CONTINUITY OF INTEGRATED PATIENT CARE:

A patient centred study of medication management

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DECLARATION

This thesis describes research carried out at the Faculty of Pharmacy, The University of Sydney under the supervision of Associate Professor TF Chen and Associate Professor P Aslani, and with the permission of the Dean of the Faculty of Pharmacy, Professor Iqbal Ramzan.

The research presented in this thesis is, to the best of my knowledge, original and entirely the product of my own scholarly work, except as acknowledged in the text. This thesis has not been submitted in part or whole for the award of a degree at any other university. Full acknowledgement has been made where the work of others has been cited or used.

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GLOSSARY

As used in this thesis: words, terms, abbreviations, acronyms, phrases

ADL(s)	Activities of daily living
ATC	Anatomical Therapeutic Chemical – Classification system for drugs controlled by the WHO Collaborating Centre for Drug Statistics Methodology
CCI	Charlson Comorbidity Index
CofC	continuity of care
CofCP	Continuity of Care Project
cohort	group with statistical similarities
COOP charts	Dartmouth Co-operative Functional Assessment charts
COOP/WONCA charts	Dartmouth Co-operative Functional Assessment/World Organisation of National Colleges and Academics charts
CPS	Cognitive Performance Scale
CRQ	Chronic Respiratory Questionnaire
Day Only (DO) patients	In Australia: Patients admitted and discharged in one day
DDI(s)	Drug to drug interaction(s)
DRG	Diagnosis related group or grouping

GLOSSARY continued

DRP(s)	Drug related problem(s)
DVA	Australian Government Department of Veterans' Affairs
effect size	measure of the strength of the relationship between two variables
empirical	based on real experience or scientific experiment (rather than theory or secondary data analysis)
EQ-5D	EuroQol Group Health Standard
explicit	clear, obvious, definite and unqualified
face value	stated value, seeming apparent worth
GP(s)	General Medical Practitioner(s)
HAD	Hospital Anxiety and Depression scale
HIC	Australian Health Insurance Commission
HMR	Home Medicines Review, medication review conducted in the patient's home
HMR Report group	Minority subgroup within the CofCP cohort
HCP	Healthcare professionals
HRQL	Health Related Quality of Life
IADL	Instrumental Activities of Daily Living
ICD - 10	International Statistical Classification of Diseases and Related Health Problems, 10th Revision
implicit	understood, implied, contained, not stated directly in what is expressed
integrated	combining expertise, people, or ideas of different types in one effective unit, group, or system
IQR	Interquartile range
LOS	Length of stay in hospital

GLOSSARY continued

MacNewQLMI	MacNew Quality of Life after Myocardial Infarction
MBS	Australian Medicare Benefits Scheme
medication	drug or medicine used to treat illness, used predominantly as an adjective/adverb in this thesis e.g. medication review
MI	myocardial infarction
MONICA	Multinational MONItoring of trends and determinants in CArdiovascular disease
nCPAP	nasal continuous positive airway pressure
NHP	Nottingham Health Profile
non-HMR Report group	Majority subgroup within the CofCP cohort
NSW	State of New South Wales in Australia
NZ	New Zealand
optimal care	best possible care for individual patient
patient-nominated	patient's choice
PBS	Australian Pharmaceutical Benefits Scheme
Polymorbidity	Many diseases
polypharmacy	concurrent and active daily consumption of many drugs (≥5 drugs)
potential	probable, but as yet not actual
Primary care	In Australia: care delivered in the community e.g. GP care
QOL	quality of life
real	physically existing, not artificial, verifiable
representativeness	truly/genuinely representative. Typical of people or things in group

RQLQ	Respiratory Quality of Life Questionnaire
SDM	Shared decision making
Secondary care	In Australia: healthcare delivered in non-acute care hospital or institution e.g. in nursing homes
Short Stay patients	In Australia: Patients who stay a few (e.g. 1-3) nights in hospital
SF-12, 36	Medical Outcomes Study 12 or 36 item Short-form Health Survey
SIP	Sickness Impact Profile
SPPB	Physical Performance Battery score
SPSS	Statistical Package for the Social Sciences
Tertiary care	In Australia: healthcare delivered in an acute care hospital
PIP(s)	Potentially Inappropriate – Prescriptions; Prescribing,
Quaternary care	In Australia: healthcare delivered by a tertiary care hospital in a consulting specialty e.g. cardiovascular disease.
USA	United States of America
WMP	Westmead Medicines Project
WSAHS	Western Sydney Area Health Service
WSDGP	Western Sydney Division of General Practice

CONTINUITY OF INTEGRATED PATIENT CARE:

A patient centred study of medication management

CHAPTER 1.0
Continuity of Integrated Care

Introduction, Thesis Outline and Primary Aim

THESIS OUTLINE

CHAPTER 1.0: Continuity of Integrated Care
Introduction, Thesis Outline and Primary Aim

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1.0 CONTINUITY OF INTEGRATED PATIENT CARE:

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1.1 RESEARCH INTRODUCTION

This research is about enhancing the continuity of patient care. It focuses on medication management at the time of patient discharge from a cardiology unit in an Australian acute care hospital. That is, during the time of the patients' transition from tertiary to primary care. The philosophical concept underpinning the research is centred on continuity of patient care which is defined, and then described, in the context of each chapter study undertaken.

The main aim of the overall research was to conduct an original, empirical research project to identify, characterise, and investigate a cohort of patients in need of ongoing care after discharge. Those subjects recruited into the Continuity of Care Project were 281 acute on chronic, cardiovascular patients. In this research, the individual chapter studies investigated the need for continuity of care by analysing the quality of prescribing recorded at hospital discharge and at medication review in the community.

1.2 THESIS OUTLINE

1.2.1 BACKGROUND TO THE EMPIRICAL RESEARCH

Between 2004-2005 an empirical research project, called the Westmead Medicines Project (WMP), primarily involving pharmacists and 'Continuity of Care' (CofC), was conducted. The WMP and its subjects were included in the research reported in this thesis as part of an empirical study called the Continuity of Care Project (CofCP) implemented between [2004] 2005-2007.[1] The project was implemented in the acute care cardiology unit of Westmead Hospital in Sydney, Australia.

In both studies, a Home Medicines Review (HMR) service referral by the patients' general practitioners (GPs) was requested by the researcher for all recruited subjects. Most of the subjects were not referred by their GP for the service.[1] After the extension of existing WMP protocols and all ethics approvals, further recruitment of patients established the CofCP cohort of 281 patients. It was proposed for investigation in the CofCP, that those patients not referred for an HMR service were disadvantaged in regard to the continuity and quality of their ongoing care after discharge back into the community.

1.2.2 DEFINING CofC THROUGHOUT THE THESIS

After the conclusion of the WMP, the conceptual and operational approach to defining and recognizing continuity of care (CofC) remained unclear.[1] The complex nature of defining or explaining the phrase in the context of its use was evidenced from the systematic review conducted for this CofCP research.[2] The published review is included as Chapter 2 in this

thesis. Importantly, the review found that CofC in research involving pharmacists and their practice excluded disadvantaged patients, and care was not usually integrated across the involved healthcare professionals. Further, and noted with professional concern, the research reviewed excluded patients most in need of continuity of care. Following the systematic review, the lack of consensus on defining CofC was discussed in a commentary which is included in Chapter 2. The commentary explained the development of the working definition used in the systematic review process and the reasons why CofC is defined and interpreted in the context of the research reported in the separate chapter studies.

1.2.3 BACKGROUND TO THE CHAPTER STUDIES

To pursue the proposal that most of the CofCP cohort had been disadvantaged in their transfer from hospital to the community, the personal characteristics, clinical status and quality of life (QOL) factors for the cohort were established at two points in time.[3] The Dartmouth Co-Operative (COOP) QOL charts were utilized for the survey of these factors.[4-6] Along with the availability to the researcher of an HMR report for 79 patients, these characteristics and factors divided the CofCP cohort (n=281) into two subgroups: the HMR Report group (n=79) and the non-HMR Report group (n=202).

In the literature, there is no hesitation in identifying the period associated with patient transfer from secondary to primary care as a time requiring attention to discharge regimen and unmet health needs.[7-11] In Australia, written discharge summaries include discharge regimen and are the responsibility of the hospital medical team prior to discharge dispensing by hospital pharmacists.[1,12] Both these duties afford the opportunity for

medication reconciliation prior to discharge and for the timely prevention of drug related problems (DRPs) after discharge.[13-14]

Drug related problems which are diverse in nature, are described in many ways and are widely reported in the literature to be exacerbated by polypharmacy.[15-16] The literature supports the completion and accuracy of discharge summaries as crucial components of successful handover of information for the patient and for healthcare providers in the community.[17-19]

In Australia, patients can be advised to hand deliver their discharge summaries directly to their GP within 3 days of discharge.[1,17] This process facilitates continuity of care, the opportunity for medication reconciliation by the GP and at the GPs' discretion, referral for a Home Medicines Review (HMR) service.[20-22] This service requires an integration of care by the patients' GP, community pharmacy and accredited HMR pharmacists for continuity in medicines management, patient education and safety.[23]

After discharge, HMR is an additional opportunity for reconciliation of medicines actually consumed in patients' homes and for identification of patients' DRPs.[21,24] Taking into account pharmacy records, hospital discharge summaries and GP's referral forms, accredited pharmacists can report on the patients' actual or potential drug related problems regardless of the sources or nature of drug prescriptions.[25-27]

It is suggested that any problems in the quality of medication management can be identified by the assessment of patients' drug regimens at hospital discharge, and post discharge at HMR service in the community. Discharged patients who were referred for

HMR, had the advantage of ongoing identification of the source and type of any DRPs or any potentially inappropriate prescribing (PIP) of their drug regimens.[28]

A published paper on identification of DRPs for the HMR Report group is included as Chapter 4.[8] Hence, after identification of any DRPs or PIP at HMR service, these patients also had the advantage of the accredited pharmacists' reports for discussion with their GPs. In Australia, resolution of actual or potential prescribing problems is predominantly the domain of the patients' GPs. Meanwhile, international and multidisciplinary researchers have developed and validated several tools for the identification of PIP by informed healthcare professionals.[29-32]

To ensure a comprehensive assessment of the drug regimen for the patients who were referred for HMR service, two diverse tools for assessment of PIP were applied and repeated at two points in time.[33-34] Beers explicit criteria (Fick et al. 2003) which were well validated internationally, were utilised alongside explicit and implicit, appropriate prescribing indicators customized by Basger et al. (2008) for the Australian healthcare environment.[35-37]

1.2.4 RESEARCH QUESTIONS

Across the chapter studies it was proposed that the majority of CofCP patients not referred for HMR service were disadvantaged by the lack of CofC arising from the missed opportunity for medication management post discharge.[3] To test this proposal, any differences in the personal and clinical characteristics and discharge regimens between the two subgroups were examined.[38-41] To identify any differences, the full cohort's

characteristics were examined. Further their discharge regimens were determined and analysed for PIP by the application of Beers criteria.[36]

In 2008, Fourrier-Réglat et al. investigated any impact on cardiovascular patients from their prescriber's response or non-response to a survey on their care. On assessing the representativeness of one patient group to another, Fourrier-Réglat et al. could find no evidence of a difference between their patient groups.[42] To determine patient representativeness, these researchers reported on the patients' personal and clinical characteristics and drug regimens. In this research, the representativeness and significance of outcomes for the minority subgroup of patients referred for medication review, to the majority subgroup of patients not referred, was investigated.

Hence, it is proposed that this research will address:

- What is the meaning of 'Continuity of Care' (CofC)?
- Did patients need CofC after hospital discharge?
- Why did patients need CofC after discharge?
- Were all patients in need of CofC?
- Can the CofC needs of a minority subgroup of patients predict those of the majority subgroup?
- How can CofC be integrated and practiced on, and after discharge?

The research documented in this thesis is directed towards answering these questions to add knowledge and to inform professional healthcare practice for the

enhancement of ongoing patient care in medication management. That is, to evidence any need for improved continuity of patient care after their discharge from hospital.

1.3 PRIMARY RESEARCH AIM

To investigate the need for safer clinical management of medications for beneficial continuity and integrated patient care on and after hospital discharge.

1.3.1 RESEARCH OBJECTIVES

To achieve the primary research aim by:

1) Developing an approach to defining the phrase 'Continuity of Care' so its use in any context, was meaningful and transparent.
2) Conducting a real world, empirical research project in a large, acute care teaching hospital.
3) Identifying and taking into account the patients' personal and clinical characteristics, and responses to quality of life surveys.
4) Analysing any identified drug related problems (DRPs), polypharmacy or exposure to potentially inappropriate prescribing (PIP) at discharge and in the community.
5) Determining, analysing and comparing any specific drugs identified as PIP in the full cohort's drug regimens.
6) Investigating whether minority subgroup outcomes can be extrapolated to predict the medication management necessary for safe, continuous patient care.

7) Recommendations for transferring the research and process outcomes into practice.

1.4 THESIS FORMAT

The format includes two chapters comprised of peer reviewed, published papers and two chapters formatted for publication. Hence all chapters have been formatted by the inclusion of chapter references and appendices immediately following the relevant chapter.

1.4.1 CHAPTER FORMAT – Figure 1.1

Chapter 1.0 Introduction, thesis outline and primary aim.

Chapter 2.0 Systematic review of the international literature questioning what pharmacists as researchers, meant by 'Continuity of Care'. This chapter consists of a published paper entitled: "Quality Patient Care and Pharmacists' Role in Its Continuity – A Systematic Review". This is followed by a commentary, prompted by the review paper, on what researchers and communicators mean by the concept and phrase "Continuity of Care".

Chapter 3.0 Describes the empirical research which recruited 281 cardiovascular patients who participated in the Continuity of Care Project (CofCP). This chapter also builds the personal, clinical and drug-related profile of the cohort. In addition a quantitative assessment of 9 health-related quality of life (HRQL) variables for the full cohort, was

conducted at 2 points in time. The availability of reports generated from referral of patients for Home Medicines Review (HMR) service divided the cohort into two subgroups.

Chapter 4.0 Investigates the number and nature of drugs, diagnoses and drug related problems (DRPs) identified from HMR reports written on the HMR service conducted for the HMR Report group. This chapter consists of a published paper entitled: "Drug related problems after discharge from an Australian teaching hospital."

Chapter 5 0 Is formatted for publication and investigates the severity ratings of drugs, instances of PIP and the source (when and where) of the prescribing. Internationally developed Beer's explicit criteria are applied to the drug regimen of the HMR Report group to determine any significant differences in PIP between discharge and HMR service.

Chapter 6.0 Is formatted for publication and identifies instances of PIP and the source of prescribing. Developed in Australia, Basger indicators are applied to the drug regimens of the HMR Report group to determine any significant differences between discharge and HMR service. The application of the customized Australian indicators augments the outcomes of the internationally developed Beers criteria.

Chapter 7.0 Establishes the number and nature, by active ingredient, of the full cohort's discharge regimen at discharge. Beers criteria were applied for identification of PIP in the full cohort's discharge regimen. The representativeness, of the HMR Report group (n=79) to the non-HMR Report group (n=202) in PIP of specific discharge drugs, was determined

to further indicate the extent to which the full cohort would be exposed to PIP after hospital discharge.

Chapter 8.0 Synthesises the concepts, empirical research processes and data analyses of the CofCP. Through the research objectives, this chapter summarises the outcomes and impact of the research findings for the HMR Report group, non-HMR Report group and CofCP cohort. The extrapolation of data outcomes and generalisation of process outcomes is discussed. From the outcomes of the data analysis and research processes, recommendations for practice and further research are proposed.

Chapter 9.0 Addresses the primary research aim and conclusions are made on the need for safer clinical management of medications for the patients' improved and integrated continuity of care after discharge.

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CHAPTER 2.0
Systematic Review of the Literature and Commentary

Pharmacists' Role in Continuity of Quality Patient Care

CHAPTER 2.0

Systematic Review of the Literature and Commentary

Pharmacists' Role in Continuity of Quality Patient Care

DEFINING AND APPLYING 'CONTINUITY OF CARE' (CofC)

"What published research centered around the concept of CofC and how were pharmacists with multidisciplinary health care professionals (HCP) involved as interventionists?"

SEARCH

Concept of Continuity of care
- *Concept synonyms: seamless, continuous, ongoing care
- *Barriers to care
- *Definitions &Themes of CofC
- *Practising Pharmacists/Pharmacies

Research Components
- *Random Control Trials (RCTs)
- *Clinical Control Trials (CCTs)
- *Retro/Prospective or crossover studies
- *Multidisciplinary HCP involvement

Review Process
- *Peer-review of retrieved articles
- *Development Relevance Quality Assessment Tool
- *1st and 2nd Relevance Quality Testing
- *Development Working Definition of CofC

SELECTION 21 ARTICLES FOR REVIEW

Data Extraction

Data Synthesis

SUMMARY of OUTCOMES
Heterogeneity of studies

***Patients most in need of continuity of care were disadvantaged by exclusion criteria**

***The involvement of multidisciplinary HCPs was beneficial**

***There was no consensus on the definition of Continuity of Care**

***The working definition of CofC provided a ready and practical template for describing the concept**

Figure 2.1 Chapter 2.0 Flowchart

CHAPTER 2.0 SYSTEMATIC REVIEW OF THE LITERATURE: DEFINING AND APPLYING 'CONTINUITY OF CARE' (CofC)

2.1 CHAPTER SUMMARY

'Continuity of Care' is a pivotal concept and aim throughout this thesis, therefore the phrase required explanation. Reporting of diverse research topics in peer reviewed literature constantly utilised the phrase and its use was varied and unexplained in claims of high quality, professional healthcare practice across all disciplines. Definition, description or explanation of the concept in the context in which it was used was rare. Hence, as a claim for excellence in practice or as a research goal in infinite circumstances, no one definition could suffice. In this chapter, a systematic review of the literature was conducted to clarify the meaning of the phrase and how it was applied in research conducted by pharmacists alone, or with multidisciplinary healthcare professionals (HCPs). For the review process it was necessary to develop a relevance quality assessment tool and a working definition of continuity of care. Further, this chapter addresses the overall thesis research question of 'What is Continuity of Care'?

2.2 WORKING DEFINITION

CONTINUITY OF CARE is a perception of quality health care resulting from the ongoing management of issues which cause disruption to optimal patient care.

2.3 PUBLICATION NOTE. The following paper is cited in subsequent chapters as: Ellitt GR, Brien JE, Aslani P, Chen TF. Quality Patient Care and Pharmacists' Role in Its Continuity – A Systematic Review. Ann Pharmacother 2009:43:677-91. doi: 10.1345/aph.1L505

Quality Patient Care and Pharmacists' Role in Its Continuity—A Systematic Review

Glena R Ellitt, Jo-anne E Brien, Parisa Aslani, and Timothy F Chen

See also page 745.

BACKGROUND: Continuity of care is important for the delivery of quality health care. Despite the abundance of research on this concept in the medical and nursing literature, there is a lack of consensus on its definition. As pharmacists have moved beyond their historical product-centered practice, a source of patient-centered research on continuity of care for practice application is required.

OBJECTIVE: To determine the scope of research in which pharmacists were directly involved in patients' continuity of care and to examine how the phrase *continuity of care* was defined and applied in practice.

METHODS: A working definition of continuity of care and a tool for relevance quality assessment of search articles were developed. MEDLINE, *International Pharmaceutical Abstracts*, EMBASE, and the Cochrane Collaboration evidence-based medicine reviews and bibliographies were searched (1996–March 2008). Reporting clarity was assessed by the Consolidated Standards of Reporting Trials checklist and outcomes were grouped by economic, clinical, and/or humanistic classification.

RESULTS: The search yielded 21 clinical and randomized controlled trials, including 11 pharmacist-only and 10 multidisciplinary studies. A broad range of research topics was identified and detailed analysis provided ready reference for considerations of research replication or practice application. Studies revealed a range of research aims, settings, subject characteristics, attrition rates and group sizes, interventions, measurement tools, outcomes, and definitions of continuity of care. Research focused on patients with depression (n = 4), cardiovascular disease (n = 4), diabetes (n = 2), and dyslipidemia (n = 1); specific drugs included non–tricyclic antidepressants, cardiovascular drugs, and benzodiazepines. From the proposed endpoints of economic cost (n = 6) and clinical (n = 14) and humanistic (n = 16) outcomes, 15 studies reported statistically significant results.

CONCLUSIONS: Medication management at primary, secondary, and tertiary levels of care indicated an expanded role and collaboration of pharmacists in continuity of care. However, the exclusion of disadvantaged patients in 19 studies is at odds with continuity of care for these patients, who may have been the most in need for the same reason that they were excluded.

KEY WORDS: cardiovascular disease, continuity of care, depression, diabetes, medications, pharmacist.

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It is well established that the concept of continuity of care is important for the delivery of quality health care.[1,2] Healthcare professionals, researchers, and policy makers regularly use the phrase to imply a high standard of health care and valued professional practice.[3] Although a plethora of diverse descriptions of *continuity of care* have been published, there is a lack of consensus on the definition of the phrase both across and within healthcare disciplines.[4]

Research encompassing continuity of care as a concept, goal, or outcome is abundant in medical and nursing literature and there has been in-depth discussion of the factors that contribute to different types of continuity of care for specific purposes.[5] However, in addition to the lack of consensus on a definition, the definitions available in the literature are not broad enough to include multidisciplinary healthcare practices.[6] In particular, literature on research showing how pharmacists contribute to patients' continuity of care is sparse.

As an example of the diverse use of the phrase, general medical practitioners

Author information provided at the end of the text.

proposed a biopsychosocial triple diagnosis model to combine continuity elements such as interpersonal, informational, and cross-boundary continuity of care. The view that continuity of care could exist only over a long period of time, or that it was a paradox that continuity of care could be researched by a cross-sectional study, illustrates a predilection for continuity to be expressed only in measures of time.[7,8] No clear preference for one type or description of continuity of care was reported.

From a UK nursing perspective, the importance of seamless care for patient transition between primary and acute care sectors was defined as including (1) surmountable organizational boundaries, (2) responsible and accountable practitioners, and (3) the use of multiprofessional teams.[9] However, this definition does not have a patient focus or specific requirement for quality care.

Other multidisciplinary research teams described continuity of care as an outcome comprising the 2 core elements of individual patient care and care delivered over time.[10] Specifically, they suggested 3 types of continuity of care, which encompassed informational, management and relational continuity, and connected and coherent care to overcome organizational and disciplinary boundaries.

The terms *continuity of care* and *seamless care* have also been used to describe effective communication in the movement of patients and information across primary and secondary care boundaries. The potential roles for community liaison pharmacists, electronic patient records, transfers across care interfaces, stakeholders' views, and optimal postdischarge visiting times have been researched.[11,12] The meaning of continuity of care was not reported in the context of these studies, but its importance was recognized and continuity of care elements included intraorganizational continuity, barriers, and boundaries.

In addition to discussing the expansion of pharmacists' traditional role as dispensers of medicines, Kuehl et al.[13] commented that the term *continuity of care* had been repeatedly redefined to accommodate changes over the years. The phrase was traditionally associated with physician–patient relationships without any reference to any other healthcare professions.

Our objectives were to determine the scope of research, through a systematic literature review, in which pharmacists were directly involved in patients' continuity of health care and to examine how the phrase *continuity of care* was defined and applied in practice.

Search Strategy

We accessed the Cochrane Collaboration glossary of terms and followed the University of York guidelines for the conduct of systematic reviews and search strategies, especially for randomized controlled trials (RCTs).[14,15] The reporting of key points of the research, as listed in the Consolidated Standards of Reporting Trials (CONSORT) guidelines for the publication of research describing RCTs, was taken as an indication of the clarity of reporting in the selected articles.[16]

REVIEW QUESTION FORMULATION

A broad review of the scope of pharmacy research and practice was planned and 2 main queries became apparent: (1) what published research was centered around the concept of continuity of care and (2) which of those studies involved pharmacists as interventionists in well-designed studies.[17,18] These 2 questions formed the review objectives and requirements for practicing interventionist pharmacists and well-designed studies were included in the review inclusion criteria.

REVIEW CRITERIA

Inclusion criteria required that (1) practicing pharmacists were the researchers and/or the interventionists; (2) continuity of care or one of its synonyms was described and/or thematically underpinned the study; (3) research had been peer reviewed; and (4) research design was well structured, with randomized subjects and comparison of parallel intervention and control groups (eg, RCTs).

Studies were excluded if they were laboratory-based, used pharmacy records only, did not directly involve the pharmacist as interventionist, recruited subjects other than patients, or were not in English.

OUTCOME CATEGORIZATION

Outcomes were categorized as economic, clinical, or humanistic outcomes (ECHO). The ECHO framework represented a balanced-system approach, as the inclusion of process and outcome indications satisfied a broader range of healthcare stakeholders by including economic analysis.[19,20]

CLARITY OF REPORTING

Each article was assessed for the clarity with which study characteristics, design, methods, intervention implementation, endpoints, impacts, experiential constraints, and constructive criticisms of the research were reported.[16] A detailed assessment of the clarity of reporting is outside the scope of this review. The reporting of these measures was recorded as clear, not clear, or not reported.[21]

RELEVANCE QUALITY ASSESSMENT TOOL

A relevance quality assessment tool was developed for this study (available from GRE). To assess the relevance of the retrieved articles, the reviewers were blinded to all au-

thor details. Relevance assessment was conducted in 2 rounds (Figure 1).[22-24]

In the first round, retrieved abstracts were assessed against the review objectives and allocated into 1 of 3 tiers of relevance by 3 reviewers. The first tier contained articles that all reviewers agreed were relevant, the second tier contained articles assessed as relevant by 2 of the reviewers, and the third tier articles were deemed not relevant and were eliminated.

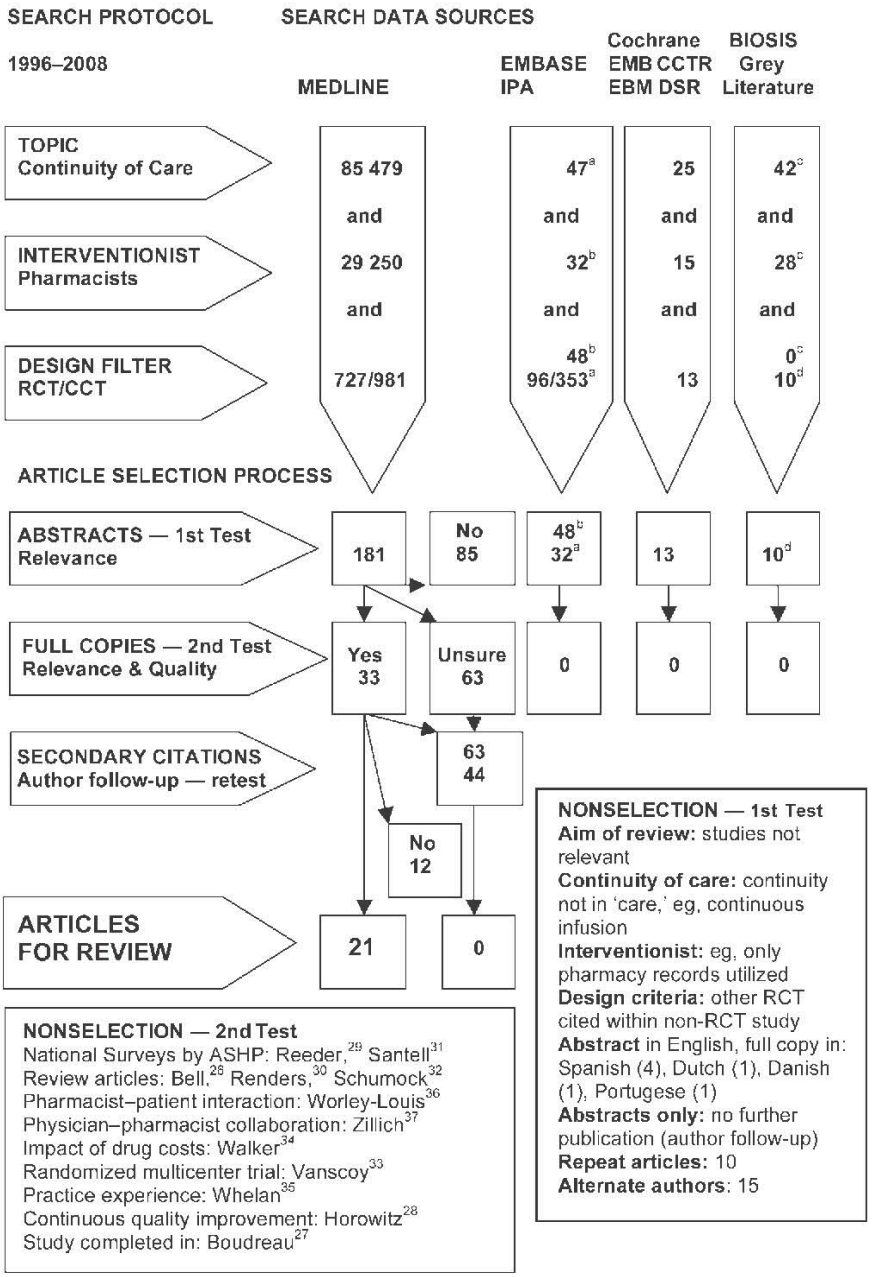

Figure 1. Search protocol for systematic search and processes for article selection. Search was limited to English language and human research. ASHP = American Society of Health-System Pharmacists; CCT = controlled clinical trial; CCTR = Cochrane Central Register of Controlled Trials; DSR = Cochrane Database of Systematic Reviews; EBM = evidence-based medicine; RCT = randomized controlled trial.
[a]IPA (*International Pharmaceutical Abstracts*).
[b]EMBASE.
[c]BIOSIS Previews (19) and Biological Abstracts (23).
[d]Grey literature.

With regret, and to respect our publishers we have not reproduced the full manuscript for e-digitization and manuscript pages 23-35 have been deleted. This complete paper is freely available on line and the contents of the paper constitute a background to the use of the developed 'working definition' of continuity of care throughout the thesis. The authors apologise and encourage readers to access the information rich paper, please.

PUBLICATION NOTE. Ellitt GR, Brien JE, Aslani P, Chen TF. Quality Patient Care and Pharmacists' Role in Its Continuity – A Systematic Review. Ann Pharmacother 2009:43:677-91. doi: 10.1345/aph.1L505

2.4 COMMENTARY ON 'CONTINUITY OF CARE'

2.4.1 WORKING DEFINITION FROM SYSTEMATIC REVIEW:

CONTINUITY OF CARE is a perception of quality health care resulting from the ongoing management of issues which cause disruption to optimal patient care**.**[1]

2.4.2 COMMENTARY SUMMARY

After publication of the systematic review assessing pharmacists' roles in the continuity of quality patient care, the above working definition developed for that review, was shown to provide a ready and practical baseline for that purpose. The working definition of continuity of care (CofC) was developed from broad searches of the literature. It required an initial indication of whose perception of *quality* healthcare was being defined. This was followed by the inclusion of three other important components: *ongoing* management; *management* of issues; and *optimal* care.

While utilising the working definition it became clear that no one definition would suffice to cover the broad, complex and professionally diverse application of the concept in healthcare research and communication. Hence, it was proposed the working definition was used as a template which was followed by a description of the four components in terms of the research or message rendered. That is, the template was used as a basis for the meaningful description of CofC in the context of its use.

2.4.3 THE CONCEPT OF CONTINUITY OF CARE

There is no doubt about the importance of 'continuity of care' in healthcare as a concept, an expression of professional achievement, significant research outcome or as a model of optimal patient care.[2-3] Despite the importance of continuity of care, there appears to be no consensus on the definition or application of the phrase.[4-5]

The vast number of articles retrieved with ease, when searching the literature for the phrase 'continuity of care', suggests that the term is in common use in all forms of research and communication within the healthcare professions.[1,4,6-7] Use of the phrase was found to be made by most professions in a diverse range of settings, but always in relation to care delivered over a long period of time. Further, the phrase has been used to describe the care of patients in most diagnosis related groups (DRGs) from a variety of societies and cultures.[8-9] Despite common usage, few articles defined the phrase and in those few, no two definitions were alike.

