12/2006) 2003.

(190) SARI. Strategy for the control of antimicrobial resistance in Ireland. National Disease Surveillance Centre 2006; www.ndsc.ie (last accessed 06/11/2006).

(191) McNulty CA. Optimising antibiotic prescribing in primary care. Int J Antimicrob Agents 2001; 18(4):329-333.

(192) Wagner AK, Soumerai SB, Zhang F, Ross-Degnan D. Segmented regression analysis of interrupted time series studies in medication use research. J Clin Pharm Ther 2002; 27(4):299-309.

(193) Feldstein AC, Smith DH, Perrin N, Yang X, Simon SR, Krall M et al. Reducing warfarin medication interactions: an interrupted time series evaluation. Arch Intern Med 2006; 166(9):1009-1015.

(194) Zwar N, Henderson J, Britt H, McGeechan K, Yeo G. Influencing antibiotic prescribing by prescriber feedback and management guidelines: a 5-year follow-up. Fam Pract 2002; 19(1):12-17.

(195) Sbarbaro JA. Can we influence prescribing patterns? Clin Infect Dis 2001; 33 Suppl 3:S240-S244.

(196) Kiefe CI, Allison JJ, Williams OD, Person SD, Weaver MT, Weissman NW. Improving quality improvement using achievable benchmarks for physician feedback: a randomized controlled trial. JAMA 2001; 285(22):2871-2879.

(197) Rasmussen HM, Sondergaard J, Kampmann JP, Andersen M. General practitioners prefer prescribing indicators based on detailed information on individual patients: a Delphi study. Eur J Clin Pharmacol 2005; 61(3):237-241.

(198) Dollman WB, Leblanc VT, Stevens L, O'connor PJ, Turnidge JD. A community-based intervention to reduce antibiotic use for upper respiratory tract infections in regional South Australia. Med J Aust 2005; 182(12):617-620.

(199) Perz JF, Craig AS, Coffey CS, Jorgensen DM, Mitchel E, Hall S et al. Changes in antibiotic prescribing for children after a community-wide campaign. JAMA 2002; 287(23):3103-3109.

(200) Steinman MA, Landefeld CS, Gonzales R. Predictors of broad-spectrum antibiotic prescribing for acute respiratory tract infections in adult primary care. JAMA 2003; 289(6):719-725.

(201) Williams D, Teljeur C, Bennett K, Kelly A, Feely J. Influence of material deprivation on prescribing patterns within a deprived population. Eur J Clin Pharmacol 2003; 59(7):559-563.

(202) van Duijn HJ, Kuyvenhoven MM, Schellevis FG, Verheij TJ. Determinants of prescribing of second-choice antibiotics for upper and lower respiratory tract episodes in Dutch general practice. J Antimicrob Chemother 2005; 56(2):420-422.

(203) Wilson RP, Hatcher J, Barton S, Walley T. The association of some practice characteristics with antibiotic prescribing. Pharmacoepidemiol Drug Saf 1999; 8(1):15-21.

(204) DeSouza V, MacFarlane A, Murphy AW, Hanahoe B, Barber A, Cormican M. A qualitative study of factors influencing antimicrobial prescribing by non-consultant hospital doctors. J Antimicrob Chemother 2006; 58(4):840-843.

(205) Metlay JP, Shea JA, Crossette LB, Asch DA. Tensions in antibiotic prescribing: pitting social concerns against the interests of individual patients. J Gen Intern Med 2002; 17(2):87-94.

(206) Gonzales R, Steiner JF, Lum A, Barrett PH, Jr. Decreasing antibiotic use in ambulatory practice: impact of a multidimensional intervention on the treatment of uncomplicated acute bronchitis in adults. JAMA 1999; 281(16):1512-1519.

(207) Bjerrum L, Cots JM, Llor C, Molist N, Munck A. Effect of intervention promoting a reduction in antibiotic prescribing by improvement of diagnostic procedures: a prospective, before and after study in general practice. Eur J Clin Pharmacol 2006; 62(11):913-918.

(208) Narine L, Persaud DD. Gaining and maintaining commitment to large-scale change in healthcare organizations. Health Serv Manage Res 2003; 16(3):179-187.

(209) Hall L, Eccles M, Barton R, Steen N, Campbell M. Is untargeted outreach visiting in primary care effective? A pragmatic randomized controlled trial. J Public Health Med 2001; 23(2):109-113.

(210) O'Connell DL, Henry D, Tomlins R. Randomised controlled trial of effect of feedback on general practitioners' prescribing in Australia. BMJ 1999; 318(7182):507-511.

(211) Haas JS, Phillips KA, Gerstenberger EP, Seger AC. Potential savings from substituting generic drugs for brand-name drugs: medical expenditure panel survey, 1997-2000. Ann Intern Med 2005; 142(11):891-897.

(212) Ashworth M, Golding S, Majeed A. Prescribing indicators and their use by primary care groups to influence prescribing. J Clin Pharm Ther 2002; 27(3):197-204.

(213) Magazzini L, Pammolli F, Riccaboni M. Dynamic competition in pharmaceuticals. Patent expiry, generic penetration, and industry structure. Eur J Health Econ 2004; 5(2):175-182.

(214) Mrazek MF, Mossialos E. Increasing demand while decreasing costs of generic medicines. Lancet 2000; 356(9244):1784-1785.

(215) Barry M, Tilson L, Ryan M. Pricing and reimbursement of drugs in Ireland. Eur J Health Econ 2004; 5(2):190-194.

(216) Department of Health and Children. Agreement between the Irish Pharmaceutical Healthcare Association Ltd and the HSE. DOHC 2006; www.dohc.ie/puplications (last accessed 03/03/2007).

(217) Department of Health and Children. Agreement between the Association of Pharmaceutical Manufactures of Ireland and HSE. DOHC 2006; www.dohc.ie/publications (last accessed 03/03/2007).

(218) Tilson L, McGowan B, Ryan M, Barry M. Generic drug utilisation on the General Medical Services (GMS) scheme in 2001. Ir Med J 2003; 96(6):176-179.

(219) McCormack PM, Feely J. The impact of hospitalisation on prescribing costs for medical patients returning to the community. Ir Med J 1997; 90(3):99-100.

(220) McGettigan P, Golden J, Fryer J, Chan R, Feely J. Prescribers prefer people: The sources of information used by doctors for prescribing suggest that the medium is more important than the message. Br J Clin Pharmacol 2001; 51(2):184-189.

(221) Okechukwu I, Bennett K, Feely J. General practitioners' ranking of evidence-based prescribing quality indicators: a comparative study with a prescription database. Br J Clin Pharmacol 2006; 62(2):218-224.

(222) McGettigan P, McManus J, O'Shea B, Chan R, Feely J. Low rate of generic prescribing in the Republic of Ireland compared to England and Northern Ireland: prescribers' concerns. Ir Med J 1997; 90(4):146-147.

(223) Andersson K, Bergstrom G, Petzold MG, Carlsten A. Impact of a generic substitution reform on patients' and society's expenditure for pharmaceuticals. Health Policy 2007; 81(2-3):376-384.

(224) Beney J, Bero LA, Bond C. Expanding the roles of outpatient pharmacists: effects on health services utilisation, costs, and patient outcomes. Cochrane Database Syst Rev 2000;(3):CD000336.

(225) Duerden M, Gogna N, Godman B, Eden K, Mallinson M, Sullivan N. Current national initiatives and policies to control drug costs in Europe: UK perspective. J Ambul Care Manage 2004; 27(2):132-138.

(226) Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. Lancet 2006; 367(9524):1747-1757.

(227) Unal B, Critchley JA, Capewell S. Explaining the decline in coronary heart disease mortality in England and Wales between 1981 and 2000. Circulation 2004; 109(9):1101-1107.

(228) WHO. International comparisons CHD death rates in 2000. WHO 2004; www.who.ch (last accessed March 2007).

(229) Central Statistics Office. Deaths from principle causes registered 1998 to 2005. CSO 2007; www.cso.ie (last accessed 05/03/2007).

(230) Bennett K, Kabir Z, Unal B, Shelley E, Critchley J, Perry I et al. Explaining the recent decrease in coronary heart disease mortality rates in Ireland, 1985-2000. J Epidemiol Community Health 2006; 60(4):322-327.

(231) Majumdar SR, McAlister FA, Furberg CD. From knowledge to practice in chronic cardiovascular disease: a long and winding road. J Am Coll Cardiol 2004; 43(10):1738-1742.

(232) Kabir Z, Bennett K, Shelley E, Unal B, Critchley J, Feely J et al. The population mortality benefits of maximizing the number of eligible patients receiving appropriate cardiology treatments in Ireland. QJM 2006; 99(8):523-530.

(233) National Heartwatch Programme. Heartwatch Clinical Report, March 2003-December 2005. ICGP 2006; www.icgp.ie/library (last accessed 02/07/2007).

(234) Gray J, Majeed A, Kerry S, Rowlands G. Identifying patients with ischaemic heart disease in general practice: cross sectional study of paper and computerised medical records. BMJ 2000; 321(7260):548-550.

(235) Renders CM, Valk GD, Griffin S, Wagner EH, Eijk JT, Assendelft WJ. Interventions to improve the management of diabetes mellitus

in primary care, outpatient and community settings. Cochrane Database Syst Rev 2001;(1):CD001481.

(236) Feely J. The therapeutic gap--compliance with medication and guidelines. Atherosclerosis 1999; 147 Suppl 1:S31-S37.

(237) Kasje WN, Denig P, Stewart RE, de Graeff PA, Haaijer-Ruskamp FM. An educational programme for peer review groups to improve treatment of chronic heart failure and diabetes mellitus type 2 in general practice. J Eval Clin Pract 2006; 12(6):613-621.

(238) Eagle KA, Kline-Rogers E, Goodman SG, Gurfinkel EP, Avezum A, Flather MD et al. Adherence to evidence-based therapies after discharge for acute coronary syndromes: an ongoing prospective, observational study. Am J Med 2004; 117(2):73-81.

(239) Kedward J, Dakin L. A qualitative study of barriers to the use of statins and the implementation of coronary heart disease prevention in primary care. Br J Gen Pract 2003; 53(494):684-689.

(240) Rosenthal MB, Landon BE, Normand SL, Frank RG, Epstein AM. Pay for performance in commercial HMOs. N Engl J Med 2006; 355(18):1895-1902.

(241) Fretheim A, Oxman AD, Flottorp S. Improving prescribing of antihypertensive and cholesterol-lowering drugs: a method for identifying and addressing barriers to change. BMC Health Serv Res 2004; 4(1):23.

(242) Smith S, Bury G, O'Leary M, Shannon W, Tynan A, Staines A et al. The North Dublin randomized controlled trial of structured diabetes shared care. Fam Pract 2004; 21(1):39-45.

(243) Heart Health Task Force. Irelands Changing Heart, second report on implementation of the Cardiovascular Health Strategy. www gov ie/publications asp 2003; (last accessed 01/06/2007).

(244) Wettermark B, Bergman U, Krakau I. Using aggregate data on dispensed drugs to evaluate the quality of prescribing in urban primary health care in Sweden. Public Health 2006; 120(5):451-461.

(245) Pope C, Ziebland S, Mays N. Analysing qualitative data. In: Pope C, Mays N, editors. Qualitative research in health care. Third ed. London: Blackwell publishing; 2006. 63-79.

(246) Nazareth I, Freemantle N, Duggan C, Mason J, Haines A. Evaluation of a complex intervention for changing professional behaviour: the Evidence Based Out Reach (EBOR) Trial. J Health Serv Res Policy 2002; 7(4):230-238.

(247) Midlov P, Bondesson A, Eriksson T, Nerbrand C, Hoglund P. Effects of educational outreach visits on prescribing of benzodiazepines and antipsychotic drugs to elderly patients in primary health care in southern Sweden. Fam Pract 2006; 23(1):60-64.

(248) Habraken H, Janssens I, Soenen K, van DM, Lannoy J, Bogaert M. Pilot study on the feasibility and acceptability of academic detailing in general practice. Eur J Clin Pharmacol 2003; 59(3):253-260.

(249) Sondergaard J, Andersen M, Vach K, Kragstrup J, Maclure M, Gram LF. Detailed postal feedback about prescribing to asthma patients combined with a guideline statement showed no impact: a randomised controlled trial. Eur J Clin Pharmacol 2002; 58(2):127-132.

(250) Drummond M, Sculpher M, Torrance G, 0'Brien B, stoddart G. Basic types of economic evaluation. Methods for the Economic Evaluation of Health Care Programmes. Third ed. Oxford: Oxford University Press; 2005. 7-26.

(251) Grimshaw J, Eccles M, Thomas R, MacLennan G, Ramsay C, Fraser C et al. Toward evidence-based quality improvement. Evidence (and its limitations) of the effectiveness of guideline dissemination and implementation strategies 1966-1998. J Gen Intern Med 2006; 21 Suppl 2:S14-S20.

(252) Sculpher M. Evaluating the cost-effectiveness of interventions designed to increase the utilization of evidence-based guidelines. Fam Pract 2000; 17 Suppl 1:S26-S31.

(253) Fretheim A, Aaserud M, Oxman AD. Rational prescribing in primary care (RaPP): economic evaluation of an intervention to improve professional practice. PLoS Med 2006; 3(6):e216.

(254) Cockburn J, Ruth D, Silagy C, Dobbin M, Reid Y, Scollo M et al. Randomised trial of three approaches for marketing smoking cessation programmes to Australian general practitioners. BMJ 1992; 304(6828):691-694.

(255) Hogg W, Baskerville N, Lemelin J. Cost savings associated with improving appropriate and reducing inappropriate preventive care: cost-consequences analysis. BMC Health Serv Res 2005; 5(1):20.

(256) Wright J, Bibby J, Eastham J, Harrison S, McGeorge M, Patterson C et al. Multifaceted implementation of stroke prevention guidelines in primary care: cluster-randomised evaluation of

clinical and cost effectiveness. Qual Saf Health Care 2007; 16(1):51-59.

(257) Gandjour A, Lauterbach KW. How much does it cost to change the behavior of health professionals? A mathematical model and an application to academic detailing. Med Decis Making 2005; 25(3):341-347.

(258) Mason J, Freemantle N, Nazareth I, Eccles M, Haines A, Drummond M. When is it cost-effective to change the behavior of health professionals? JAMA 2001; 286(23):2988-2992.

(259) Walker S, Palmer S, Sculpher M. The role of NICE technology appraisal in NHS rationing. Br Med Bull 2007.

(260) Department of Health and Children. Primary Care, a new direction, Quality and Fairness Health strategy. DOHC 2001; www.doh.ie/publications (last accessed 09/05/2007).

(261) Mason A, Towse A, Drummond M, Cooke J. Influencing prescribing in a primary care led NHS. Office of Health Economics 2002; London www.ohe.org (last accessed 02/04/2007).

(262) Lanier DC, Roland M, Burstin H, Knottnerus JA. Doctor performance and public accountability. Lancet 2003; 362(9393):1404-1408.

Appendix one

Antibiotic and generic prescribing

Postal bulletin & Academic detailing powerpoint slides

DEPARTMENTS OF PHARMACOLOGY AND
THERAPEUTICS & PUBLIC HEALTH AND PRIMARY CARE

Rational GP Prescribing Study

Quality Prescribing indicators

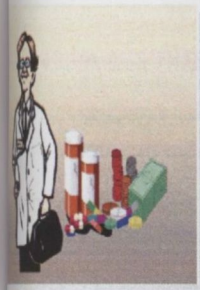
Dr. Num:

A quality prescribing indicator is a measurable element of practice performance for which there is evidence or consensus that it can be used to assess quality and hence change in quality of care provided.[1]

Quality indicators used in this bulletin include
- **Generic prescribing**
- **Antibiotic prescribing**

All prescribing data relates to the GMS database from Nov2003 to Oct 2004.

Generic prescribing



Generic Drugs are drugs whose original patent has expired and they can be manufactured by other companies. For the purpose of this bulletin 'generics' describes both pure and branded generics. Generic prescriptions on the GMS scheme in 2003 in Ireland accounted for 19% (branded generics 15%, non-branded 4%) of all prescriptions. Compared to other European countries, such as the UK with a rate of 69% in 2000, Ireland has a low rate of generic prescribing. Generic prescribing could be increased by as much as 21% on the GMS scheme alone if proprietary preparations were substituted for their generic equivelant.[2]

Why use generic drugs?

The primary motivation behind generic prescribing is cost containment within the healthcare system without any alteration to the quality of care.For the GMS scheme in 2003 there was the potential to save approximately **€12.7 million on the drug budget** if the cheapest generic equivalent was substituted for the branded product for the top 30 most frequently prescribed drugs[3].

Are they safe?

Generic products will only be awarded a product licence if they are proven to be bio-equivalent to the brand leader. They are subject to the same regulatory requirements, which are the same throughout the European union.

Can you always substitute generics for the branded product?

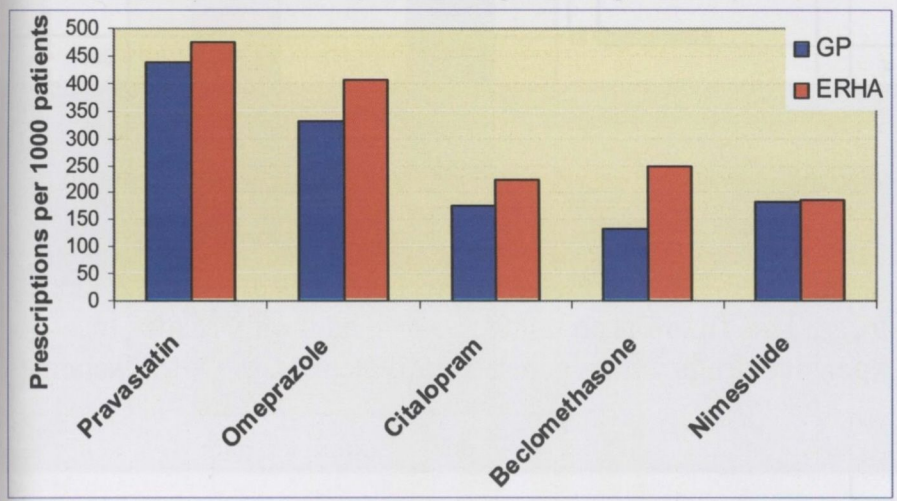
Exercise caution with modified–release, combination products and drugs with narrow therapeutic range.

For the following drugs it is recommended that the same products (either branded or non-branded) be consistently used e.g. carbamazepine, phenytoin, theophylline, cyclosporin, lithium.

All modified release preparations e.g. nifidipine and diltiazem should be prescribed by their brand name due to the difficulty formulating such drugs.[4]

Five of the most expensive branded drugs with a generic equivalent on the GMS list:

Fig 1: A comparison of your individual (GP) and ERHA total prescribing rates for 5 of the most expensive drugs with a generic equivalent.



- The drugs in this graph have the greatest potential for increasing the level of generic prescribing.
- These are among the most frequently prescribed and costly of the proprietary drugs with a generic equivalent.
- You prescribe less of these drugs compared to the ERHA average.

Generic prescribing continued:

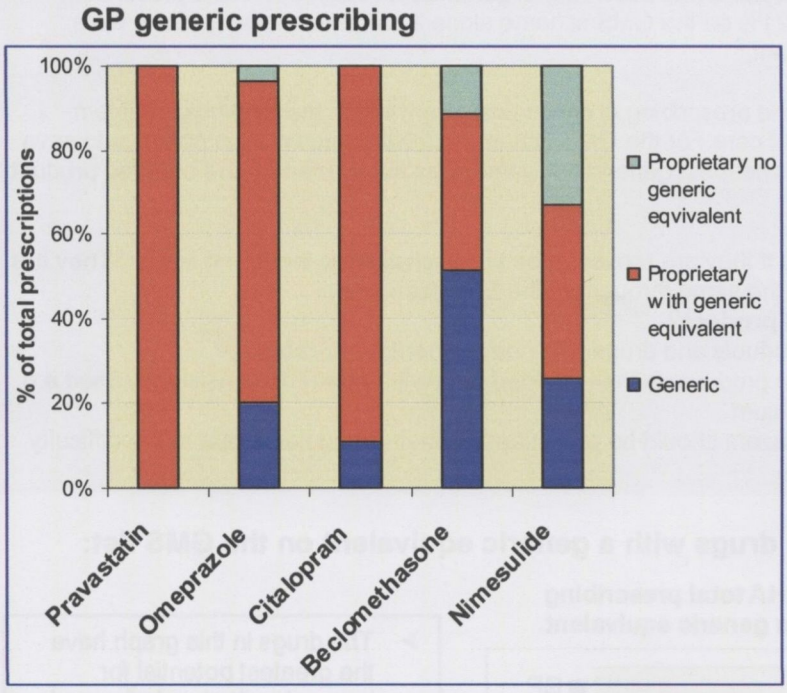
Table 1: Potential cost savings by substitution of the cheapest generic equivalent.

This table reflects your individual prescribing costs for the top 5 most expensive drugs with a generic equivalent and the potential savings to your prescribing if the cheapest generic was substituted.

Proprietary Drugs with generic equivalent	Cost of your prescribing for Nov 2003-Oct 2004 €	Cheapest generic available (unit cost €)		Potential savings if cheapest generic used €	Potential savings as a % of the total actual cost %
Pravastatin	14,334	Pravatin Pravamel Pravamel	10mg = 0.65 20mg = 1.25 40mg = 1.56	2,758	8.5
Omeprazole	10,377	Losepine Lopraz	10mg = 0.68 20mg = 1.03	3,266	10.0
Citalopram	4,015	Cipramil Citrol	10mg = 0.49 20mg = 0.73	929	2.8
Beclomethasone inhalers	2,231	Beclazone Beclazone Beclazone	250mcg = 10.7 100mcg = 12.2 50mcg =6.25	840	2.6
Nimesulide	1,633	Mesulid	100mg = 0.35	135	0.4
Total cost for 2003 -2004	32,590	Potential cost saving for your practice		7,928	24.3

Is there Scope to increase your current level of generic prescribing?

Fig 2: A Breakdown of your generic prescribing of the 5 most expensive drugs by preparation classification
(generic, proprietary with generic equivalent, proprietary version of the drug with no generic equivalent).



- In general there is a low level of generic prescribing.
- You prescribe more generics for older drugs such as beclomethasone, but the cheapest alternative is not always used.
- The generic equivalent for pravastatin was only introduced in August 2004 so it is not expected to be reflected here.
- An increase in generic prescribing can help control your drug budget cost thus helping to keep within or below budget, such savings can be recouped for your practice through the Indicative Drugs Saving Scheme.

- There is the potential to increase generic prescribing in your practice.
- The greatest saving would be realised if you increased generic prescribing for pravastatin, omeprazole and beclomethasone.
- You have the potential to save nearly € 8,000 over 1 year if the cheapest generic equivalent was substituted for the above drugs. This figure is an underestimate as it only relates to patients receiving the 5 most expensive drugs with a generic equivalent on the GMS scheme.

Antibiotic prescribing



- Antibiotic consumption in Ireland has increased by 13.4 % over the last 3 years[5].
- It is estimated that 50% of antibiotics prescribed maybe unnecessary[6]
- In 2002 a European surveillance antimicrobial consumption study (EASC) placed Ireland in the medium range of usage. France had the highest and the Netherlands the lowest use of antibiotics.
- In Ireland there is predominant use of penicillin/beta-lactamase combinations, other broad spectrum penicillins and 2nd generation cephalosporins.
- This pattern of antibiotics prescribing is associated with higher levels of resistance. [7]

- Penicillin resistant Streptococcus Pneumonia (PRSP) is the most common community antimicrobial problem, but in 2003 - 2004 only 11% of Strep. pneumoniae had true penicillin resistance

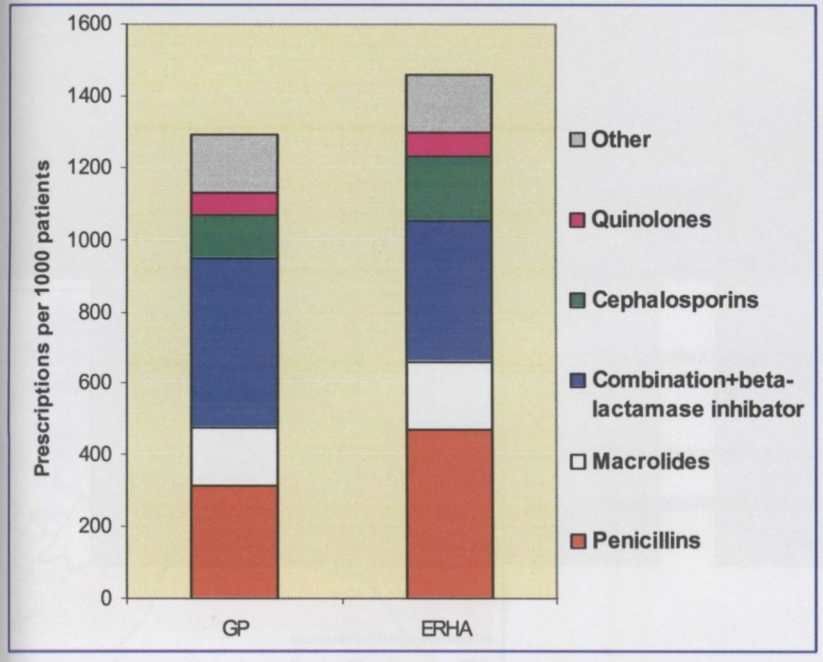
- A comparison of antimicrobial susceptibility of lower respiratory tract pathogen between the UK and Ireland concluded that susceptibility to most antimicrobials including penicillin remains high in Ireland but is lower than in the UK[8].

What are the markers of good practice or quality prescribing for antibiotics?

- **A low rate of overall antibiotic prescribing** – only use when necessary.
- **Avoid new generation antibiotics -** Second & third generation Cephalosporins e.g. cefaclor, cefprozil, cefuroxime axetil, cefixime, cefpodoxime
  New Macrolides – Telithromycin
  Quinolone e.g. Ofloxacin, ciprofloxacin
  Reasons: *Safety and efficacy*: Less well established in a community population compared to older compounds.
  Resistance: Wide spread use will shorten the time until resistance develops
  Cost: They are considerably more expensive than older antibiotics with an unproven record of superior benefit in situations where the organism causing the infection is unknown.
- **A high rate of prescribing of first line treatment antibiotics i.e. narrow and broad spectrum penicillins (penicillin, amoxicillin erythromycin/clarithromycin) compared to second line antibiotics i.e. combination antibiotics (co-amoxiclav), second/third generation cephalosporins or quinolones**

What is your pattern of antibiotic prescribing?

Fig 3: A Comparison of your antibiotic prescribing compared to the ERHA



- Your overall rate of antibiotic prescribing is lower than the ERHA average.
- Your preference is for second line antibiotics i.e. combination antibiotics (co-amoxiclav), cephalosporins and quinolones.
- Your prescribing rate for combination antibiotics is nearly 1.5 times that of the ERHA average.
- You prescribe comparatively less first line antibiotics i.e. penicillins and macrolides (erythromycin) than the ERHA.
- Current recommendations are to reduce the overall rate of antibiotic prescribing.
- Second line antibiotics should only be used if there is failure of first line antibiotics or known resistance.

Antibiotic prescribing cont'd

What are the current recommendations?