In general, in the few articles where the phrase was defined and where a claim for attainment of CofC or 'seamless' care was made, the definitions seemed narrow, prescriptive and exclusive.[10-12] These definitions implied an exclusivity for CofC to the authors' profession, to their own health care setting and/or to patients in (only) their care for a specified, long period of time.[10]

Beside well known factors such as a long time period and knowledge of the patient's medical history, other less obvious factors influence CofC but are rarely explained when the phrase is used. These include, for example: the need for a patient focus; the quality of care; the quality of research evidence; the geography and religion of the care setting. In the literature, cultural and ethical aspects of health care settings were found to be factors which were integral to the context in which the phrase was used.[13-14]

When these factors were addressed, culture and ethics were described as being separate and unique, and not as being integral to CofC. For example, there has been significant criticism about the movement of primary (medical) care towards specialization and the way in which it undermined the patients' CofC especially when patients were from minority cultural groups.[13] Other articles discussed the ethics of fee-for-service systems

where uninsured patients were refused treatment or patients in managed care systems felt abandoned and frustrated where CofC was concerned. Contextual factors such as culture and ethics were even more rarely reported when found to be barriers to the quality of the patients' CofC.[15-18]

It was challenging to adequately include, in one description, the vast number of components which could comprise continuity of care. The expression is comfortably adopted and utilized by so many professionals in so many ways to indicate so many different ideas. Hence, how could CofC communication by healthcare professionals be unambiguous, or research findings described as 'enhancing continuity of care', be validated or interpreted unambiguously?

2.4.4 DEFINING CONTINUITY OF CARE

In an effort to find a standard or benchmark for professional communication and research outcomes, after conducting the systematic review in this chapter, it was concluded that no one fixed definition of continuity of care could suffice.[19] As a starting point for clarity, it is proposed that the working definition of CofC developed for the review, be used as a generic template on which particular components of the CofC research or message were described. The template included four main components consisting of:

1) a perception of *quality* healthcare;

2) *ongoing* management;

3) *management* of disruptive issues; and

4) *optimal* patient care.

In the systematic review of the literature on how pharmacists contributed to patients' continuity of care, the proposed template was used to assess descriptions of CofC.[1] Of the twenty one articles reviewed, eleven articles clearly contained the words or the phrase

'continuity of care' or one of its synonyms however, only the three following studies offered any explanation of the concept in the context of their studies.

Bolas et al, (2004) in Northern Ireland, stated the clear benefits of achieving seamless pharmaceutical care which they defined as "concerned with the transfer of patients between primary and secondary sectors without loss of continuity….."[20] They added that few pharmacy services were able to deliver that type of care and that communication and timely information exchange were the most important components of seamless care.

Nickerson et el. (2005) in Canada, defined seamless care in the profession of pharmacy as continuity of care delivered 'across the spectrum of caregivers and their environments'.[12] In addition, to improve medication use, it was stated that pharmacy care should be un-interrupted as pharmacists take responsibility for patient care as it is passed from one professional to the next. These researchers named 'medication reconciliation' as an important subset of seamless care.

Kuehl et al. (1998) in the USA, commented that 'continuity of care' had been repeatedly re-defined and even though the term was increasingly more relevant to pharmacy practice, an applicable definition was lacking.[21] Kuehl described the term as including information exchange, coherent provider/consumer relationships, sharing of professional knowledge and patient interaction across healthcare systems. It was also suggested that patient interaction alone, even with a knowledgeable healthcare professional, did not totally define the concept.

The above three examples from the systematic review showed the template's utility and flexibility as a baseline on which to assess the concept in the context of its use. In the examples it was assumed, and not reported, that readers would know whose perception of

quality healthcare was being researched in patient transfer between primary and secondary sectors; across the spectrum of caregivers; or across healthcare systems.

It was reported that *ongoing* management could be achieved by 'transfer without loss of continuity'; and 'uninterrupted pharmacy care'. *Management* of disruptive issues was implied by the achievement of communication and timely information exchange; taking responsibility for patient care; and providing coherent consumer relationships. *Optimal* patient care was implied by the conduct of medication reconciliation; and the clear benefits of achieving seamless care. The template accommodated these specialised descriptions of CofC in the context of three very different research studies. However, none of the examples included all four of the proposed components.

Further, it is noteworthy that none of the twenty one reviewed studies suggested fragmentation of the concept into different types of CofC (e.g. interpersonal, relational, organisational, or informational continuity), which was identified in abundant medical and nursing literature.[4,19,22] The lack of CofC fragmentation suggested a tendency to intra-disciplinary consensus between pharmacists from seven different countries, in twenty one disparate studies. The pharmacists, by chance, used the same general expression of the concept in their studies and CofC was not broken up into several different types of continuity.

In an editorial on the systematic review of CofC in this chapter, Murray M (2009) suggested that healthcare professionals 'Keep it simple" when discussing CofC.[23] These comments were consistent with the proposed non-fragmentation of the concept into many different types. In the literature, the four components of the template were repeatedly reported to be necessary for successful continuity of patient care.[24-31] It is suggested that the components are not negotiable in describing the phrase. However, the template allows

flexibility in the way components are included to describe the concept. That is, descriptions could include interpersonal, relational, organization or informational care as optimal for the patient.[32]

It is intended that the generic template be customized so the meaning of each component is clarified. That is, it was recorded whose perception of *quality healthcare* was envisaged; what form the *ongoing* management takes in a particular setting; how *management* of disruptive issues is proposed; and what care is seen as *optimal* for the patient. The four generic components have been derived from the plethora of opinions and descriptions in the literature and are commonplace factors expected in professional healthcare practice.[30,33] The concept of 'continuity of care' seems to be idealised and generalised, but claims of its attainment were not reported as patient centred and meaningful in a specific context.

Hence, only the users of the phrase 'continuity of care'; in any study or message, could answer the question of what was meant by the phrase at the time of its use. If no explanation or description in the context of the message was provided, then an accurate interpretation by the reader or listener could not be expected. If the meaning was reported as suggested, the receiver of the message could decide how far the proffered description of CofC was acceptable, adequate and applicable within their own ethical, research or practice ethos. For the patients' welfare, communication should be less ambiguous.

It is accepted that consensus on one definition of CofC is unlikely, but inclusion of the intended meaning of the phrase in context, would reduce the ambiguity of its use. To this end in the following chapters, the concept of CofC was defined by the same template but was described in the context of the overall thesis or in the context of each of the separate studies of which the thesis was comprised.

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CHAPTER 3.0

Continuity of Care Project (CofCP)

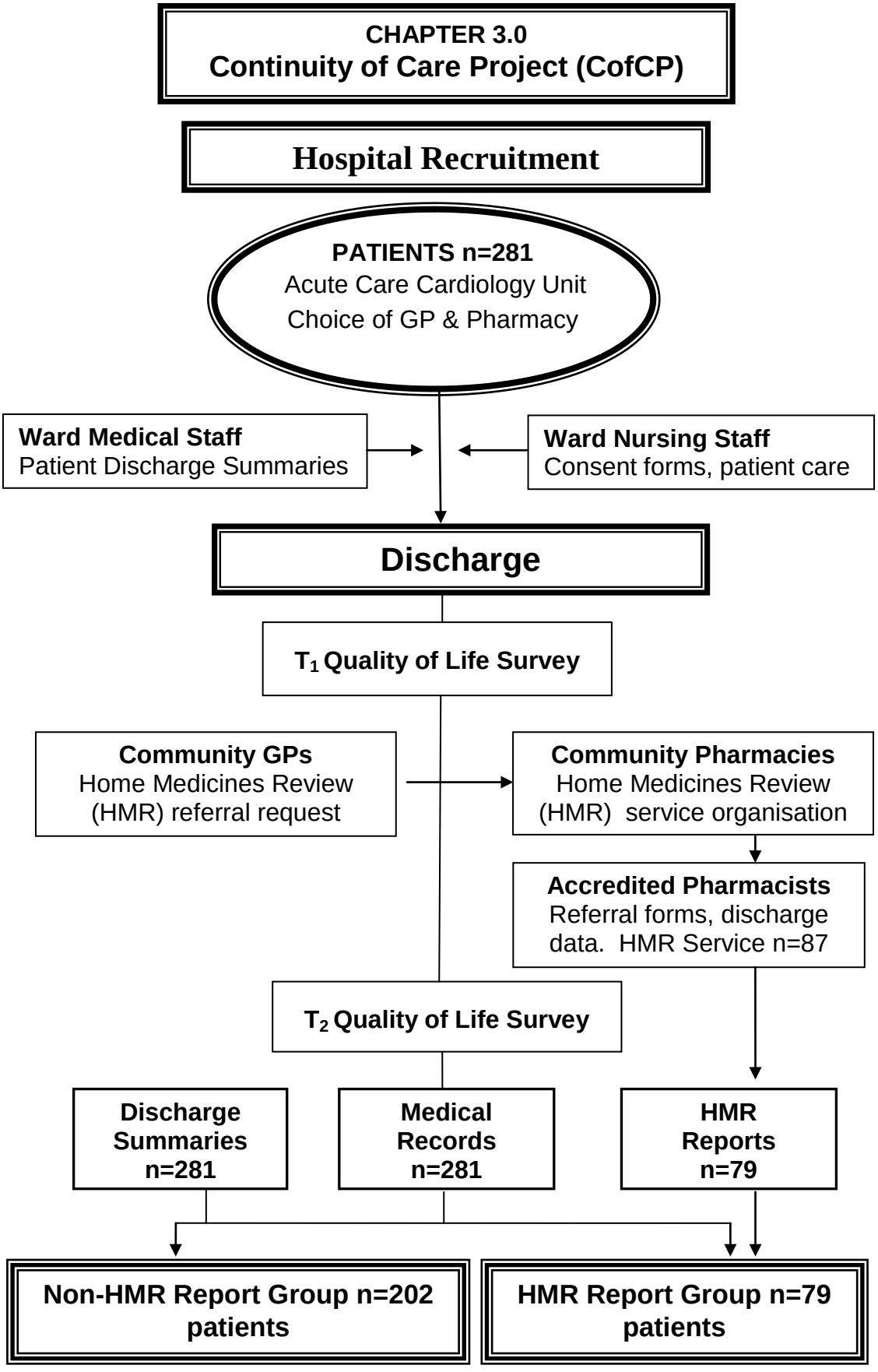

Figure 3.1 Chapter 3.0 Flowchart

CHAPTER 3.0 CONTINUITY OF CARE PROJECT and SUBJECT CHARACTERISTICS

3.1 CHAPTER SUMMARY

This chapter introduces the empirical Continuity of Care Project (CofCP), characterises the patients recruited, describes the implementation of the CofCP and justifies the division of the cohort into subgroups. The cohorts' characteristics of age, gender, length of stay (LOS) and number of prescriptions are assessed along with the outcomes of a Health Related Quality of Life (HRQL) survey at discharge and post discharge.

At these two points in time, the cohorts' personal and clinical characteristics were also compared to ascertain any differences between HRQL survey responders and non-responders. Justification for the division of the cohort into the non-HMR Report group (n=202) and HMR Report group (n=79) is reported, as is the representativeness of the minority subgroup in the above variables. Description of the project implementation and cohort characteristics in this chapter precedes investigations into the patients' medication management for continuity of care in the following chapters.

3.2 BACKGROUND TO CONTINUITY OF CARE PROJECT (CofCP)

A previous study known as the Westmead Medicines Project (WMP) was conducted in the cardiology unit of Westmead Hospital which is a major teaching hospital in Sydney, Australia. The WMP tested a multidisciplinary 'continuity of care' model for cardiovascular patients, involving community pharmacists. Referral for Home Medicines Review (HMR) services by the patients' general medical practitioners (GPs) after discharge, was requested for all subjects. After referral, the involvement of pharmacists combined the patients' community pharmacies and accredited pharmacists as providers of the HMR services after hospital discharge.

By the final date of funding for the WMP and report to the Pharmacy Guild of Australia, the recruitment of 176 patients and collection of 46 HMR reports was achieved. The original WMP research design had been approved by 4 institutional ethics boards for the recruitment of 280 subjects and subsequently, these boards approved an extension of time to complete patient recruitment and follow up.

An additional 105 patients were recruited under WMP protocols and conditions, and all details appear in the methods section of this chapter. The full cohort of patients (n=281) and their data sources, constituted the subjects and resources for the Continuity of Care Project (CofCP) on which studies in this, and the following chapters are focussed.

3.3 INTRODUCTION TO THE CONTINUITY OF CARE PROJECT (CofCP)

3.3.1 CONTINUITY OF CARE

The concept of continuity of care (CofC) is important and is upheld by most professional practitioners from internationally diverse cultures and healthcare environments.[1-4] While there is ready acceptance and common use of the phrase, there is no consensus on the definition of the concept.[5]

More often than not, CofC is not defined or explained in the context of the situation or research in which the phrase is used.[5-8] There is however, no disagreement that continuity in patient safety and quality of care is most at risk on transfer from one healthcare sector to another. Several researchers concluded that clear and accurate communication between healthcare professionals was vital to patient safety and care. [9-13] Wenger and Young (2007) equated safety and quality of care with having patient

focussed communication with a dedicated primary care physician after hospital discharge.[14]

3.3.2 HOSPITAL DISCHARGE

However, Shakib et al (2009) found the opportunity for effective communication with the patients' GPs through discharge summaries, was 'spurned' in Australia by hospital medical staff.[15] Research by Richardson and McKie (2008) found a proposal for improved supervision and support of junior doctors was rated highest overall in their investigation of options for reducing adverse events in Australian hospitals.[16] These same junior doctors are generally responsible for the documentation of hospital discharge summaries which are often computer printed after manual input for hand delivery, by the patient, to their local GP.[17-19]

In 2001, Australian researchers reviewed the reliability, delivery timeliness and accuracy of discharge summaries and found only 27.1% of the patient-nominated GPs received summaries and 36.4% of discharge summaries contained errors.[17] In 2011, Swiss researchers targeted omitted and unjustified drugs recorded in 577 discharge summaries. They found that 32% of omissions and 16% of the unjustified drugs identified, were potentially harmful.[20]

Responsible patient discharge from an acute care hospital back into the community relies heavily on the provision of accurate clinical documentation, patients' health needs and education on their drug regimen.[21-23] Comprehensive discharge summaries are a base line for recognition of change in patients' health status, medical treatment and pharmacotherapy, post discharge.[24] As such, discharge summaries can efficiently transfer patient information.[25-26] Internationally, the literature shows

discharge summaries are recognised as an important link in communication between hospitals and healthcare practitioners in the community.[27-32]

3.3.3 HOME MEDICINES REVIEWS

In general, diligent communication would effectively maintain information exchange between hospital medical staff and patients' GPs for the successful integration of tertiary and primary care.[14,33-34] In particular, information exchange between healthcare professionals is pivotal to the accuracy and relevance of all forms of post discharge medication reviews by pharmacists.[35-36]

In comparison to Australia, international primary care services which include medication review and reconciliation; vary in name, process, involved healthcare professional (HCP) and patient interview location.[35,37-40] When investigating patients' self efficacy after medication review services, Canadian and UK researchers concluded that medication review by pharmacists did not necessarily lead to health gains or cost effectiveness. The international researchers claimed pharmacists' advice had the potential to "undermine and threaten the patients' assumed competence, integrity, and self governance." (pp1105[79])[42-44]

In Australian HMR services, GPs are requested to document their patients' current diseases and prescribed drugs on referral forms to inform pharmacists prior to their provision of the service. Also, as the service name implies, HMRs are conducted in the patients' homes where accredited pharmacists have access to all medications the patient is currently consuming.[18] As a service requirement, pharmacists report back to the referring GP on the patients' health status and any potential drug related problems

identified.[39,45-46] Also during HMR, pharmacists exchange information with patients to encourage adherence to prescribed drug regimen.[47-48]

Although there have been reports of slow uptake of HMR in Australia by GPs, no reports of potential, detrimental outcomes from the service have been published.[36,48-50] Australian research shows multidisciplinary HMR services can address drug related problems; improve the appropriateness of prescribing; warfarin management; regimen adherence and the timely identification of potentially inappropriate medications post discharge.[48,50-54] Australian researchers have also shown how continuity of care intervention by multidisciplinary teams of primary care providers can positively affect the patients' quality of life (QOL) post discharge.[55]

3.4 PERSONAL CHARACTERISTICS OF THE PROJECT COHORT

In this chapter the personal characteristics of the study cohort (n=281 patients) were assessed as a prelude to the identification, in the following chapters, of any drug related problems experienced by the cohort. Preen et al. (2005) claimed that an acknowledgement and consideration of the influence of human factors such as age, gender and QOL, on drug related research validity and on the patients' continuity of care, was essential.[55]

For patients with primary or co-morbid cardiovascular disease, the literature on QOL research is vast, geographically and culturally diverse, and published by many healthcare disciplines. Age and gender are routine inclusions in QOL investigations. Further, QOL research can be conducted at primary care/community and or hospital/clinical research sites. In addition, the increasing importance of quantifying the

impact of all HRQL interventions has realised an extensive array of QOL measurement charts, questionnaires, health surveys, scales, indexes and programmes.[56-57] From a literature search, international research into HRQL has been compared with Australian and New Zealand (NZ) research as these two countries have many geographic, cultural, social and (in particular) healthcare system similarities.

3.4.1. JUSTIFICATION FOR ASSESSMENT OF QOL AS A PATIENT CHARACTERISTIC

3.4.1.1 QOL International Perspective: Primary Care/Community Environment

In Norway, Stavem and Jodalem (2002) assessed the reliability, construct and discriminant validity of the Dartmouth Co-operative Functional Assessment; World Organisation of National Colleges and Academics (COOP/WONCA) charts against the EuroQol Group Health Standard (EQ-5D) and Respiratory Quality of Life Questionnaire (RQLQ) in a respiratory outpatient clinic. These researchers found the reliability of the COOP/WONCA items were acceptable for group level use, but were lower than recommended reliability for individual patient use.[58] Benetti et al.(2010) in Brazil, ran a community exercise programme for cardiorespiratory fitness and QOL improvement after myocardial infarction (MI) using the MacNew Quality of Life after Myocardial Infarction (MacNewQLMI) scale and found greater intensity exercises increased functional capacity and QOL after MI.[59]

Landi et al. (2007) in Italy, researched the impact of inappropriate drug use, identified by Beers criteria for subjects ≥65 years of age. The researchers assessed physical performance and functional status in the elderly from a mountain community. Measurement of QOL utilised the Cognitive Performance Scale (CPS), Physical Performance Battery Score (SPPB) and Instrumental Activities of Daily Living (IADL)

scale. Landi et al. found the mean age of his subjects was 85 years and that amongst these 'frail-old subjects', the use of inappropriate drugs is associated with impaired physical performance.[60]

3.4.1.2 QOL Australian and New Zealand Perspective: Primary Care/Community Environment

In a NZ primary care environment, Eaton et al. (2005) compared the COOP charts, Chronic Respiratory Questionnaire (CRQ), Medical Outcomes Study 36 item Short-form Health Survey (SF-36) and Hospital Anxiety and Depression (HAD) scale. Eaton et al. found many HRQL tools were not user-friendly in the clinic setting and the COOP charts were simple, reliable, valid and responsive.[61] Further HRQL research was conducted by Krass et al. (2011) in a community pharmacy Diabetes Medication Assistance Service and Clarke et al. (2009) in a Fenofibrate Intervention and Event Lowering in Diabetes study. Both research teams utilized clinical and the EQ-5D for QOL outcome measurement. Krass et al. found the diabetes service would reduce diabetes-related complications and cardiovascular risk.[62] Clarke et al. found EQ-5D was an independent predictor of mortality risk, diabetes complications and future vascular events.[56]

3.4.1.3 QOL International Perspective: Hospital/Clinical Environment

In a Spain, Parra et al. (2011) assessed the impact of nasal continuous positive airway pressure (nCPAP) in first time ischaemic stroke patients in seven acute care teaching hospitals. The Barthel Index, Canadian Scale, Rankin Scale and SF-36 were repeated over 24 months and patient age, gender, number of drugs and hospital length of stay (LOS) were included variables. Parra et al. found nCPAP accelerated neurological

recovery and delayed cardiovascular events, although improved survival and QOL was not shown.[63]

Researchers from the United Kingdom and Norway combined to systematically review fifteen HRQL instruments and assessed older people whose specific co-morbidities included chronic heart disease and stroke. Of the fifteen instruments the most extensive evidence for reliability, validity and responsiveness was found for the SF-36, COOP charts, EQ-5D, Nottingham Health Profile (NHP), and Sickness Impact Profile (SIP). Age, gender and LOS characterised the patients and the effect size statistic was claimed to be the most common method of providing a standardised unit of expression of the size and meaning of score change.[64]

3.4.1.4 QOL Australian/New Zealand Perspective: Hospital/Clinical Environment

In an Australian/New Zealand (NZ) healthcare environment Dixon et al. (2001) tested the independent predictive qualities of a 'heart-specific' QOL measurement in cardiac emergency, hospital admissions. The MacNew Instrument (previously known as the QLMI) measured QOL, Charlson Comorbidity Index (CCI) determined clinical status, and prognostic factors included age, gender and LOS.[65] Dixon et al. found global QOL scores predicted mortality and cardiovascular morbidity; and that emotional, physical and social domains predicted adverse outcomes post discharge.

In an on-going study, Du et al. (2011) studied patients with chronic heart failure from four Sydney hospitals. These researchers measured physical function and activity, self efficacy and self-care behaviour with the SF-36, a Home-Heart-Walk 6 minute test and the Minnesota Living with Heart Failure Questionnaire.[66] Preen et al. (2005) investigated the mental and physical aspects of quality of life for cardiovascular patients

in a multidisciplinary intervention using the SF-12 survey to improve discharge care planning. Preen et al. found GP participation, patient satisfaction, and continuity of care were enhanced in a study which included length of stay (LOS) as a variable for consideration.[55]

3.5 CLINICAL CHARACTERISTICS OF THE PROJECT COHORT

In this chapter the clinical characteristics of the CofCP cohort (n=281 patients) were assessed as a prelude to the identification in the following chapters, of any drug related problems experienced by the cohort. In characterising the cohort, LOS and the number of drugs the patients were prescribed, were considered as clinical characteristics.

The influence of these two factors on polypharmacy and in particular on the patients' continuity of care, was taken into account. In addition, for the CofCP cohort of chronically ill cardiovascular patients, LOS was the determining factor on which the provision or non-provision, and comprehensiveness of a hospital discharge summary, was decided.[18]

3.5.1 JUSTIFICATION FOR ASSESSMENT OF LOS AS A CLINICAL CHARACTERISTIC

In the literature, research into LOS for patients with cardiovascular disease predominantly centred around organisational resource management, health insurance or the cost of hospital care. These factors were commonly targeted regardless of whether Australian or international healthcare environments were investigated.[67-69] For example, Australian researchers investigated cost estimation for LOS in the monitoring of acute coronary syndromes and cost savings from pharmacist initiated changes to drug therapy, medical procedures and LOS prediction.[70-71] American researchers

investigated safety and LOS with the prescribing of glycoprotein IIb/IIIa inhibitors in percutaneous coronary interventions and found an economically driven change in medication selection may not have been appropriate.[72]

3.5.1.1 Australian Perspective: Clinical Aspects of LOS

However, the literature did reveal Australian research which reported LOS when targeting the clinical aspects of care. This research included a) an evaluation of a rehabilitation casemix classification which predicted LOS in stroke care but not in spinal cord injury and b) an analysis of the effects of a post discharge CofC intervention on discharge satisfaction. These latter researchers found no difference between the experimental groups in hospital LOS.[55,73-74]

3.5.1.2 International Perspective: Clinical Aspects of LOS

International research which reported LOS when targeting clinical aspects of care included USA research into a) the impact of cross-clamping time in aortic arch repair which showed increased LOS correlated with increased age and b) the effect of nesiritide versus dobutamine in heart failure. These latter researchers concluded there was no difference in LOS for treatment with nesiritide however, mortality and readmissions were reduced.[75-76]

Lisby et al. (2010) in Denmark, specifically targeted LOS as a primary endpoint when studying the outcomes of medication review on admission of elderly patients to an acute care, internal medicine hospital. Medical physicians were 'not obliged' to comply with clinical pharmacists' recommendations to modify or change inappropriately prescribed drugs and less than half the involved hospital physicians did. Lisby et al. found there were no significant or clinically relevant differences in LOS or QOL

between the control and intervention groups.[77] As intended in this study, Swiss research included LOS when characterising their study cohort for investigation of the association of polypharmacy with high risk, potential drug-drug interactions in cardiovascular disease.[78]

3.5.2 ASSESSMENT OF NUMBER OF PRESCRIBED DRUGS AS A CLINICAL CHARACTERISTIC

Drug-drug interactions are one only, of a number of drug related problems (DRP) and 'DRP' is one only, of a number of acronyms applied to drug related situations, burdens, events or reactions.[79] Further, problems can be drug related or patient related; actual or potential and of high or low severity.[45-80] Most of these drug problems affect the patients' safety and quality of care and hence, the patients' continuity of care.[55] Further and in addition to the broad range of factors associated with DRPs, the higher the number of drugs routinely consumed by chronically ill patients with cardiovascular disease, the more their problems were compounded.[78]

Several researchers described polypharmacy as the concurrent and active, daily consumption of ≥5 prescribed drugs.[81-83] An in-depth study of polypharmacy in heart failure by Flesch and Erdmann (2006), reported the high consumption levels of cardiovascular drugs necessary for treatment and found that American patients (on average) were prescribed 7.5 drugs and 11.1 doses daily on hospital discharge.

Fialová et al. (2005) and Müller (2008) found the relative risk of potentially inappropriate medication (PIP) use was also positively associated with polypharmacy.[81-83] Regardless of the specific patient characteristics, situation factors or drug components, partly unpredictable drug interactions are created or exacerbated by polypharmacy.[78,83-84] In turn, the larger the number of drugs to be listed on patients'

notes and in discharge summaries the larger was the leeway for inaccuracies and incompleteness in transferring patient information across health care sectors.[16]

In Australia, widespread and comprehensive electronic recording and transfer of accurate patient information is still not a reality.[16,33,36,85] Richardson and McKie (2008) described the transfer of healthcare information in Australia by claiming that patient notes were still transferred using '19th Century clipboards' (p.36)[16.] Therefore, staff were not alerted to the risks of polypharmacy or of inappropriate procedures such as the administration of conflicting drugs, the failure to administer a drug or to document pre and post discharge requirements.[16] These researchers raised some practical suggestions to improve the continuity, safety and quality of health care while they acknowledged their research was limited and that their survey response rates were low and circumspect.

3.6 SURVEY RESPONSE CHARACTERISTICS OF THE CofCP COHORT

In this chapter not only the response rates, but the characteristics of the patients in the CofCP cohort who did and did not respond to QOL surveys were taken into account. Any non-response bias was considered to be a confounder to the validity of outcomes generated from survey responses. Hence, the respondents/non-respondents characteristics of 1) age at discharge; 2) LOS and 3) number of discharge prescriptions, were assessed to identify any relevant differences between proposed subgroups.

Several research studies on the representativeness of survey/questionnaire results, reported that differences between respondents and non-respondents were likely to bias estimations from respondents' data on socio-economic status and health profiles.[85-89] In 2005, Tolonen et al. studied these differences in 27 populations which

included an Australian cohort. Differences, hence bias, were reported for cohorts which included subgroups of patients with cardiovascular disease.[89]

In addition to the likelihood of survey bias from respondents' socio-economic status and health profile differences within a population, Tolonen et al. (2006) researched these differences across populations. They found that survey bias from differences in respondents'/non-respondents' socio-economic status and health profiles tended to be similar even when they had geographical and cultural differences.[90] It was also found that the larger the difference in response rates between surveys conducted over two points in time, the larger the difference in the trend of the survey results. However, it should be noted that the Tolonen et al. studies, analysed data from two points in time separated by ≥10 years.[90]

3.7 IMPLEMENTATION OF THE CONTINUITY OF CARE PROJECT (CofCP)

OPERATIONAL DEFINITIONS

3.7.1 CONTINUITY OF CARE is a perception of quality health care resulting from the ongoing management of issues which cause disruption to optimal patient care.

In the context of the study reported in this chapter:

Continuity of Care is perceived by the researchers as the ongoing support of patients recruited into the research project, by provision of a comprehensive discharge protocol and a post discharge medication review to identify any drug related problems.

3.7.2 POTENTIALLY INAPPROPRIATE PRESCRIBING (PIP)

In this study the phases 'potentially inappropriate prescribing or prescriptions' and 'potentially inappropriate medication' are equal in meaning and represented by the abbreviation 'PIP(s)'. Prudent et al. (2008) define 'potentially inappropriate medication' as drugs with an unfavourable risk/benefit ratio when safer or equally effective alternatives are available.[126]

3.8 PROJECT METHOD

3.8.1 PROJECT DESIGN

The CofCP was a prospective clinical trial in which patients were randomised by GP referral or non-referral for a Home Medicines Review (HMR) service post hospital discharge. All patients were recruited into the study on an 'intention to treat' basis for the provision of an HMR service. The provision of an HMR report to the researchers, which was written by an accredited pharmacist for the patients' GP, confirmed the patients' continuity of care after discharge and was the end-point of data collection for this project.

3.8.2 PROJECT SITE

A quarter of the population in the state of NSW, Australia; lived in Western Sydney with a regional population estimated at 1.9 million people in 2009. The area was serviced by the healthcare professionals (HCP) in the Western Sydney Division of General Practice (WSDGP).[92] In Western Sydney, Westmead Hospital is an affiliated teaching hospital with the University of Sydney, as well as being a specialised quaternary referral hospital for cardiovascular disease.

Prior to upgrading and extensions in 2005, the hospital was recorded as having 975 beds.[18] Due to constant change and primarily, seasonal fluctuation in bed numbers, Westmead Hospital is currently included in the '>500 beds' classification of hospital size by the NSW Government Department of Health.[93] The hospital provided comprehensive medical and surgical services and is a leading centre for the treatment and rehabilitation of patients with cardiovascular impairment. The cardiology unit of Westmead Hospital was the site chosen for recruitment of patients into this study between 2004 - 2007.

3.8.3 PROJECT SUBJECT RECRUITMENT

The cardiology Unit at Westmead Hospital was divided into three wards. One ward admitted primarily, 'Day Only' or 'Short Stay' patients and the second ward accommodated critically ill, monitored cardiac patients. The third, a Coronary Care step down ward, included patients transferred directly from the Emergency Department. Patients were recruited from all wards.

The project received ethics approval from The University of Sydney and the recruitment process required separate patient consent for the Ethics Committees of 1) Western Sydney Area Health Service (SWAHS), 2) the Australian Health Insurance Commission (HIC), and 3) the Australian Department of Veterans Affairs (DVA). Project recruitment consents included the agreement that any patients' data collected prior to a point of mishap (e.g. death or injury) or withdrawal from the project, could be included in de-identified group analyses. The recruited patients were fully consented prior to discharge.

There were no incentive payments to either patients or HCP involved in the study and no cost to the patients for Home Medicines Review (HMR) service. After

referral by GPs, HMR services were approved items for cost reimbursement to GPs and pharmacies in the community, by the HIC through the Australian Medicare Benefits Scheme (MBS).[94]

3.8.3.1 Selection of Patients

Initially, patients were approached for recruitment on, but not restricted to, their utilisation of HCPs practising in Western Sydney. Secondly, each subject was discharged on at least one cardiovascular medication. Third, it was ascertained that patients, or an untrained carer, would administer their daily medications at home. In addition, patients met one or more of the guidelines for HMR service referral by GPs.[95-98] Subject and carer recruitment criteria are shown in Figures 3.2 and 3.3.