There are no national antibiotic prescribing guidelines for Ireland. The working group on the 'Strategy for the control of antimicrobial resistance in Ireland' (SARI) are expected to produce community antibiotic guidelines in the next few months

This information is based on UK antibiotic prescribing guidelines.[6] and in liaison with SARI

The majority of antibiotics are prescribed for respiratory conditions and otitis media

- Simple coughs & colds -No antibiotics
- Viral sore throats - No antibiotics > If group Aβ haemolytic streptococcus suspected (3 out of the 4 following symptoms history of fever, tonsillar exudates, no cough, tender anterior cervical lympdadenopathy) – phenoxymethylpenicillin is recommended.
- Acute bronchitis - antibiotics have minimal effect, cough & sputum production reduced by half a day .If antibiotic deemed necessary penicillin 500mg is recommended (low dose more likely to select out resistance)
- Those with persistent cough should be tested for pertussis
- Acute exacerbation of COPD/bronchitis – if history of increase in purulent sputum – Amoxicillin is first choice
- Co-amoxiclav reserved for clinical failure of first line antibiotics.
- Suspected pneumonia – pulse>100/min, respiratory rate>24 breaths /min, temp>38^{O}C, focal consolidation on chest examination, high index of suspicion in elderly and chronic lung disease patients
  Sputum specimen should be obtained in suspected cases
  Antibiotics treatment depends on severity of pneumonia infection. Mild: - Amoxicillin, or co-amoxiclav or macrolide e.g. clarithromycin. Moderate:- Quinolone e.g. moxifloxacin. Severe:- Hospitalisation for intravenous antibiotic treatment.

Otitis Media 85% of cases will resolve spontaneously. Cochrane meta-analysis estimated that between 7-20 children will need antibiotics to achieve a benefit in one child [9].

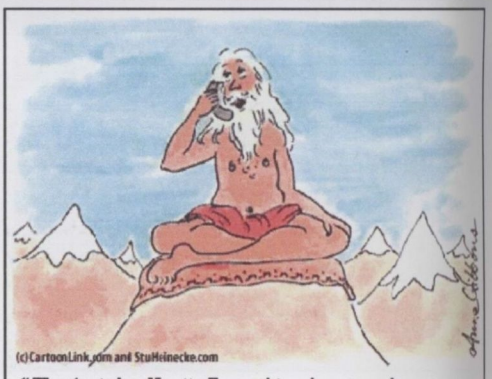
Acute Otitis Media(AOM), diagnosis if : (a)recent abrupt onset of symptoms, (b) middle ear effusion, (c) middle ear inflammation, distinguish from otitis media with effusion.

- Children>6 mths: Supportive treatment with analgesia & 'watchful waiting' approach.
- If symptoms>2/3 days or severe – amoxicillin 80-90mg/kg/day BID/TID, for 5 days if >2 years. For 10 days if <2 years complications. Waiting not recommended in children <6 months.
- Second line treatment e.g. co-amoxiclav is reserved for those particularly ill or failure of first line therapy.

Overall Summary

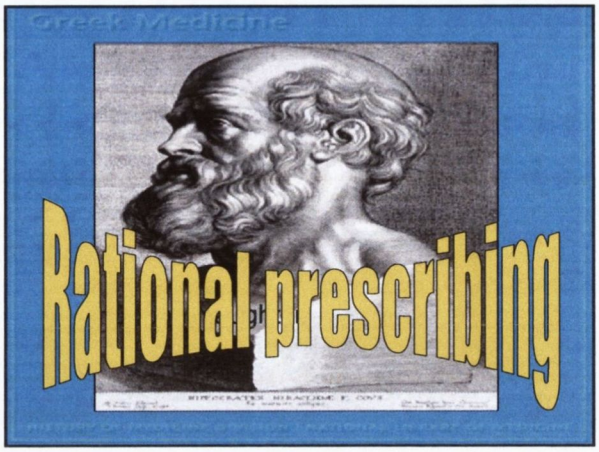
- **There is the potential to save at least €7,928 per year if prescribing for the five most expensive drugs with a generic equivalent was increased, especially pravastatin, omeprazole and beclometasone inhalers.**
- **Reduce antibiotic prescribing further.**
- **Avoid new generation antibiotics.**
- **Use penicillin or a macrolide antibiotic as first line treatment.**
- **Co-amoxiclav, second / third generation or quinolones should be reserved for cases of know antibiotic resistance or failure of first line treatment.**

1. WHO A conceptual framework for constructing prescribing quality indicators:2004 @euro.who.int
2. Tilson L Eur J Health Econ 2004, www.ncpe.ie
3. TilsonL Ir Med J 2003 96(6):176-179
4. Generic prescribing. 6 number 3. 2000 www.stjames.ie/clinicalinformation/nmic
5. Antibiotic Consumption on the GMS Scheme www.ncpe.ie
6. Compass Therapeutic notes-infection part1 2004 www.centralserviceagency.n-i.nhs.uk
7. Cunney Epi-insight 2004 vol5 (4) www.ndsc.ie
8. Reynolds J antimicrobial chemotherapy 2003 52 931-943
9. Cunney R Irish Medical News Dec 2004



"That's right, Kenji. Everything happens for a reason, but no one has a clue what it is!"

Antibiotic & generic drug powerpoint presentation



Rational Prescribing

Use of pharmaceuticals in such as a manner that the outcomes of therapy, both clinical & economic, are optimal given the present state of knowledge

Background

- Prescribing of medicine commonest intervention

Background

- Prescribing of medicine commonest intervention
- 3.1% of hospital admissions due to drug-related adverse effects

Background

- Prescribing of medicine commonest intervention
- 3.1% of hospital admissions due to drug-related adverse effects
- Rising cost of community drug budgets

Background

- Prescribing of medicine commonest intervention
- 3.1% of hospital admissions due to drug-related adverse effects
- Rising cost of community drug budgets
- 2002 GMS drug payments €550.89 million (Tilson I 2002)

Background

- Prescribing of medicine commonest intervention
- 3.1% of hospital admissions due to drug-related adverse effects
- Rising cost of community drug budgets
- 2002 GMS drug payments €550.89 million (Tilson I 2002)
- Inappropriate prescribing for chronic conditions, e.g. CVS, diabetes, GI symptoms

Background

- Prescribing of medicine commonest intervention
- 3.1% of hospital admissions due to drug-related adverse effects
- Rising cost of community drug budgets
- 2002 GMS drug payments €550.89 million (Tilson I 2002)
- Inappropriate prescribing for chronic conditions, e.g. CVS, diabetes, GI symptoms
- Nearly 50 % under prescribing of statins in at risk groups (Teeling 2005)

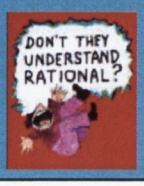
Background

- Prescribing of medicine commonest intervention
- 3.1% of hospital admissions due to drug-related adverse effects
- Rising cost of community drug budgets
- 2002 GMS drug payments €550.89 million (Tilson I 2002)
- Inappropriate prescribing for chronic conditions, e.g. CVS, diabetes, GI symptoms
- Nearly 50 % under prescribing of statins in at risk groups (Teeling 2005)
- Increasing resistance to antimicrobial therapy

Rational prescribing indicators

Quality prescribing indicators:

- Measurable element of practice
- Evidence & consensus
- Detect quality & change



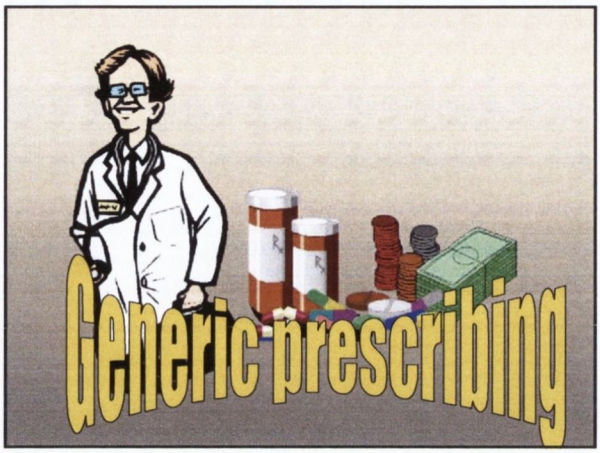
Quality prescribing indicator survey

1 st	A high rate of corticosteriods prescribing to bronchodilators in moderate to severe asthma
2nd	A high rate of statin prescribing in patients on aspirin and a nitrate
3rd	Low rate of benzodiazepine prescribing for prolonged periods

Quality indicators used

- Generic prescribing —— • Cost conscious prescribing (ranked 4th in survey)
- Antibiotic prescribing —— • International consensus to reduce & control antibiotic use (ranked 8th in survey)

External Validity: Internationally used markers of quality/ rational prescribing



what is it about





- 17% increase in Drugs budget in 2003
- 19% generic prescribing in Ireland,
  - only 4% pure generics
  - low compared to most other EU countries e.g. UK 69% pure generic prescribing
- 21 % potential to increase generic prescribing on GMS
- **Potential Cost saving € 12.7 million in 2003 on the GMS scheme alone** (Tilson 2003 data)

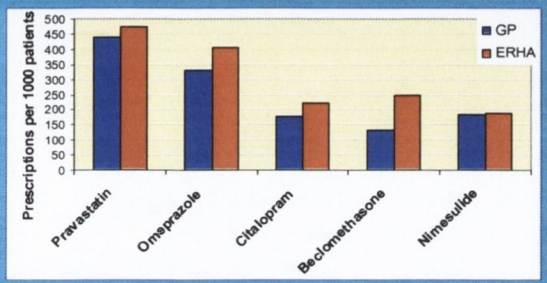
Our Aim

- To promote generic prescribing

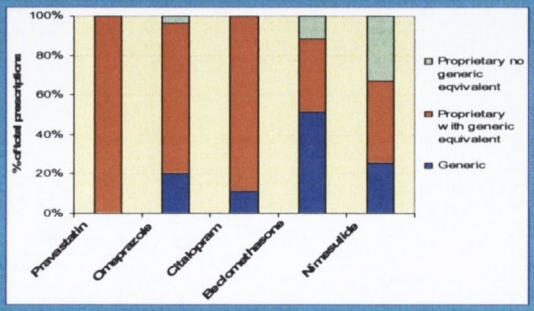
How

- Targeting top 5 most expensive proprietary drug with a generic equivalent
- Increase awareness of the generic options
- All data based on GMS data from Nov 2003 – Oct 2004

Prescribing of most expensive proprietary drugs with a generic equivalent



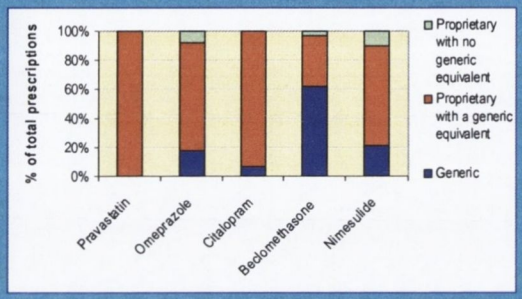
GP proportion of generic prescribing



There is a low level of generic prescribing

You prescribe more generics for the older drugs e.g. beclomethesone.

ERHA proportion of generic prescribing



Potential cost saving

Proprietary drug with generic equiv	Actual cost €	Cheapest generic	Saving if generic used €	% of actual total cost
Pravastatin	14,334	Pravatin	2,758	8.5
Omeprazole	10,377	Lopraz	3,266	10.0
Citalopram	4,015	Citrol Citramil	929	2.8
Beclomethasone inhalers	2,231	Beclazone 250 Beclazone easi breth	840	2.6
Nimesulide	1,633	Mesulide	135	0.4
Total cost	32,590	Potential savings	7,928	24.3

Summary

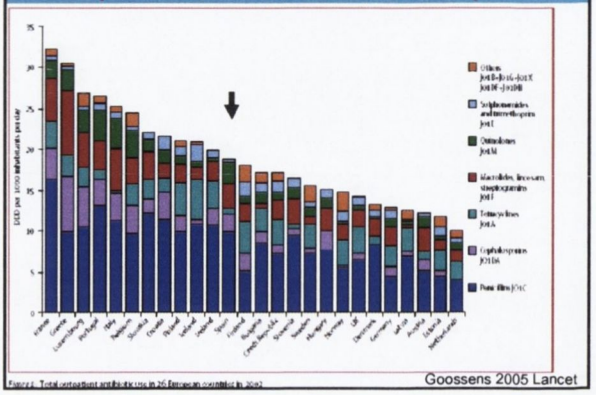
- There is the potential to increase generic prescribing
- The greatest savings would be realised if you increased generic prescribing for pravastatin, omeprazole and beclomethasone inhalers
- You have the potential to save € 7,928 if the cheapest generic equivalent was substituted for the top 5 most expensive drugs



Antibiotic prescribing

- Antibiotic consumption in ambulatory care is up by 13.4% in last 3 years
- Compared to the rest of Europe Ireland is in the 'medium range' of antibiotic usage

Outpatients antibiotic use in Europe



Goossens 2005 Lancet

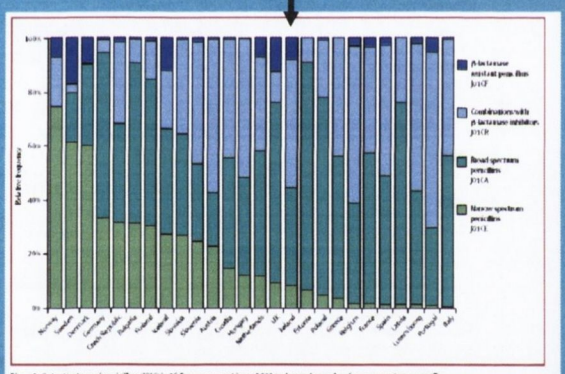
Why worry

"Resistance has emerged to every antibiotic class and analogue that has been marketed" (Livermore 2004)