Figure 3.2 Subject Inclusion Criteria
1. Patients who were currently in Westmead Hospital under the management of the cardiovascular team
2. Patients who were taking 1 or more cardiovascular drugs
3. Patients who met one or more of the following conditions: • Currently taking five or more regular prescribed drugs • Taking more than 12 doses of prescribed drugs per day • Had significant changes made to drug regimen in the last three months • On drugs with narrow therapeutic index or requiring therapeutic Monitoring • Symptoms suggestive of an adverse drug reaction • Sub-therapeutic response to medication treatment • Are possibly non-compliant or not managing drug-related therapeutic devices • Managing their own medications and are at risk due to language difficulties, physical impairment, dexterity problems, impaired sight or hearing, or cognitive difficulties
4. Patients who were recently discharged directly to their homes or a private Residence
5. Patients who managed their own prescribed drugs at home
6. Patients who lived and were treated or serviced through a Health Care Professional practicing within the WSDGP boundaries

Figure 3.3 Carer Inclusion Criteria
1. Carers who regularly administered medications to a discharged patient who met the inclusion criteria for patients
2. Carers who were not formally trained in medication administration

Recruitment in the Cardiology Unit was limited by 1) the transfer in, of around 10% ward capacity from Regional and NSW Country Hospitals; 2) many patients were day only patients and were admitted and discharged in one day, and 3) the same chronically ill patients were regularly readmitted for short lengths of stay (LOS).[18]

Patients recruited into the study were discharged through existing standard hospital procedures, prior to receiving HMR service through patient nominated community GPs and pharmacies. The patient's participation in the study was not controlled in any way and all HCPs in the community were nominated by the patient. All patients were offered an HMR service post discharge, and a request for referral was sent by the project researcher to all patients' GPs. The patients were informed before discharge, that there was no cost to them for the service and that HMR referral was at the discretion of their GP.

3.8.3.2 Subjects from a Non-English Speaking Background

The necessity for interpreters at all stages of recruitment was ascertained. Every subject was sent the Dartmouth COOP Quality of Life survey to assess their activities of daily living (ADL) on two occasions. The COOP charts were made available to patients in English, Spanish, Chinese, Slovak, and Arabic (Appendix 10.0). A few carers were

recruited on behalf of participants and, although offered, none of the recruited patients or carers requested an interpreter.

3.8.4 PROJECT DATA SOURCES

3.8.4.1 Medical Records and Discharge Summaries

After patient consent on recruitment, the patients' full medical records and current treatment files were accessed by researchers. Research files for each recruited patient contained coded copies of demographic details, admission forms, serum biochemistry results, drugs prescribed pre admission and prior to discharge.

Routinely, discharge summaries were not provided for 'Day Only' patients who were not commenced on new pharmacotherapy. Partially computerised discharge summaries were generally written by junior resident medical officers. On discharge, patients were given a sealed copy of their summaries to hand deliver to their GPs at consultation within 3 days. However, patients were not provided with a separate copy of their discharge drug regimen, for their own information.

In this project, copies of the discharge summaries were again offered to all patients' GPs by facsimile, when contacted by the researchers, immediately post discharge. At the same time, all patient nominated community pharmacies were provided with a discharge summary by facsimile. In general, these summaries included a brief outline of the patients' treatment while hospitalised, their chronic and acute diseases and drugs prescribed on discharge.

3.8.4.2 Home Medicines Review (HMR) Reports

On the same day as the subjects' discharge, a request for an HMR referral was sent by facsimile to the patients' GPs by the researchers. On receipt of GPs' referrals, the

community pharmacies arranged for accredited pharmacists to conduct an HMR in the patients' homes. Besides the patients' discharge summaries, current serum biochemistry results were provided to the accredited pharmacists by researchers.

The community pharmacy provided the accredited pharmacists with the GPs' referral forms which included the patients' post discharge pharmacotherapy. Hence, HMR reports were a source of drug regimen prescribed by the GP post discharge, drugs currently consumed by the patient at HMR, and patients' drug related problems. Reports written for the referring GPs were copied to the research team, on request, by the accredited pharmacists.

3.8.4.3 The Dartmouth COOP Charts

The original version of the Dartmouth Co-Operative 'Generic Measure of Function, Health Status and Quality of Life' charts (COOP charts) was selected to measure any change in the cohort's quality of life at two points in time (Appendix 10.0). These self administered surveys were explained to the patients prior to discharge and were mailed out immediately and 6 months after discharge.

The patients reported on the quality of 9 different aspects of daily living, including their physical, emotional and social status during the two weeks preceding receipt of the survey. Patients were followed up with two phone calls if the charts were not returned after three weeks from mailing at discharge and post discharge.

Selection of the COOP charts was influenced by the extensive literature available on their use in research with components and, or subjects similar to this project.[61,99-101] The COOP charts were developed and repeatedly tested for reliability and validity during the Dartmouth Primary Care Co-operative Information Project.[102]

The charts were also chosen as they were in a form of lifestyle measurement suited to the subjects recruited into this study.[103] Further, the charts were deemed effective and quick to complete because of their broad patient/subject appeal from lack of complexity.[104] The availability and standardization of measures in different languages also added to their practicality.

There have been claims of lack of sensitivity in the COOP charts and this was considered, however did not outweigh their practicality for use.[105-106] Each COOP chart recorded the patients' responses to illustrated activities of daily living (ADLs), emotional and social factors affecting patients' quality of life. Responses to each factor were recorded on a scale of 1 – 5 and a score of 1 indicated the healthiest or most ideal score. There were nine COOP charts in the sets mailed to the subjects and summation of the scores on each chart allowed derivation of changes in the factors assessed, and in overall quality of life (QOL) between discharge and 6 months post discharge.

3.8.5 MULTIDISCIPLINARY HEALTH CARE PROFESSIONALS (HCPs)

Medical, nursing and pharmacy staff in the hospital cardiology unit were invited to participate in the research and were consulted prior to implementation of the project. Subsequently, formal participation was demonstrated by representation on the project steering committee. This involved a Consultant Cardiologist, Nurse Unit Manager and Hospital Patient Advocate. Pharmacists were represented by the Director of Pharmacy WSAHS, the Pharmacy Guild and Pharmaceutical Society of Australia (NSW Branch). Informal participation on the wards included the patients' medical and nursing teams who witnessed the three separate consent forms, for each subject.

Primary HCPs were represented by their professional affiliates in Western Sydney Division of General Practice (WSDGP). Besides providing All community

GPs, pharmacies and accredited pharmacists with comprehensive patient information, these HCPs were provided with information packages and invited to participate in the research.

3.8.6 PROJECT DATA ANALYSIS

Whenever continuous variables resulted from data collection, and were normally distributed, relevant paired or independent samples students' t tests were conducted and chi squared approximations were conducted for categorical or dichotomous variables. It was outside the realm of this research to empirically measure the clinical impact of changes to patients QOL at discharge or 6 months post discharge. Instead when relevant, an effect size approximation was conducted using an eta squared estimation. Where appropriate, this estimation was conducted on results yielding a 't' value for students 't' tests showing statistically significant differences between the means of the variables tested. Eta squared estimations (tsq/tsq+(N-1)) for effect size were based on Cohen's values of 0.01~small effect; 0.06~moderate effect and 0.14~large effect.[107-108]

3.9 PROJECT RESULTS

The 281 subjects in the CofCP were comprised of 194 (69.0%) patients who did not receive an HMR, and 87 (31.0%) patients for whom there was an indication they had received a GP referral and HMR service. The latter group included 79 (28.1%) patients whose HMR reports, confirming HMR service, were copied to the researchers as data sources for post discharge health status and drug related analyses. As there was no confirmation of HMR service or report available for 8 of the 87 patients, they were re-allocated to the majority subgroup for discharge data assessment only.

The project recruitment consents included the agreement that patients' data collected prior to a point of mishap (e.g. death or injury) or withdrawal from the project, could be included. The withdrawal of one patient soon after discharge and the reported death of a patient a few days after their HMR report was provided to the research team, did not reduce the number of discharge summaries or HMR reports available for data analyses (Figure 3.1). Hence, all patients recruited into the project (n=281) were divided into an experimental group called the HMR Report Group (n=79) and non-experimental group called the non-HMR Report Group (n=202).

3.9.1 CofCP COHORT CHARACTERISTICS

3.9.1.1 Age and Length of Stay (LOS)

The median age of a) the CofCP cohort (n=281) was 65 (IQR 19: 55-74) years, b) the HMR Report group (n=79) was 69 (IQR 18: 58-76) years and c) the non-HMR Report group (n=202) was 65 (IQR 18: 56-74) years at discharge. The mean LOS for the cohort was 13.9 (SD± 11.8) days.

3.9.1.2 Gender Distribution – within groups

Within group testing for gender was analysed using Chi-square testing with the expectation of equal numbers of males and females in each group at discharge. Table 3.1 shows the male gender distribution as 162 (57.7%) in the cohort; 121 (59.9%) in non-HMR Report group and 41 (51.9%) in HMR Report group. The cohort (n=281) and non-HMR Report group (n=202) showed a statistically significant predominance of male patients.

3.9.1.3 Prescriptions for Discharge Drugs

Table 3.2 shows the distribution of prescriptions written for drugs prescribed at discharge for the CofCP cohort and subgroups. It should be noted that all separately

documented prescriptions on discharge summaries were counted, regardless of the strength or form of the drug's active ingredient. For example, one patient may have been concurrently prescribed different strengths of warfarin dependent on ongoing, and changing, biochemistry results.

There were 2476 prescriptions written for the cohort on their discharge with a mean 8.8 (SD± 6.3) prescriptions. Comparison of mean number of prescriptions, between the non-HMR Report group and HMR Report group showed no significant difference at discharge (CI 95% t=-0.61 df=279 p=0.55).

Table 3.1 Gender distribution within cohort and subgroups at discharge

Patient Group	**Male**		**Female**		**Chi-square test**		
	Number patients	**% frequency**	**Number patients**	**% frequency**	**χ^2**	**df**	**Sig.**
Cohort (n=281)	162	57.7	119	42.3	6.5	1	<0.05
Non-HMR Report group (n=202)	121	59.9	81	40.1	7.8	1	<0.05
HMR Report group (n=79)	41	51.9	38	48.1	0.1	1	>0.05

df=degrees of freedom. Sig=significance

Table 3.2 Distribution of prescriptions for the cohort and subgroups for discharge drugs

Patient Group	**Discharge Drugs**		
	Number prescriptions	**Mean (±SD)**	**Range**
CofC cohort n = 281	2476	8.8 (6.3)	1 - 34
Non-HMR Report group n = 202	1751	8.6 (6.4)	1 - 34
HMR Report group n 79	725	9.1 (6.0)	1 - 32

SD = standard deviation

3.9.2 QUALITY OF LIFE (QOL) SURVEY

3.9.2.1 QOL Health status - within the cohort

Table 3.3 shows paired t tests of the COOP survey results, listing the 9 contributing health status charts, within the CofCP cohort (n=281) at discharge and 6 months post discharge. An assessment of physical fitness showed a statistically significant difference between these two points in time with p=0.04. A decrease in the mean score indicated an improvement in the cohort's physical fitness 6 months after discharge. An estimation of the effect size on the improvement in physical fitness, between discharge and post discharge, shows an Eta squared result of small<0.03<moderate effect on the cohort.

An assessment of 'Change in health' showed a statistically significant difference over the same time period with p=0.01. An increase in the mean score indicated the cohort perceived a decline in their overall health status 6 months after discharge. The Eta squared result indicated a moderate<0.10<large effect on the cohort.

3.9.2.2 QOL Health status - between the subgroups

Table 3.4 shows independent samples t tests of the COOP survey results listing the 9 contributing health status charts between groups for the HMR Report (n=79) and non-HMR Report (n=202) groups at discharge. Table 3.5 shows the same analysis between the subgroups at 6 months post discharge. For all nine charts at both points in time, there were no significant differences between the two subgroups.

Table 3.3 Comparison of the COOP QOL response and scores within the CofCP cohort between discharge and 6 months post discharge surveys

CofCP cohort (n=281)		**Discharge**	**6m post discharge**	**t tests**		
COOP Charts	**Number patients**	**Mean (SD±)**	**Mean (SD±)**	**t value**	**df**	**p value**
Chart 1 Physical fitness	163	3.6 (1.1)	3.4 (1.2)	2.07	162	0.04*
Chart 2 Feelings	163	2.4 (1.1)	2.4 (1.2)	0.13	162	0.90
Chart 3 Daily activities	162	2.6 (1.2)	2.4 (1.2)	1.54	161	0.13
Chart 4 Social activities	165	2.3 (1.3)	2.1 (1.2)	1.56	164	0.12
Chart 5 Pain	160	2.8 (1.3)	2.8 (1.3)	-0.47	159	0.64
Chart 6 Change in health	162	2.2 (1.1)	2.7 (1.0)	-4.17	161	0.01*
Chart 7 Overall health	161	3.3 (0.9)	3.2 (1.1)	0.74	160	0.46
Chart 8 social support	161	2.0 (1.2)	2.1 (1.2)	-0.59	160	0.56
Chart 9 Quality of life (patients' view)	159	2.5 (0.8)	2.4 (0.9)	0.77	158	0.44

df=degrees of freedom. SD=standard deviation. *significant at $p \leq 0.05$

Table 3.4 Comparison of COOP QOL Survey response and scores between the HMR Report and non-HMR Report groups at discharge

T_1: DISCHARGE	HMR Report Group: n=79		non-HMR Report Group: n=202		t tests		
COOP Charts	**Number patients**	**Mean (SD±)**	**Number patients**	**Mean (SD±)**	**t value**	**df**	**p value**
Chart 1 Physical fitness	62	3.7 1(1.2)	149	3.6 (1.2)	0.37	209	0.72
Chart 2 Feelings	65	2.6 4(1.2)	153	2.5 (1.2)	0.32	216	0.75
Chart 3 Daily activities	64	2.7 (1.3)	149	2.8 (1.2)	-0.63	211	0.52
Chart 4 Social activities	65	2.5 (1.3)	154	2.4 2(1.3)	0.75	217	0.46
Chart 5 Pain	64	2.7 (1.3)	153	2.9 (1.3)	-1.30	215	0.20
Chart 6 Change in health	62	2.3 (1.3)	150	2.3 (1.1)	0.27	210	0.79
Chart 7 Overall health	65	3.3 (1.0)	152	3.4 (0.9)	-0.67	215	0.51
Chart 8 social support	65	2.1 (1.3)	152	2.1 (1.2)	0.30	215	0.76
Chart 9 Quality of life (patients' view)	64	2.54 (0.9)	150	2.5 (0.8)	-0.07	212	0.94

df=degrees of freedom. SD=standard deviation.

Table 3.5 Comparison of COOP QOL Survey response and scores between the HMR Report and non-HMR Report groups at 6 months post discharge

T_2: 6 MONTHS	HMR Report Group: n=79		Non-HMR Report Group: n=202		t tests		
COOP Charts	**Number patients**	**Mean (SD±)**	**Number patients**	**Mean (SD±)**	**t value**	**df**	**p value**
Chart 1 Physical fitness	60	3.30 (1.3)	120	3.3 (1.3)	-0.32	178	0.75
Chart 2 Feelings	60	2.2 (1.2)	119	2.4 (1.2)	-0.87	177	0.33
Chart 3 Daily activities	59	2.4 (1.3)	119	2.4 (1.2)	-0.15	176	0.88
Chart 4 Social activities	60	2.0 (1.2)	120	2.1 (1.3)	-0.89	178	0.37
Chart 5 Pain	59	2.6 (1.3)	117	2.8 (1.3)	-0.78	174	0.43
Chart 6 Change in health	60	2.7 (1.0)	120	2.7 (1.0)	000	178	1.00
Chart 7 Overall health	60	3.1 (1.2)	117	3.2 (1.0)	-1.27	175	0.21
Chart 8 Social support	59	1.9 (1.2)	118	2.1 (1.2)	0.96	175	0.34
Chart 9 Quality of life (patients' view)	60	2.4 (1.0)	117	2.4 (0.9)	0.03	175	0.97

df=degrees of freedom. SD=standard deviation.

3.9.3 QUALITY OF LIFE (QOL) SURVEY RESPONSE

3.9.3.1 QOL Survey – within groups

Table 3.6 shows paired samples t tests of COOP survey response rates within the cohort and subgroups at discharge and 6 months post discharge. The HMR Report group patients included in these analyses received their HMR service at any time during implementation of the project.

Response rates for the CofCP cohort (n=281) were 219 (77.9%) at discharge and 180 (64.1%) post discharge. Table 3.6 also shows there were no significant differences in the mean scores for the overall COOP survey within any of the groups between the two points in time.

3.9.3.2 QOL Survey – between groups

Table 3.7 shows independent samples t tests of the COOP survey response rates, and difference in means for overall QOL assessment, between subgroups at discharge and 6 months post discharge. This assessment was the overall QOL assessed over 9 charts. The HMR Report group patients included in these analyses received their HMR service at any time during implementation of the project.

Comparison of the means for HMR Report group (n=79) and non-HMR Report group (n=202) showed no significant difference when t tested at discharge and post discharge.

3.9.3.3 Overall QOL for HMR recipients – within groups

Table 3.8 shows paired samples t tests COOP survey response rates and QOL scores within the CofCP cohort and HMR Report group. These are the results of patients who were the recipients of an HMR service between discharge and 6 months post discharge. It should be noted that the difference between this table and Tables 3.6 and 3.7, is that only these

patients had received their HMR service before responding to the second round of the COOP surveys at 6 months post discharge. Hence, these analyses were conducted to detect any differences in survey results bought about by the conduct of an HMR service as an intervention.

At discharge 68 (24.4%) and 50 (63.3%) HMR recipients in the CofCP cohort (n=281) and HMR report group (n=79) responded, respectively. At 6 months post discharge 62 (22.1%) and 49 (62.0%) HMR recipients in the cohort and HMR Report group responded, respectively. Table 3.8 also shows there were no significant differences in the mean scores for the COOP survey for overall QOL assessment between the two time points for either group.

Table 3.6 Comparison of COOP survey response and overall QOL from 9 charts within the CofCP cohort and subgroups at discharge and 6 months post discharge.

COOP Survey: QOL – 9 charts	**Discharge**		**Post Discharge 6 months**		**t tests within groups**		
GROUP	**Number patients (% response)**	**QOL mean (SD±)**	**Number patients (% response)**	**QOL mean (SD±)**	**t value**	**df**	**p value**
CofCP cohort n = 281 patients	219 (77.9)	24.0 (7.1)	180 (64.1)	23.4 (7.4)	0.21	164	0.83
Non-HMR Report group n = 202	154 (76.2)	24.0 (7.0)	120 (56.4)	23.7 (7.1)	-0.17	110	0.87
HMR Report group n = 79	65 (82.3)	23.9 (7.5)	60 (75.9)	22.8 (8.1)	0.66	53	0.51

df=degrees of freedom. SD=standard deviation.

Table **3.7** Comparison of COOP survey response and overall QOL scores between the CofCP subgroups at discharge and 6 months post discharge.

COOP Survey: QOL- 9 charts	**HMR Report Group n=79**		**non-HMR Report Group n=202**		**t tests between subgroups**		
TIME	**Number patients (% response)**	**QOL Mean (SD±)**	**Number patients (% response)**	**QOL Mean (SD±)**	**t value**	**df**	**p value**
Discharge	65 (82.3)	23.9 (7.5)	154 (76.2)	24.0 (7.0)	-0.41	218	0.68
Post Discharge	60 (75.9)	22.8 (8.1)	120 (59.4)	23.7 (7.1)	-0.72	178	0.47

df=degrees of freedom. SD=standard deviation.

Table 3.8 Comparison of overall QOL scores within CofCP cohort and HMR Report group for recipients of HMR services between discharge and 6 months post discharge.

COOP Survey: **QOL – 9 charts** **HMR service recipients**	**Discharge**		**Post Discharge 6 months**		**t tests within groups**		
	Number patients (% response)	**QOL mean (SD±)**	**Number patients (% response)**	**QOL mean (SD±)**	**t value**	**df**	**p value**
CofCP cohort n= 281 patients	68 (24.4)	19.2 (11.4)	62 (22.1)	19.5 (11.4)	-0.53	55	0.60
HMR Report group n= 79 patients	50 (63.3)	23.5 (7.3)	49 (62.0)	23.2 (7.9)	-0.91	41	0.37

df=degrees of freedom. SD=standard deviation

3.9.4 QUALITY OF LIFE (QOL) SURVEY RESPONDERS AND NON-RESPONDERS

The personal and clinical characteristics of patients who did and did not respond to the COOP QOL survey were compared at discharge and 6 months after discharge. The characteristics compared were: 1) Age in years at discharge, 2) LOS in days, and 3) number of prescriptions at discharge. These comparisons determined any differences in the composition of the response/non-response groups within the cohort and subgroups at discharge and post discharge.

3.9.4.1 Survey Responders/non-Responders at discharge – within groups

Table 3.9 shows independent samples t tests of characteristics of subjects who responded to the COOP QOL survey and those who did not, at discharge, within the CofCP cohort and subgroups. Survey responders and non-responders were analysed for age at discharge, LOS and the number of drug prescriptions on discharge.

For discharge age in the CofCP cohort (n=281), there was a significant difference between responders and non-responders at discharge, with responders 4.3 years older than

non-responders. This result was reflected in the non-HMR Report group (n=202) with a significant difference in age at discharge with responders 5.2 years older than non-responders. In the HMR Report group (n=79) there was no significant difference in age between responders and non-responders at discharge.

In the CofCP cohort and non-HMR Report group, Levene's tests showed significance values below 0.05 for variance in LOS. Hence the t test values tabulated in Table 3.9 for LOS, were calculated with equal variances not assumed. In the cohort, HMR Report group and non-HMR Report group there were no significant differences in LOS between responders and non-responders at discharge.

For number of prescriptions at discharge in the CofCP cohort, HMR Report group and non-HMR Report group there were no significant differences in number between responders and non-responders at discharge.

3.9.4.2 Survey Responders/non-Responders post discharge – within groups

Table 3.10 shows independent samples t tests of the differences in the same three characteristics of subjects who responded to the COOP QOL survey and those who did not at 6 months post discharge, within the CofCP cohort and subgroups.

For discharge age in the CofCP cohort and non-HMR Report group, Levene's tests indicated that t tests were calculated with equal variances not assumed (Table 3.10). There was a significant difference between responders and non-responders. For discharge age in the cohort and non-HMR group, the post discharge survey responders were 3.6 and 4.9 years older, respectively. In the HMR Report group there was no significant difference in age at discharge, between responders and non-responders to the post discharge survey.

For LOS and number of discharge prescriptions in the cohort, non-HMR Report group and HMR Report group there were no significant differences between responders and non-responders to the 6 months post discharge survey.

Table 3.9 Comparison of subject characteristics between COOP survey responders within CofCP cohort and subgroups at discharge.

DISCHARGE		**COOP Responders**		**COOP Non-Responders**		**t tests**		
		Number patients	**Mean (SD±)**	**Number patients**	**Mean (SD±)**	**t value**	**df**	**p value**
CofC cohort n=281	Age: years	221	65.4 (11.9)	60	61.1 (13.9)	2.33	279	0.02*
	LOS: days	221	14.7 (12.4)	60	14.7 (25.5)	-0.73	67	0.47[a]
	Discharge prescriptions	221	8.8 (6.4)	60	8.6 (5.8)	0.34	279	0.74
non-HMR Report group n=202	Age: years	153	64.9 (11.5)	49	59.7 (13.7)	2.61	198	0.01*
	LOS: days	153	11.7 (12.0)	49	15.0 (28.2)	-0.78	51	0.44[a]
	Discharge prescriptions	153	8.7 (6.5)	49	8.7 (6.3)	-0.05	198	0.96
HMR Report group n=79	Age: years	68	66.2 (12.9)	11	66.2 (13.8)	-0.02	78	0.97
	LOS: days	68	13.4 (13.3)	11	13.6 (12.6)	-0.06	78	0.95
	Discharge prescriptions	68	9.4 (6.3)	11	8.1 (3.7)	0.72	78	0.47

[a]Equal variances not assumed. *significant at $p \leq 0.05$. df=degrees of freedom. LOS=length of stay. SD=standard deviation

Table 3.10 Comparison of subject characteristics between COOP survey responders within CofCP cohort and subgroups post discharge.

POST DISCHARGE 6 months		**COOP Responders**		**COOP Non-Responders**		**t tests**		
		Number patients	**Mean (SD±)**	**Number patients**	**Mean (SD±)**	**t value**	**df**	**p value**
CofC cohort n=281	Age: years	180	65.7 (11.3)	101	62.1 (14.1)	2.19	173	0.03[a]*
	LOS: days	180	12.3 (16.1)	101	13.6 (17.8)	-0.63	279	0.53
	Discharge prescriptions	180	8.5 (6.2)	101	9.4 (6.5)	-1.06	279	0.29
non-HMR Report group n=202	Age: years	120	65.7 (10.7)	82	60.8 (13.7)	2.75	145	0.01[a]*
	LOS: days	120	12.4 (16.1)	82	13.6 (19.4)	-0.63	200	0.53
	Discharge prescriptions	120	8.2 (6.4)	82	9.3 (6.5)	-1.14	200	0.26
HMR Report group n=79	Age: years	60	65.6 (12.6)	19	67.8 (14.7)	-0.65	77	0.52
	LOS: days	60	12.8 (12.9)	19	13.3 (8.9)	-0.14	77	0.89
	Discharge prescriptions	60	9.1 (5.9)	19	9.6 (6.6)	-0.33	77	0.74

[a]Equal variances not assumed. *significant at $p \leq 0.05$. df=degrees of freedom. SD=standard deviation

3.10 PROJECT DISCUSSION

3.10.1 CofCP - IMPLEMENTATION

This chapter describes the implementation of the CofCP empirical research designed to investigate the medication management of chronically ill patients after hospital discharge. Recruitment into the project was labour intensive and required a strict consideration of the acute on chronic, cardiovascular patients' disease severity. The extended timeframe for recruitment of a pre-conceived number of subjects (from the WMP[17]) meant that one to one patient contact hours stretched between mid 2004 to early 2007. Completion of HMR services and 6 month QOL survey follow-up was completed by mid 2007.

Restriction of project implementation to one clinical researcher slowed progress, but standardised and controlled all components of hospital protocol, data collection, interpretation and analysis. A total of 281 patients were recruited into the CofCP and medical records and discharge data were available for all subjects.

Provision of an HMR report was the end point of data collection and confirmed continuity of care in the community. The CofCP cohort (n=281) was divided into the HMR Report group (n=79) and non-HMR Report group (n=202) for further investigations into medication management at hospital discharge and post discharge.

3.10.2 CofCP COHORT CHARACTERISTICS

Subjects were characterised by assessing their age, gender, LOS and number of drug prescriptions at discharge and by surveying the HRQL factors affecting the cohort. Subject characteristics were also compared to determine differences in survey responders and non-responders, and between the HMR Report and non-HMR Report subgroups.

Landi et al. (2007) reported that most elderly people are unable to undertake all activities of daily living (ADLs); have higher rates of morbidity; and long hospitalizations. In addition these patients had multi-drug regimens; have poorer pharmacokinetics and pharmacodynamics and hence, have poorer QOL.[60] Parra et al.(2011) and Haywood et al. (2005) not only included several established HRQL scales and indexes in their research, importantly, as research variables and for patient characterisation, they included age, gender, number of drugs consumed and LOS.[63-64] In their research with cardiovascular patients, researchers targeted LOS for cost of care evaluations or clinical research and Dixon et al, determined clinical status and prognostic factors which included age, gender and LOS.[65,70-71,73-75]

These variables were determined to characterise the CofCP patients and were the same variables assessed for the same purpose by Straubhaar et al. (2006) and Tolonen et al. (2005).[78,90] It was found the CofCP cohort and both subgroups had more male than female patients. However, the cohort (n=281) and the non-HMR Report group (n=202) showed a significant predominance of males not found in the HMR Report group (n=79). The predominance of male patients was consistent with a large Australian population study which showed gender distribution for initial and follow up surveys as 658/1297 (50.7%) and 456/891 (51.2%) male cardiovascular patients, respectively.[90]

The mean number of drugs prescribed for the cohort and subgroups clearly indicated polypharmacy in the prescribing of discharge drugs. For the number of discharge prescriptions, there was no significant difference between the two subgroups which reinforced the representativeness of the minority HMR Report group for the majority non-HMR Report group. The exacerbation of DRPs and PIP by polypharmacy was stressed by several researchers including Flesch and Erdmann (2006), Fialová et al. (2005) and Müller (2008), particularly at hospital discharge.[81-84] For the study cohort of chronically ill

cardiovascular patients, polypharmacy was found to further complicate their already complex pharmacotherapy.

There is little doubt it is important to quantify the HRQL factors which influence the patients' ADLs and which influence their management of complex drug regimens.[56-57,109] In addition, researchers found an association between impaired physical performance; reduced ability in routine ADLs; and inappropriate drug use identified by Beers criteria.[60] These HRQL factors were measured in the CofCP cohort by application of the COOP QOL charts at hospital discharge and 6 months post discharge. The survey ascertained any characteristic QOL differences between subgroups and any change in the cohort's QOL after HMR service.

The COOP QOL survey showed a significant improvement in the CofCP cohort's physical fitness factor, 6 months post discharge. The improvement was estimated to have a small to moderate effect on the cohort. However, the cohort also showed a significant decline in their 'overall health status' after 6 months and this had a moderate to large effect. Notably, Schenkeveld et al. (2010) found a perceived decline in the health status of cardiovascular patients, was not related to higher 6 year mortality rates.[110]

In an on-going study, Du et al. (2011) assessed self efficacy and self-care behaviour beside QOL factors in patients from the same cardiology unit assessed in this, and the following chapters. In the future, this research might help explain the CofCP cohort's perceived health decline, as no changes were found in the other seven survey factors.[66] Hence in the cohort's overall QOL assessment, there were no significant differences between discharge and 6 months post discharge within or between the cohort and subgroups.

Although the sensitivity of the COOP charts to detect changes in QOL has been questioned by some researchers, their use was recently found to be simple, reliable, valid and responsive for group use by international and Australian/NZ researchers.[58,61] The high COOP response rates reported in this chapter centred around 75.0% and were in agreement with the literature. In most of the accessed research which involved cardiovascular patients, QOL was measured pre and post an HRQL intervention.[55-57,59,62-63,66]

In this CofC project, COOP charts were also utilised to measure any changes in QOL for the recipients of an HMR service. The number of QOL survey responses assessed were limited by the restriction to patients serviced within 6 months of discharge. It was of note that there was a high response rate, particularly before HMR service (63.3%), by those patients who were subsequently, recipients of the service.

No significant differences were found in QOL for the HMR recipients when assessed as part of the cohort or within the HMR Report group after HMR service. In characterising the CofCP patients, all QOL outcomes reinforced the proposition that the minority HMR Report group (n=79) was representative of the majority subgroup and hence, the cohort (n=281), at discharge and post discharge.

3.10.3 SURVEY RESPONDENTS AND NON-RESPONDENTS

In the literature, researchers stressed the importance of acknowledging differences in response rates and the characteristics of non-responders to avoid bias in establishing patients' health profiles.[89-90] Tolonen et al (2005) researched the effect and potential effect of the non-response components of surveys on international populations in the Multinational monitoring of trends and determinants in Cardiovascular Disease Project (WHO MONICA), which included an Australian population.[89]

The Australian population response rate was 136/1161 (11.7%) for the initial survey and 127/764 (16.6%) for the 10 year follow up survey. The QOL survey response rate for the CofCP cohort was 219/281 (77.9%) patients at discharge and 180/281 (64.1%) patients at 6 months post discharge (Table 3.6). Although the Diagnosis Related Group (DRG), clinical characteristics, gender distribution and mean ages of the two cohorts were comparable, the size of the Australian population studied and the expanse of time between their initial and follow-up surveys was not.

In the CofCP, responders to the COOP surveys in the cohort and non-HMR Report group were significantly older (mean range 64.9 to 65.7 years) than non-responders for both surveys. In the cohort and both subgroups, there were no significant differences between responders and non-responders, in either survey, for LOS (mean range 11.7 to 15.0 days).

Also, in the cohort and both subgroups there were no significant differences between responders and non-responders in either survey, for number of prescriptions at discharge (mean range 8.2 to 9.6 prescriptions). Hence, in LOS and prescriptions at discharge, the responders in the HMR Report group (n=79) were representative of the CofCP cohort in both surveys.

For follow-up surveys, assessment of the CofCP cohort found the general response rate decreased, with increased respondent age. These findings were consistent with those of Tolonen et al. when assessing cardiovascular patients.[89-90] However, in characterising the Australian population of cardiovascular patients at follow-up, Tolonen et al. showed a ratio of 0.56 (14.0%:25.0%) responders to non-responders in 275/764 (36.0%) patients assessed for drug-related factors.

Utilising the number of drugs prescribed at discharge as 'drug-related factors', the CofCP cohort showed a ratio of 1.7 (64.1%:35.9%) responders to non-responders in 281 patients at follow up. Compared with the Tolonen et al. research,[89-90] and acknowledging the disparity in cohort sizes and follow-up periods, it is suggested that the CofCP cohort was shown to be characteristically, highly responsive to QOL survey participation.

3.11 CONCLUSION

Measurement of the cohort and subgroups' overall QOL from accumulated scores in physical fitness, feelings, daily activities, social activities, pain levels, change in health, overall health, social support and patients' perception of their quality of life, showed no significant difference between the subgroups. In addition, there were no significant differences in the survey response rates at either discharge or post discharge between the subgroups. There were significantly more male patients in the CofCP cohort (n=281) and non-HMR Report group (n=202).

In support of the QOL survey outcomes as characteristic of the cohort's health profiles, it was found that the majority of responders to the follow-up survey were significantly older than non-responders. However, there were no significant differences between responders and non-responders in the subgroups in either survey, for LOS or importantly, in the number of prescriptions at discharge. Further, the CofCP cohort was shown to be characteristically responsive to QOL survey participation.

It was shown the study cohort was subject to polypharmacy in their discharge regimen. Polypharmacy has been claimed to exacerbate DRPs and PIP and is innately associated with complex cardiovascular pharmacotherapy.[20,45,78,83-84] Hence, the cohort's

level and nature of DRPs and PIP at both discharge and in the community requires further investigation.

In this chapter study, other than for male gender, it was shown that there was an absence of any significant differences in personal, clinical, QOL characteristics or survey factors, between the subgroups. For these variables, assessment showed there were no significant confounders which might jeopardise comparison of outcomes in further subgroup investigations.

The subdivision of the cohort (n=281) into the HMR Report group (n=79) and the non-HMR Report group (n=202) based only on the availability or non-availability of an HMR report, was supported. In the context of this thesis, the availability of the HMR report was confirmation and indicative of continuity of patient care in the community.

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CHAPTER 4.0
Investigating Drug Related Problems (DRPs)

Identification of DRPs at post discharge medication review

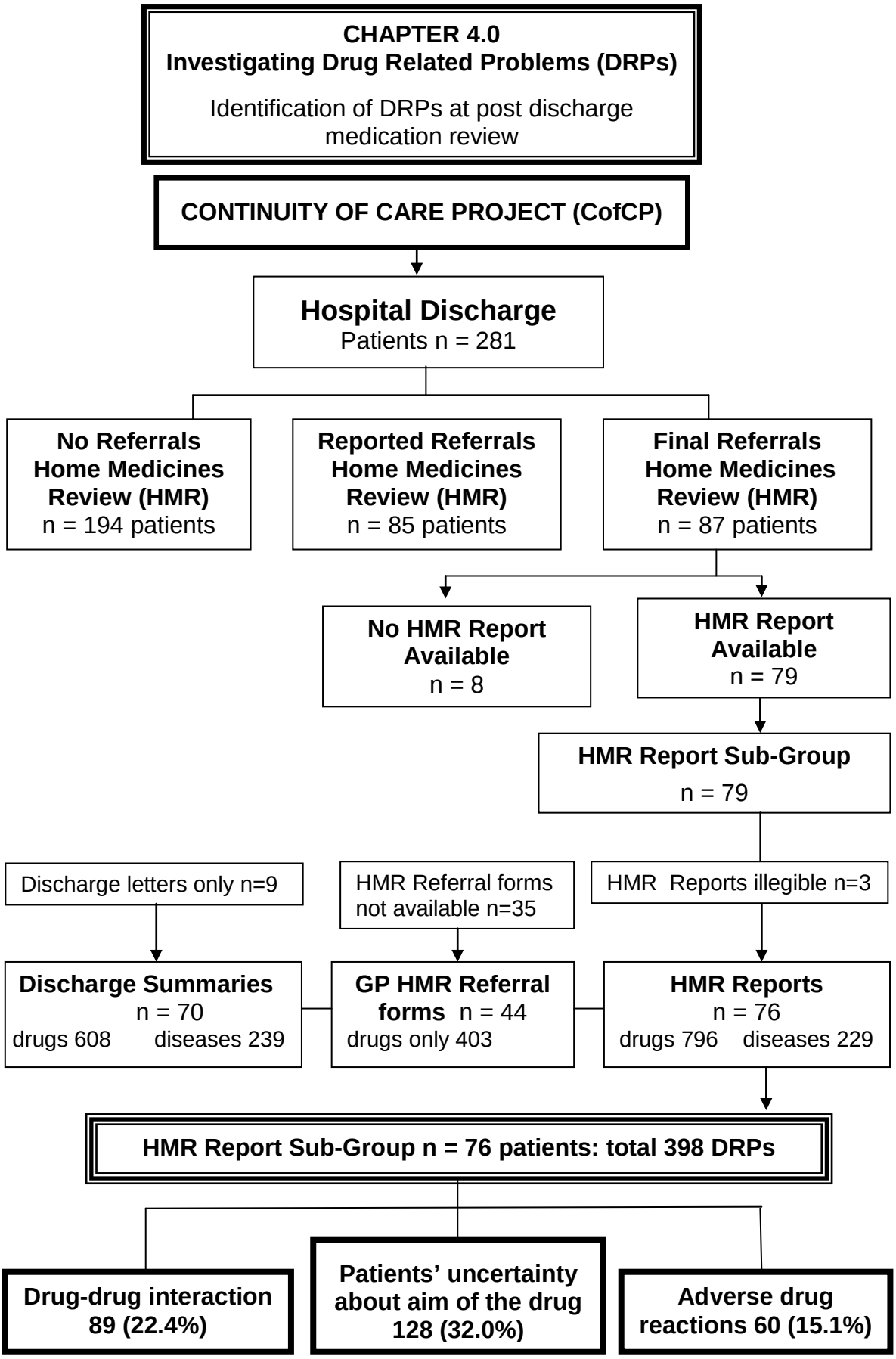

Figure 4.1 Chapter 4.0 Flowchart

CHAPTER 4.0 INVESTIGATING EXPOSURE TO DRUG RELATED PROBLEMS (DRPs)

4.1 CHAPTER SUMMARY

Following the identification of the complex nature and polypharmacy associated with the discharge regimen of the CofCP cohort, this study investigated any interruption by DRPs to the patients' continuity of care after discharge. For the Home Medicines Review (HMR) Report group (n=79), drugs and diseases were recorded on discharge summaries, HMR referral forms and HMR reports. The documents were analysed for comparison at hospital discharge and after GP consultation in the community, at HMR service. After categorisation of drugs and diseases by Anatomical Therapeutic Chemicals (ATC) and International Classification of Diseases Version 10, respectively, DRPs identified from available HMR reports were classified according to the Westerlund System. This system not only classified potential DRPs but also recognised actual patient related problems arising from their complex pharmacotherapy.

4.2 OPERATIONAL DEFINITION

4.2.1. CONTINUITY OF CARE is a perception of quality health care resulting from the ongoing management of issues which cause disruption to optimal patient care.

In the context of the study reported in this chapter:

Continuity of care is perceived by the researchers as the ongoing management of patients' complex drug regimen by identification and resolution of drug related problems at post discharge medication review.

4.3 PUBLICATION NOTE: In the following paper, the empirical study is referred to as the Westmead Medicines Project (WMP) (n=281 patients). The paper is cited in subsequent chapters as: Ellitt GR, Engblom E, Aslani P, Westerlund T, Chen TF. Drug related problems after discharge from an Australian teaching hospital. Pharm World Sci. 2010;32:622-630. Doi: 10.1007/s11096-010-9406-9

Pharm World Sci (2010) 32:622–630
DOI 10.1007/s11096-010-9406-9

RESEARCH ARTICLE

Drug related problems after discharge from an Australian teaching hospital

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Abstract *Objective* To reconcile patients' medicines and to classify drug related problems identified during medication review conducted after discharge from hospital. *Setting* Patients were discharged from the cardiology unit of Westmead Hospital after recruitment into the Westmead Medicines Project which ran from 2004 to 2007. *Method* This retrospective study involved an analysis of drugs, diseases and drug related problems in medication review reports available for 76 out of 85 patients who received a Home Medicines Review (HMR). Data sources for medication reconciliation and analyses also included hospital discharge summaries (n = 70) and GP referrals for HMR (n = 44). Comprehensive clinical profiles were constructed for the 76 subjects whose drug related problems were identified, coded, and then classified from their HMR reports. *Main outcome measures* Number, type, distribution and international classification of drugs, diseases and drug-related problems. *Results* Patients were prescribed drugs for a broad range of cardiovascular, circulatory, endocrine, respiratory and digestive system diseases. Mean number of drugs per patient in discharge summaries: 8.7 ± SD 3.3 (range 3–19); in GP referrals: 8.9 ± SD 4.3 (range 2–23); and in HMR reports: 10.8 ± SD 4.0 (range 3–24). Mean number of diseases per patient in discharge summaries: 4.1 ± SD 2.9 (range 1–11); and in HMR reports: 4.7 ± SD 2.6 (range 1–12). A total of 398 drug related problems were identified for 71 (93.3%) patients with mean 5.6 ± SD 4.3 problems (range 1–21). The most frequently recorded problems were the patients' uncertainty about drug aim: n = 128 (32.0%); potential interactions n = 89 (22.4%); and adverse reactions n = 60 (15.1%). *Conclusion* This study showed that patients recently discharged from a tertiary care hospital had a significant number of drug related problems. Classification of drugs and diseases revealed a broad range of non-cardiovascular medicines and conditions in the patients from an acute care cardiology unit. We found that home medicines review provided continuity of care and an opportunity for medication reconciliation which revealed marked differences in number of drugs, between hospital discharge and medicines review. The patients' uncertainly about their drugs and their diverse range of co-morbidities indicated the need for timely counselling by pharmacists in the community.

Keywords Australia · Cardiovascular · Continuity of care · Drug related problems · Medication reconciliation · Medication review

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Impact of findings on practice

- Patient uncertainty about why a drug has been prescribed is common.
- Drug related problems are common after discharge from hospital.
- Pharmacist-conducted medication review provides an opportunity for reconciliation of drugs, and identification and timely resolution of drug related problems.

Introduction

Drug related problems (DRPs) are associated with significant hospital re-admission, morbidity and mortality, especially in older patients with multiple co-morbidities and polypharmacy [1, 2]. The classes of drugs most commonly associated with DRPs include those prescribed for cardiovascular, nervous and, alimentary tract and metabolic systems [3–5]. During hospitalisation there are often changes to patients' long established drug regimens, and so patients are at increased risk of DRPs occurring in the period after discharge [6].

Continuity of primary care and vigilant management of drug regimens are especially required for prevention of DRPs in patients taking multiple drugs for multiple conditions [7]. This is particularly relevant considering that changes to the drug regimen are often made during hospitalisation and further changes may be made by general medical practitioners (GPs) post discharge [8–10]. Hence, the timely management of DRPs, especially after patient transfer from hospital to the community, is crucial for optimal pharmacotherapy and its continuity [11].

Community pharmacists are well placed to provide ongoing pharmaceutical care and medication management services to patients after discharge from hospital [12–14]. In Australia, Home Medicines Review (HMR) has been a Commonwealth funded service since October 2001 [15]. The HMR programme has been designed to facilitate the quality use of medicines by patients and collaborative links between pharmacists and GPs [16, 17]. The HMR service comprises the following key steps:

- Identification of potential recipients of an HMR.
- GP referral to the patient's preferred community pharmacy.
- Community pharmacy coordination of the HMR service which includes a patient interview, usually in the patient's home, and a medication review report by an accredited pharmacist for the patient's GP.
- GP and patient consultation to jointly formulate a medication management plan based on the pharmacist's medication review report [15].

In the United Kingdom (UK) a different approach to medication review, known as Medication Use Review, has been implemented [18]. One evaluation of pharmacist-led reviews in the UK was received positively by both GPs and practice nurses [14]. Other benefits of identifying DRPs through medication review were described for specific patient groups such as those with hypertension, dyslipidaemia and chronic pain [19, 20]. In Sweden, community pharmacists routinely identify, code and resolve DRPs using the Westerlund System [21]. In Australia, medication reconciliation and identification of DRPs for resolution are routinely practised as part of the HMR service [22, 23].

Study aim

To reconcile patients' medicines and to classify drug related problems identified during medication review conducted after discharge from hospital.

Method

Study design and patient recruitment

This retrospective study involved an analysis of patients' DRPs identified during HMR service, conducted by pharmacists, and recorded in the HMR report for the patient's GP. Data on patients' characteristics, drugs and diseases were collated from discharge summaries, GP referrals for HMR and HMR reports. Patients whose drugs were recorded on all three data sources were identified for drug reconciliation. Patients' drug regimen and disease states were analysed to profile the study cohort and record their co-morbidities and associated pharmacotherapy.

This study formed part of a larger research project known as the Westmead Medicines Project (WMP) [22]. Recruitment into the WMP required that patients met the eligibility guidelines for HMR, were discharged back to their homes and were prescribed at least one cardiac medicine [23]. Specifically, patients under the care of a cardiovascular medical team were recruited from the Cardiology unit (only) of a large acute care hospital, from 2004 to 2007. Inclusion in this present study required that patients also received an HMR service post-discharge (n = 85). The breakdown of patient numbers is shown in Fig. 1.

Classification of drug related problems

In this study, DRPs were defined as 'a circumstance related to the patient's use of a drug that actually or potentially prevents the patient from gaining the intended benefit of the drug' as defined for the Westerlund System of DRP classification [24]. This system known as the Westerlund System, which accommodates over the counter (OTC) and complementary medicines, was designed for use by community pharmacists in Sweden and was selected for use in this study [25]. It is a 13 category system which includes patient related problems such as therapy failure and practical drug administration problems. The system received a favourable evaluation in a review of 14 DRP classification systems. The review found that the Westerlund System had undergone a form of validation, clearly defined DRPs, was

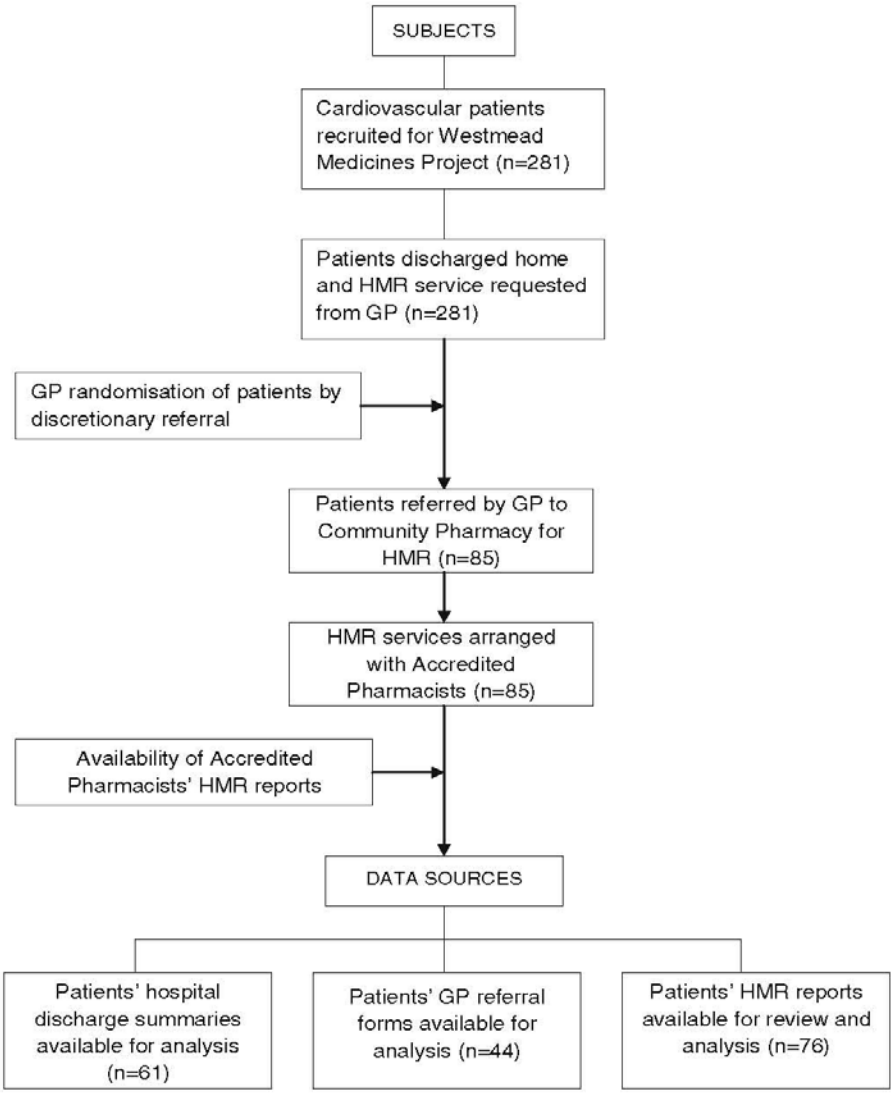

Fig. 1 Patient flow and data sources for patients' drugs, diseases and drug-related problems

not hierarchical, integrated the cause of the problem into its description and its usability has been explicitly studied [24]. The primary reason this system was chosen, was the opportunity to acknowledge and record problems which were described as 'patient related'.

Collection of data

Data sources included hospital records and discharge summaries, GP referrals for HMR, and HMR reports. Drugs and diseases were recorded from all 3 documents and DRPs were identified from HMR reports. Copies of the HMR reports were requested by the researchers, from the patients' community pharmacies.

On receipt, HMR reports were collated by a research registered nurse (RN), reviewed by two HMR accredited, hospital pharmacists; and all data were classified by a third 'blinded' research pharmacist. All participating pharmacists, either in the community or research team, were registered in Australia and the 'blinded' research pharmacist was trained in Sweden and in the use of the Westerlund System. The availability of data sources is shown in Fig. 1.

Data analysis

All data were entered into spreadsheets in the Statistical Package for Social Sciences (SPSS) Version 16.0 for Windows. Drugs were entered according to Anatomical

Table 1 Reconciliation of drugs documented in discharge summaries, GP referrals and HMR reports for a subgroup of 43 patients with full documentation

Anatomical therapeutic chemical classification of drugs	Discharge summaries (n = 43) Frequency (% relative frequency)	GP referrals (n = 43) Frequency (% relative frequency)	HMR reports (n = 43) Frequency (% relative frequency)
Category			
A: Alimentary tract and metabolism	65 (16.8)	55 (13.6)	77 (16.1)
B: Blood and blood-forming organs	38 (9.8)	32 (8.2)	41 (8.6)
C: Cardiovascular system	179 (46.4)	177 (44.6)	189 (39.5)
D: Dermatologicals	4 (1.0)	2 (0.5)	6 (1.3)
G: Genito urinary and sex hormones	4 (1.0)	4 (1.0)	4 (0.8)
H: Systemic hormonal preparations[a]	8 (2.0)	7 (1.7)	7 (1.5)
J: Anti-infectives for systemic use	1 (0.3)	1 (0.2)	1 (0.2)
L: Antineoplastic and immunomodulating agents	2 (0.5)	3 (0.7)	3 (0.6)
M: Musculoskeletal system	14 (3.6)	14 (3.5)	21 (4.4)
N: Nervous system	47 (12.2)	63 (15.9)	86 (18.0)
R: Respiratory system	16 (4.1)	31 (7.8)	34 (7.1)
S: Sensory organs	8 (2.1)	8 (2.0)	8 (1.7)
V: Various	0	0	2 (0.4)
Total	386 (100.0)[b]	397 (100.0)[b]	479 (100.0)[b]

Patients' drug regimen recorded in all three documents

[a] Excluding sex hormones and insulin

[b] Decimal places may be rounded

Therapeutic Chemicals (ATC) categorisation, diagnoses were entered according to International Classification of Diseases-10 (ICD-10) categorisation, and DRPs were coded according to the Westerlund System (Version 4) [21, 26, 27]. Reconciliation of drug regimens was conducted at three time points and the distribution and nature of DRPs, drugs and diseases were analysed.

Results

Data from hospital discharge summaries and GP referral forms for HMR were analysed in conjunction with the available 76 HMR reports.

Subject demographics

Subject demographics were collated from hospital medical records. The mean age of patients was 66.0 ± SD 13.2 years (range 32–88) and mean length of hospital stay was 12.5 ± SD 12.0 days (range 1–57). The study cohort (n = 76) comprised 40 (52.6%) males and 36 (47.4%) females.

Medication reconciliation

Medication regimens were recorded on hospital discharge summaries, GP referral forms for HMR, and HMR reports and were recorded on all 3 documents for 43/76 (56.5%) patients. Not unexpectedly, discharge summaries recorded only prescribed drugs; GP referral forms recorded prescribed drugs and occasionally, OTC and complementary medicines. Home Medicines Review reports generally recorded prescription, OTC and complementary medicines. Drugs were categorised according to the ATC system. The relative frequency of ATC categories of drugs, recorded in all 3 documents for 43 patients, is shown in Table 1.

Hospital discharge summaries

Discharge summaries for 61/76 (80.3%) patients were available for distribution to community pharmacies and accredited pharmacists. Some patients (n = 9) were admitted to the cardiology unit as day only admissions and did not receive a discharge summary (routine practice). Hence, nine accredited pharmacists were sent a list of the patients' discharge medications, by the research RN, in lieu of the discharge summaries. Hence, discharge medication regimens were available for 70/76 (92.1%) patients. The mean number of prescribed drugs per patient was 8.7 ± SD 3.3 drugs (range 3–19). The most frequently prescribed drugs were for the cardiovascular system: 280 drugs (46.1%) followed by alimentary tract and metabolic systems: 108 drugs (17.8%) (Table 2).

Diagnoses were recorded for 60/76 (78.9%) patients. The mean number of diseases per patient was 4.1 ± SD 2.9

Table 2 Number of drugs documented in discharge summaries, GP referrals and HMR reports for the study cohort

Anatomical therapeutic chemical classification	Discharge summaries (n = 70)[a] Frequency (% relative frequency)	GP referrals (n = 44)[b] Frequency (% relative frequency)	HMR reports (n = 74)[c] Frequency (% relative frequency)
Category			
A: Alimentary tract and metabolism	108 (17.8)	55 (13.0)	143 (18.0)
B: Blood and blood-forming organs	63 (10.4)	33 (8.2)	67 (8.4)
C: Cardiovascular system	280 (46.1)	181 (44.0)	314 (39.4)
D: Dermatologicals	4 (0.7)	2 (0.5)	11 (1.4)
G: Genito-urinary and sex hormones	7 (1.2)	4 (1.0)	6 (0.8)
H: Systemic hormonal preparations[d]	14 (2.3)	7 (1.7)	15 (1.9)
J: Anti-infectives for systemic use	4 (0.7)	1 (0.2)	3 (0.4)
L: Antineoplastic and immunomodulating agents	3 (0.5)	3 (0.7)	4 (0.5)
M: Musculoskeletal system	18 (3.0)	14 (3.5)	34 (4.3)
N: Nervous system	72 (11.8)	64 (15.9)	134 (16.8)
P: Antiparasitics/insecticides/repellents	0	0	2 (0.3)
R: Respiratory system	24 (3.9)	31 (7.7)	49 (6.2)
S: Sensory organs	11 (1.8)	8 (2.0)	11 (1.4)
V: Various	0	0	3 (0.4)
Total	608 (100.0)[e]	403 (100.0)[e]	796 (100.0)[e]

[a] Total 70/76 discharge drug regimen from: 61/76 hospital discharge summaries and 9/76 medication lists provided in lieu of discharge summary

[b] 44/76 copies of GP referral forms were available for analysis

[c] 74/76 HMR reports included patient's current, post discharge regimen

[d] Excluding sex hormones and insulin

[e] Decimal places may be rounded

diseases (range 1–11). The most frequently recorded diseases were in the circulatory system: 131 diseases (54.0%) followed by endocrine, nutritional and metabolic systems: 42 diseases (17.6%) (Table 3).

General practitioner HMR referrals

Accredited pharmacists were requested to send copies of the GP referrals with their HMR reports to the research team. General practitioner referral forms were available for 44/76 (57.0%) patients. The mean number of post discharge drugs per patient was 8.9 ± SD 4.3 drugs (range 2–23). The most frequently prescribed drugs were for the cardiovascular system: 181 drugs (44.0%) followed by nervous system: 64 drugs (15.9%) (Table 2). Referrals from GPs for HMR, in general, did not include the patients' diagnoses.

Home medicines review reports

Medication regimens were recorded in 74/76 (97.4%) HMR reports. The mean number of drugs per patient was 10.8 ± SD 4.9 (range 3–24). The most frequently recorded drugs were for cardiovascular system: 314 drugs (39.4%) followed by alimentary tract and metabolic systems: 143 (18.0%) (Table 2). No drugs were listed as current on 2/76 (2.6%) HMR reports. These two patients were noted to have had 7 drugs and 5 drugs prescribed on discharge summaries provided to the accredited pharmacists.

Patient diagnoses were recorded in 60/76 (78.9%) HMR reports. The mean number of diseases per patient was 4.7 ± SD 2.6 diseases (range 1–12). The most frequently recorded diseases were in the circulatory system: 120 diseases (52.4%) followed by endocrine, nutritional and metabolic systems: 57 diseases (24.9%) (Table 3).

Drug related problems from HMR reports

A total of 398 DRPs were coded and classified from 71/76 (93.3%) HMR reports. The mean number of problems per patient was 5.6 ± SD 4.3 (range 1–21). The most frequently reported DRP was patients' actual 'uncertainty about the aim of the drug' which was 32.0% of all problems reported. This problem was followed by reports of potential 'interaction' (22.4%) and 'adverse reaction' (15.1%). No DRPs were listed for 5/76 (6.7%) patients. The frequency of all DRPs recorded, is shown in Table 4.

Table 3 Number of diseases documented in discharge summaries and HMR reports for the study cohort

International classification disease-10	Discharge summaries (n = 60)[a] Frequency (% relative frequency)	HMR reports (n = 60)[b] Frequency (% relative frequency)
Category		
A00-B99: certain infections and parasites	0	1 (0.4)
C00-D48: neoplasms	0	2 (0.9)
D50-D89: blood and blood-forming organs and certain disorders involving the immune mechanism	1 (0.4)	0
E00-E90: endocrine, nutritional and metabolic systems	42 (17.6)	57 (24.9)
F00-F99: mental and behavioural disorders	2 (0.8)	6 (2.6)
G00-G99: nervous system	4 (1.7)	3 (1.3)
H00-H59: eye and adnexa	2 (0.8)	7 (3.1)
H00-H95: ear and mastoid processes	0	2 (0.9)
I00-I99: circulatory system	131 (54.0)	120 (52.4)
J00-J99: respiratory system	18 (8.0)	11 (4.8)
K00-K99: digestive system	18 (8.0)	17 (7.4)
L00-L99: skin and subcutaneous tissue	1 (0.4)	3 (1.3)
M00-M99: musculoskeletal system	12 (5.0)	0
N00-N99: genitourinary system	8 (3.3)	0
Total	239 (100.0)[c]	229 (100.0)[c]

[a] 60/76 Hospital discharge summaries included patients' diseases

[b] 60/76 HMR reports included patients' diseases

[c] Decimal places may be rounded

Table 4 Number of drug related problems documented in HMR reports for the study cohort

Westerlund System for DRP Classification (version 4)	HMR reports (n = 71)[a] Frequency (% relative frequency)
Categories	
1 Uncertainty about aim of the drug	128 (32.0)
2 Drug duplication	8 (2.5)
3 Interaction	89 (22.4)
4 Contraindication	6 (1.5)
5 Therapy failure	12 (3.0)
6 Adverse reaction	60 (15.1)
7 Underuse of drug	48 (12.1)
8 Overuse of drug	5 (1.3)
9 Inappropriate time for drug intake/wrong dosage interval	11 (2.4)
10 Problem administering drugs	12 (3.0)
11 Difficulty opening drug container	0
12 Inappropriate storage of drug	7 (1.8)
13 Other drug related problems	12 (3.0)
Total	398 (100.0)[b]

[a] 5/76 HMR reports recorded no DRPs

[b] Decimal places may be rounded

Discussion

Our study coded and classified DRPs from 76 HMR reports for patients discharged from the cardiology unit of a large, acute care, teaching hospital. A large number of DRPs were identified, indicating the importance of continuity of care as patients move between the hospital and community settings. This finding is consistent with the literature which describes discharge from hospital as a 'high risk' time for patients in terms of DRPs [28, 29]. Contributing risk factors included changes to existing medication regimens during hospitalisation, further changes identified during GP follow-up, and the relatively high number of drugs consumed by patients with a broad range of co-morbidities [30].

We found that patients' uncertainty about the aims of their drugs was the most frequently reported, actual DRP. This finding is similar to outcomes of a study conducted in European community pharmacies [5]. Furthermore, this study also found that the most common drugs associated with the problems were in the ATC category for cardiovascular drugs which, not unexpectedly, were common to our study cohort.

Drug interactions and adverse reactions (ADRs) were identified as the next most frequent DRPs in our study. In France the preventability of potential drug problems was researched in recently discharged patients, and ADRs were emphasised as of great consequence in determining patients' DRPs [28]. Consistent with our findings, this study concluded that patients needed clearer information about their drugs and that cardiovascular drugs were the most frequently reported drugs associated with DRPs.

It is noteworthy that our approach in using a relatively simple method to identify DRPs, has been advocated by others especially in the context of large-scale multicentre studies in community pharmacies in Europe [31]. Our methods are also consistent with recommendations from research involving community pharmacies by Sorensen et al. [32] in Australia and Sturgess et al. [33] in Northern Ireland. These researchers recognised the necessity for new approaches to the measurement of healthcare services and documentation of process measures or indicators. Our findings were further in agreement with Sturgess et al. who found the most common DRPs, such as non-compliance, resulted from a lack of patient information. Use of the Westerlund System ensured acknowledgement and documentation of 'patient related' problems, and hence, identified 'uncertainty about aim of the drug' as the primary problem for our cohort.

In addition to an evaluation of DRPs, we also compared the distribution of patients' drugs and diseases across three different time points: hospital discharge, post-discharge at the time of GP's HMR referral and post-discharge during HMR. A reconciliation of drugs documented on the three occasions demonstrated poor agreement in mean number of drugs per patient between discharge (8.7 $\pm$ SD 3.3) and HMR service (10.8 $\pm$ SD 4.9). The difference in mean number of drugs reported by accredited pharmacists in HMR reports, compared with GP referrals and discharge summaries, emphasised the benefit of pharmacist-led medication review and patient focussed reporting [29]. This is significant because medication review serves as an important continuity of care service in identifying both actual and potential DRPs when taking into account all types of drugs consumed by the patient.