Patterns of antibiotic prescribing in Ireland

- Few narrow spectrum antibiotics
- 51% of total penicillin use is combination antibiotics i.e. co-amoxiclav
- 18 % increase in cephalosporins(2nd/3rd generation)
- There is a direct relationship between antibiotic use and level of antibiotic resistance



Antimicrobial Resistance in Ireland

Data based on blood or CSF laboratory samples
EARSS September 2004 data

- Irelands pattern of prescribing is associated with higher levels of resistance
- S.Pneumoniae – Penicillin resistance 11.1%
- E Coli – Resistant to 3rd generation cephalosporins 1.4%, to ciprofloxacin 13.4%, gentamicin 6%
  - Resistance to this organism in particular seems to be increasing
- Saphylococcus Aureus - MRSA 43%

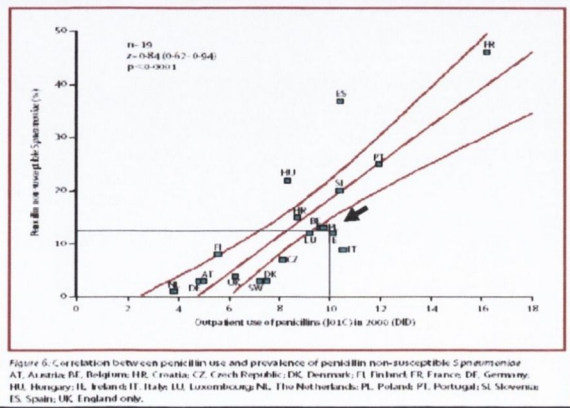


Figure 6. Correlation between penicillin use and prevalence of penicillin non-susceptible *S pneumoniae*
AT, Austria; BE, Belgium; HR, Croatia; CZ, Czech Republic; DK, Denmark; FI, Finland; FR, France; DE, Germany; HU, Hungary; IE, Ireland; IT, Italy; LU, Luxembourg; NL, The Netherlands; PL, Poland; PT, Portugal; SI, Slovenia; ES, Spain; UK, England only.

Antimicrobial susceptibility of community acquired lower respiratory tract pathogens in UK & Ireland

Reynolds R et al Journal of antimicrobial chemotherapy 2003

- Ireland has lower rates of antimicrobial susceptibility compared to UK
- Yet susceptibility to most antimicrobials remains high in Ireland
- There is no note worthy increase in penicillin non-susceptibility

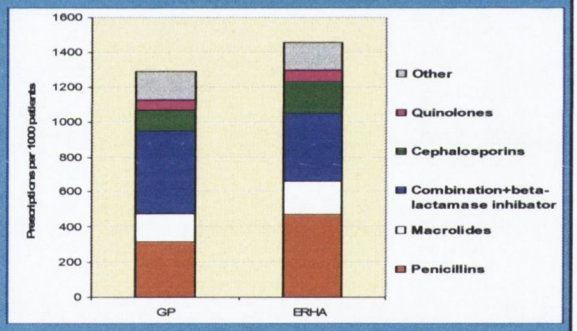
Breakdown of antimicrobial susceptibility

Organism	Antibiotics	UK % susceptible	Ireland % susceptible
Streptococcus pneumonia	B-lactams	92-100	68-99
	Penicillin	92.8	67.8
	Erythromycin	89	78
	Tetracycline	93	82
	Fluoroquinolones	94-100	94-100
Haemophilus influenzae	B-lactams (exception cefaclor)	79-100	Similar
	Erythromycin	96	
	Tetracycline	97	
	Trimethoprim	89	
	Fluoroquinolones	99	
Moraxella catarrhalis	Ampicillin	9	Similar
	Co-amoxiclav		
	Cefotaxime	>99	
	Erythromycin		
	Fluoroquinolones		

Our Aim

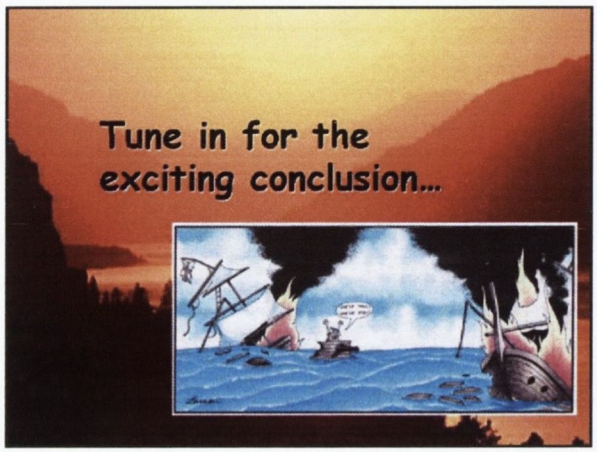
- Reduce overall rate of antibiotic prescribing
- Avoid new generation antibiotics
- Higher proportion of **first line antibiotics** (penicillins & erythromycin) compared to **second line antibiotics** (co-amoxiclav, cephalosporins & Quinolones)

Individual antibiotic prescribing



Comments

- Your overall rate of antibiotic prescribing is lower than the ERHA average.
- Your preference is for second line antibiotics i.e. combination antibiotics (co-amoxiclav), cephalosporins and quinolones.
- Your prescribing rate for combination antibiotics is nearly 1.5 times that of the ERHA average.
- You prescribe comparatively less first line antibiotics i.e. penicillins and macrolides (erythromycin) than the ERHA.
- Current recommendations are to reduce the overall rate of antibiotic prescribing.
- Second line antibiotics should only be used if there is failure of first line antibiotics or known resistance.



Summary

- There is the potential to save nearly €8,000 on your drugs budget
  - The majority of these savings can be realized if the cheapest generic for the following drugs are used, pravastatin, omeprazole, beclomethasone inhalers
7,928
- Efforts should be made to reduce antibiotic prescribing
- If antibiotics are required use narrow spectrum antibiotics instead of combination antibiotics or cephalosporins or Quinolones

Appendix two

CVD preventive therapies

Postal bulletin & Academic detailing powerpoint slides

DEPARTMENTS OF PHARMACOLOGY AND
THERAPEUTICS & PUBLIC HEALTH AND PRIMARY CARE

Rational GP Prescribing Study

Dr. Num:

Quality indicators in this bulletin include

- ***Prescribing in Cardiovascular disease(CVD)***
- ***CVD prevention in Diabetics***

All prescribing data relates to the GMS database from Nov 2003 to Oct 2004.

Quality prescribing in CVD



In 2003 mortality from cardiovascular disease (ischemic heart or cerebrovascular disease) accounted for 27% (7903/28823) of all deaths in Ireland [1]. A World Health Organisation survey in 2000 placed Ireland among the 10 countries with the highest mortality rates for CVD [2].
Management of CVD focuses on 1) Identification of patients at high risk 2) Risk factor modification through a combination of lifestyle changes and pharmacological therapies to prevent thrombosis, control hypercholesterolemia and hypertension.

Who is in the target population for primary & secondary prevention?

1) Patients with established CVD i.e. coronary heart disease, cerebrovascular atherosclerotic disease or peripheral artery disease.
2) Asymptomatic individuals with single or multiple risk factors for CVD resulting in a >5% risk of a fatal CVD event over 10 years.
   Multiple risk factors: gender, age, blood pressure cholesterol, smoking (SCORE Risk charts).
   Single significant risk factors: Cholesterol>8mmol/l, blood pressure>180/110 mmHg, diabetes[3].
3) Familial predisposition to CVD i.e. early onset of CVD in men<55 or women <65 years[3].

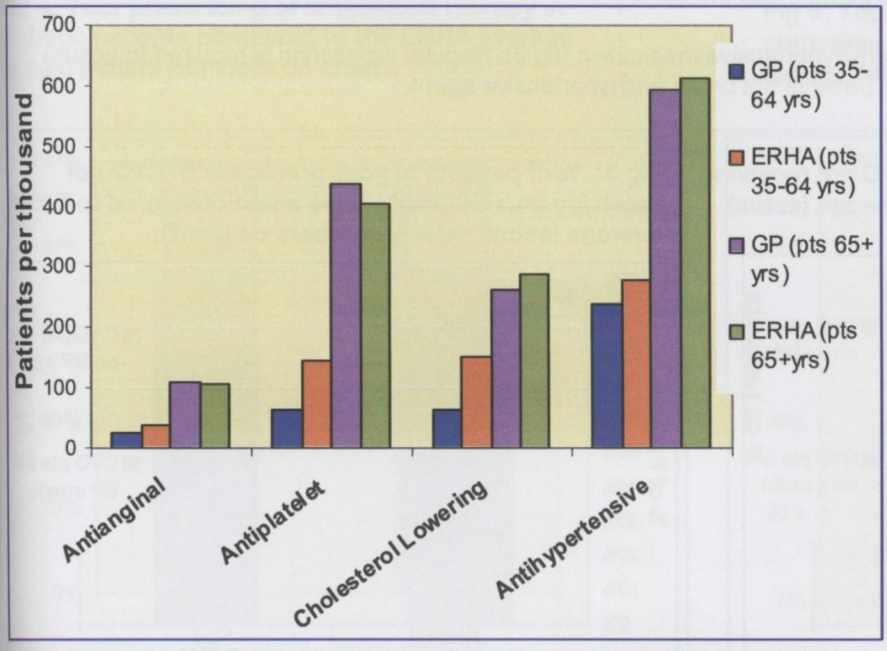
Identifying patients with established CVD on the GMS database:

The GMS data is not diagnosis linked therefore combinations of drug therapy are used as surrogate markers for disease. Antiplatelet therapy (aspirin or clopidogrel) is standard of care for patients with established CVD [3]. 80% of patients in the Heart watch scheme were on aspirin on their first visit [4]. In addition coronary artery vasodilator or antianginals (nitrates and nicorandil) are solely used for the relief of angina. The population selected includes all patients aged 35 years or older on an antiplatelet agent plus or minus a coronary artery vasodilator.

Markers of quality prescribing in CVD are:

- A high rate of antiplatelet prescribing (aspirin or clopidogrel) in patients on antianginal drugs (Nitrates/Nicorandil).
- A high rate of lipid lowering drug prescribing in patients with CVD.
- A high rate of antihypertensive drugs prescribing (ACE inhibitors, Beta blockers etc) in patients with CVD

Fig 1: Your prescribing rate of cardiovascular medication compared to the ERHA average. Data is stratified by age (patients (pts) age 35-64 & 65+ yrs)



!Antihypertensive agents: Ace inhibitors, angiotensin antagonists(AIIA), Beta blockers, calcium channel blockers (Ca Ch blockers), Diuretics.

- This graph compares your rate of prescribing of CVD medication to the ERHA average.
- The data is stratified by age and adjusted for individual GP GMS population size.
- The data captures information on both primary and secondary prevention.
- Your prescribing of antiplatelet, cholesterol lowering and anti-hypertensive drugs in the young population (35-64 yrs) is lower than the ERHA average.
- Your rate of prescribing of these drugs for patients aged 65 plus is similar to the ERHA average.

Risk reduction in CVD

Condition	**Increased risk of vascular events in patients with established CVD**
Risk Reduction	Estimated risk reduction in serious vascular events was 36 per 1000 treated for 2 yrs in patients with CVD treated with an antiplatelet agent[5]
Which Therapy	Aspirin in virtually all patients with clinically established CVD is standard of care[3] Clopidogrel (plavix) in high risk patients e.g. recent MI, stents or stroke is more effective than aspirin. However major bleeding may be more likely and more difficult to control [6, 7].
Condition	**Hyperlipidaemia**
Physiological target	General population Total cholesterol<5.0 mmol/l Established CVD Total cholesterol<4.5 mmol/l LDL <2.5 mmol/l [3]
Risk Reduction	19-31% risk reduction in serious vascular events [8].
Which Therapy	Statins can effectively address the problems of dyslipidaemia, lower triglyceride and LDL cholesterol and increase HDL cholesterol [8]. In 2004 Heartwatch reported that 30% of patients continued to have elevated cholesterol (> 5mmol/l) despite statin therapy. Recent clinical trials suggested benefits in lowering cholesterol <4.5mmol/l. This is unlikely to be achieved with older low dose statins e.g. Simvastatin or Pravastatin 10mg [8, 9, 10]
Condition	**Hypertension**
Physiological target	If risk CVD>5% / End organ damage / BP >180/110 mmHg **Goal** BP<140/90mmHg [3].
Risk Reduction	15% risk reduction in coronary events, 40% risk reduction in strokes [11].
Which Therapy	Research suggests that the majority of patients require combination antihypertensive therapy to achieve treatment goals. The British Hypertension society recommends an AB/CD algorithm for drug selection [12]. If<55 yrs *Step 1*: A=ACE inhibitor / Angiotensin receptor blocker(AIIA) **OR** B=Beta blocker If ≥55yrs C=Calcium channel blocker **OR** D= Diuretic *Step 2*: (A or B) + C or D *Step 3*: (A or B) + C + D (/=OR ; +=Add)

- Using your GMS number we identified 167 patients who were receiving an antiplatelet therapy (aspirin or clopidogrel) with or without an antianginal (nitrate or nicorandil).
- 12% (5/41) of patients on antianginal therapy were not receiving an antiplatelet or anticoagulant. The ERHA average is 17% (2641/15760) for non-prescribing of antiplatelet drugs in patients on antianginal therapy.
- 57% of CVD patients were not receiving a statin (see fig. 2) compared with 50% in the ERHA.
- Your prescribing of antiplatelet agents and statins is similar to the ERHA average, but optimum treatment targets are for virtually all patients with established CVD to be on these therapies [3,4].
- The majority of your patients are receiving antihypertensive medication (fig 3). Regular monitoring is required to ensure treatment targets are achieved especially in patients not on an antihypertensive agent.

Fig 2: % of patients in your practice with CVD not receiving a statin (orange area) compared to ERHA average (actual patient numbers on chart).

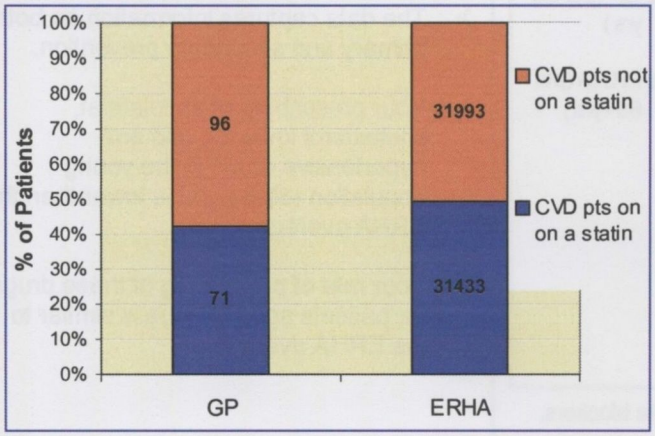
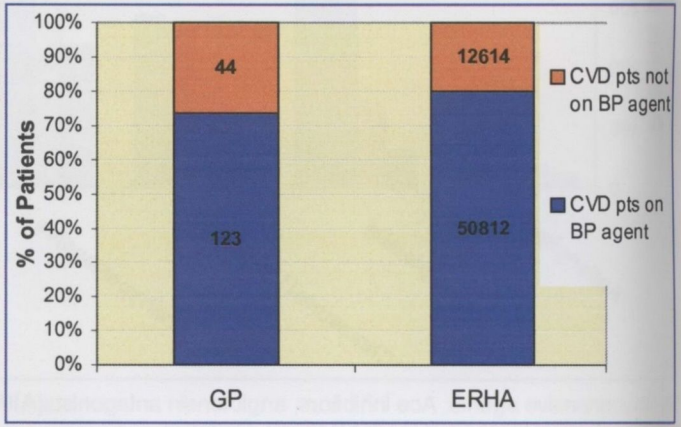


Fig 3: % of patients in your practice with CVD not receiving an antihypertensive agent compared to ERHA average (actual patient numbers on chart).



CVD prevention in Diabetics

The prevalence of diabetes especially type II is increasing world wide as a consequence of an aging population and the global increase in obesity. Cardiovascular disease kills over 70% of patients with type II diabetics [13,14]. Efforts to reduce mortality in this group of patients have focused on management of hyperglycaemia and CVD risk reduction.

Primary prevention in type II or type I diabetes with end organ damage e.g. microalbuminuria:

Condition	Treatment targets	Therapies
Hyperglycaemia	HbA1c (%) ≤6.1 Fasting glucose ≤6 mmol/l	Diet, weight loss , exercise, metformin and acarbose especially in obese patients may be effective in delaying the progress from glucose intolerance to type II diabetes [13 14]
Dyslipidemia	Chol <4.5 mmol/l LDL <2.5 mmol/l	Multiple trials have demonstrated a greater risk reduction in CVD for diabetic patients treated with statin therapy compared to non-diabetic patients [15]. A statin is recommended for all type II diabetics or type I with end organ damage [3]
Hypertension	B/P <130/80mmHg	ACE inhibitors or angiotensin II receptor antagonists (AIIA) are recommended for B/P control. They also may have separate renal and cardiac protective effects. Combination therapy is often required, 2nd line treatment should be a diuretic. [12,16,17]
Procoagulant state	Aspirin 75mg for all diabetic patients	There is evidence of raised levels of coagulation factors e.g. fibrinogen in diabetics. Data suggests that diabetics patients experience greater benefit when treated with aspirin than non diabetic patients [3,13]

Markers of Quality prescribing in patients with diabetes:

Data analysis is restricted to patients over 35 years of age on insulin or oral glycaemic therapy

- High rate of aspirin prescribing
- High rate of statin prescribing
- A high rate of ACE inhibitor or angiotensin II receptor antagonists (AIIA) use relative to other antihypertensive agents (Beta blockers, calcium channel blockers, diuretics).

- 27 patients on diabetic medication were identified using your GMS number
- 44% of these patients were not on antiplatelet medication, while 59% were not receiving a statin (see fig 4&5). The ERHA average for non-prescribing is 35% for antiplatelet therapy and 41% for statins in diabetics.
- Your prescribing of these therapies is below the ERHA average.
- Current targets are for 90% of patients at risk from CVD including diabetics to receive preventative therapy.

Fig 4: Your prescribing of antiplatelet therapy in diabetic patients compared to the ERHA average (actual patient numbers on chart).

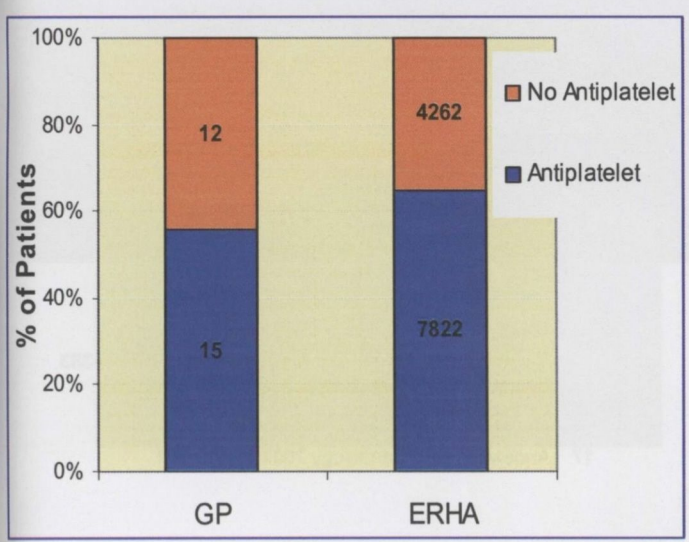


Fig 5: Your prescribing of statins in diabetic patients compared to the ERHA average (actual patient numbers on chart).

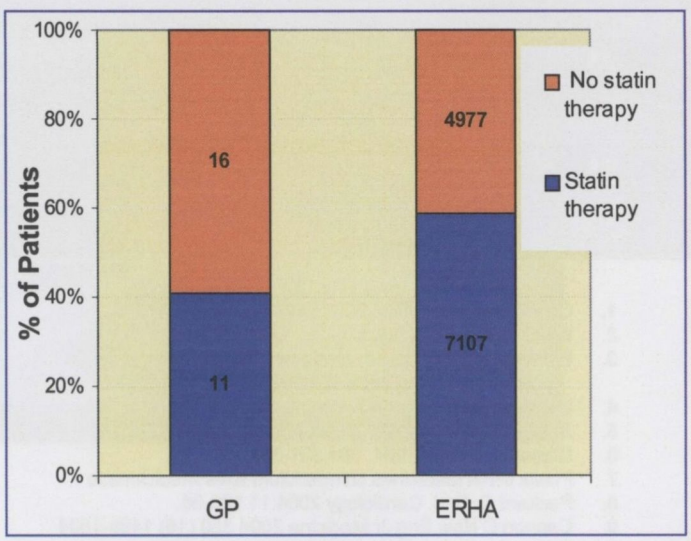
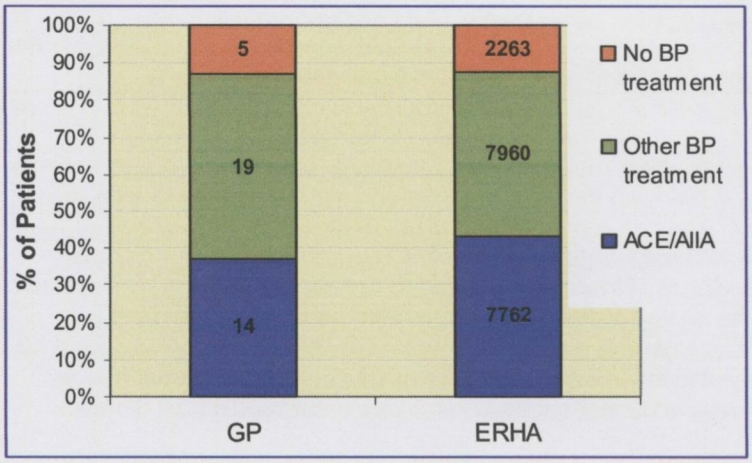


Fig 6:% of diabetic patients receiving an antihypertensive agent compared to the ERHA average (actual patient numbers on chart) Some patients receive more than 1 antihypertensive



- Over 85% of your diabetic patients are on antihypertensive medication.
- This is evidence of good practice
- Over 35% of them are on an ace inhibitor or angiotensin antagonist.
- ACE inhibitors or AIIAs should be considered if there is evidence of microalbuminuria or other end organ damage

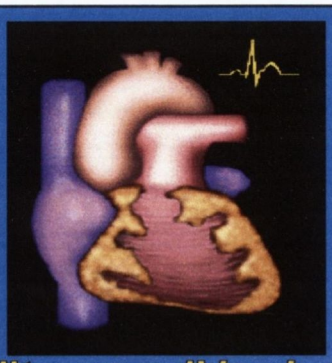
ACE/AIIA= ACE inhibitors, angiotensin antagonists(AIIA),
Other BP =Beta blockers, calcium channel blockers , diuretics.

Overall Summary

- **Overall your prescribing of preventative therapies is lower than ERHA average.**
- **12% of your patients receiving nitrates or nicorandil and 44% of diabetic patients were not on an antiplatelet therapy.**
- **Recommendations are for virtually all patients with established CVD or diabetes (type II or type I with end organ damage) to receive antiplatelet therapy.**
- **57% of patients with CVD and 59% of diabetics were not receiving a statin. Current treatment targets are for over 90% of at risk patients to receive a statin.**
- **The majority of your CVD and diabetic patients received an antihypertensive agent.**
- **Aggressive hypertension management is advised in all patients with CVD and diabetes before end organ damage occurs.**
- **Ace inhibitor or angiotensin II receptor antagonists (AIIAs) are believed to offer renal protection for diabetics.**

1. Central statistics office 2004 www.cso.ie/statistics
2. WHO 2004 www.who/ch
3. European guidelines on cardiovascular disease Atherosclerosis 2004 173 381-391
4. Heartwatch Report 2004 www.doh.ie
5. Antithrombotic Trialists' Collaboration BMJ 2002 :324:71-86
6. Diener H, Lancet 2004: 364;331-337
7. Plavix IPHA medicines compendium www.medicines.ie
8. Packard C. Br J. Cardiology 2004:11 129-36.
9. Cannon C New Eng Jr Medicine 2004 350 (15) 1495-1504
10. Nissen SE JAMA 2004 291(9) 1071-80
11. Staessen JA. Eur Heart Jr 2003 24,504-514
12. Williams: Br J Cardiology 2004;11:112-17
13. Sarang S Mount Sani Jr of Medicine2004 71(6)375-383
14. Scarpello J. Br J Cardiology 2004;11:138-143
15. Colhoun H. 2004 lancet vol 364 685-696
16. Barnett A Br J Cardiology 2004;11:123-128
17. Andews P. Br J Cardiology 2004;11:118-121

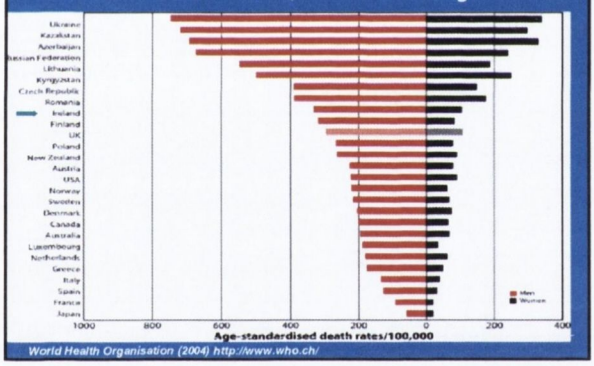
CVD Preventive Prescribing powerpoint presentation



Quality prescribing in CVD

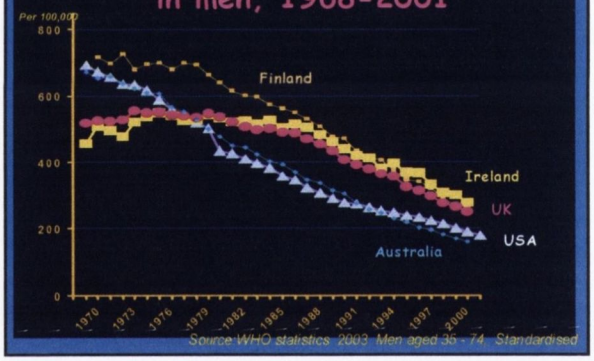
International comparisons

CHD death rates in 2000, men & women aged 35-74



World Health Organisation (2004) http://www.who.ch/

International CHD mortality trends in men, 1968-2001

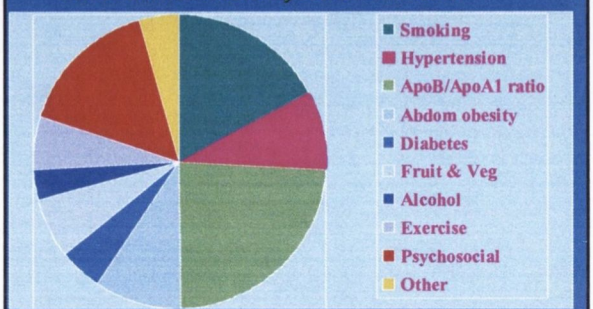


Source:WHO statistics 2003 Men aged 35 - 74 Standardised

Why have CHD death rates halved since the 1980s?