Further when the ATC categories of drugs were computed across the three time points, the differential in the nature of drugs within and between anatomical categories was unexpected. For example, cardiovascular drugs constituted only 46.4% drugs on hospital discharge summaries and only 39.5% drugs on HMR reports. However and more importantly, this showed that a significant proportion of drugs ($\sim$60%) were from non-cardiovascular categories. This finding emphasises the broad range of drugs and diseases which describe our cohort and which would have contributed to the patients' uncertainty about the aim of any of their drugs. Consistent with other research, identification and documentation of co-morbidities and associated pharmacotherapy is pivotal when resolving DRPs in any specific diagnoses related group of patients [34].

Limitations of study

Limitations of this study include, primarily, the size of the cohort for whom HMR reports were available for analysis. Secondly, in calculating the frequency of drugs recorded in ATC categories, the count did not differentiate between prescribed, OTC and complementary medicines which were all counted equally in association with DRPs. Further, that 'non-compliance' was not overtly listed as a DRP in our classification system, but phrased as "underuse of drug".

Conclusion

This study showed that patients, after recent discharge from an acute care hospital, had a significant number of DRPs which were identified during medication review in the community. We found that a clear profile of the patients studied, and an awareness of changes or numbers in their drug regimen, diagnoses and co-morbidities was vital. However more importantly for pharmacy practice, we found that the most common DRP was the patients' uncertainty about their drugs which was an acknowledgement of 'patient related' drug problems. This indicated the need for improvement in the provision of appropriate drug information to the patient on their discharge from hospital and at medical follow up. The study demonstrated the value of HMR in providing patients with continuity of care and the opportunity for immediate resolution of their actual, most frequent drug problem by community pharmacists.

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Conflict of interest The authors have no conflict of interest to declare.

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4.4 Drug related problems (DRPs), Polypharmacy and CofC

In the preceding paper, analyses of data 'at discharge' were conducted on lists of drugs and diseases in patients' discharge summaries. Analysis of data and DRPs 'at HMR' service were conducted on lists of drugs and diseases in HMR reports written by accredited pharmacists. The comments and recommendations of the accredited pharmacists were taken into account for analysis of DRPs.

This study found the most frequently reported drug related problem (DRP) was the patients' uncertainty about the aim of their drugs which was followed by the potential for drug-drug interaction (DDI) and adverse drug reactions (ADRs). Regardless of the level at which any of the problems were reported, all actual and potential DRPs were a barrier to the patients' continuity of care (CofC) after hospital discharge. However, the HMR Report group benefited by the identification of these problems at HMR service.

Further evidence of the HMR Report group's exposure to polypharmacy was found at both discharge and at HMR service in the community, however it was not considered under the Westerlund System as a DRP. There was a high level of actual DRPs which could receive timely resolution at HMR service, and potential DRPs to be reported to the group's referring GPs. The representativeness of the HMR Report group to the CofCP cohort has been proposed and the potential DRPs identified for the subgroup in this chapter, require further investigation. Hence, it is recommended that the risk severity of involved drugs and the extent and source of any potentially inappropriate prescribing for the subgroup, be investigated at discharge and post discharge after GP consultation, at HMR service.

Authors statements and original signatures
appear in the print copies of this thesis

CHAPTER 5.0
Low and High Severity Risk Drugs

Identifying the severity rating of drugs prescribed on, and post, discharge

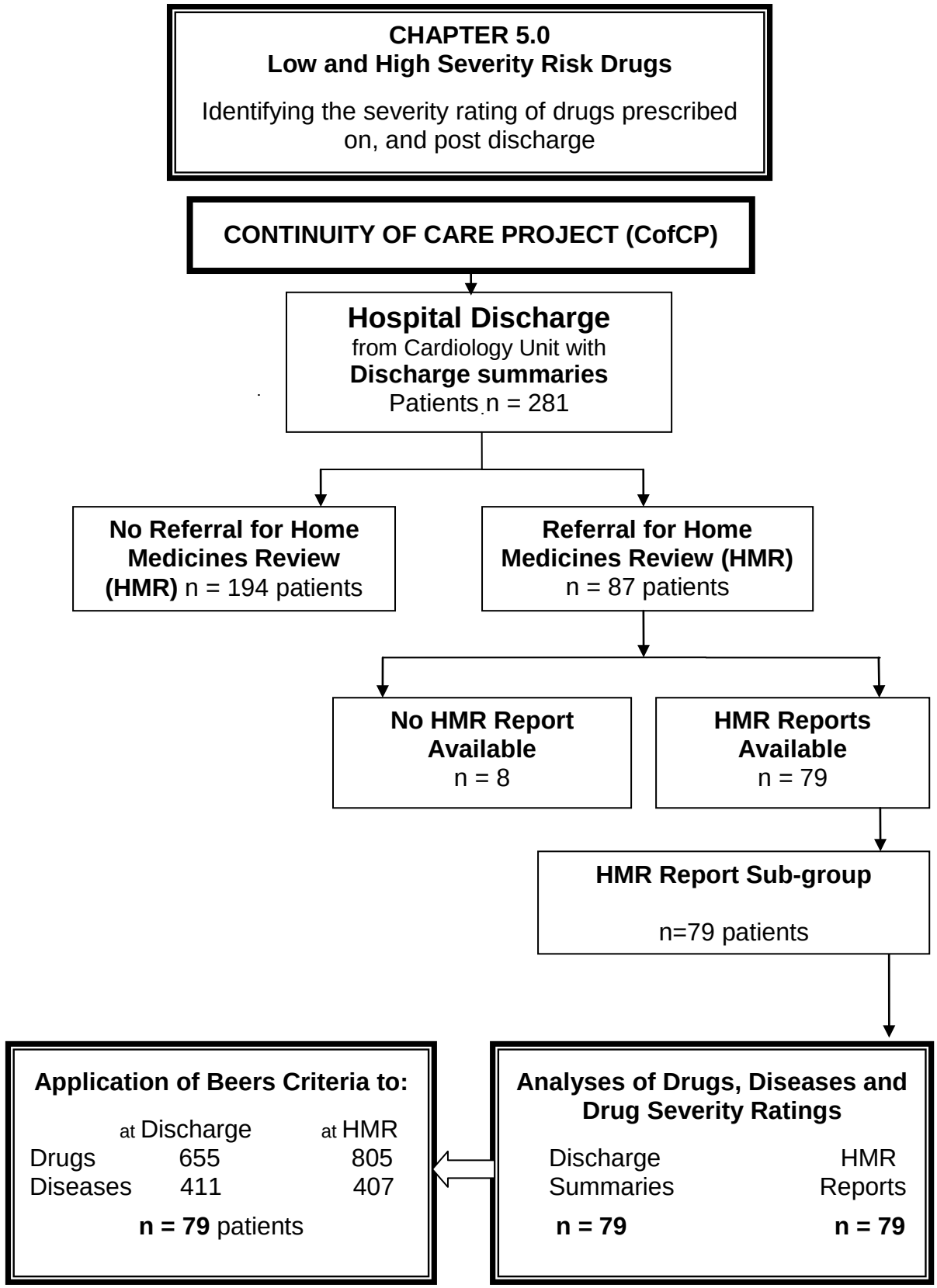

Figure 5.1 Chapter 5.0 Flowchart

CHAPTER 5.0 LOW and HIGH SEVERITY RISK DRUGS

5.1 CHAPTER SUMMARY

This chapter investigates the effect of prescribing high risk drugs on continuity of patient care between discharge from an acute care hospital and Home Medicines Review (HMR) service in the community.. The number of patients at risk and high risk drugs were investigated at discharge and at HMR for a subgroup (n=79) of patients from the Continuity of Care Project (CofCP) (n=281 patients). Patients' drugs and diseases were analysed by application of an international, well validated method to identify predetermined severity ratings allocated to specific drugs, and the source and extent of potentially inappropriate prescribing (PIP).

In this chapter study, analyses of PIP 'at discharge' were conducted on lists of drugs and diseases in hospital discharge summaries. Analyses of PIP 'at HMR' service were conducted on lists of drugs and diseases in HMR reports written by accredited pharmacists. The comments and recommendations made by the pharmacists in HMR reports were not taken into account.

5.2 INTRODUCTION

The period following a patient's discharge from hospital into the community and to primary care is crucial in the management of their prescribed drugs and is heavily reliant on an integration of medical and pharmacy-based services.[1-2] In turn those services are reliant on the accurate transfer of information between the hospital, patient and primary healthcare professionals.[3-4] Even with the best intentions and accurate transfer of patient information, it is the quality and appropriateness of that transferred

information which is instrumental in maintaining the safety and continuity of patient care.[5]

Discharge summaries in Australia are the primary mode of transferring the patients' in-hospital history, treatments, diagnoses and pharmacotherapy to their primary care, general medical practitioner (GP).[6-7] As such, the provision of comprehensive and accurate information is of utmost importance regardless of the patients' age.[8] It is also essential to transfer accurate information from the patients' GPs to the patients' nominated pharmacies for organisation of medication reviews.[24,149]

It then follows that patient focussed reports written after Home Medicines Review (HMR) can reveal the accumulated changes to the patients' pharmacotherapy between discharge and HMR.[11-12] Timely medication review post discharge from hospital, and conducted in the patients' homes, presents an opportunity to access and record the drugs the patient is actually consuming, regardless of the appropriateness or source of the prescribing.[13]

The literature abounds with advice and tools for determination of appropriate prescribing, potentially inappropriate prescribing (PIP) and polypharmacy, medication appropriateness, drugs-to-avoid, problematic prescribing and suboptimal prescribing.[14-20] These indicators, indices and criteria are described in many ways by their developers and include descriptions such as sensitive, descriptive, disease-dependent/independent, explicit and/or implicit.[21-24] The outcomes measures include e.g. satisfaction/non-satisfaction of criteria, allocation of low or high severity ratings, proportions of patients receiving appropriate treatment, patient risk and most of the outcomes which describe drug related problems including misuse, under and over prescribing.[11,23-25]

This study investigated the appropriateness of prescribing immediately post discharge from an acute care hospital. The identification of an PIP at discharge and at medication review in the community was to determine the source (when and where), the extent, and the severity of risk to the continuity and quality of the patients' healthcare after discharge.

5.3 STUDY AIM To determine the extent of potentially inappropriate prescribing to which patients were exposed at hospital discharge and at medication review in the community.

5.3.1 NULL HYPOTHESES

To achieve the study aim for a cohort of patients (n=79) for whom an HMR report was available as shown in Figure 5.1, the following null hypotheses were proposed.

There is no statistically significant difference between discharge and HMR in:

1. the distribution of patients' drugs and diseases.
2. the distribution of allocated severity ratings.
3. the distribution of instances of potentially inappropriately prescribed (PIP) drugs or drug related situations.
4. the distribution of patients at risk and degree of allocated severity ratings.
5. the type and distribution of criteria identifying the severity rating of prescribed drugs.

5.4 OPERATIONAL DEFINITIONS

5.4.1 CONTINUITY OF CARE is a perception of quality health care resulting from the ongoing management of issues which cause disruption to optimal patient care.

In the context of the study reported in this chapter:

Continuity of Care is perceived by the researchers as the quality use of medicines by the ongoing management and timely identification of inappropriately prescribed drugs which put the patients' healthcare and optimal pharmacotherapy at risk.[26]

5.4.2 POTENTIALLY INAPPROPRIATE PRESCRIBING (PIP)

In this study, the terms 'potentially inappropriate prescribing' 'potentially inappropriate prescriptions' and 'potentially inappropriate medication' are adopted as equivalent concepts and are abbreviated as 'PIP'. Prudent et al. (2008) define 'potentially inappropriate medication' as drugs with an unfavourable risk/benefit ratio when safer or equally effective alternatives are available.[27]

5.5 METHOD

5.5.1 STUDY DESIGN

The study reported in this chapter, involved a retrospective analysis of patients' drugs and diseases on discharge from hospital and at medication review in the community. The provision of HMR reports to the patients' GPs by accredited pharmacists was the end point of data collection for this study. Patients' drugs were examined to identify

any predetermined severity ratings allocated by Beers criteria to those drugs, and to identify the risk of potentially inappropriate prescribing(PIP) at two points in time.[28]

5.5.2 SUBJECTS AND DATA SOURCES

This study analysed the drugs prescribed for, and diseases of a subgroup of (n=79) patients of the Continuity of Care Project (CofCP) (n=281) (Figure 5.1). All subjects recruited to the project were patients under the care of a cardiovascular team and were discharged from the Cardiology Unit of Westmead Hospital to their homes, between mid 2004 and 2007. Patients whose median age was 69 (IQR 18: 58-76) years, met the suggested Australian Commonwealth Government's eligibility criteria for HMR referral by a GP, and were discharged on at least one cardiovascular drug.[29]

All research consent forms and protocols were accepted by the ethics committees of The University of Sydney, Western Sydney Area Health Service, Commonwealth Health Insurance Commission and the Veteran's Affairs Board.[6] From the full cohort of patients a subgroup of patients (n=87) received an HMR and 79/87 HMR reports were received by the research team at Westmead hospital.[30-31] In this study, the subgroup of patients for whom an HMR report was received by the research team, are reported as the HMR Report group (n=79) (Fig. 5.1).

Data sources analysed, included the patients' hospital medical records, discharge summaries and HMR reports. Hospital discharge summaries were generated by the attending medical teams for the patients' delivery to their community GP.[32] Short stay or 'day only' patients did not routinely receive a discharge summary hence, a list of the patients' discharge drugs was recorded in lieu of the summary. All HMR referring GPs

and nominated pharmacies received copies of their patient's discharge summary or medication list.

HMR reports written for the patients' referring GPs, by accredited pharmacists, were copied to the research team by those pharmacists.[31] Prior to writing their reports, accredited pharmacists received copies of patients' discharge summaries and GPs referral forms. This allowed a comparison and/or reconciliation of discharge regimen, GP's orders on referral forms, and drugs consumed at time of medication review. This study analysed diseases and drugs recorded on hospital discharge summaries and on HMR service reports (Fig. 5.1).

5.5.3 DRUG SEVERITY RATING CRITERIA

The updated Beers criteria, published by Fick et al. (2003), were chosen for identification of PIP. These explicit criteria rate potentially inappropriate drugs as of low or high severity.[27,33-36] Beers criteria were developed using a modified Delphi method for formulating group judgements by an expert panel on the rating of specific drugs prescribed for patients ≥65 years of age.[28,37] Beers criteria are criticized in the literature for inclusion, exclusion and omission of specific drugs in diverse circumstances which this study does not replicate.[14-15,18,20-21]

These criticisms have been taken into account and Beers criteria were used in this study as a tool to identify an evidence base. That is, data relevant to the patient population under study, and to quantify any health gains or negative consequences relevant to achieving the aim of this study.[1] Beers criteria were chosen for this study after consideration of literature reviews and research which included:

a) Literature reviews assessed the application of Beers criteria in various healthcare settings and found that Beers' identification of inappropriate prescribing and prescribing trends, were noteworthy regardless of methodological differences.[35]

b) Beers criteria were also compared with other consensus-approved clinical indicators which demonstrated important links between patterns of care and clinical outcomes.[38]

c) Systematic review of healthcare outcomes identified by Beers criteria, found an association with the detrimental healthcare impact of inappropriate medication use.[39]

d) As an indication of the widespread acceptance of Beers criteria, Blackwell et al. (2008) researched and reported on the national uptake of the criteria for the assessment of American Medicaid and Medicare enrolees.[40]

Therefore, it was accepted that application of the Beers criteria could provide an explicit, validated and international approach to identification of PIP in the Australian healthcare environment.[21,23]

5.5.3.1 Application of Beers Criteria

Beers Criteria allocate a severity rating for specific drugs independent of diagnoses or conditions in 48 criteria (Table 1) [28] and ratings considering diagnoses or conditions in 20 criteria (Table 2).[28] In this study, the Beers criterion targeting blood clotting disorders or patients receiving anticoagulant therapy was divided into two criteria for ease of analysis (No.54 and No.55) and the two tables of criteria were numbered consecutively from 1–69 (Appendix 5.1).

In this study, the 69 criteria were applied to patients' drugs and diseases to determine criteria applicability.[41] Criteria were deemed applicable to the group if at least one patient was prescribed the drugs and, or met the conditions of the criterion. The active ingredients of drugs in the explicit criteria were counted whenever they were

targeted by any criterion and as many times as prescribed in a different form or strength (e.g. insulin, warfarin). That is, unless specific conditions were expressed as in criteria No. 10: temazepam dose >15mg; No.22: ferrous sulphate >325mg/day.

For the HMR Report group (n=79), purpose designed databases were constructed for all drugs prescribed and diseases diagnosed at discharge and HMR. All drugs and diseases were coded numerically for data entry purposes. Alphabetical and numerical lists of the drugs and diseases were then prepared and further databases were designed to record patient responses to the applicable Beers criteria.

In the response databases, dichotomous (yes, no) responses to the criterion were recorded in rows, against the patients' code numbers, with applicable Beers criteria in columns. If a therapeutic category was listed in a criterion, it was necessary to repeatedly access the drugs database to capture *all* drugs within the category being assessed e.g. anticoagulants: warfarin, heparin, and low dose aspirin. The patient was scored as being/not being exposed to an instance of PIP, along with the severity risk indicated by that criterion.

Identification of PIP by Beers criteria 'at discharge' was conducted on lists of drugs or diseases in discharge summaries. Identification of PIP by Beers criteria 'at HMR' service was conducted on lists of drugs or diseases in HMR reports written by accredited pharmacists. The pharmacists' comments and recommendations in the report, were not taken into account..

The provision of the HMR reports, to the researchers by the accredited pharmacists, was the end point of data collection for this study

5.5.3.2 Allocation of Severity Ratings

Application of the Beers criteria allowed analyses that indicated the number of high and low severity ratings allocated to the patients' drugs at discharge and HMR. In order to apply Beers criteria, each of the patients' drugs and disease states were repeatedly assessed by different criteria for allocation of severity ratings. For example, a patient with heart failure, rheumatoid arthritis and a gastric ulcer who was taking piroxicam would have recorded 3 high severity ratings allocated for the one drug from the application of the following criteria.

No.28 Independent of diagnoses or conditions: Long-term use of full-dosage, longer half-life, non-COX-selective non-steroidal anti-inflammatory drugs (NSAIDs). Concern: Have the potential to produce GI bleeding, renal failure, high blood pressure, and heart failure

No.52 Considering Diagnoses or Conditions: Gastric or duodenal ulcers; taking NSAIDs or aspirin (>325mg) (coxibs excluded). Concern: May exacerbate existing ulcers or produce new/additional ulcers.

No.55 Considering Diagnoses or Conditions: Blood clotting disorders or receiving anticoagulant therapy; taking Aspirin, NSAIDs, dipyridamole, ticlopidine or clopidogrel. Concern: May prolong clotting time and elevate INR values or inhibit platelet aggregation, resulting in an increased potential for bleeding. (Appendix 5.1)

5.5.4 DATA ANALYSES

For data analysis and outcome interpretation, three units of analysis were targeted namely: 1) allocation of severity ratings to patients' prescribed drugs 2) patients' exposure to PIP and 3) the form and utility of Beers criteria.

Data on drugs and diseases were extracted from the HMR Report group's discharge summaries and HMR reports. Drugs and diseases were recorded and coded according to the Anatomical Therapeutic Chemical (ATC) classification and International Classification of Disease version 10 (ICD-10), respectively.[42-43] After coding, patients' drugs and diseases were analysed to determine the nature and distribution of severity ratings allocated to their drugs and drug related situations. This was an indication of whether or not those patients were at risk of PIP.[44-45]

It was outside the realm of this study to empirically measure the clinical impact on the patients of identified PIP. Instead, an effect size approximation was conducted using an eta squared estimation. This calculation was based on the 't' value of students' t-tests (t-tests) conducted to assess the null hypothesis of any differences in the allocation of severity ratings between discharge and HMR.

Eta squared estimations (tsq/tsq+(N-1)) for effect size were based on Cohen's values of 0.01~small effect; 0.06~moderate effect and 0.140~large effect.[46-48] In addition, the percentage difference in severity ratings allocated to patients was estimated if the difference was shown to be statistically significant. Regardless of severity rating level, all outcomes between discharge and HMR were included to describe the proposed impact of that difference in PIP on the patients.

The form and distribution of the applied criteria were also analysed to assess how many criteria were applied, and whether or not they carried a low or high severity rating. These analyses indicated the source and changes in the extent of inappropriate prescribing at discharge and/or HMR. In turn, the outcomes provided an insight into the

continuity and appropriateness of patients' pharmacotherapy at discharge and its continuance through follow-up in the community.[49-51]

Data were analysed at discharge and HMR using the Statistical Package for the Social Sciences: Statistics Version 17 and Microsoft Excel 2003 software. All specific tests were conducted at an alpha level of 0.05 and included multiple response frequencies; t-tests and chi squared relationships.

5.6 RESULTS

5.6.1 DRUGS AND DISEASES

A total of 87 patients received an HMR post discharge, and a report was available for 79/87 (90.8%) of those patients. Table 5.1 shows the number and distribution of drugs and diseases analysed for the HMR Report study group (n=79) and paired samples t-testing of the null hypothesis of no difference between discharge and HMR. There was a significant increase in number of drugs documented at HMR (p=0.001) and a significant decrease in number of diseases documented at HMR (p=0.001) than at discharge.

5.6.2 APPLICABILITY OF BEERS CRITERIA

Beers criteria (n=69) were initially applied to the drugs and diseases of the HMR Report group (n=79) to determine which criteria were applicable to ≥1 patient in the group at any time (Appendix 5.1). This resulted in 27 criteria being found applicable to the group. Of the applicable criteria, there were 22 criteria which rated drugs/situations of high severity and 5 criteria which rated drugs/situations of low severity.

Table 5.1 Distribution of drugs and diseases recorded for the HMR Report group (n=79) at discharge and HMR

Group Characteristic	DISCHARGE			HMR			t value	Significance p value
	Total number	Mean (SD±)	Range	Total number	Mean (SD±)	Range		
Drugs	658	8.2 (3.0)	2 - 19	805	10.1 (4.9)	1- 23	-4.09	0.001
Diseases	411	5.2 (2.8)	1 - 14	286	3.6 (2.9)	1- 12	3.34	0.001

(t-test: N=79, df=78)

Table 5.2 Distribution of severity ratings allocated to the prescribed drugs for the HMR Report group (n=79) by application of the Beers Criteria[28] at discharge and HMR.

Severity ratings	DISCHARGE	HMR	t value	Significance p value
	Number of ratings Mean (SD±) per patient	Number of ratings Mean (SD±) per patient		
Low severity ratings allocated	0.2 (0.15)	0.1 (0.3)	1.42	0.16
High severity ratings allocated	2.8 (1.12)	2.2 (1.2)	2.91	0.01
Low + High severity ratings allocated	2.9 (1.21)	2.3 (1.3)	3.19	0.02

(t-test: N=79, df=78) Beers criteria[28] (Appendix 5.1).

5.6.3 LOW AND HIGH SEVERITY DRUG RATINGS

Table 5.2 shows the results of HMR Report group (n=79) assessment for the allocation of low or high severity ratings to patients' drugs/situations. Table 5.2 shows the number and distribution of severity ratings allocated by Beers criteria and paired samples t-testing of the null hypothesis of no difference between discharge and HMR. There was no significant difference between discharge and HMR in the number of low severity ratings allocated to patients' drugs/situations (p=0.159). From discharge, there was a significant decrease at HMR in the high severity ratings allocated to patients' drugs (p=0.005). The combination of low and high severity ratings allocated to patients' drugs/situations showed a significant decrease at HMR (p=0.002).

5.6.3.1 Proposed Impact of Identified Severity Ratings

The impact on patients of prescribing low and high severity drugs was approximated using an eta squared estimation (tsq/tsq+(N-1)). As shown in Table 5.2, the paired samples t-testing of high severity ratings allocated to patients' drugs/situations at discharge and at HMR showed a significant decrease at HMR (t(78)=2.91; p=0.005). The eta squared estimation (0.098) indicated a moderate to large effect size.

When the relatively small number of low severity ratings was combined with the high severity ratings, t testing showed a significant decrease at HMR (t(78)=3.19; p=0.002). The eta squared estimation (0.115) indicated an unchanged, moderate to large effect size from the combined ratings. In addition, from Table 5.2 the paired samples t-testing of the combined severity ratings showed a significant difference at HMR with a percentage decrease of 20.4% in total severity ratings at HMR.

5.6.4 INSTANCES OF POTENTIALLY INAPPROPRIATE PRESCRIBING (PIP)

Table 5.3 shows the paired samples t testing of the total number of instances (high and low severity) of PIP relative to the number of routine drugs prescribed and patients assessed at discharge and at HMR. The ratio of PIP instances to the number of routine drugs (Table 5.1) prescribed for the study group was 127 (19.3%) at discharge and 115 (14.3%) at HMR service. Table 5.3 also shows the mean number of PIP instances for the HMR Report group (n=79). Although there was no significant difference in the mean number of instances identified by Beers criteria between discharge and HMR (p=0.069), the results are consistent with the marked reduction of high severity ratings allocated at HMR service.

5.6.5 PATIENTS AT RISK – SPECIFIC CRITERIA

5.6.5.1 Patients at Risk – High Severity Criteria

The results in Table 5.4 indicated marked differences in the number of patients prescribed drugs, or in drug related situations allocated high severity rating at discharge and at HMR service. The relative frequency analysed at discharge and at HMR across the 22 criteria showed 7.2% patients and 6.6% patients were prescribed high risk drugs, respectively. Although paired samples t testing of the decrease in number of patients prescribed drugs allocated high severity ratings at HMR was not significant (p=0.064), the results reflect the reduction of PIP identified at HMR.

Table 5.3 Instances of drugs or drug related situations identified as PIP for the HMR Report group (n=79) by Beers criteria[28] at discharge and HMR.

PIP situations identified by Beers Criteria	DISCHARGE: n = 658 drugs*			HMR: n = 805 drugs*			t value	Significance p value
	Total Number	Mean (SD±) per patient	Ratio PIP to discharge drugs*	Total Number	Mean (SD±) per patient	Ratio PIP to discharge drugs*		
Potentially inappropriate prescribing instances	127	1.6 (1.1)	19.3%	115	1.4 (1.1)	14.3%	1.84	0.069

(t-test: N=79, df=78) * % PIP frequency relative to total number drugs prescribed. Beers criteria[28] (Appendix 5.1).

Table 5.4 Distribution of HMR Report group patients (n=79) identified as at risk from high severity drugs or drug related situations by applicable Beers criteria* at discharge and HMR.

No.	Beers Criteria applied High Severity (n=22)	DISCHARGE		HMR	
		Number Patients no risk[a] (% relative frequency)[b]	Number Patients at risk[a] (% relative frequency)[b]	Number Patients no risk[a] (% relative frequency)[b]	Number Patients at risk[a] (% relative frequency)[b]
2	Indomethacin (Indocin and Indocin SR)	77 (97.5)	2 (2.5)	75 (94.9)	4 (5.1)
7	Amitriptyline (Elavil), chlordiazepoxide-amitriptyline (Limbitrol), and perphenazine-amitriptyline (Triavil)	78 (98.7)	1 (1.3)	77 (97.5)	2 (2.6)
8	Doxepin (Sinequan)	78 (98.7)	1 (1.3)	78 (98.7)	1 (1.3)
10	Doses of short-acting benzodiazepines: doses greater than temazepam (Restoril) 15 mg. [no other listed drugs were prescribed]	78 (98.7)	1 (1.3)	0	0
11	Long-acting benzodiazepines: diazepam (Valium) [no other listed drugs were prescribed]	78 (98.7)	1 (1.3)	0	0
27	Amphetamines and anorexic agents	78 (98.7)	1 (1.3)	77 (97.5)	2 (2.6)
29	Daily fluoxetine (Prozac)	78 (98.7)	1 (1.3)	0	0
31	Amiodarone	78 (98.7)	1 (1.3)	74 (93.7)	5 (6.3)
42	Short acting nifedipine (Procardia and Adalat)	75 (94.9)	4 (5.1)	77 (97.5)	2 (2.6)
44	Mineral oil	0	0	76 (96.2)	3 (3.8)

Table 5.4 Analysis and distribution of HMR Report group patients (n=79) identified as at risk from high severity drugs or drug related situations by applicable Beers criteria* at discharge and HMR, continued

No.	Beers Criteria applied High Severity (n=21)	DISCHARGE		HMR	
		Number Patients no risk[a] (% relative frequency)[b]	Number Patients at risk[a] (% relative frequency)[b]	Number Patients no risk[a] (% relative frequency)[b]	Number Patients at risk[a] (% relative frequency)[b]
50	Heart Failure	69 (87.3)	10 (12.7)	71 (89.9)	8 (11.3)
51	Hypertension	78 (98.7)	1 (1.3)	77 (97.5)	2 (2.6)
53	Seizures or epilepsy	77 (97.5)	2 (2.6)	0	0
55	Receiving anticoagulant therapy	6 (7.6)	73 (92.4)	8 (10.1)	71 (89.9)
56	Bladder outflow obstruction	74 (93.7)	5 (6.3)	76 (96.2)	3 (3.8)
58	Arrhythmias	69 (87.3)	10 (12.7)	75 (94.9)	4 (5.1)
59	Insomnia	0	0	78 (98.7)	1 (1.3)
60	Parkinson Disease	78 (98.7)	1 (1.3)	78 (98.7)	1 (1.3)
62	Depression	76 (96.2)	3 (3.8)	78 (98.7)	1 (1.3)
64	Syncope or falls	78 (98.7)	1 (1.3)	0	0
66	Seizure disorder	77 (97.5)	2 (2.6)	77 (97.5)	2 (2 6)
68	COPD	78 (98.7)	1 (1.3)	78 (98.7)	1 (1.3)

COPD, chronic obstructive pulmonary disease. [a]0 = none documented.. [b] % frequency relative to total number of patients (n=79). * Beers criteria (Appendix 5.1). Please Note: Where brand named drugs were specified in criteria, only those drugs were taken into account.

In Table 5.4 the highest number of patients prescribed drugs rated as of high severity was recorded for criterion No.55. This criterion explicitly rated aspirin, non-steroidal anti-inflammatory drugs (NSAIDS), dipyridamole (Persantin), ticlopidine (Ticlid), and clopidogrel (Plavix) as drugs of high severity when anticoagulant therapy was also prescribed. For example, patients in the HMR Report group who were receiving anticoagulant therapy were also prescribed aspirin, indomethacin, diclofenac, ketoprofen, meloxicam, or ibruprofen. At discharge, 73 (92.4%) patients were prescribed one of the listed drugs while receiving anticoagulant therapy. At HMR, 71 (89.9%) patients were prescribed one of the listed drugs while receiving anticoagulant therapy.

The second highest number of patients prescribed drugs rated as high severity was recorded for criterion No.50. This criterion explicitly rated disopyramide (Norpace, and high sodium content drugs (sodium and sodium salts [alginate, bicarbonate, biphosphate, citrate, phosphate, salicylate, and sulphate]) as drugs of high severity when patients were diagnosed with heart failure. For example, patients in the HMR Report group who were diagnosed with heart failure were prescribed sodium bicarbonate or sodium citrate. At discharge, 10 (12.7%) patients were prescribed one of the listed drugs while diagnosed with heart failure. At HMR, 8 (11.3%) patients were prescribed one of the listed drugs while diagnosed with heart failure.

5.6.5.2 Patients at Risk – Low Severity Criteria

Table 5.5 shows the insignificant number of patients prescribed drugs, or in drug related situations of low severity rating at discharge and HMR. The relative frequency analysed at discharge and HMR across the 5 criteria showed 1.7% patients and 1.2% patients were at low risk, respectively. Paired samples t testing of the decrease in number of patients with low severity ratings at HMR was not statistically significant ($p=0.821$).

Table 5.5 Distribution of HMR Report group patients (n=79) identified as at risk from low severity drugs or drug related situations by Beers criteria* at discharge and HMR.