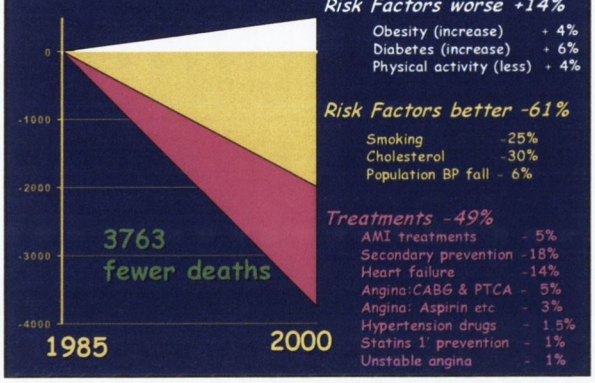
- Evidence-based cardiology treatments?
  - Thrombolysis,
  - CABG,
  - Angiography
- Risk factor reductions?
  - Hypercholesterolaemia
  - Hypertension
  - Smoking

INTERHEART Study "nine potentially modifiable risk factors account for over 90% of the risk of an initial acute myocardial infarction"

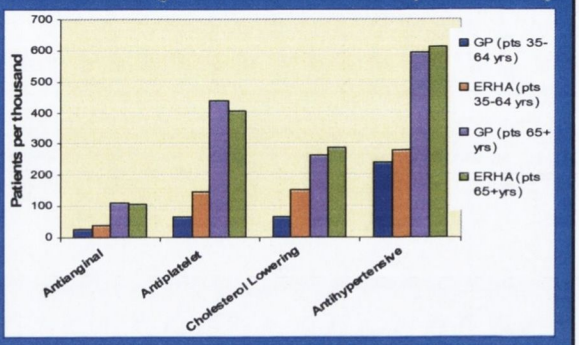


Salim Yusuf et al . Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study). Lancet 364 9438 11 Sept 2004

Fig 2. CHD mortality fall in Ireland 1985 - 2000 explained by a) treatments in CHD patients & b) population risk factors



Overview of your cardiovascular prescribing



Quality prescribing indicators

- High rate of antiplatelet prescribing in patients on antianginals (nitrates or nicorandil)
- High rate of statin prescribing in patients with CVD (antiplatelet +/- antianginal)
- High rate of antihypertensive prescribing in patients with CVD

Antiplatelet therapy in CVD

Meta analysis of 287 studies-135,000 patients at high risk of occlusive vascular event: (BMJ 2002)

Outcome: Serious vascular event (SVE) - MI, CVA, Vascular related death

Results: Absolute Risk Reduction:

SVE in pts with Acute MI - 38/1000 pts treated over 1 month

SVE in pts with old MI - 36/1000 pts treated over 2 yrs

SVE in Pts with Acute CVA- 9/1000 pts treated over 3 weeks

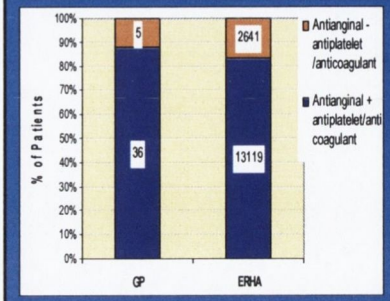
SVE in pts with old CVA/TIA- 36/1000 pts treated over 2 yrs

SVE in other high risk pts - 22/1000 pts treated fro 2 years

Current European guidelines on cardiovascular disease 2004:

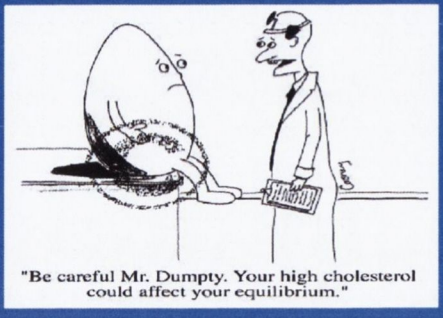
"Aspirin or other platelet-modifying drugs in virtually all patients with established CVD"

Prescribing of antiplatelet therapy in patients on antianginals. Your rates compared to ERHA



- 167 CVD patients
- 12% of your patients on antianginals are not on a anticoagulant or platelet inhibitor.
- This compared to 17% in the ERHA
- However European guideline stress that all patients at risk should be on this therapy.

Statins in CVD



"Be careful Mr. Dumpty. Your high cholesterol could affect your equilibrium."

Statins in CVD

Therapeutic goals: Cholesterol <4.5 mmol

LDL <2.5mmol/l

Only 1/3 of patients achieve targets (Eurospirell study 2001)

Meta analysis of 10 studies - 79497 patients at risk of occlusive vascular event: (Br J Clin pharmacol)

Outcome: Serious vascular event (SVE) - MI, CVA, Vascular related death

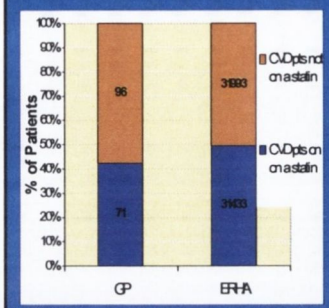
Results: Reduction in

Major coronary events	27% (95% CI23-30%)
CVA	18% (95%CI10-25%)
All cause mortality	15% (955 CI 8-21%)

Independent of gender, hypertension and diabetes

European guidelines: "Prescribe a statin in patients with established CVD, multiple risk factors and Diabetes"

Statin prescribing in patients with CVD



- 57% of your patients were not receiving a statin
- This is below the ERHA average
- 50% of patients with CVD were prescribed a statin in The ERHA
- Treatment targets are for over 90% of patients at risk to receive a statin therapy.
- 30% of Heartwatch patients continued to have elevated cholesterol despite statin therapy

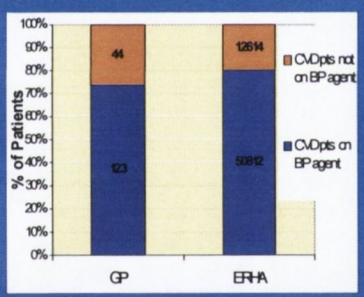
Antihypertensives in CVD

Therapeutic goal B/P <140/90

Meta-analysis -9 studies 62,605 patients

- Risk reduction
  - Coronary endpoints 15-23%
  - Stroke 30-40%
- No significant difference between agents optimum blood pressure reduction was the significant factor (Staessen 2003 European Heart Journal)
- 44% of patients in Heartwatch were outside target B/P at first visit. (Heartwatch report 2004)
- Combination therapy often required to achieve optimum blood pressure control
- European guidelines: Consider need for antihypertensives, beta blockers & ACE inhibitors

Antihypertensive prescribing in patients with CVD



- Over 70% of your patients with CVD received antihypertensive therapy
- This is below the ERHA average
- 41% of HW patients failed to reach targets systolic B/P by fourth visit

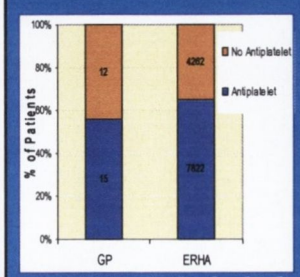
CVD prevention in Diabetics

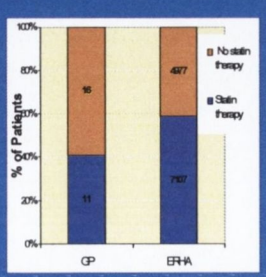
- Diabetes accelerates cardiovascular risk
- 70% of type II diabetics die from CVD
- Efforts to reduce mortality has focused on target driven CVD risk reduction
  - Cholesterol <4.5mmol/l, LDL <2.5mmol/l
  - B/P <130/80mmhg

Quality Prescribing Indicators

- High rate of antiplatelet prescribing
- High rate of statin prescribing
- A high rate of ACE inhibitor/AIIA prescribing relative to other antihypertensives

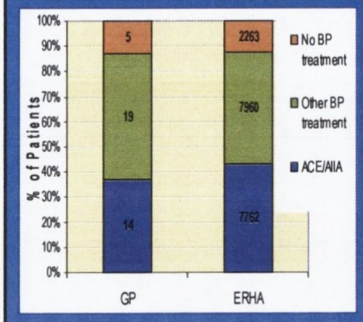
Antiplatelet & Statin prescribing





- 27 diabetic patients
- Antiplatelet and statin prescribing is below the ERHA average.
- All patients should receive these therapies

Antihypertensive prescribing in CVD



- Antihypertensive prescribing is similar to the ERHA average
- Over 35% of diabetic patients receive an ACE/AIIA

Summary

- Overall your prescribing of preventative therapies is lower than the ERHA average.
- 12 - 44% of at risk patients do not receive antiplatelet therapy.
- 57- 59% of at risk patients do not receive a statin.
- Recommendations are for virtually all patients with established CVD or diabetes (type II or type I with end organ damage) to receive these therapies
- Aggressive hypertension management is advised in all patients with CVD and diabetes before end organ damage occurs.

Appendix Three

Cost difference between five targeted proprietary drugs and their generic equivalent

Table 1 Cost difference of proprietary and generic drugs for five targeted drugs.

	Proprietary		Generic		Difference	
	Name	Average Cost per tablet €		Average cost per tablet €	per tablet €	per pack 28 tablets €
Pravastatin	Lipostst 10 mg	0.79	Cholstat Pravitin Pravamel Pravat, Byvat	0.63	0.16	4.48
	Lipostat 20mg	1.52	As above	1.21	0.31	8.68
	Lipostat 40mg	1.94	As above	1.53	0.41	11.48
Omeprazole	Losec 10mg	0.93	Lopraz Losepine	0.68	0.25	7.00
	Losec 20mg	1.74	Lopraz Ulcid Losepine Losepine	1.21	0.53	14.8
	Losec 40mg	3.50	Lopraz	2.53	0.97	27.16
Nimesulide	Aulin100mg	0.41	Mesulid Mesine	0.33	0.08	2.24
Citalopram	Cipramil 10mg	0.61	Ciprotan Citrol Citalopram Ciprapine Ciprager	0.47	0.14	3.92
	Cipramil 20mg	0.97	As above	0.73	0.23	6.58
		Cost per inhaler		Cost per inhaler		
Beclome-thasone inhalers	Becotide 50	7.34	Beclozone 50	6.25	1.09	N/A
	Becotide 100	13.85	Beclozone 50	12.16	1.69	N/A
	Becotide 250	30.71	Beclozone 250	25.99	4.72	N/A

Appendix Four

Questionnaire evaluating first postal bulletin

Evaluating of the GP rational prescribing bulletin

PLEASE COMPLETED AND RETURNED IN THE PRE-PAID ENVELOPE.

I would appreciate it if you could take the time to complete this form. I will act on your suggestions for the next bulletin. If you do not have time to complete the form you can email any suggestions you may have to naughtc@tcd.ie.

<table>
<tr>
<td>Q1 Please indicate what you think of the information presented to you in the first bulletin (circle one)

Too little Just right Too much</td>
<td rowspan="2">Q5 Was the content of the bulletin relevant to your practice. (circle one)

Very Slightly Not Relevant</td>
</tr>
<tr>
<td>Q2 Indicate which bulletin format you would you prefer:

Prescribing feedback alone
☐
Or
Prescribing feedback with individual comments
☐
Or
Combination of prescribing feedback with individual comments and evidence based information ☐</td>
<td>Q6 Is there any additional prescribing feedback you would like to have seen in relation to antibiotic or generic prescribing?</td>
</tr>
<tr>
<td>Q3 Did you find the graphs on generic prescribing (circle one)

Very useful Slightly useful Not useful</td>
<td rowspan="3">Q7 What would you change or like to see in the next bulletin in the next bulletin?</td>
</tr>
<tr>
<td>Q3 Did you find the table on generic prescribing (circle one)

Very useful Slightly useful Not useful</td>
</tr>
<tr>
<td>Q4 Did you find the graph on antibiotic prescribing (circle one)

Very useful Slightly useful Not useful</td>
</tr>
</table>

Appendix Five

Final questionnaire evaluating postal prescribing feedback

Evaluating of the GP rational prescribing bulletin

PLEASE COMPLETE THIS QUESTIONNAIRE AND RETURN IN THE PRE-PAID ENVELOPE.

Q1 Please indicate what you think of the information presented to you in the 2nd bulletin (circle one)

Too little Just right Too much

Q2 Did you find the graphs on the prescribing of cardiovascular disease (CVD)medication(circle one)

Very useful Slightly useful Not useful

Q3 Did you find the graphs on prescribing of CVD medication in diabetics (circle one)

Very useful Slightly useful Not useful

Q4 Was the content of the bulletin relevant to your practice (circle one)

Very Slightly Not Relevant

Q5 Would you make any recommendations to improve the current format of the bulletin

Q5 Overall do you think providing GPs with information on their prescribing patterns is (circle one)

Very useful Slightly useful Not useful

Q6 Do you think providing information in a paper bulletin format is an effective way of providing prescribing feedback?(circle one)

Very Slightly Not effective

Q6 Which format would you prefer in the future
(circle one)

Paper bulletin CD format Other
Email copy Disc

Q7 Would you like to see the bulletins continuing beyond the pilot project stage?

Yes No

Q8 How frequently would you like to receive such a bulletin (circle one)

Not at all Once a month
Every 2 months Every Quarter
Every 6 months Once a year

Q6 Do you think the bulletins had an impact on your practice (circle one)

Yes No

If yes explain how?

Q10 Do you think a once off bulletin on a particular topic will have (circle one)

A prolonged effect(>12 months) on my prescribing

Needs to be repeated at regular intervals

Bulletins will not effect my prescribing

Please feel free to make any additional comments on the back of this page
Thank you for your help and continued cooperation.

Appendix six

Questionnaire evaluating academic detailing visits

Evaluating Outreach Visit in the GP rational prescribing study

PLEASE COMPLETE THIS QUESTIONNAIRE AND RETURN IN THE PRE-PAID ENVELOPE.

Dear Dr

I would appreciate it if you could take the time to complete this form. The evaluation is important in order to critically appraise this method of providing prescribing feedback to GPs. If you do not have time to complete the form you can email any suggestions you may have to naughtc@tcd.ie

Q1 Please indicate whether you found the outreach visits you received (circle one in each case)

Very useful Slightly useful Not useful

Q2 Did you find the content of the visit

Too much About right Too little

Q3 Please comment on the style of the presentation

Was the power point presentation useful Yes No

Would you prefer discussion alone Yes No

Other comments:

Q4 How would like to receive prescribing feedback in the future (tick box)

a) Bulletin only ☐

b) Bulletin plus visit ☐

c) Visit only ☐

d) None of the above ☐

e) Other (please specify)

Q5 What is your attitude to the outreach visit (tick as many statements as you agree with)

a) The visit encouraged me to read the bulletin ☐

b) The visit reinforced the bulletin message ☐

c) The visit encouraged me to examine aspects of my practice ☐

d) It encouraged me to change aspects of my prescribing practice ☐

e) Had no effect on my prescribing practice ☐

f) I felt it was a waste of my time ☐

g) Any other comment

Q6 If the visits were to continue beyond the pilot stage how frequently would you like to receive such a visit (tick one)

Not at all ☐ Once a month ☐

Every 2 months ☐ Every Quarter ☐

Every 6 months ☐ Once a Year ☐

Q7 In future who would you like to receive the visits from a (tick one)

a) Doctor ☐

b) Pharmacist ☐

c) Nurse ☐

d) It does not matter as long as they understand the data that is presented. ☐

e) Other (please specify)

Q8 Do you think a once off visit & bulletin on a particular topic will have (tick one)

a) A prolonged effect(>12 months) on my prescribing ☐

b) Needs to be repeated at regular intervals ☐

c) This combination will not effect my prescribing ☐

Q9 Would you make any recommendations to improve either the visit or providing GP with prescribing feedback in the future.

Please feel free to make any additional comments on the back of this page

Thank you for your help and continued cooperation.

Yours sincerely,

Corina Naughton

Office use ☐

Appendix Seven

Article published in Family Practice August 2007

Family Practice Advance Access published August 1, 2007

© The Author 2007. Published by Oxford University Press. All rights reserved. For permissions, please e-mail: journals.permissions@oxfordjournals.org.
doi:10.1093/fampra/cmm044

A clustered randomized trial of the effects of feedback using academic detailing compared to postal bulletin on prescribing of preventative cardiovascular therapy

Corina Naughton, John Feely and Kathleen Bennett

Naughton C, Feely J and Bennett K. A clustered randomized trial of the effects of feedback using academic detailing compared to postal bulletin on prescribing of preventative cardiovascular therapy. *Family Practice* 2007; Pages 1–6 of 6.

Background. Interventions to promote prescribing of preventive therapies in patients with cardiovascular disease (CVD) or diabetes have reported variable success.

Objective. (i) To evaluate the effect of prescribing feedback on GP practice using academic detailing compared to postal bulletin on prescribing of CVD preventive therapies in patients with CVD or diabetes at 3 and 6 months post intervention and (ii) to evaluate the intervention from a GP's perspective.

Methods. Volunteer GP practices (n = 98) were randomized to receive individualized prescribing feedback via academic detailing (postal bulletin plus outreach visit) (n = 48) or postal bulletin (n = 50). The proportion of CVD or diabetic patients on statins and antiplatelet agents/warfarin pre- and post-intervention was calculated for each GP practice. Multivariate regression with a random effects model was used to compare differences between the groups adjusting for GP clustering and confounding factors. β-Coefficients and 95% confidence intervals (CIs) are presented.

Results. There was a 3% increase in statin prescribing in CVD patients at 6 months post-intervention for both randomized groups, but there was no statistical difference between the groups (β = 0.004; 95% CI = –0.01 to 0.02). Statin and antiplatelet/warfarin prescribing also increased in the diabetic population; there was no significant differences between the groups. GPs participating in the project expressed a high level of satisfaction with both interventions.

Conclusion. Prescribing of preventive therapies increased in both randomized groups over the study period. But academic detailing did not have an additional effect on changing prescribing over the postal bulletin alone.

Keywords. Academic detailing, feedback, prescribing, primary care.

Introduction

Mortality from cardiovascular disease (CVD) continues to decline in the western world.[1] This is largely attributed to improved primary and secondary prevention with pharmacological agents and lifestyle changes.[2] International guidelines on the management of CVD aim to standardize therapeutic targets for cholesterol and hypertension and promote prescribing of antiplatelet and stain agents as preventive therapies in patients with established CVD or Type II diabetes.[3]

The uptake of the clinical trial evidence and the guidelines has been slow and variable.[4] Ireland is no exception with studies showing age, gender and regional variation in the prescribing of preventive therapies.[5,6] At present, there are few interventions aimed at improving primary care physician prescribing of CVD preventive therapies in Ireland. The exception is the Heartwatch programme aimed at secondary prevention of CVD which involves 20% of GPs' practices in Ireland and has enrolled over 7000 patients. The programme has shown significant improvements in the

Received 9 September 2006; Revised 12 April 2007; Accepted 21 June 2007.
Department of Pharmacology and Therapeutics, Trinity College, Trinity Centres for Health Sciences St James Hospital, Dublin D 8, Ireland. Correspondence to Corina Naughton, Department of Pharmacology and Therapeutics, Trinity College, Trinity Centres for Health Sciences St James Hospital, Dublin D 8, Ireland; Email: naughtc@tcd.ie

management of CVD risk factors after only 2 years.[7] However, it targets only the highest risk population, those with a history of myocardial infarction, coronary artery bypass surgery or percutaneous transluminal coronary angioplasty and a small number of diabetic patients.

Alternative interventions which complement the Heartwatch programme but have a broader focus on patients with CVD and that can potentially involve a greater number of practices should be evaluated. Interventions involving individualized prescribing feedback alone or in addition to educational outreach visits have been evaluated in other countries.[8,9] However, the results from these studies are variable and there is a need for further evaluation of these interventions in different health care systems.

The purpose of this study is to evaluate the effect of randomizing GP practices to prescribing feedback using academic detailing (postal bulletin plus an educational outreach visit) compared to postal bulletin alone on prescribing of cardiovascular preventive therapies in patients with CVD or diabetes. A secondary objective was to evaluate the effectiveness of both interventions from a GP's perspective.

Methodology

Population selection

The sample size calculation was based on demonstrating a 25% improvement in appropriate prescribing, with a power of 80% and statistical significance of 5%, between the randomized groups and allowing for clustering of GPs within practices [cluster size = 2, intraclass correlation coefficient = 0.1]. The number of practices required per arm of the study was 26.[10]

Following ethical approval, 300 GPs based in the Eastern Regional Health Authority (ERHA) in Ireland were contacted. GPs had to have a minimum of 500 registered patients on the Health Service Executive-primary care reimbursement service (HSE-PCRS) scheme (see below for details). Thirty-seven per cent of GPs (n = 110; n = 98 practices) agreed to participate. These GPs were randomized to receive prescribing feedback using either (i) academic detailing including postal bulletin (n = 48 GP practices) or (ii) postal bulletin alone (n = 50 GP practices) (Fig. 1). The unit of randomization was the GP practice, with all GPs within the same practice being randomized to the same intervention. However, there were only 10 practice (n = 22 GPs) in which there was more than one GP participating in the study (two practices had three GPs, the remaining eight practices had two GPs participating). As the ERHA includes the largest urban centre in Ireland, the randomization was allocated by area of GP practice to ensure a balanced distribution of practitioners working in deprived and non-deprived areas and urban and semi-urban areas.

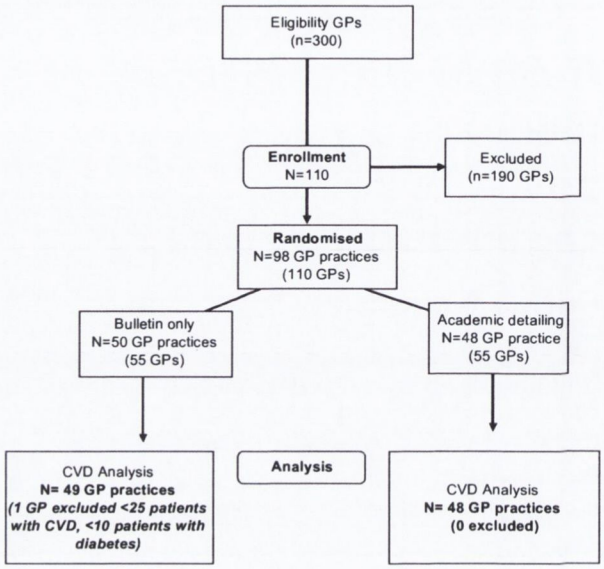


FIGURE 1 *Trial flow diagram.*

Data collection

The study utilized the HSE-PCRSs pharmacy claims database to provide individualized GP prescribing feedback and evaluate the effect of the interventions. The HSE-PCRS is a means tested health care scheme for all those under 70 years but is free to those aged 70 years or older. The scheme provides free health care including medicines to 30% (n = 1.15 million) of the Irish population. However, it over represents the elderly, the very young and the most socio-economically disadvantaged.

The HSE-PCRS pharmacy database includes a unique patient identification number with demographic information (age and gender) and the registered doctor number. Thus, each prescription can be linked to the patient and their registered GP. Full details of all drugs prescribed are recorded and the drugs are coded using the WHO Anatomical Therapeutic Chemical (ATC) classification system.[11] The database does not contain information on patient diagnosis, instead specific drug therapy or combinations of drug therapy are used as surrogate markers of disease. This methodology has been reported by other authors.[12–15] The surrogate markers for CVD are antiplatelet therapy (aspirin or clopidogrel, B01AC04 &06) plus or minus a coronary artery vasodilator (nitrates C01DA or nicorandil C01DX16), also coronary artery vasodilators are used to identify ischemic coronary artery disease.[16] Diabetes is identified using insulin and oral hypoglycaemic agents (A10A/B). Data on all patients registered to the participating GPs, aged 45 years and older and who received at least one prescription for one of the above CVD or diabetes-related drugs was included in the analysis during the defined study periods.

Intervention: postal bulletin

The postal bulletins contained individualized GP prescribing feedback and educational information based on the 2003 European guidelines on CVD prevention.[3] The aim of the bulletin was to increase the level of (i) antiplatelet prescribing in patients with coronary artery disease; (ii) statin prescribing (C10AA) in patients with CVD and (iii) antiplatelet and statin prescribing in patients with diabetes.[5] The feedback was displayed using graphs and included the actual number of GP-registered patients not receiving recommended therapy. All bulletins were sent out in June 2005.

Academic detailing

Following distribution of the bulletin, the educational outreach visits took place between June and July 2005. Fifty-four visits were carried out by a single researcher to ensure consistency of the information given, one GP in the academic detailing group declined to participate at this stage. The visits ranged from 15 to 30 minutes and were held in the GP practice. Each visit consisted of a 10-minute powerpoint presentation based on the bulletin data with extra information on CVD risk factor management. The GP was encouraged to ask questions about the data and clarify any points raised. The majority of the visits were one to one with the GP participating in the project, though some practices held group meetings involving other GP partners and the practice nurse.

Evaluation questionnaires

The postal bulletin and outreach visit were evaluated separately. All GPs (n = 110) received a postal questionnaire with their prescribing feedback bulletin evaluating this aspect of the study. In addition, GPs in the academic detailing arm of the study received a separate questionnaire related to the outreach visit. The majority of questions were based on a three-point Likert scale and focused on the content, format and frequency of the bulletin and outreach visit. GPs were also encouraged to make free text comments on the study and its perceived effects on their practice.

Data analysis

GPs with <25 patients with CVD or 10 patients with diabetes were excluded from the analysis to avoid calculations based on small numbers (random error). Thus in the postal bulletin only group, one GP practice was excluded from the CVD and diabetes analysis (n = 49) while in the academic detailing group no GP practices (n = 48) were excluded (Fig. 1). Analysis was on an intention to treat basis.

The GP characteristics, patient population structure and post intervention evaluation questionnaires were compared using chi-square statistic for categorical variables or analysis of variance for continuous variables. The analysis time periods were 3 months (August 2005–October 2005) and 6 months post-intervention (August 2005–January 2006) compared to 3 months (March 2005–May 2005) and 6 months pre-intervention (December 2004–May 2005). All prescribing data and GP patient population structure was obtained from the HSE-PCRS. In each analysis period, the GP registered patient populations with CVD (excludes patients with diabetes), coronary artery disease and diabetes were identified. Following this, the proportion of patients in each disease group receiving statin or anticoagulant therapy (antiplatelet/warfarin therapy; patients on warfarin therapy are considered anticoagulated and may not normally be considered eligible for additional antiplatelet therapy) was calculated. Pre-intervention mean population proportion and the post intervention proportional increase in the population receiving appropriate therapy are presented. The proportion of males and those aged 70 years or older was also calculated for each practice.

The prescribing differences between the randomized groups were examined using multivariate regression with a random effects model for each therapy, e.g. statin therapy in patients with CVD. This allowed for adjustment of GP clustering within practices, baseline prescribing and confounding factors such as practice participation in the Heartwatch programme and patient population structure. β-Coefficients and 95% confidence intervals are presented. All analyses were performed using SAS (v 9.1 SAS Institute, Cary, NC).

Results

There was no statistical difference between the data at 3 and 6 months. Thus, the later 6-month data are presented because it is more likely to capture an increased number of patients with CVD or diabetes (repeat prescriptions are issued for a 3-month period).

The characteristics of the GPs in both groups were similar with no significant difference seen in GP age, gender, years qualified or participation in the Heartwatch programme (Table 1). Patient panel size and distribution of males were similar between the groups but academic detailing practices had significantly more patients aged 70 years and older compared to the postal bulletin group ($P < 0.001$).