No.	Beers Criteria applied Low Severity (n=6)	DISCHARGE		HMR	
		Number Patients no risk (% relative frequency)[b]	Number Patients at risk (% relative frequency)[b]	Number Patients no risk (% relative frequency)[b]	Number Patients at risk (% relative frequency)[b]
13	Digoxin (Lanoxin) (should not exceed >0.125mg/d except when treating atrial arrhythmias)	76 (96.2)	3 (3.8)	76 (96.2)	3 (3.9)
22	Ferrous sulphate >325mg/d	78 (98.7)	1 (1.3)	0	0
49	Estrogens only (oral)	78 (98.7)	1 (1.3)	0	0
65	SIADH/hyponatremia	77 (97.4)	2 (2.5)	78 (98.7)	1 (1.3)
69	Chronic constipation	0	0	78 (98.7)	1 (1.3)

SIADH, syndrome of inappropriate antidiuretic hormone secretion. .[b] % frequency relative to total number of patients (n=79). * Beers criteria (Appendix 1)

5.6.6 APPLICATION OF CRITERIA

Application of the Beers criteria also allowed analyses of the number and type of criteria that were applied to the HMR Report group at discharge and at HMR service as shown in Table 5.6. It was found during analysis, that one high severity criterion could be applied to one patient a number of times for a number of different drugs. For example, a patient with chronic obstructive pulmonary disease (COPD), anxiety and hypertension whose pharmacotherapy included taking diazepam and propanolol was assessed at least twice by the following high severity criterion.

No.68 Considering Diagnoses or Conditions: COPD; taking long-acting benzodiazepines: chloriazepoxide, chlordiazepoxide-amitriptyline, clidinium-chloridazepoxide, diazepam, quazepam, halazepam or chlorazepate. B-blockers: propanolol. Concern: Central nervous system adverse effects. May induce respiratory depression. May exacerbate or cause respiratory depression. (Appendix 5.1)

5.6.6.1 Application of Low and High Severity Criteria

Table 5.6 shows results of paired samples t testing of the number and distribution of low and high severity criteria applied to the group. The table shows the t-testing of the null hypothesis of no difference between discharge and HMR. There was no significant difference between discharge and HMR in the number of low severity criteria applied ($p=0.088$). There was a significant decrease between discharge and HMR in the number of high severity criteria applied at HMR ($p=0.045$). There was no significant difference between discharge and HMR when the number of low and high severity criteria were combined ($p=0.090$).

Table 5.6 Distribution of applicable Beers criteria* applied to HMR Report group (n=79) at discharge and HMR.

Beers Criteria (n=27)	**DISCHARGE** **Number applied Mean (SD±)**	**HMR** **Number applied Mean (SD±)**	**t value**	**Significance** **p value**
Low severity criteria	0.01 (0.1)	0.3 (0.8)	-1.76	0.088
High severity criteria	6.6 (14.4)	4.7 (13.3)	2.09	0.045
Low + High severity criteria	6.6 (14.4)	5.0 (13.2)	1.76	0.090

(t-test: N=27, df=26) * Beers criteria (Appendix 1)

5.7 DISCUSSION

For the HMR group of patients, this study aimed to test several null hypotheses of no differences between discharge and HMR in 1) the distribution of patients' drugs and diseases and 2) the distribution of severity ratings allocated by Beers explicit criteria. The study tested for differences in 3) the distribution of instances of PIP. Further the study tested for differences in 4) the distribution of patients at risk and degree of severity ratings identified by specific criteria and finally in 5) the distribution and type of the applied Beers criteria.

While testing the null hypotheses all analyses 'at discharge' were conducted on lists of drugs and diseases in discharge summaries. All analyses 'at HMR' service were conducted on lists of drugs and diseases in HMR reports written by accredited pharmacists. The pharmacists' comments and recommendations in the HMR reports were not taken into account.

From Chapter 4, the distribution of drugs and diseases for the HMR Report group unexpectedly showed that cardiovascular drugs constituted only 46.4% of discharge drugs and 39.5% drugs in HMR reports.[11] This showed that a significant proportion of drugs (~60%) were from non-cardiovascular categories and that within the markedly high number of drugs prescribed, most were for co-morbidities.

The prescription of ≥ 5 concurrent active drugs is defined in the literature as polypharmacy which is at times, independently labelled as inappropriate prescribing.[52] Polypharmacy is also strongly linked to a "presence of drugs included in the Beers criteria….." (p1331 Steinman et al. 2009).[18,27,53-54] Fialova et al. (2005) found the relative risk of PIP was positively associated with polypharmacy.[52] Alternatively, when researching functional burden from (specifically) anticholinergic and sedative drugs, Hilmer et al. (2007) found that simply counting drugs was insufficient in assessment of potentially harmful drug regimens. Identification of polypharmacy alone, "provides no guidance for identifying the drugs that should be reduced or eliminated to minimise drug-related risk" (p782).[55]

In testing the differences in the distribution of drugs and diseases, it was found the study group were prescribed very high numbers of drugs ranging between 1-23drugs with a discharge mean 8.2 (±3.0) drugs and HMR mean 10.1 (±4.9) drugs.[11] This level of prescribing, and the significant increase shown at HMR indicates that polypharmacy should not be ignored as a unique or contributing factor in determinations of PIP and as a barrier to continuity of care for cardiovascular patients.[26,54,56-57]

The impact on patients, in a comparable study group, of significant outcomes from the allocation of Beers high severity ratings, was not found in the literature.

Further, the literature on estimations of the impact of statistically significant outcomes calculated from continuous and/ or repeated measures in cardiovascular healthcare research was diverse and dissimilar.[58-59]

As an example of impact estimations and research diversity (with study similarities), a Cochrane review calculated standard effect size on continuous measures. The review examined shared decision making (SDM) (e.g. appropriate prescribing) by healthcare professionals. In the review, Légaré et al. claimed that SDM was considered to be the crux of patient-centred care in cardiovascular risk factor management.[60] The review selected studies in which primary research outcomes (e.g. drug severity ratings), were evaluated using an objective 'third-observer instrument' (e.g. Beers criteria).[60]

In this study, despite a statistically significant reduction in the allocation of high severity ratings at HMR, the result gave no indication of the impact of the reduction on the study group. By using eta squared calculations; the beneficial impact of the reduction on patients was estimated to have a large effect size at HMR. In addition, it is proposed that an estimated reduction of 20.4% in severity ratings at HMR, is indicative of a highly beneficial impact on the study group. Taken at face value, the reduction reflects the improved patient care administered in the community after acute care hospital discharge.

Potentially inappropriate medication use in a European cohort of elderly patients (n=2707) was studied by Fialová et al. (2005) who combined both versions of Beers criteria (1997 and 2003) with criteria developed by McLeod et al.[20,52] Overall, Fialová found that 536 (19.8%) patients used at least 1 inappropriate medication with substantial

relative differences in patient numbers documented in the Czech Republic (41.1%); Denmark (5.8%); and Italy (26.5%).

Barry et al. (2006) combined Table 1 and Table 2 of Beers criteria and assessed patients in Ireland (n=181) and identified (also) at least 1 inappropriate prescription in 62 (34.0%) patients. Cardiovascular drugs were over 75% of medications documented for the Irish cohort.[38] Research by Steinman et al. found 214 (6.0%) prescribed drugs were flagged as potentially inappropriate by application of the Beers criteria. This outcome resulted from a study cohort of elderly patients (n=256) who used 3678 medications with a mean (SD±) of 14.4 (±5.0) medications indicated by predominantly cardiovascular diseases.[18]

Outcomes from this study, where the allocation of severity ratings to patients' drugs or drug related situations were indicative of PIP instances, were in general agreement with the literature. In this study, patients' PIP instances showed a mean (SD±) of 1.5 (±1.1) at discharge and 1.4 (±1.1) at HMR service. Comparable outcomes from the literature were expressed as 'greater than 1 inappropriate medication' which was read as a result between 1 and 2 inappropriate drugs per patient.[35,40,52,54,61]

However in this study, the ratio of PIP drugs to the number of routine drugs prescribed for the HMR Report group at discharge (19.3%) and at HMR (14.3%) was markedly higher than those reported by Steinman et al. at (6.0%). Steinman et al. compared the application of Beers and Zhan explicit criteria in a cohort of 'very elderly' geriatric patients.[18] They found outcomes were strongly influenced by the limited ability of drugs-to-avoid criteria, such as Beers, to distinguish between drugs that were problematic for individual patients and those which were not e.g. clopidogrel and

aspirin.[18] However, Steinman also found that drugs-to-avoid criteria were best used to warn physicians of PIP and a simple means to identify PIP for follow up in individualised medication review.

Analyses of differences in where or when potentially inappropriate prescribing occurred, utilizing Beers criteria and relevant to this study, were not found in the literature. In this study, the location or time of PIP was described as the source of the prescribing i.e. at hospital discharge or after GP consultation in the community. When the outcomes from application of Beers criteria were accepted at face value, the allocation of high severity rankings to the patients' prescribed drugs showed a distinct and significant decrease from discharge to HMR. Hence, these outcomes indicated the beneficial intervention of the patients' GP at post discharge follow-up prior to HMR in the community.[39] In support of such a finding, research has shown that community physicians perceive the most influential factor in safe and effective prescribing, relative to hospital-based prescribing, was their personal experience and contact with the patients.[56,62]

Use of the Beers criteria to identify PIP has been extensively reported in the literature. Many researchers, including Spinewine et al. (2007), were critical of the Beers criteria for ignoring drug availability in countries other than the USA.[21,63-65] Further, in developing alternate quality assessments for prescribing in primary health care, Wettermark et al. (2003) and Galagher and O'Mahoney (2008), specifically referred to the importance of taking individual patient diagnoses and prescribing practices into account.[63,66]

Similarly in this study, differences were found in the availability of drugs and prescribing practices in Australia. In addition, the majority of the Beers criteria were found to be inflexible and did not facilitate patient focussed deliberations on the severity ratings allocated to prescribed drugs or drug related situations.[16,36,67] This study found Beers severity ratings were misleading when allocated to drugs which were rated 'independent of diagnoses or conditions'.

As an example, this shortcoming was marked in the application of criterion No. 55 which rated clopidogrel as a high severity drug when prescribed with aspirin. Beers explicit criteria made no allowance for combing low dose aspirin and clopidogrel as a first line treatment under any circumstances. This combination of drugs was dispensed on discharge and was an accepted prescribing practice by the medical team treating the study cohort of cardiovascular patients at Westmead Hospital.[6,68-69] The explicit, high severity drug ratings allocated by Beers to clopidogrel and aspirin, were inflated at discharge and subsequently exaggerated the apparent 'significant' reduction of inappropriate prescribing at HMR.

Converse to the criticisms of explicit criteria, or 'drugs to avoid criteria' or 'disease-independent criteria' such as Beers, the use of these criteria especially for psychotropic agents, is supported in the literature.[18,24,55] These criteria were also considered a necessity by researchers who found that 'disease-dependent' criteria were too restrictive.[27,65]

Beers criteria are generally described as explicit and 'disease independent' however, Beers criterion No. 58 is a criterion that took into account the patients' diagnoses or conditions (Appendix 5.1). This study found that application of Beers

criterion No. 58 (Table 5.4) identified the largest reduction of patients at risk of PIP. This occurred after GP consultation in the community when tricyclic antidepressants prescribed at discharge, were beneficially withdrawn from the regimens of patients with cardiac arrhythmia.

5.8 STUDY STRENGTHS AND LIMITATIONS

It is acknowledged that the number of subjects and HMR reports available for analysis, limited generalisation from the study. The assessment of prescribing appropriateness was limited by any inaccuracies and or non-completion of documentation in medical records, discharge summaries, GP referral forms and medication review reports. However, documentation was representative of a real healthcare environment not artificially controlled for research purposes.

The explicit nature of Beers criteria was found to constrain analysis of potentially inappropriate prescribing (PIP) in Australia. It is suggested however, that it is unrealistic to expect that one set of criteria could accommodate worldwide differences in every context requiring identification PIP. In this study, differences in the healthcare system, availability of drugs, individual patient characteristics and local prescribing practices were not accommodated by application of Beers criteria.

5.9 CONCLUSION

A determination of the extent of PIP after discharge from an Australian acute care hospital into the community, confirmed the need for increased vigilance and safer prescribing. It is suggested that the conduct of routine medication reviews in patients'

homes would increase vigilance and improve information exchange with patients and healthcare professionals across healthcare borders.

The study evidenced elevated levels of polypharmacy and PIP of high risk drugs which, although reduced after GP follow-up, remained at an unacceptable level. This problem especially concerned the ratio between identified instances of PIP and drugs routinely prescribed at both hospital discharge and after GP follow up in the community.

It is recommended that further research be conducted to identify and address PIP using an alternate method to compensate for the constraints of the Beers criteria in Australia. Timely and comprehensive identification of PIP in the period immediately after hospital discharge is crucial to the patients' sustained improvement and continuity of care.

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CHAPTER 5.0

Appendix 5.1

Beers Criteria

Table 1 & Table 2
(69 criteria)

Chapter 5 Appendix 5.1. Copied from "Updating the Beers Criteria for Potentially Inappropriate Medication Use in Older Adults" Fick et al.[28]

Beers Table I 2002 Criteria for Potentially Inappropriate Medication Use in Older Adults: Independent of Diagnoses or Conditions. (Criteria are numbered according to the complete list of Beers Criteria)

Drug	Concern	Severity Rating	Applicability of indicator in this study of the HMR Report group (n=79)
1. Propoxyphene (Darvon) and combination products (Darvon with ASA, Darvon-N, and Darvocet-N)	Offers few analgesic advantages over acetaminophen, yet has the adverse effects of other narcotic drugs.	Low	No: drug/s not prescribed
2. Indomethacin (Indocin and Indocin SR)	Of all available nonstreroidal anti-inflammatory drugs, this drug produces the most CNS adverse effects	High	Applicable
3. Pentazocine (Talwin)	Narcotic analgesic that causes more CNS adverse effects, including confusion and hallucinations, more commonly than other narcotic drugs. Additionally, it is a mixed agonist and antagonist.	High	No: drug/s not prescribed
4. Trimethobenzamide (Tigan)	One of the least effective antiemetic drugs, yet it can cause extrapyramidal adverse effects.	High	No: drug/s not prescribed
5. Muscle relaxants and antispasmodics: methocarbamol (Robaxin), carisoprodol (Soma), chlorzoxazone (Paraflex), metaxalone (Skelaxin, cyclobenzapeine (Flexeril), and oxybutynin (Ditropan). Do not consider the extended-release Ditropan XL.	Most muscle relaxants and antispasmodic drugs are poorly tolerated by elderly patients, since these cause anticholinergic adverse effects, sedation, and weakness. Additionally, their effectiveness at doses tolerated by elderly patients is questionable.	High	No: drug/s not prescribed
6. Flurazepam (Dalmane)	This benzodiazepine hypnotic has an extremely long half-life in elderly patients (often days), producing prolonged sedation and increasing the incidence of falls and fracture. Medium- or short-acting benzodiazepines are preferable.	High	No: drug/s not prescribed

Beers Table I 2002 Criteria for Potentially Inappropriate Medication Use in Older Adults: Independent of Diagnoses or Conditions continued.

Drug	Concern	Severity Rating (High or Low)	Applicability of indicator in this study
7. Amitriptyline (Elavil), chlordiazepoxide-amitriptyline (Limbitrol), and perphenazine-amitriptyline (Triavil)	Because of its strong anticholinergic and sedation properties, amitriptyline is rarely the antidepressant of choice for elderly patients.	High	Applicable
8. Doxepin (Sinequan)	Because of its strong anticholinergic and sedating properties, Doxepin is rarely the antidepressant of choice for elderly patients.	High	Applicable
9. Meprobamate (Miltown and Eqanil)	This is a highly addictive and sedating anxiolytic. Those using meprobamate for prolonged periods may become addicted and may need to be withdrawn slowly..	High	No: drug/s not prescribed
10. Doses of short-acting benzodiazepines: doses greater than lorazepam (Ativan), 3mg; oxazepam (Serax, 60mg; alprazolam (Xanax), 2mg; temazepam (Restoril), 15mg; and triazolam (Halcion), 0.25mg	Because of increased sensitivity to benzoadiazepines in elderly patients, smaller doses may be effective as well as safer. Total daily doses should rarely exceed the suggested maximums.	High	Applicable
11. Long-acting benzodiazepines: chlordiazepoxide (Librium), chlordiazepoxide -amitriptyline (Limbritol) clidinium-chlordiazepoxide (Librax), diazepam (Valium), quazepam (Doral), halazepam (Paxipam), and chlorazepate (Tranxene)	These drugs have a long half-life in elderly patients (often several days), producing prolonged sedation and increasing the risk of falls and fractures. Short- and intermediate-acting benzodiazepines are preferred if a benzodiazepine is required	High	Applicable
12. Disopyramide (Norpace and Norpace CR)	Of all antiarrhythmic drugs, this is the most potent negative inotrope and therefore may induce heart failure in elderly patients. It is also strongly anticholinergic. Other antiarrhythmic drugs should be used.	High	No: drug/s not prescribed
13. Digoxin (Lanoxin)(should not exceed >0.125mg/d except when treating atrial arrhythmias)	Decreased renal clearance may lead to increased risk of toxic effects	Low	Applicable

Beers Table I 2002 Criteria for Potentially Inappropriate Medication Use in Older Adults: Independent of Diagnoses or Conditions continued.

Drug	Concern	Severity Rating	Applicability of indicator in this study
14. Short-acting dipyridamole (Persantine). Do not consider the long-acting dipyridamole (which has better properties than the short-acting in older adults) except with patients with artificial heart valves	May cause orthostatic hypotension	Low	No: drug/s not prescribed
15. Methyldopa (Aldomet) and methyldopa-hydrochlorothiazide (Aldoril)	May cause bradycardia and exacerbate depression in elderly patients	High	No: drug/s not prescribed
16. Reserpine at doses >0.25mg	May induce depression, impotence, sedation, and orthostatic hypotension.	Low	No: drug/s not prescribed
17. Chlorpropamide (Diabinese)	It has a prolonged half-life in elderly patients and could cause prolonged hypoglycaemia. Additionally, it is the only oral hypoglycemic agent that causes SIADH.	High	No: drug/s not prescribed
18. Gastrointestinal antispasmodic drugs: dicyclomine (Bentyl), hyoscyamine (KLevsin and Levsinex), propantheline (Pro-Banthine), belladonna alkaloids (Donnatal and others), and clidinium-chlordiazepoxide (Librax)	GI antispasmodic drugs are highly anticholinergic and have uncertain effectiveness. These drugs should be avoided (especially for long-term use).	High	No: drug/s not prescribed
19. Anticholinergics and antihistamines: chlorpheniramine (Chlor-Trimeton), diphenhydramine (Benadryl), hydroxyzine (Vistaril and Atarax), cyproheptadine (Periactin), promethazine (Phenergan), triplennamine, dexchlorpheniramine (Polaramine)	All non-prescription and many prescription antihistamines may have potent anticholinergic properties. Nonanticholinergic antihistamines are preferred in elderly patients when treating allergic reactions	High	No: drug/s not prescribed
20. Diphenhydramine (Benadryl)	May cause confusion and sedation. Should not be used as a hypnotic, and when used to treat emergency allergic reactions, it should be used in the smallest possible dose.	High	No: drug/s not prescribed

Beers Table I 2002 Criteria for Potentially Inappropriate Medication Use in Older Adults: Independent of Diagnoses or Conditions continued.

Drug	Concern	Severity Rating (High or Low)	Applicability of indicator in this study
21. Ergot mesyloids (Hydergine) and cyclandelate (Cyclospasmol)	Have not been shown to be effective in the doses studied.	Low	No: drug/s not prescribed
22. Ferrous sulphate >325mg/d	Doses >325mg/d do not dramatically increase the amount absorbed but greatly increase the incidence of constipation.	Low	Applicable
23. All barbiturates (except phenobarbital) except when used to control seizures	Are highly addictive and cause more adverse effects than most sedative or hypnotic drugs in elderly patients.	High	No: drug/s not prescribed
24. Meperidine (Demerol)	Not an effective oral analgesic in doses commonly used. May cause confusion and has many disadvantages to other narcotic drugs	High	No: drug/s not prescribed
25. Ticlopidine (Ticlid)	Has been shown to be no better than aspirin in preventing clotting and may be considerably more toxic. Safer, more effective alternatives exist.	High	No: drug/s not prescribed
26. Ketorolac (Toradol)	Immediate and long term use should be avoided in older persons, since a significant number have asymptomatic GI pathologic conditions.	High	No: drug/s not prescribed
27. Amphetamines and anorexic agents	These drugs have potential for causing dependence, hypertension, angina, and myocardial infarction	High	Applicable
28. Long-term use of full-dosage, longer half-life, non-COX-selective NSAIDs: naproxen (Naprosyn, Avaprox, and Aleve), oxaprozin (Daypro), and piroxicam (Feldene)	Have the potential to produce GI bleeding, renal failure, high blood pressure, and heart failure	High	No: drug/s not prescribed
29. Daily fluoxetine (Prozac)	Long half-life of drug and risk of producing excessive CNS stimulation, sleep disturbances, and increasing agitation. Safer alternatives exist.	High	Applicable

Beers Table I 2002 Criteria for Potentially Inappropriate Medication Use in Older Adults: Independent of Diagnoses or Conditions continued.

Drug	Concern	Severity Rating (High or Low)	Applicability of indicator in this study
30. Long-term use of stimulant laxatives: bisacodyl (Dulcolax), cascara sagrada, and Neoloid except in the presence of opiate analgesic use	May exacerbate bowel dysfunction	High	No: drug/s not prescribed
31. Amiodarone (Cordarone)	Associated with QT interval problems and risk of provoking torsades de pointes. Lack of efficacy in older adults.	High	Applicable
32. Orphenadrine (Norflex)	Causes more sedation and anticholinergic adverse effects than safer alternatives	High	No: drug/s not prescribed
33. Guanethidine (Ismelin)	May cause orthostatic hypotension. Safer alternatives exist.	High	No: drug/s not prescribed
34. Guanadrel (Hylorel)	May cause orthostatic hypotension.	High	No: drug/s not prescribed
35. Cyclandelate (Cyclosdpasmol)	Lack of efficacy	Low	No: drug/s not prescribed
36. Isoxsurpine (Vasodilan)	Lack of efficacy.	Low	No: drug/s not prescribed
37. Nitrofurantoin (Macrodantin)	Potential for renal impairment. Safer alternatives available.	High	No: drug/s not prescribed
38. oxazosin (Cardura)	Potential for hypotension, dry mouth, and urinary problems.	Low	No: drug/s not prescribed
39. Methyltestosterone (Android, Virilon, and Testrad)	Potential for prostatic hypertrophy and cardiac problems.	High	No: drug/s not prescribed
40. Thioriadzine (Mellaril)	Greater potential for CNS and extrapyramidal adverse effects	High	No: drug/s not prescribed
41. Mesoriazine (Serentil)	CNS and extrapyramidal adverse effects.	High	No: drug/s not prescribed
42. Short acting nifedipine (Procardia and Adalat)	Potential for hypotension and constipation.	High	Applicable
43. Clonidine (Catapres)	Potential for orthostatic hypotension and CNS adverse effects.	Low	No: drug/s not prescribed
44. Mineral oil	Potential for aspiration and adverse effects. Safer alternatives available	High	Applicable

Beers Table I 2002 Criteria for Potentially Inappropriate Medication Use in Older Adults: Independent of Diagnoses or Conditions continued.

Drug	Concern	Severity Rating (High or Low)	Applicability of indicator in this study
45. Cimetidine (Tagamet)	CNS adverse effects including confusion	Low	No: drug/s not prescribed
46. Ethacrynic acid (Edecrin)	Potential for hypertension and fluid imbalances. Safer alternatives available	Low	No: drug/s not prescribed
47. Desiccated thyroid	Concerns about cardiac effects. Safer alternatives available	High	No: drug/s not prescribed
48. Amphetamines (excluding methylphenidate hydrochloride and anorexics)	CNS stimulant adverse effects	High	No: drug/s not prescribed
49. Estrogens only (oral)	Evidence of carcinogenic (breast and endometrial cancer) potential of these agents and lack of cardioprotective effect in older women.	Low	Applicable

Abbreviations: CNS, central nervous system; COX, cyclooxygenase; GI, gastrointestinal; NSAIDs, nonsteroidal anti-inflammatory drugs; SIADH, syndrome of inappropriate antidiuretic hormone secretion

Beers Table 2 2002 Criteria for Potentially Inappropriate Medication Use in Older Adults: Considering Diagnoses or Conditions. (continuous numbering from Table 1)

Disease or Condition	Drug	Concern	Severity Rating (High or Low)	Applicability of indicator in this study
50. Heart Failure	Disopyramide (Norpace, and high sodium content drugs (sodium and sodium salts [alginate, bicarbonate, biphosphate, citrate, phosphate, salicylate, and sulphate])	Negative inotropic effect. Potential to promote fluid retention and exacerbation of heart failure.	High	Applicable
51. Hypertension	Phenylpropanolamine hydrochloride (removed from the market in 2001), pseudoephedrine; diet pills, and amphetamines	May produce elevation of blood pressure secondary to sympathomimetic activity.	High	Applicable
52. Gastric or duodenal ulcers	NSAIDs and aspirin (>325mg) (coxibs excluded)	May exacerbate existing ulcers or produce new/additional ulcers	High	No: diagnoses/drugs not recorded
53. Seizures or epilepsy	Clozapine (Clozaril), chlorpromazine (Thorazine), thioridazine (Mellaril), and thiothixene (Navane)	May lower seizure thresholds.	High	Applicable
54. Blood clotting disorders or **55.** receiving anticoagulant therapy	Aspirin, NSAIDs, dipyridamole (Persantin), ticlopidine (Ticlid), and clopidogrel (Plavix)	May prolong clotting time and elevate INR values or inhibit platelet aggregation, resulting in an increased potential for bleeding	High	No: diagnoses/drugs not recorded Applicable
56. Bladder outflow obstruction	Anticholinergics and antihistamines, gastrointestinal antispasmodics, muscle relaxants, oxybutynin (Ditropan), flavoxate (Urispas), anticholinergics, antidepressants, decongestants, and tolterodine (Detrol)	May decrease urinary flow, leading to urinary retention.	High	Applicable
57. Stress incontinence	α-Blockers (Doxazosin, Prazosin, and Terazosin), anticholinergics, tricyclic antidepressants (imipramine hydrochloride, □oxepin hydrochloride and amitriptyline hydrochloride), and long-acting benzodiazepines	May produce polyuria and worsening of incontinence	High	No: diagnoses/drugs not recorded

Beers Table 2 2002 Criteria for Potentially Inappropriate Medication Use in Older Adults: Considering Diagnoses or Conditions continued.

Disease or Condition	Drug	Concern	Severity Rating (High or Low)	Applicability of indicator in this study
58. Arrhythmias	Tricyclic antidepressants (imipramine hydrochloride, Doxepin hydrochloride, and amitriptyline hydrochloride)	Concern due to proarrhythmic effects and ability to produce QT interval changes	High	Applicable
59. Insomnia	Decongestant, theophylline (Theodur), methylphenidate (Ritalin), MAOIs, and amphetamines	Concern dur to CNS stimulant effects	High	Applicable
60. Parkinson disease	Metoclopramide (Reglan), conventional antipsychotics, and tacrine (Cognex)	Concern due to their antidopaminergic/ cholinergic effects.	High	Applicable
61. Cognitive impairment	Barbitutrates, anticholinergics, antispasmodics, and muscle relaxants. CNS stimulants: dextroAmphetamine (Adderall), methylphenidate (Ritalin), methamphetamine (Desoxyn), and pemolin	Concern due to CNS-altering effects	High	No: diagnoses/drugs not recorded
62. Depression	Long-term benzodiazepine use. Sympatholytic agents: methyldopa (Aldomet), reserpine, and guanethidine (Ismelin)	May produce or exacerbate depression	High	Applicable
63. Anorexia and malnutrition	CNS stimulants: DextroAmphetamine (Adderall), methylphenidate (Ritalin), methamphetamine (Desoxyn), pemolin, and fluoxetine (Prozac)	Concern due to appetite-suppressing effects.	High	No: diagnoses/drugs not recorded
64. Syncope or falls	Short- to intermediate-acting benzodiazepine and tricyclic antidepressants (imipramine hydrochloride, Doxepin hydrochloride, and amitriptyline hydrochloride)	May produce ataxia, impaired psychomotor function, syncope and additional falls.	High	Applicable
65. SIADH/hyponatremia	SSRIs: fluoxetine (Prozac), citalopram (Celexa), fluvoxamine (Luvox), paroxetine (Paxil), and sertraline (Zoloft)	May exacerbate or cause SIADH.	Low	Applicable
66. Seizure disorder	Bupropion (Wellbutrin)	May lower seizure threshold	High	Applicable

Beers Table 2 2002 Criteria for Potentially Inappropriate Medication Use in Older Adults: Considering Diagnoses or Conditions continued.