CVD patient analysis

Patients receiving cardiovascular medication represent ~30% of the patient population aged 45 years or older in both groups. Pre-intervention just over 50% of patients in both the academic detailing and postal bulletin groups were receiving statin therapy (see Table 1). Post-intervention after adjusting for baseline prescribing and other confounding factors, there was no significant differences seen between the groups. Both

TABLE 1 *Baseline characteristics of randomized GPs and patient population structure*

		Bulletin only		Academic detailing	
		n	%	*n*	%
GP characteristics		*N* = 54 GPs		*N* = 55 GPs	
GP age	Mean (SD)	50	7.6	51	6.8
GP gender	Males	41	46	48	54
Years qualified	0–10	11	21	7	13
	>10 years	41	79	47	87
Heartwatch	Yes	19	43	25	57
Patient population		*N* = 49 GP practices		*N* = 48 GP practices	
HSE-PCRS panel size	Mean (SD)	856	245	940	380
Population >45 years		20 955		26 317	
≥70 years		10 897	52	14 842	56*
Male		8716	42	10 897	41

*$P = 0.001$.

groups increased statin prescribing in this population by 3% over a 6-month period. In patients with coronary artery disease (on nitrate therapy), 96% were already receiving anticoagulants. Post-intervention there was a 1% increase in prescribing seen in both groups.

Diabetes patient analysis

Patients receiving diabetic therapy accounted for 7% of patients aged 45 years or over in both randomized groups. Pre-intervention between 64% and 66% of diabetic patients were on statin therapy, both groups increased statin prescribing by 4–5% in the post intervention period but there was no significant difference between the groups. A higher proportion of diabetic patients were on anticoagulant therapy, between 74% and 76%; again post intervention there was a small increase in anticoagulant prescribing with no significant difference found between the groups (see Table 2).

Evaluation questionnaire

In the questionnaire evaluating the outreach visit aspect of the study, there was a response rate of 89% (48/54). There was a high level of satisfaction with the content and format of the visit and 81% (39/48) indicated that they would like the academic detailing visits to continue in conjunction with the postal bulletin. GPs found that the visits prompted them to review the postal bulletin and they liked the opportunity to clarify points raised in the bulletin.

There was a response rate of 80% (88/110) in the questionnaire evaluating the postal bulletin aspect of the study. In total, 45 postal bulletin and 43 academic detailing GPs replied with no significant difference between the groups in their replies to the questions. Both groups expressed a high level of satisfaction with the respective interventions they received. All the respondents indicated they would like to continue receiving prescribing feedback as a postal bulletin. The majority 94% (79/84) felt the feedback had some impact on practice. Those who expanded on this point identified an increased awareness of their own performances against recommended practice.

Discussion

There was an increase in the prescribing of preventive therapies seen in both academic detailing and postal bulletin GP practices over the study period. Statin prescribing in patients with CVD and diabetes increased by 3–5%, while anticoagulant therapy in diabetic patients increased by 2–3% in both groups. However, at 3 and 6 months post-intervention, academic detailing did not have a significant additional impact on prescribing of these therapies above postal bulletin alone. Anticoagulant prescribing in patients on nitrate therapy was already at 96% pre-intervention in both groups and it was not anticipated that this could be significantly improved upon as the small numbers of patients not on this therapy are likely to be those who refuse or are unable to tolerate anticoagulants.

In the evaluation of the project from the GP's perspective, 81% of those who received an outreach visit felt it was useful, while all GPs who returned their evaluation questionnaires (80%) would like to see the postal bulletins continue. Both groups acknowledge the limitations of a one-off intervention in having a sustained effect on practice but felt that participation in the project had effected their prescribing in some way and all would like to continue receiving prescribing feedback, with or without the visit.

Academic detailing is described as one of the most promising interventions used to promote changes in physician behaviour[9] and has been used widely in the area of CVD. Simon *et al.*[17] reported a significant increase in prescribing of certain anti-hypertensive

TABLE 2 *Six month post-intervention proportional change in patients receiving CVD preventative therapies: academic detailing (n = 48 GP practices) versus bulletin-only GP practices (n = 49 GP practices)*

	Randomized groups	Pre-intervention mean proportion	Mean proportion increase	β[a]	95% CI
CVD[b] population	Postal bulletin	0.29	0.02		
	Academic detailing	0.29	0.01		
Statins	Postal bulletin	0.51	0.03	0.004	–0.01 to 0.02
	Academic detailing	0.53	0.03		
Anticoagulants	Postal bulletin	0.96	0.01	0.001	0.00 to 0.01
	Academic detailing	0.96	0.01		
Diabetic population[c]	Postal bulletin	0.07	—		
	Academic detailing	0.07	—		
Statins	Postal bulletin	0.64	0.05	0.01	–0.02 to 0.04
	Academic detailing	0.66	0.04		
Anticoagulants	Postal bulletin	0.74	0.03	–0.004	–0.03 to 0.02
	Academic detailing	0.76	0.02		

[a]β-Coefficient (group difference).
[b]CVD = Cardiovascular disease: proportion of patients aged ≥45 years (excluding diabetic patients).
[c]Proportion of patients aged ≥45 years with diabetes, postal bulletin GP practices are used as the baseline comparison group in the regression analysis.

therapies, while Lobo *et al.*[18] identified significant improvement in preventive measures for CVD but did not include prescribing of preventive therapies. However, negative results from academic detailing have also been reported. Fretheim *et al.*[19] found a single significant change in thiazide use out of nine other quality care indicators in prevention of CVD, while Witt *et al.*[20] reported that academic detailing had no effect on prescribing of asthma medication.

In this study, over 20–40% of high-risk patients were not receiving recommended preventive therapy. The provision of academic detailing in addition to individualized prescribing feedback had a minimal impact on clinical practice though many GPs believed the intervention increased their awareness of this issue. The gap between clinical practice and clinical knowledge is well documented especially in relation to CVD.[4] The lack of intensity of the intervention in this study (one bulletin and a single visit with no follow-up) may certainly have contributed to the negative result.[21,22] In addition, prescribing feedback with or without academic detailing only provides motivation for GPs to change practice through increasing awareness and reinforcing best practice guidelines. It does not tackle more complex obstacles to effective prescribing in CVD. These factors include patient non-compliance, variation in patient morbidities, lack of computerized patient registers, lack of time, ancillary personnel, space to run dedicated clinics and financial incentive to deal with the extra work load, such obstacles are readily identified in the literature as well as by the GPs participating in this study.[23–25]

Providing a prescribing feedback service plus or minus prescribing advisers would require a considerable investment in financial resources without guaranteeing substantial improvement in the management of CVD in the community.[9] This is particularly likely to be the case in the absence of investment in primary care infrastructure such as computerized patient registers, automated patient follow-up, additional staff to run CVD clinics as in the Heartwatch programme and patient education. Prescribing feedback may be a useful adjunct to multifaceted interventions targeting local barriers to CVD management but in isolation it is not likely to have a substantial effect.

Study limitations

There is a lack of diagnosis information to validate the quality prescribing indicators. This was a voluntary sample of GPs; thus, the acceptability of prescribing feedback to a broader population of GPs is difficult to determine. Not all GPs in multi-partner practices agreed to participate, which will have affected the sample size calculation (based on assuming at least two GPs per practice participated in the study). This also meant that the data analysis was based on the individual GPs' registered population and not the whole practice patient population. Thus, some patients who may have been prescribed preventative therapy by the participating GP but who were not registered with that GP were excluded from the analysis. In addition, using the registered GP patient number to identify patients with CVD or diabetes does not guarantee that the participant GP in multi-partner practices prescribed the therapies under review. However, patients tend to see their own GP whenever possible especially for management of chronic conditions. Also, for the purpose of data analysis, a stable patient population was required. The pharmacy database covers a particular group of the Irish population and may not be generalizable to the rest of the population; however, the database represents ~65% of all prescribing in primary care.

Conclusion

The prescribing of preventative therapies for CVD and diabetes showed a small increase after a randomized intervention to improve prescribing, but academic detailing had no additional impact over postal bulletin alone. There was a high level of satisfaction among participant GPs in both intervention arms of the study. Interventions to further improve management of CVD and diabetes in primary care need to address local barriers to implementing evidence-based medicine.

Acknowledgements

We would like to thank all the GPs in the ERHA who took part in the intervention study and Fergus O'Kelly for his advise and support. Also the HSE-PCRS payments board for the data on which this study is based.

Declaration

Funding: Health Research Board of Ireland (Grant No. HO1199).
Ethical approval: The Irish College of General Practitioners, Protocol number REC0904-1.
Conflicts of interest: None.

References

[1] Kabir Z, Bennett K, Shelley E *et al.* The population mortality benefits of maximizing the number of eligible patients receiving appropriate cardiology treatments in Ireland. *QJM* 2006; **99:** 523–530.

[2] Yusuf S, Hawken S, Ounpuu S, Tiukinhoy S, Rochester C. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet* 2004; **364** (9438): 937–952.

[3] de Backer G, Ambrosioni E, Borch-Johnsen K *et al.* European guidelines on cardiovascular disease prevention in clinical practice. Third Joint Task Force of European and other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of eight societies and by invited experts). *Atherosclerosis* 2004; **173:** 381–391.

[4] Majumdar SR, McAlister FA, Furberg CD. From knowledge to practice in chronic cardiovascular disease: a long and winding road. *J Am Coll Cardiol* 2004; **43:** 1738–1742.

[5] Bennett KE, Williams D, Feely J. Inequalities in prescribing of secondary preventative therapies for ischaemic heart disease in Ireland. *Ir Med J* 2002; **95:** 169–172.

[6] Bennett KE, Williams D, Feely J. Under-prescribing of cardiovascular therapies for diabetes in primary care. *Eur J Clin Pharmacol* 2003; **58:** 835–841.

[7] National Hearwatch Programme. Heartwatch Clinical Report, March 2003–December 2005. http://www.icgp.ie (accessed on July 2, 2007).

[8] Jamtvedt G, Young JM, Kristoffersen DT, Thomson O'Brien MA, Oxman AD. Audit and feedback: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev* 2003; **3:** CD000259.

[9] Thomson O'Brien MA, Oxman AD, Davis DA, Haynes RB, Freemantle N, Harvey EL. Educational outreach visits: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev* 2000; **2:** CD000409.

[10] Campbell MK, Thomson S, Ramsay CR, MacLennan GS, Grimshaw JM. Sample size calculator for cluster randomized trials. *Comput Biol Med* 2004; **34:** 113–125.

[11] WHO. *Anatomical Therapeutics Chemical (ATC) Classification Index with Defined Daily Doses (DDDs).* WHO, Geneva, Switzerland, 2001 http://www.who.int/medicines (accessed on July 8, 2007).

[12] Maio V, Yuen E, Rabinowitz C *et al.* Using pharmacy data to identify those with chronic conditions in Emilia Romagna, Italy. *J Health Serv Res Policy* 2005; **10:** 232–238.

[13] Von KM, Wagner EH, Saunders K. A chronic disease score from automated pharmacy data. *J Clin Epidemiol* 1992; **45:** 197–203.

[14] Hoven JL, Haaijer-Ruskamp FM, Vander Stichele RH. Indicators of prescribing quality in drug utilisation research: report of a European meeting (DURQUIM, 13-15 May 2004). *Eur J Clin Pharmacol* 2005; **60:** 831–834.

[15] Kendall H. Why prescribing data are monitored. *Pharm J* 2004; **272:** 21–22.

[16] Gray J, Majeed A, Kerry S, Rowlands G. Identifying patients with ischaemic heart disease in general practice: cross sectional study of paper and computerised medical records. *BMJ* 2000; **321:** 548–550.

[17] Simon SR, Majumdar SR, Prosser LA *et al.* Group versus individual academic detailing to improve the use of antihypertensive medications in primary care: a cluster-randomized controlled trial. *Am J Med* 2005; **118:** 521–528.

[18] Lobo CM, Frijling BD, Hulscher ME *et al.* Improving quality of organizing cardiovascular preventive care in general practice by outreach visitors: a randomized controlled trial. *Prev Med* 2002; **35:** 422–429.

[19] Fretheim A, Oxman AD, Havelsrud K, Treweek S, Kristoffersen DT, Bjorndal A. Rational prescribing in primary care (RaPP): a cluster randomized trial of a tailored intervention. *PLoS Med* 2006; **3:** e134.

[20] Witt K, Knudsen E, Ditlevsen S, Hollnagel H. Academic detailing has no effect on prescribing of asthma medication in Danish general practice: a 3-year randomized controlled trial with 12-monthly follow-ups. *Fam Pract* 2004; **21:** 248–253.

[21] Horn FE, Mandryk JA, Mackson JM, Wutzke SE, Weekes LM, Hyndman RJ. Measurement of changes in antihypertensive drug utilisation following primary care educational interventions. *Pharmacoepidemiol Drug Saf* 2007; **16:** 297–308.

[22] Kiefe CI, Allison JJ, Williams OD, Person SD, Weaver MT, Weissman NW. Improving quality improvement using achievable benchmarks for physician feedback: a randomized controlled trial. *J Am Med Assoc* 2001; **285:** 2871–2879.

[23] Perreault S, Lamarre D, Blais L *et al.* Persistence with treatment in newly treated middle-aged patients with essential hypertension. *Ann Pharmacother* 2005; **39:** 1401–1408.

[24] Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. *Lancet* 2003; **362:** 1225–1230.

[25] Nazareth I, Freemantle N, Duggan C, Mason J, Haines A. Evaluation of a complex intervention for changing professional behaviour: the Evidence Based Out Reach (EBOR) Trial. *J Health Serv Res Policy* 2002; **7:** 230–238.