Disease or Condition	Drug	Concern	Severity Rating (High or Low)	Applicability of indicator in this study
67. Obesity	Olanzapine (Zyprexa)	May stimulate appetite and increase weight gain	Low	Applicable
68. COPD	Long-acting benzodiazepines: chlordiazepoxide (Librium) chlordiazepoxide-amitriptyline (Limbritol), clidinium-chlordiazepoxide (Librax), diazepam (Valium), quazepam (Doral), halazepam (Paxipam), and chlorazepate (Tranxene). ß-blockers: propanolol	CNS adverse effects. May induce respiratory depression. May exacerbate or cause respiratory depression	High	Applicable
69. Chronic constipation	Calcium channel blockers, anticholinergics, and tricyclic antidepressant (imipramine hydrochloride, Doxepin hydrochloride, and amitriptyline hydrochloride)	May exacerbate constipation	Low	Applicable

Abbreviations: CNS, central nervous systems; COPD, chronic obstructive pulmonary disease; INR, international normalized ratio; MAOIs, monamine oxidase inhibitors; NSAIDs, nonsteroidal anti-inflammatory drugs; SIADH, syndrome of inappropriate antidiuretic hormone secretion; SSRIs, selective serotonin reuptake inhibitor

CHAPTER 6.0
Quality of Prescribing

Determining any discontinuity in appropriate pharmacotherapy

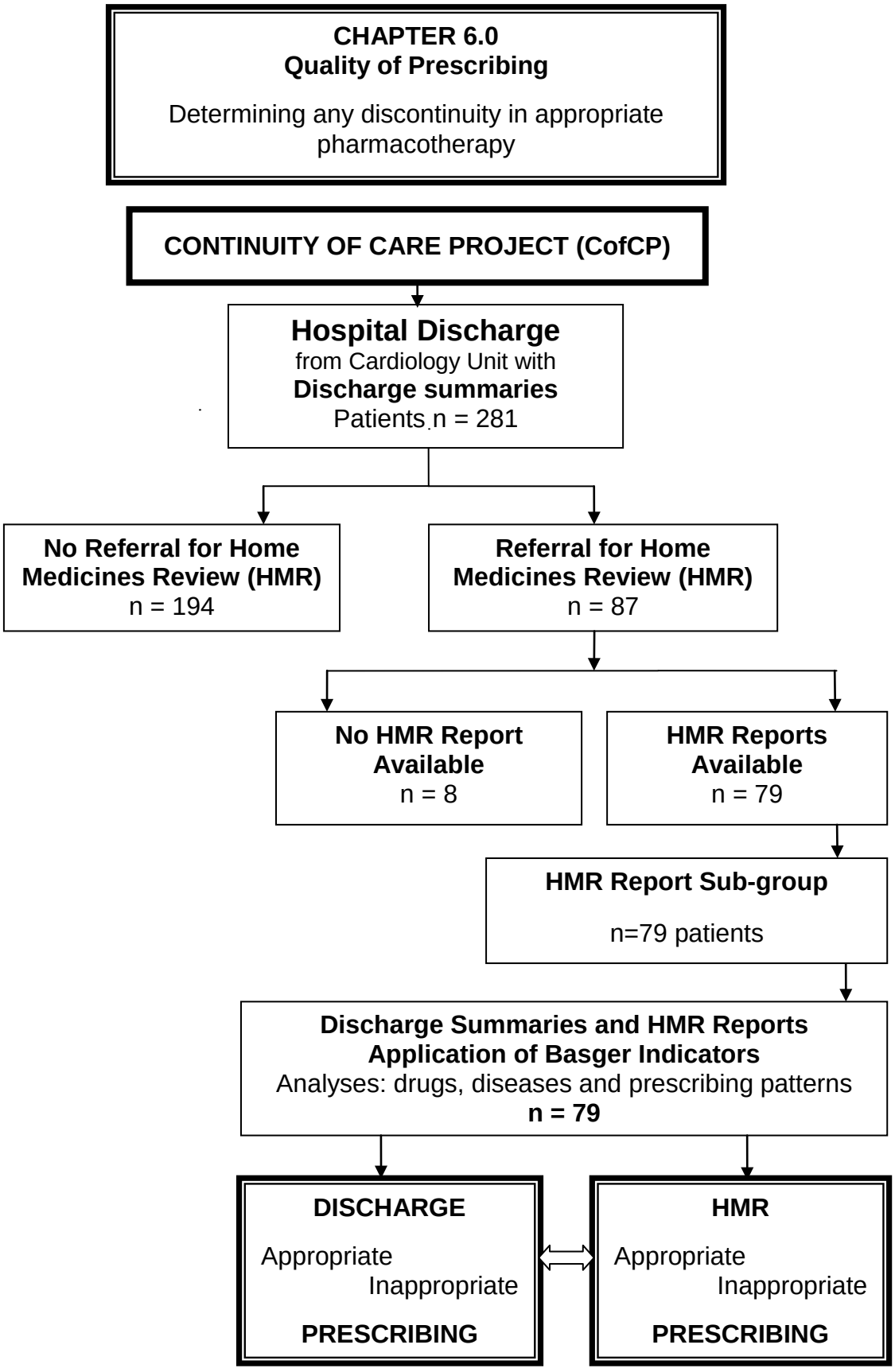

Figure 6.1. Chapter 6.0 Flowchart

CHAPTER 6.0 QUALITY OF PRESCRIBING

6.1 CHAPTER SUMMARY

In this chapter discontinuity in appropriate prescribing, identified in Chapter 5, was again examined to determine its affect on the continuity of patient care during the period immediately post discharge from acute care hospitalisation. A Home Medicines Review (HMR) Report group of patients (n=79) from the Continuity of Care Project (CofCP) (n=281), was identified as being exposed to potentially inappropriate prescribing (PIP) at discharge and at HMR. The HMR Report group's exposure was previously identified by application of the Beers criteria, and is further investigated in this chapter, using indicators custom-designed for use in an Australian healthcare environment. The alternate method of identification was applied and the subgroups' results on patterns, sources, extent, and patient impact of PIP, were analysed.

In this chapter study, analyses of PIP 'at discharge' were conducted on lists of drugs and diseases in hospital discharge summaries. Analyses of PIP 'at HMR' service were conducted on lists of drugs and diseases in HMR reports written by accredited pharmacists. The comments and recommendations made by the pharmacists in HMR reports were not taken into account.

6.2 INTRODUCTION

Medication safety and medication problems in acute care are the subjects of several published reports for the Australian Commission on Safety and Quality in Health Care (2009).[1-2] In these reports, methods of developing or sustaining medication safety and information transfer were examined, especially during the patient's transition between acute care hospital and the community.[3] In 2001, introduction of the HMR service to the Australian healthcare system was instigated by the Commonwealth Government to be

organised through community pharmacies after referral by the patient's nominated general practitioner (GP).[4,5-6] This service, which included pharmacists' HMR reports to the referring GP with the aim of resolving any drug related problems, targeted 'at risk' patients of all ages transferred to their homes.

At risk patients included those with three or more medical conditions, heart failure, polypharmacy and patients with significant changes to their prescribed drug regimen.[7-8] To research and address widespread concerns on patient medication misadventure post hospital discharge, the Westmead Medicines Project (WMP) was implemented at Westmead Hospital, a large teaching hospital of The University of Sydney, from mid 2004-2005.[9] At the completion of the WMP (n=176 patients), a further 105 additional patients were recruited to form the cohort for the Continuity of Care Project (CofCP) (n=281) between 2005-2007.

During the recruitment of the 281 patients from the cardiology Unit of Westmead Hospital, the discharge process included utilising existing, partially computerised discharge summaries. Throughout the CofCP the recruited patients did not receive a written copy, for their own use, of their prescribed discharge drugs nor was there an apparent ward mechanism for education of patients about their medicines on discharge.[9-11]

Hospital discharge summaries were the GPs' primary, patient focused communication link with the hospital after discharge. Hence, the provision of comprehensive and accurate information was of the utmost importance for the patients' transfer into primary care and for subsequent, ongoing healthcare services such as HMR.[12-14]

Ellitt et al. (2010) identified the drug related problems (DRPs) experienced by the HMR Report group from their available HMR reports.[10] These reports revealed the most

frequent drug related problem was the patients' uncertainty about the aim of their prescribed drugs.[4-10] The complexity of the subgroup's multiple diagnoses, co-morbidities and associated pharmacotherapy was also shown. In addition, it was found that an unacceptable level of polypharmacy resulted from the polymorbidity which characterised the HMR Report group.[15]

In Chapter 5, discontinuity in patient medication safety at both discharge and at HMR was revealed by Beers explicit criteria when applied to HMR Report group data. The criteria identified a severely high risk of potentially inappropriate prescribing (PIP) at both points in time.[16] Published shortcomings in the design of the Beers criteria, when applied to international healthcare systems, were found to constrain application of the criteria to the Australian healthcare system.[17] In particular, this applied to the study group of cardiovascular patients in the CofCP who were subject to different, local prescribing practices.[18-19]

In this Chapter 6 study the quality of prescribing, for the HMR Report group of acute care cardiovascular patients, was re-examined using prescribing indicators developed specifically for use in Australia. The results were to augment the outcomes from application of the Beers criteria in the previous chapter. Any affect on the subgroups' continuity of care was determined by investigation of the extent and source (where and when) of any PIP identified during the patients' transfer from hospital into the community.[20-21]

6.3 STUDY AIM

To investigate differences in the quality of prescribing between acute care hospital discharge and HMR service in primary healthcare.

6.3.1 NULL HYPOTHESES

To achieve the study aim for a cohort of patients (n=79) for whom an HMR report was available as shown in Figure 6.1, the following null hypotheses were proposed.

There is no statistically significant difference between discharge and HMR in:

1. the distribution of patients' drugs and diseases.
2. the distribution of prescribing appropriateness for patients
3. the distribution of potentially inappropriately prescribed (PIP) drugs or drug related situations.
4. the distribution of patients at risk of PIP.
5. the distribution of indicators identifying appropriate and potentially inappropriate prescribing.

6.4 OPERATIONAL DEFINITIONS

6.4.1 CONTINUITY OF CARE is a perception of quality health care resulting from the ongoing management of issues which cause disruption to optimal patient care.

In the context of the study reported in this chapter:

Continuity of Care is perceived by the researchers as the quality use of medicines for ongoing management of optimal pharmacotherapy through identification of appropriate prescribing by customised Australian indicators.[22]

6.4.2 POTENTIALLY INAPPROPRIATE PRESCRIBING

In this study, the terms 'potentially inappropriate medication', 'potentially inappropriate prescribing' (PIP) and their derivatives, have been adopted as equivalent concepts. Prudent et al. (2008) define 'potentially inappropriate medication' as drugs with an unfavourable risk/benefit ratio when safer or equally effective alternatives are available.[23]

6.5 METHOD

6.5.1 STUDY DESIGN

This study involved a retrospective analysis of prescribing quality on discharge from hospital and during medication review in the community, in Australia. Drug regimens on patients' discharge summaries and post discharge on HMR reports, were examined to identify any PIP at two points in time.[24] Provision of HMR reports, for the patients' GPs, to the researchers was the end point of data collection for this study. The quality of prescribing was determined by the application of Basger indicators which were specifically designed for use in the Australian healthcare environment.[25]

6.5.2 SUBJECTS AND DATA SOURCES

All subjects were recruited into the CofCP (n=281) as patients under the care of a cardiovascular team and were discharged from the Cardiology Unit of Westmead Hospital to their homes, between mid 2004 and 2007. Patients whose median age was 69 (IQR 18: 58-76) years, met the suggested Australian Commonwealth Government's eligibility criteria for HMR referral by a GP. In addition, the patients were discharged on at least one cardiovascular drug.[4] All research consent forms and protocols were accepted by the Ethics Committees of the University of Sydney, Western Sydney Area Health Service, Australian Health Insurance Commission and Australian Government Veteran's Affairs Board.[9]

The receipt of an HMR report was confirmation that an HMR service had been conducted and the report provided data for analysis of drugs currently consumed by the patient post discharge. The HMR services were conducted in the patients' homes after consultation and referral by their GPs. Accredited pharmacists copied 79/87 HMR reports to the research team at Westmead Hospital (Figure 6.1).[5-6] The clinical status, diagnoses

and drug regimen of the HMR Report group were examined in detail, at two points in time, for identification of PIP.

Data sources included the patients' hospital medical records, discharge summaries and HMR reports. The attending medical teams at Westmead Hospital generated the hospital discharge summaries. The patients then hand delivered these to their community GP at an arranged follow up consultation a few days post separation from the hospital. This method of information transfer has been demonstrated to be most reliable and only one nominated GP (from 281 patient contacts) requested a repeat copy by facsimile.[9]

During patient recruitment, short stay or 'day only' patients did not routinely receive a discharge summary therefore a list of the patients' drugs at discharge was recorded in lieu of the summary. All nominated GPs and pharmacies received copies of their patient's discharge summary or medication list and full information regarding the research. General practitioners were requested, and encouraged, to consider referring their patients to their nominated pharmacy for an HMR service.

Discharge summaries and HMR reports were analysed for drugs, diseases and prescribing patterns at discharge and at HMR service. Medical records were analysed for demographics and Quality of Life (QOL) surveys were analysed for 9 QOL components (Appendix 10.0). The surveys were conducted within 2 weeks of discharge and 6 months post discharge. In this study, the subgroup of patients for whom an HMR report was received by the research team, are reported as the HMR Report group (n=79) (Fig. 6.1).

6.5.3 PRESCRIBING INDICATORS

The tool for identification of appropriate prescribing was chosen for its recent development and applicability in the Australian health care system.[26-27] Basger et al. (2008) developed a

set of indicators after considering the limitations of many other recently developed, or updated systems for the international health care environment in which they were developed.[16,25,28] Furthermore, the Basger indicators appeared to address the shortcomings of the explicit Beers criteria which were designed in the USA for international application to the prescribed drugs and diseases of patients ≥65 years of age.[16,29]

Although well validated and extensively applied internationally, the Beers criteria utilized in Chapter 5 excluded considerations of polypharmacy, patient characteristics, local prescribing practices and the availability of drugs in other countries.[17,19,30] These exclusions influenced the outcomes of the Chapter 5 study which applied internationally developed criteria for the identification of PIP in Australia.

The Basger indicators were developed from sources which showed the 'most common reasons that elderly Australians seek or receive healthcare' and these reasons were cross referenced with the '50 highest-volume Australian Pharmaceutical Benefits Scheme (PBS) medications prescribed in Australia.[31-32] Although the Basger indicators were not published until 2009, data collection from the Australian healthcare system took place in 2006 and is highly relevant to this study. Along side use as a guide for optimum prescribing, Basger et al. proposed that the indicators were suitable for use as an adjunct to medication review services such HMR, medical and surgical patients transferring across care boundaries, quality assessment and in research.[25]

Basger et al. describe the developed indicators as predominantly explicit. However, when the majority of Basger indicators are applied to a patient's drug regimen because of the inclusion of a specific drug, a deduction on the appropriateness of prescribing is still required.[25] Conversely, the application of Beers explicit criteria to a patient's drug regimen, immediately labels any of the Beers listed drugs as potentially

inappropriate. The 48 Basger indicators and foot notes are attached in Appendix 6.1, at the end of this chapter.

6.5.3.1 Application of the Basger Indicators

Basger indicators test the appropriateness of prescribing of drugs whilst taking into account the disease indicators for the drugs, co-morbidities and patient characteristics e.g. pain and activities of daily living. Purpose designed databases were constructed in SPSS - Statistics Version 17 and Microsoft Excel 2007 programmes for all drugs prescribed. Similar databases were constructed for diseases and co-morbidities recorded for the HMR Report group at discharge and after GP consultation at HMR service.

Alphabetical and numerical listings of the drugs and diseases, and their codes, were recorded for the study group. Separate SPSS databases recorded the demographics and quality of life (QOL) responses required for Basger indicator application. Additional databases were constructed to record patient responses to the 48 Basger indicators at discharge and at HMR.

For this study, indicators were considered applicable to the study group if at least one patient was prescribed the primary drugs and/or disease state and/or situation in question. Further, it was necessary that all secondary information required for an indicator was common to all subjects e.g. QOL responses. That is, indicators were applied to the study group if ≥1 patient was shown to meet the requirements of an indicator.

In the patient response databases, dichotomous (yes, no) responses to each component of the criterion were recorded in rows with applicable Basger indicators in columns. To respond to each component of the criteria, it was necessary to repeatedly scan the drugs and diseases databases to capture *all* entries within the category being assessed e.g. anticoagulant drug category: warfarin, heparin, low dose aspirin; or cardiovascular

disease category: e.g. hypertension, atrial fibrillation, coronary artery disease. Depending on the response to each of the components of the indicator, the indicator was scored as satisfied or not satisfied for each patient assessed.

Identification of PIP by Basger indicators 'at discharge' was conducted on lists of drugs or diseases in discharge summaries. Identification of PIP by Basger indicators 'at HMR' service was conducted on lists of drugs or diseases in HMR reports written by accredited pharmacists. The pharmacists' comments and recommendations in the report, were not taken into account.

The provision of the HMR reports, to the researchers by the accredited pharmacists, was the end point of data collection for this thesis.

6.5.4 QUALITY OF LIFE CHARTS

In addition to the primary requirement of the indicator, some indicators required secondary data on quality of life (QOL) scores for pain during activities of daily living (ADLs).[33-34]

For this study, QOL scores for pain level and ADLs were derived from the results of a Dartmouth Co-operative (COOP) QOL survey conducted on the CofCP cohort (n=281) and reported in Chapter 3 (Appendix 10.0).[33-34] Patient reported QOL surveys were distributed from, and returned by mail to the researcher.[9] Scores for pain level and performance of ADLs for the HMR Report group (n=79) were taken from the QOL survey collected within two weeks of discharge and then again, 6 months after discharge. The scores for each of the 9 charts in the survey ranged from 1 to 5, with a score of 1 indicating no pain or no difficulty managing ADLs. A score >2 for both these charts informed responses to components of Basger indicators at both discharge and HMR for the following indicators.

No. 21 Patient with osteoarthritis pain interfering with daily activities has been trialled on paracetamol (acetaminophen) 2-4g/day.

No. 22 Patient taking analgesic(s) does not have pain (j*) that interferes with daily activities. j* Pain: back complaint, osteo-arthritis, cancer, rheumatoid arthritis. (Appendix 6.1)

6.5.5. DATA ANALYSES

For data analyses and outcome interpretation, three units of analysis were targeted:

1) the appropriateness of prescribing to which the patients were exposed

2) the number of patients exposed to potentially inappropriate prescribing (PIP) by specific indicators

3) the number of indicators applied to the study group.

Data from the HMR Report group's discharge summaries and HMR reports were recorded for the analyses of drugs and diseases at discharge and HMR. Drugs and diseases were recorded and coded according to the Anatomical Therapeutic Chemical (ATC) classification and International Classification of Disease version 10 (ICD-10), respectively.[35-36] After coding, the data were analysed to determine whether or not the patient was prescribed drugs which did or did not satisfy Basger indicators and this signified whether a patient was or was not at risk of PIP. Basger indicators were expressed in an affirmative [x^{af}] or negative [x^{ne}] format or a combination[c] of the two.[25] For example:

Indicator No. 5^{af} Patient with heart failure ***is*** taking a β-blocker.

Indicator No. 7^{ne} Patient with heart failure is ***not*** taking medications that may exacerbate heart failure (d*).

(d* Medications that may exacerbate heart failure: antiarrhymthmic drugs (except digoxin or amiodarone), carbamazepine, diltiazem, nifedipine, verapamil, NSAIDs (excluding low-dose aspirin), sotalol, thiazolidinediones (significant disease), tricyclic antidepressants, corticosteroids (oral or inhaled)).

Indicator No. 16[c] Patient with diabetes at high risk of a cardiovascular event (b*) **is** taking an antiplatelet agent **unless** taking an anticoagulant (c*).

(b*Patients at high risk of a cardiovascular event: Age >75 years, symptomatic cardiovascular disease (angina, myocardial infarction, previous coronary revascularization procedure, heart failure, stroke, transient ischaemic attack (TIA), peripheral vascular disease) genetic lipid disorder, diabetes and evidence of renal disease (micoralbuminuria and/or proteinuria and/or glomerular filtration rate <60ml/min)). (c*Antiplatelet agents: aspirin, clopidogrel. Anticoagulants: phenindione, warfarin. Non-haemorrhagic stroke or TIA: aspirin/dipyridamole, dipyridamole, ticlopidine) (Appendix 6.1)

It was outside the realm of this study to directly measure the clinical impact on the patients of any identified PIP. Hence, an effect size approximation was conducted using an eta squared estimation. This calculation was based on the 't' value of students' t-tests (t tests) conducted to assess the null hypothesis of no differences in the distribution of prescribing appropriateness between discharge and HMR. Eta squared estimations (tsq/tsq+(N-1)) for effect size were based on Cohen's values of 0.01~small effect; 0.06~moderate effect and 0.140~large effect.[37-39]

In addition, the percentage difference in severity ratings allocated to patients was estimated if the difference was shown to be statistically significant. All outcomes between discharge and HMR were included to describe the proposed impact of that difference in PIP on the patients.

The distribution of the prescribing indicators was also analysed to assess how many indicators were applied to the study group between discharge and HMR. In turn, analysis of the applied indicators provided an insight into the continuity and appropriateness of patients' pharmacotherapy at discharge and its continuance through follow-up in the community.[40-41]

Data were quantitatively analysed at discharge and at HMR. Tests were conducted at an alpha level of 0.05 and included multiple response frequencies; t tests; chi squared tests; and eta squared estimations of effect size.

6.6 RESULTS

6.6.1 DRUGS AND DISEASES

Table 6.1 shows the numbers of drugs and diseases analysed for the HMR Report group (n=79) at discharge and at HMR. It was found that reconciliation and analysis of both drugs and diseases showed polypharmacy and polymorbidity were problematic clinical characteristics for the study group. Table 6.1 shows the paired samples t testing of the number and distribution of drugs and diseases and testing of the null hypothesis of no difference between discharge and HMR. After discharge, there was a significant increase in the number of drugs documented after GP consultation, at HMR (p=0.001) and a significant decrease in number of diseases documented at HMR (p=0.001).

6.6.2 APPLICABILITY OF BASGER INDICATORS

There were 48 Basger indicators initially applied to the drugs and diseases of the HMR Report group (n=79) to determine which criteria were applicable to ≥1 patient in the subgroup at any time. Of the 48 Basger indicators published, 32 were found to be applicable to the subgroup and the reasons for the non-applicability of 16 indicators appear in Appendix 6.1.

6.6.3 ALLOCATION OF PRESCRIBING APPROPRIATENESS

It was found that application of the Basger indicators required yes/no scoring on each of the components of the indicator and a final score on whether or not the components met the

overall indicator requirements. During analysis, it was necessary to repeatedly assess each patient's drugs and disease states to confirm whether or not affirmative or negative components of the indicator were met. As an example:

> **Indicator No. 14** Patient with cardiovascular [yes[1] or no[1]], **or** respiratory disease [yes[2] or no[2]] **or** diabetes mellitus [yes[3] or no[3]] who smokes [yes[4]] has been offered smoking cessation therapy [yes[5]] (g*).
>
> (g* Smoking cessation therapy: counselling, use of support services, medication; for patients smoking >10 cigarettes per day, bupropion, nicotine replacement therapy, varenicline (Appendix 6.1).

6.6.4 POTENTIALLY INAPPROPRIATE PRESCRIBING (PIP) INSTANCES

Table 6.2 shows the paired sample t testing of HMR Report group assessment for identification of appropriate and PIP instances and testing of the null hypothesis of no difference between discharge and at HMR service. After discharge there was a significant difference in appropriate prescribing with a decrease of 11.3% at HMR (p=0.009) and a concurrent, significant increase of 29.0% in PIP at HMR (p=0.001). No significant difference was found between the two points time, in the total number of assessments for each patient (p=0.173).

Table 6.1 Distribution of drugs and diseases recorded for the HMR Report group at discharge and HMR.

Group Characteristic	DISCHARGE			HMR			t value	Significance p value
	Total number	Mean (SD±)	Range	Total number	Mean (SD±)	Range		
Drugs	658	8.3 (3.0)	2 - 19	805	10.2 (4.9)	0 - 23	-4.09	0.001
Diseases	411	5.2 (2.8)	1 - 14	286	3.6 (2.9)	0 - 12	3.34	0.001

(t-test: N=79, df=78)

Table 6.2 Distribution of instances of prescribing appropriateness identified by Basger indicators for HMR Report group at discharge and HMR.[25]

Patients (n=79)	DISCHARGE			HMR			t value	Significance p value
	Total number	Mean (S.D±) per patient	Range	Total number	Mean (S.D±) per patient	Range		
Appropriate prescribing instances identified	450	5.7 (2.2)	2 - 12	399	5.1 (2.2)	1 - 12	2.69	0.009
Potentially inappropriate prescribing identified	255	3.2 (1.4)	1 - 8	329	4.2 (2.0)	1 - 10	-4.63	0.001
Assessments	705	8.8 (2.8)	3 - 16	728	9.2 (3.3)	3 - 17	-1.37	0.173

(t-test: N=79, df=78)

6.6.4.1 Estimated Impact of Potentially Inappropriate Prescribing (PIP)

The adverse clinical effects on patients of a significant decrease in appropriate prescribing and significant increase in PIP were estimated using eta squared (Tsq/tsq + [N-1]). As shown in Table 6.2, the t test of appropriate prescribing at discharge and HMR showed a significant decrease at HMR ($t(78)=2.69$; $p=0.009$). The eta squared estimation (0.085) indicated a moderate effect size.

From Table 6.2, the t test of PIP at discharge and at HMR service showed a significant increase at HMR ($t(78)=-4.63$; $p=0.001$). The eta squared estimation (0.216) indicated a large effect size on the patients. That is, from Table 6.2, the t testing of appropriate prescribing showed a significant decrease at HMR of 11.3% and a concurrent significant increase in PIP at HMR of 31.6%.

6.6.5 IDENTIFICATION OF POTENTIALLY INAPPROPRIATE PRESCRIBING (PIP)

Table 6.3 shows the distribution of instances of PIP identified by the Basger indicators for the HMR Report group, and its relationship to the number of routine drugs prescribed between discharge and HMR.

Table 6.3 shows paired samples t testing of the null hypothesis of no difference in the number of instances of PIP identified for the HMR Report group. The mean and (SD±) instances per patient were identified at discharge as 3.1 (±1.4) instances and at HMR as 5.1 (±2.2) instances with a significant increase in PIP at HMR ($p=0.009$).

The instances of PIP or potentially inappropriate drug related situations relevant to the number of routine drugs prescribed for the group were recorded at discharge as 250 (38.2%) and at HMR as 399 (49.6%). It should be noted that the satisfaction/non-

satisfaction of Basger indicators did not rely solely on explicit identification of specific drugs. Hence, unlike outcomes from the application of Beers criteria, these results are a ratio of *number of potentially inappropriate prescribing instances* (e.g. Indicator No. 48) to the number of routine drugs prescribed.

6.6.6 SOURCE AND DISTRIBUTION OF INAPPROPRIATE PRESCRIBING BY SPECIFIC INDICATORS

The results in Table 6.4a-e indicate marked differences in the number and relative frequency of patients, identified by separate indicators, at risk of PIP at discharge and at HMR. The relative frequency tabled, represented the proportion of patients identified as at risk in relation to those assessed by a specific indicator. The relative frequency analysed across the 32 indicators showed means (SD±) at discharge of 0.3 (±0.1) patients and at HMR of 0.4 (±0.1) patients. This is approximately 1 in 3 patients at discharge and 1 in 2 patients at HMR. The increase in patients at risk at HMR is consistent with the significant increase in instances of PIP at HMR, shown in Tables 6.2 and 6.3.

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Table 6.3 Distribution of PIP situations identified by Basger indicators at discharge and HMR for the HMR Report group (n=79).[25]

PIP situations	DISCHARGE: n = 658 prescriptions			HMR: n = 805 prescriptions			t value	Significance p value
	Total Number	Mean (SD±) per patient	Ratio PIP to discharge drugs*	Total Number	Mean (SD±) per patient	Ratio PIP to HMR drugs*		
Potentially inappropriate prescribing instances	250	3.1 (1.4)	38.2%	399	5.0 (2.2)	49.6%	2.69	0.009

(t test: N=79, df=78) *% PIP frequency relative to total number drugs prescribed.

Table 6.4$_a$ Distribution of HMR Report group patients identified as at risk of PIP by Basger indicators at discharge and HMR.[25]

Basger Indicators applied to HMR Report Group (n=79)	DISCHARGE		HMR	
	Patients Assessed (% relative frequency)[a]	Patients at risk (% relative frequency)[b]	Patients Assessed (% relative frequency)[a]	Patients at risk (% relative frequency)[b]
2. Patient at high risk of a cardiovascular event (b) is taking an HMG-CoA reductase inhibitor (statin)	76 (96.2)	22 (28.9)	78 (98.7)	25 (32.1)
3. Patient with IHD or a history of MI is taking a ß-blocker (ß-adrenoceptor antagonist)	32 (40.5)	16 (50.0)	36 (45.6)	12 (33.3)
4. Patient with IHD or a history of MI is taking an antiplatelet agent unless taking an oral anticoagulant (c)	31 (39.2)	16 (51.6)	37 (46.8)	35 (94.6)
5. Patient with heart failure is taking a ß-blocker	11 (13.9)	8 (72.7)	10 (12.7)	4 (40.0)
6. Patient with heart failure is taking an ACE inhibitor or ARB	11 (13.9)	7 (63.6)	10 (12.7)	5 (50.0)
7. Patient with heart failure is not taking medications that may exacerbate heart failure (d)	11 (13.9)	2 (18.2)	10 (12.7)	3 (30.0)
8. Patient with heart failure or hypertension is not taking high sodium-containing medications (e)	29 (36.7)	0	45 (57.0)	0
9. Patient with AF is taking an oral anticoagulant	20 (25.3)	4 (20.0)	12 (15.2)	5 (41.7)

Table 6.4$_b$ Distribution of HMR Report group patients identified as at risk of PIP by Basger indicators at discharge and HMR, continued[25]

Basger Indicators applied to HMR Report Group (n=79)	DISCHARGE		HMR	
	Patients Assessed (% relative frequency)[a]	Patients at risk (% relative frequency)[b]	Patients Assessed (% relative frequency)[a]	Patients at risk (% relative frequency)[b]
11. Patient with a history of non-haemorrhagic stroke or TIA is taking an antiplatelet agent unless taking an anticoagulant (c)	1 (1.3)	1 (100.0)	4 (5.1)	3 (75.0)
12. Patient with risk factors for myopathy (f) is not taking ≥ 40mg/day of simvastatin or atorvastatin	48 (60.8)	0	35 (44.3)	2 (5.7)
13. Patient with cardiovascular disease is not taking an NSAID	73 (92.4)	6 (8.2)	68 (86.1)	8 (11.8)
16. Patient with diabetes at high risk of a cardiovascular event (b) is taking an antiplatelet agent unless taking an anticoagulant (c)	18 (22.8)	10 (55.6)	22 (27.8)	10 (45.5)
17. Patient with diabetes is not taking a medication that may increase or decrease blood glucose concentrations (h)	16 (20.3)	0	22 (27.8)	4 (18.9)
20. Patient taking metformin for diabetes is not concurrently taking glibenclamide	6 (7.6)	0	21 (26.6)	0

Table 6.4$_c$ Distribution of HMR Report group patients identified as at risk of PIP by Basger indicators at discharge and HMR, continued[25]

Basger Indicators applied to HMR Report Group (n=79)	DISCHARGE		HMR	
	Patients Assessed (% relative frequency)[a]	Patients at risk (% relative frequency)[b]	Patients Assessed (% relative frequency)[a]	Patients at risk (% relative frequency)[b]
21. Patient with OA pain interfering with daily activities has been trialled on paracetamol (acetaminophen) 2-4 g/day	6 (7.6)	1 (16.7)	2 (3.8)	2 (100.0)
22. Patient taking analgesic(s) does not have pain (j) that interferes with daily activities	45 (57.0)	30 (66.7)	11 (14.1)	7 (36.4)
23. Patient taking an opioid (k) is taking prophylactic treatment for constipation	1 (1.3)	1 (100.0)	11 (13.9)	7 (63.6)
24.Patient with risk factors for impaired renal function (l) is not taking an NSAID	72 (91.1)	10 (13.9)	73 (92.4)	24 (32.9)
25. Patient is not concurrently taking an ACE inhibitor or ARB, diuretic and NSAID (excluding low-dose aspirin [acetylsalicylic acid])	51 (64.6)	3 (5.9)	47 (59.5)	2 (4.3)
27. Patient with depression is not taking anticholinergic-type antidepressants (m)	3 (3.8)	0	1 (1.3)	0
29. Patient taking an SSRI is not concurrently taking medications known to increase the risk of gastrointestinal bleeding (o)	2 (2.5)	2 (100.0)	1 (1.3)	1 (100.0)

Table 6.4$_d$ Distribution of HMR Report group patients identified as at risk of PIP by Basger indicators at discharge and HMR, continued[25]

Basger Indicators applied to HMR Report Group (n=79)	DISCHARGE		HMR	
	Patients Assessed (% relative frequency)[a]	Patients at risk (% relative frequency)[b]	Patients Assessed (% relative frequency)[a]	Patients at risk (% relative frequency)[b]
30. Patient taking an SSRI is not currently taking other medications that may contribute to serotonin toxicity (p)	2 (2.5)	1 (50.0)	0	0
32. Patient is not taking more than one medication with anticholinergic activity (q)	9 (11.4)	1 (11.1)	17 (21.5)	3 (17.6)
33. Patient taking a PPI is not taking a medication that may cause dyspepsia (r)	30 (38.0)	25 (83.3)	26 (32.9)	13 (50.0))
34. Patient with COPD is not taking benzodiazepines	4 (5.1)	0	4 (5.1)	0
36. Patient using a salbutamol (albuterol) or terbutaline inhaler more than three times per week for reversible airways disease has been prescribed an inhaled corticosteroid	6 (7.6)	4 (66.7)	15 (19.0)	15 (100.0)
37. Patient with asthma is not taking a medication that may worsen asthma (s)	5 (6.3)	2 (80.0)	6 (7.6)	5 (83.3)
41. Patient with an URTI (t) is not receiving antibacterials	1 (1.3)	0	1 (1.3)	0

Table 6.4$_e$ Distribution of HMR Report group patients identified as at risk of PIP by Basger indicators at discharge and HMR, continued[25]

Basger Indicators applied to HMR Report Group (n=79)	DISCHARGE		HMR	
	Patients Assessed (% relative frequency)[a]	Patients at risk (% relative frequency)[b]	Patients Assessed (% relative frequency)[a]	Patients at risk (% relative frequency)[b]
42. Patient with osteoporosis who is not receiving at least 600 IU of vitamin D daily from dietary sources is receiving supplementation with vitamin D (u)	2 (2.5)	2 (100.0)	6 (7.6)	5 (83.3)
43. Patient with osteoporosis who is not receiving at least 1200mg of calcium daily from dietary sources is receiving calcium supplementation (v)	2 (2.5)	1 (50.0)	4 (5.1)	1 (25.0)
44. Patient with osteoporosis is receiving anti-osteoporotic medication (w)	2 (2.5)	1 (50.0)	8 (10.1)	3 (37.5)
48. Patient has had no significant change in medications in the previous 90 days	79 (100.0)	79 (100.0)	79 (100.0)	79 (100.0)

[a]Relative frequency of: patients assessed by the indicator/ patients in the HMR group (n=79).
[b]Relative frequency of: patients at risk of potentially inappropriate prescribing/ patients assessed by the indicator.
(b-w) these letters refer to additional information on requirements of indicators which appear in Appendix 6.1.

6.6.6.1 Specific Prescribing Indicators

From Table 6.4 the highest number of patients to whom any one indicator was applied and not satisfied, signifying PIP, was recorded for Indicator No.48. For optimal prescribing, this indicator required that there had been no changes made to the patients' drug regimen in a period of 90 days preceding the assessment. This indicator was applied to 79 (100%) patients and was 100% not satisfied at either discharge or HMR. The entire subgroup of patients was exposed to the risk of PIP in the form of changes to their established drug regimen while in hospital, and then again following discharge, at follow-up with their GP, prior to HMR.

The possibility or occurrence of change in the study group's drug regimen, was not unexpected. However, the level and source of PIP identified was unexpected. Indicator No 48 reinforced the importance of identifying and qualifying any recent change in patients' drug regimen under any circumstances.

The second highest number of patients in Table 6.4 to whom an indicator was applied and not satisfied signifying PIP, at both discharge and at HMR service, was recorded for Indicator No.2. This indicator required that patients at high risk of a cardiovascular event were taking a 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase inhibitor (statin). The indicator was applied at discharge to 76 (92.2%) patients and applied at HMR to 78 (98.7%) patients. The indicator was not satisfied at discharge for 22 (28.9%) patients and at HMR for 25 (32.1%) patients. The nature of all applicable indicators and number of patients assessed and identified as at risk of potentially inappropriate prescribing by those indicators, appears in Table 6.4.

6.6.7 APPLICATION OF PRESCRIBING INDICATORS

Table 6.5 shows the results of paired samples t testing of the number and distribution of prescribing indicators applied to the HMR Report group (n=79). The table shows the testing of the null hypothesis of no difference between discharge and HMR. There was no significant difference between discharge and HMR in the number of indicators whose requirements were satisfied when applied to the subgroup (p=0.542) or total number of indicators applied to the group (p=0.743). After discharge, the increase in mean number of indicators whose requirements were not satisfied when applied to the group at HMR, was marked; however was not statistically significant (p=0.092). This result was consistent with:

a) significant increase in the degree of inappropriateness of prescribing for the group at HMR (e.g. decrease in appropriate prescribing) (Table 6.2);

b) significant increase in instances of PIP or drug related situations at HMR (Table 6.3); and

c) significant increase in numbers of patients at risk as identified by specific indicators at HMR (Table 6.4).

Table 6.5 Distribution of Basger indicators across HMR Report group (n=79) at discharge and at HMR.[25]

Basger Indicators (n=32)	**DISCHARGE: Number Indicators Mean (S.D±)**	**HMR: Number Indicators Mean (S.D±)**	**t value**	**Significance p(value)**
Requirements satisfied	13.9 (20.6)	13.0 (17.3)	0.01	0.542
Requirements not satisfied	7.7 (15.2)	10.1 (15.3)	0.99	0.092
Number applied	22.0 (24.9)	22.6 (23.7)	0.38	0.703

(t test: N=79, df=78)

6.7 DISCUSSION

For the HMR Report group of patients, this study tested several null hypotheses of no difference between discharge and HMR in 1) the distribution of patients' drugs and diseases and 2) the distribution and appropriateness of prescribing. The study also tested for differences in 3) the instances of potentially inappropriate prescribing (PIP) in relation to patients' overall drug consumption. Further, differences were determined in 4) the risks to patients identified by specific criteria and finally in 5) the distribution of the applied prescribing indicators. The aim was achieved utilising the Basger indicators.[25]

While testing the null hypotheses all analyses 'at discharge' were conducted on lists of drugs and diseases in discharge summaries. All analyses 'at HMR' service were conducted on lists of drugs and diseases in HMR reports written by accredited pharmacists. The pharmacists' comments and recommendations in the HMR reports were not taken into account.

In their diverse range of diseases and high number of prescribed drugs, the HMR Report group of patients were shown to need the specialised care recommended by Lim et al. for older patients discharged from Australian hospitals to their homes.[14] These researchers listed 10 guidelines for appropriate care of patients with polypharmacy indicated by multiple co-morbidities. The guidelines included the early organisation of post acute care services e.g. HMR, medication awareness and management for continuity of patient care.[10]

In the literature 'low level' polypharmacy was defined as the prescription of 5 concurrent active drugs and in previous chapters, the HMR Report group of patients

were shown to experience a 'high level' of polypharmacy which was defined in the literature as 'greater than 10 routine drugs'.[15,42-44] Several researchers, including Steinman et al. (2009) described polypharmacy as the prescription of ≥6 concurrent active medications and labelled this level of prescribing, by itself, as potentially inappropriate.[23,43,45]

The health and safety of the HMR Report group, with an average of 8.3 drugs at discharge and 10.2 drugs at HMR, were found to be compromised by the patients' level of polypharmacy. In addition, the high number of drugs prescribed at discharge was significantly increased after post discharge, GP follow-up in the community. Although the Basger indicators were designed to be patient focussed, polypharmacy, by itself, was not included as a hazard to medication safety.[46-50]

A review of strategies and activities for improving medication safety in Australia and New Zealand, stressed the need for sustaining medication safety and information transfer across healthcare boundaries.[1-2] Tamblyn et al. (2003) found the level of PIP at discharge indicated that inadequate risk screening occurred pre discharge.[51] These researchers concluded that inadequate screening for drug related problems was demonstrated by the communication of inappropriate medication orders across healthcare boundaries.[51-52] Mansur et al. also found a direct correlation between polypharmacy at discharge and the prevalence of inappropriately prescribed drug use, and recommended further research.[53]

It is not unreasonable to assume that tertiary care hospitals, when providing the highest level of acute care in Australia, would demonstrate responsibility, accountability and accuracy in medication management and in communicating medicines information. These principles are a partial requirement of National guidelines for quality and

medication continuity between hospitals and primary care in Australia.[54-55] However, the assumption of quality in medication management was not supported by the study outcomes.

This study found that there was a significant increase from discharge to HMR, in the patients' exposure to PIP. Not only was there an increase in PIP, but an unacceptable risk to the patients' medication safety was already evident at discharge from an acute care hospital.[1-2] As well as the significant increase in PIP at HMR, risks to the patients' medication safety were intensified by a concurrent, significant decrease in appropriate prescribing after GP follow up prior to HMR.

When estimated by effect size, the clinical impact of these two significant outcomes was found to have a large, adverse effect on the study group at HMR.[56-58] As a proportion of PIP instances identified, the estimated reduction of 11.3% in appropriate prescribing instances and increase of 29.0% in PIP instances is indicative of a highly adverse impact on the study group at HMR. These concurrent adverse impacts on the patients, reflect a lack of patient centred care in the community after acute care hospital discharge.[59]

No reports of the Basger indicators applied by other researchers, or of comparative research utilising explicit criteria, were found in the literature for a similar patient cohort during transfer from tertiary to primary care.[25] Hence comparisons, of the extent of inappropriate prescribing from the literature, are approximated for the outcomes of this study. Research in similar cohorts, conducted by Fialová et al. (2005 and 2009) and Barry et al. (2006), using the well validated and explicit criteria

developed by Beers, found that patients in Europe and Ireland respectively, also consumed 'at least 1 inappropriate medication'.[16-16,43,60]

Steinman et al. (2009) found that the ratio of PIP relative to the number of routine drugs prescribed for a similar study cohort in the USA was 6.0%.[45] A direct comparison of Steinman et al's. ratio outcomes with Basger's identification of PIP situations was not appropriate. However, outcomes from the application of Beers criteria in Chapter 5 to the HMR report group, showed markedly higher ratios of PIP drugs relative to the number of routine drugs prescribed as 19.2% at discharge and 12.7% at HMR.

Outcomes from the present study using the Basger indicators, found a mean (SD±) number of potentially inappropriate drug related situations per patient at discharge of 3.1 (±1.1) instances and at HMR of 5.1 (±2.2) instances. These high patient averages for drug related instances, were found to have resulted from the application of more sensitive indicators custom designed for the Australian healthcare system.

When potentially inappropriate drug related instances were substituted for PIP drugs, Basger indicators showed high instances of PIP relative to the number of routine drugs prescribed for the cohort. These were over one third of the routine drugs prescribed at discharge [250 (38.2%)] and approximately half of the routine drugs recorded for the study group at HMR [399 (49.5%)]. The Basger indicators were found to be decidedly less explicit in drugs to avoid, than the previously utilised Beers criteria.[16,45]

In this study, the application of 32 of the Basger indicators to the HMR Report group of 79 patients showed at discharge there were 85 occasions and at HMR there were 89 occasions when 100% relative risk of PIP was identified. It should be noted that these results included 5 occasions when an indicator was applied to 1 patient only. The arbitrary decision to apply the indicators when found applicable to 1 patient (only), ensured that every patient at risk of PIP was identified.

It was found that the indicators readily identified patients at risk and clearly indicated the combinations of disease, pharmacotherapy and health status which exacerbated that risk. Application and scoring of the Basger indicators required a decision on whether or not the numerous components of each indicator were satisfied. Hence, it was found that Basger's description of the indicators being 'predominantly explicit' should be open for further discussion.[23,25,61]

The application of the Basger indicators to data recorded at HMR found the availability of the data was an opportunity to identify PIP for subsequent, timely resolution. The early organisation of post acute care discharge services in the community are recommended for patients such as the HMR Report group of the CofCP, by the Australian and New Zealand Society for Geriatric Medicine.[14]

Non-referral by GPs in the Australian community, of hospital patients deemed in need of an HMR by other healthcare professionals, was also recorded in a small; Australian study by Bollella et al (2008).[62] The Bollella study is another reflection of the barriers to continuity of care in the current Australian healthcare environment. Outcomes of this present study have shown that non-referral for HMR was a missed opportunity for the chronically ill patients in the CofCP who were not referred for HMR after hospital discharge (Fig. 6.1).[9]

Analysis of the distribution of the Basger Indicators showed there were no significant differences between the number or type of indicators applied at discharge and HMR. This signified the consistency with which the indicators were applied to the same group of patients, in different healthcare environments, at two discrete assessment points.

It was an advantage to be able to include the assessment of recent changes to patients' established drug regimen as a risk factor in PIP. This was shown to be particularly relevant to cohorts recently discharged from an acute care hospital and moving from one healthcare sector to another. Use of the Basger indicators took into account drug availability and accepted prescribing practices in Australia (e.g. the combination of clopidogrel and aspirin); and individual patient characteristics. These factors added a further dimension to the assessment of the HMR Report group's drug regimens and identification of barriers to their continuity of care after hospital discharge.

6.8 STUDY STRENGTHS AND LIMITATIONS

It is acknowledged that the number of subjects and HMR reports available for analysis, limited generalisation from the study. To date, the application of the Basger indicators to a research cohort (other than by Basger et al.), has not been reported in the literature and hence the scoring and interpretation of results in this study, was not objectively supported by the literature.

The assessment of prescribing appropriateness using clinical notes was limited by the questionable accuracy and completeness of documentation of medical records, discharge summaries and especially, medication review reports. However,

documentation was representative of the real healthcare environment in which the patients were transferred from hospital to the community, and which was not artificially controlled for research purposes.

6.9 CONCLUSION

The study found that there was a distinct and unacceptable level of PIP for the study group at hospital discharge and notably, during primary care. The PIP identified was an indication of the sub-optimal prescribing and, or inaccurate documentation of drug regimens. Regardless of the type, level or source of discrepancy identified, this constituted a barrier to the patients' health safety and continuity of care. The identification and timely management of these patient or drug-related problems at HMR would be a great advantage to the patients referred for medication review after their acute care hospital discharge.

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CHAPTER 6.0

Appendix 6.1

BASGER INDICATORS

Chapter 6.0 Appendix 6.1. Copied from "Inappropriate Medication Use and Prescribing Indicators in Elderly Australians" by Basger et al.[25]

Basger Table II. Suggested Australian prescribing indicators for commonly occurring conditions in patients aged >65 years[a,b]

Indicator	**Reason for non-applicability in this study***
1. Patient taking an antihypertensive is at their target blood pressure (a)	*Situation not recorded: target blood pressure achievement
2. Patient at high risk of a cardiovascular event (b) is taking an HMG-CoA reductase inhibitor (statin)	Applied
3. Patient with IHD or a history of MI is taking a ß-blocker (ß-adrenoceptor antagonist)	Applied
4. Patient with IHD or a history of MI is taking an antiplatelet agent unless taking an oral anticoagulant (c)	Applied
5. Patient with heart failure is taking a ß-blocker	Applied
6. Patient with heart failure is taking an ACE inhibitor or ARB	Applied
7. Patient with heart failure is *not* taking medications that may exacerbate heart failure (d)	Applied
8. Patient with heart failure or hypertension is not taking high sodium-containing medications (e)	Applied
9. Patient with AF is taking an oral anticoagulant	Applied
10. Patient with AF taking an anticoagulant has an INR between 2 and 3	*Blood/Biochemistry results not available: INR
11. Patient with a history of non-haemorrhagic stroke or TIA is taking an antiplatelet agent unless taking an anticoagulant (c)	Applied
12. Patient with risk factors for myopathy (f) is *not* taking ≥ 40mg/day of simvastatin or atorvastatin	Applied
13. Patient with cardiovascular disease is *not* taking an NSAID	Applied
14. Patient with cardiovascular, respiratory disease or diabetes mellitus who smokes has been offered smoking cessation therapy (g)	*Situation not recorded: smoking cessation therapy offer
15. Patient with type 2 diabetes and hypertension and albuminuria is taking an ACE inhibitor or ARB	*Blood/Biochemistry results not available: albuminuria results
16. Patient with diabetes at high risk of a cardiovascular event (b) is taking an antiplatelet agent unless taking an anticoagulant (c)	Applied

Basger Table II. Suggested Australian prescribing indicators for commonly occurring conditions in patients aged >65 years[a,b] continued

Indicator	**Reason for non-applicability in this study**
17. Patient with diabetes is *not* taking a medication that may increase or decrease blood glucose concentrations (h)	Applied
18. Patient with diabetes has had an HbA_{1c} measurement within the previous 6 months	*Blood/Biochemistry results not available: HbA_{1c} results
19. Patient taking metformin for diabetes has had the dose adjusted for creatinine clearance (l)	*Blood/Biochemistry results not available: creatinine levels
20. Patient taking metformin for diabetes is not concurrently taking glibenclamide	Applied
21. Patient with OA pain interfering with daily activities has been trialled on paracetemol (acetaminophen) 2-4 g/day	Applied
22. Patient taking analgesic(s) does *not* have pain (j) that interferes with daily activities	Applied
23. Patient taking an opioid (k) is taking prophylactic treatment for constipation	Applied
24.Patient with risk factors for impaired renal function (l) is *not* taking an NSAID	Applied
25. Patient is not concurrently taking an ACE inhibitor or ARB, diuretic and NSAID (excluding low-dose aspirin [acetylsalicylic acid]	Applied
26. Patient with sleep disturbance or anxiety has *not* been taking benzodiazepines for >4 weeks	*Disease state, disease or drug not recorded: sleep patterns or anxiety
27. Patient with depression is *not* taking anticholinergic-type antidepressants (m)	Applied
28. Patient with a history of falls is *not* taking psychotropic medications (n)	*Disease state, disease or drug not recorded: history of falls
29. Patient taking an SSRI is *no*t concurrently taking medications known to increase the risk of gastrointestinal bleeding (o)	Applied
30. Patient taking an SSRI is *not* currently taking other medications that may contribute to serotonin toxicity (p)	Applied
31. Patient with dementia is *not* receiving anticholinergic medications (n)	*Disease state, disease or drug not recorded: dementia
32. Patient is *not* taking more than one medication with anticholinergic activity (q)	Applied
33. Patient taking a PPI is *not* taking a medication that may cause dyspepsia (r)	Applied
34. Patient with COPD is *not* taking benzodiazepines	Applied

Basger Table II. Suggested Australian prescribing indicators for commonly occurring conditions in patients aged >65 years[a,b] continued

Indicator	**Reason for non-applicability in this study**
35. Patient with asthma using an inhaled LABA is also using an inhaled corticosteroid	*Disease state, disease or drug not recorded: LABA
36. Patient using a salbutamol (albuterol) or terbutaline inhaler more than three times per week for reversible airways disease has been prescribed an inhaled corticosteroid	Applied
37. Patient with asthma is *not* taking a medication that may worsen asthma (s)	Applied
38. Female patient with recurrent UTIs has been prescribed intravaginal estrogen	*Disease state, disease or drug not recorded: recurrent UTIs
39. Patient with a creatinine clearance <60 ml/min is *not* receiving nitrofurantoin for UTI	*Blood/Biochemistry results not available: creatinine level
40. Patient with a creatinine clearance <50 ml/min is *not* receiving methenamine (hexamine) for UTI prophylaxis	*Blood/Biochemistry results not available: creatinine level
41. Patient with an URTI (t) is not receiving antibacterials	Applied
42. Patient with osteoporosis who is not receiving at least 600 IU of vitamin D daily from dietary sources is receiving supplementation with vitamin D (u)	Applied
43. Patient with osteoporosis who is not receiving at least 1200mg of calcium daily from dietary sources is receiving calcium supplementation (v)	Applied
44. Patient with osteoporosis is receiving anti-osteoporotic medication (w)	Applied
45. Patient using topical corticosteroids does *not* have itch or discomfort that interferes with daily activities	*Disease state, disease or drug not recorded: topical corticosteroids
46. Patient has received influenza and pneumococcal vaccination (x)	*Situation not recorded: vaccination record
47. Patient has *no significant* medications interactions (agreement between two medication interaction databases)	*Situation not recorded: specific medication interactions
48. Patient has had no significant change in medications in the previous 90 days	Applied

*Reason for non-applicability of indicator to HMR group assessment

a. *Blood pressure targets*: proteinuria >1g/day, <125/75mmHg; diabetes, renal impairment, proteinuria 0.25-1 g/day, <130/85mmhg; age >65 years (unless any of the other targets apply), <140/90mmHg

b. *Patients at high risk of a cardiovascular event*: age >75 years, symptomatic cardiovascular disease (angina, MI, previous coronary revascularization procedure, heart failure, stroke, TIA, PVD). genetic lipid disorder, diabetes and evidence of renal disease (micoralbuminuria and/or proteinuria and/or GFR <60mL/min)

c. *Antiplatelet agents*: aspirin, clopidogrel. *Anticoagulants*: phenindione, warfarin. Non-haemorrhagic stroke or TIA: aspirin/dipyridamole, dipyridamole, ticlopidine
d. *Medications that may exacerbate heart failure*: antiarrhythmic drugs (except digoxin or amiodarone), carbamazepine, dilitiazem, nifedipine, verapamil, NSAIDs (excluding low-dose aspirin), sotalol, thiazolidinediones (significant disease), tricyclic antidepressants, corticosterioids (oral or inhaled)
e. *High sodium-containing medications*: effervescent tablets and powders - Panadol® Soluble, Berocca®, Supradyn®, Aspro Clear® Ural®, Alks-Seltzer®, Eno®, vitamin C (sodium ascorbate), Gaviscon®, Mylanta®
f. *Risk factors for statin myopathy*: drugs inhibiting metabolism by cytochrome P450 3A4 (dilitiazem, verapmil, macrolides); medicines inhibiting metabolism by other means (gemfibrozil); disease states (diabetes, hypothyroidism, renal and hepatic disease); age ≥70 years; dose ≥40 mg/day
g. *Smoking cessation therapy*: counselling, use of support services, medication; for patients smoking >10 cigarettes per day, bupropion, nicotine replacement therapy, varenicline
h. *Medications that may increase or decrease blood glucose concentrations*: baclofen, chlorpromazine, clozapine, cyclosporin, corticosteroid, haloperidol, hormone replacement therapy, olanzapine, phenytoin quetiapine, resperidone, tricyclic antidepressants. The following may decrease blood glucose concentrations: alcohol, isopyramide, perhexiline, quinine and trimethoprim/sulfamethoxazole
i. *Metformin dose*: 2 g/day maximum for creatinine clearance 60-90 ml/min, 1 g/day for creatinine clearance 30-60 ml/min
j. *Pain*: back complaint, OA cancer, rheumatoid arthritis
k. *Opioids*: buprenorphine, codeine, fentanyl, hydromorphone, methadone, morphine, oxycodone (dextropropoxyphene and tramadol have minimal gastrointestinal effects)
l. *Risk factors for impaired renal function*: creatinine clearance <60mL/min, heart failure, salt-restricted diet, volume depletion, concurrent use of diuretics, ACE inhibitors or ARBs, ciclosporin or aspirin
m. *Anticholinergic-type antidepressants*: amitriptyline, dosulepin (dothiepin) doxepin, imipramine, mianserin, nortriptyline, trimipramine
n. *Pyschotropic medications*: antidepressants (all), antipsychotics, sedatives/hypnotics
o. *Increased risk of bleeding with SSRIs:* aspirin, NSAIDs, warfarin. Consider gastroprotective medication if SSRI to be continued
p. *Medications that may contribute to serotonin toxicity*: tricyclic antidepressants, MAOIs (including moclobemide), venlafaxine, St John's wort (hypericum), tramadol, pethidine (meperidine), dextromethorphan, phentermine, sibutramine, selegiline, lithium
q. *Anticholinergic medications*: as per Australian Medicines Handbook, page A90
r. *Medications that may cause dyspepsia*: aspirin, bisphosphonates, calcium channel antagonists, corticosteroids, dopaminergic agents, erythromycin, iron, nitrates, NSAIDS, potassium chloride, tetracycline
s. *Medications that may worsen asthma*: NSAIDs (including aspirin), ß-blockers (including eye drops, royal jelly, Echinacea)
t. *URTI*: includes sore throat, acute otitis media, sinusitis, acute bronchitis and the common cold
u. *Sources of vitamin D*: skin exposure for at least 5 (summer) to 15 (winter) minutes per day four to six times per week between 10am and 2pm (11am and 3pm daylight saving time), fatty fish (e.g. salmon), meat, eggs, liver, vitamin D-fortified foods (e.g. margarine)
v. *Sources of calcium*: adequate calcium intake can be provided by three serves of dairy food per day – one serve + 250 ml milk or 200g of yoghurt or 40g cheddar cheese. Calcium-rich non-dairy foods = almonds, beans, dried figs, tofu, broccoli, bok choy, tinned salmon and sardines
w. *Anti-osteoporotic medication:* bisphosphonate, calcitriol, raloxifene, strontium, teriparatide
x. *Vaccination*: annual vaccination with influenza vaccine, vaccination every 5 years with pneumococcal vaccine

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a This indicator list is intended to be used by appropriately trained and qualified health professionals as a tool to assist in making clinical decisions as part of the medication review process.
b Prior to the commencement of any medication, the contraindications and precautions for that medication should be considered (see table III).

AF = atrial fibrillation**; ARB**= angiotensin ll type 1 receptor antagonist (angiotensin receptor blocker); **COPD**=chronic obstructive pulmonary disease**; GFR**=glomerular filtration rate; **HBA_{1c}**=glycosylated haemoglobin**; IHD**=ischaemic heart disease**; INR**=international normalized ratio; **IU**=international units: **LABA**=long acting ß-adrenoceptor agonist; **MAOI**=monoamine oxidase inhibitor; **MI**=myocardial infarction; **OA**=oseteoarthritis; **PPI**=proton pump inhibitor; **PVD**=peripheral vascular disease; **SSRI**=selective serotonin reuptake inhibitor; **TIA**=transient ischaemic attack; **URTI**=upper respiratory tract infection; **UTI**=urinary tract infection.

CHAPTER 7.0
Identifying Patients at Risk

Specific drugs and their potential for inappropriate prescribing (PIP) at discharge

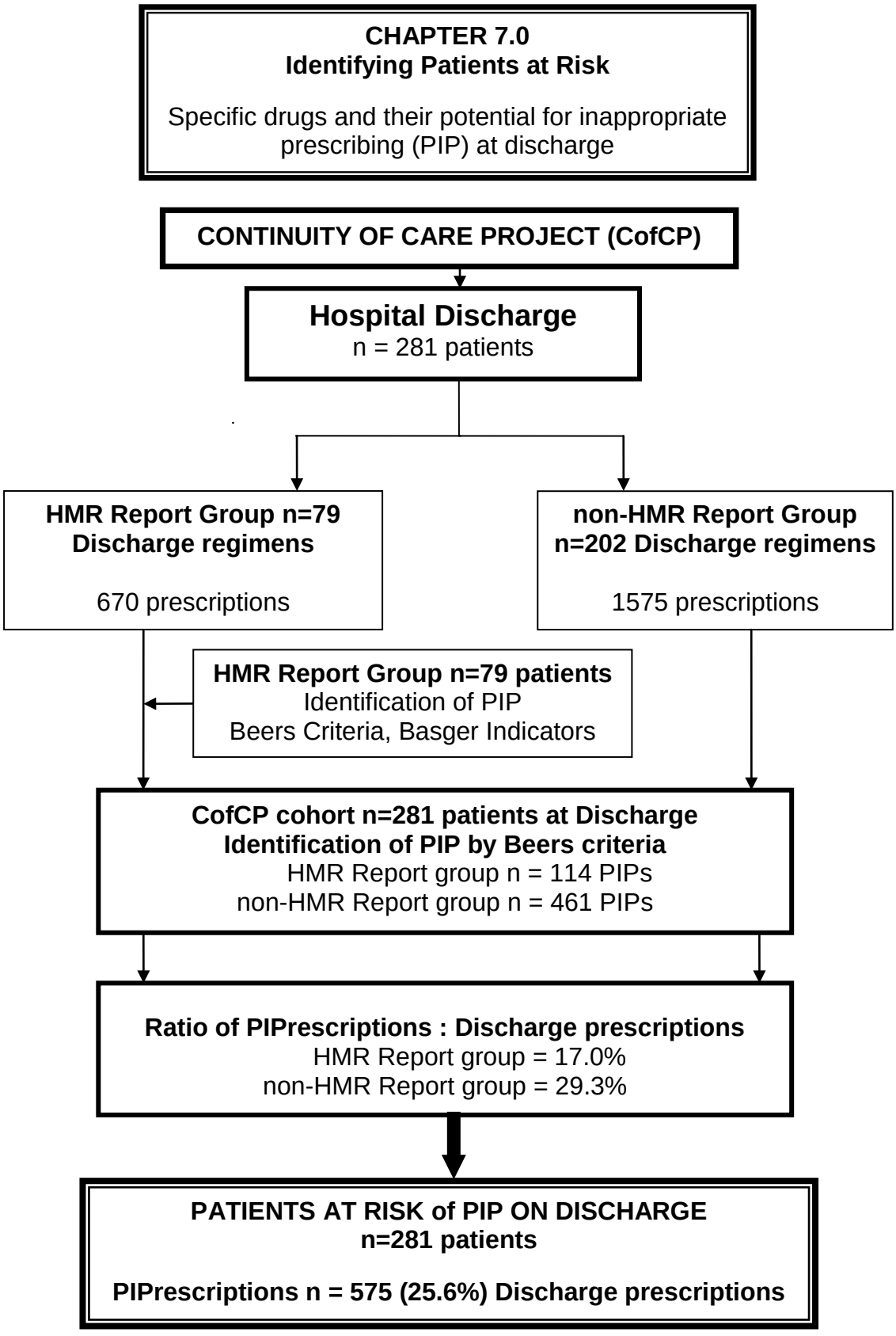

Figure 7.1 Chapter 7.0 Flowchart

PIP(s) = potentilly inappropriate prescribing/prescriptions. HMR = Home Medicines Review

CHAPTER 7.0 IDENTIFYING PATIENTS AT RISK

7.1 CHAPTER SUMMARY

Initially, this chapter determined and analysed the discharge regimens of the full Continuity of Care Project (CofCP) cohort (n=281) for specific drug nature (active ingredient) and frequency of prescribing. Discharge regimens for the Home Medicines Review (HMR) Report group (n=79) and the non-HMR Report group (n=202) were compared.

Secondly, this chapter identified patients at risk of potentially inappropriate prescribing (PIP) by comparing the re-application of Beers criteria and Basger indicators to the HMR Report group (n=79). In this chapter, in comparison with chapters 5 and 6, the specific nature of drugs was targeted within therapeutic classifications of PIP drugs. Lists of drugs and diseases on discharge summaries and post discharge HMR reports were compared for PIP. For the minority HMR Report group, these analyses ascertained any change in the specific nature of identified PIP drugs at discharge and at HMR service.

Thirdly, Beers criteria were applied to the full cohort's regimen at discharge to determine any PIP, and data were tabulated for comparison between the two subgroups. These analyses showed the specific nature of any PIP drugs, their prescribing frequency and the ratio of PIP to discharge prescriptions for the cohort.

Throughout this chapter, further clinical characteristics of the cohort were investigated and included the nature (active ingredient) of discharge drugs and of any identified PIP drugs. Comparisons of all characteristics of the minority subgroup with those of the majority subgroup were made to establish the representativeness of the HMR Report group for the non-HMR Report group, hence for the full CofCP cohort.

These factors were ascertained to determine the need for medication review for *all* patients, to augment their continuity of care after hospital discharge.

7.2 INTRODUCTION

Achieving continuity of care (CofC) in healthcare environments involves the integration of all aspects of patient care and most importantly, involves the quality and completeness of care necessary during transfer from hospital back into the community.[1-5] In the Australian healthcare system there is still a heavy reliance on the production of partially computerised discharge summaries collated by junior members of the patients' hospital medical team.[6-10] On patient transfer, these summaries are the only tangible record of the ongoing care required for the many patients whose post discharge wellbeing is primarily sustained by pharmacotherapy.[11] Hence, the opportunity for timely reconciliation of medicines and review of appropriateness of drugs prescribed on discharge is crucial to the integration of quality care in any healthcare system.[12-14]

In the Australian healthcare system, Home Medicines Review (HMR) services are organised and conducted by pharmacists after referral at the discretion of the patient's general medical practitioner (GP).[15-17] These medication reviews are designed to be conducted in the patients' homes which present real environments for comprehensive reconciliation of all medicines actually consumed.[1,18-21] The HMR service post discharge, updates the patients' GPs on current regimen adherence and facilitates timely information exchange on patient related problems and any potentially inappropriate prescribing (PIP) identified.[4,22-25]

Beers explicit criteria, written for identification of PIP in international healthcare systems, are well validated by use in research and practice and were updated in 2003.[26-30] There is however, a dearth of literature reporting the use of Beers criteria in

Australian research or practice and in particular, of prescribing in an Australian acute healthcare setting.[31-32] In the development of Beers criteria, differences in the availability of drugs or prescribing practices in all countries and patient related clinical characteristics were not taken into account. Hence, these factors were seen as important inclusions in the prescribing indicators developed by Basger et al. (2008) which were customised for use in the Australian healthcare system.[33-34]

The combined application of Beers criteria and Basger indicators, in Chapters 5 and 6, to the HMR Report group (n=79) comprehensively identified an unjustifiably high level of PIP. The subgroup was exposed to PIP at both discharge and at HMR.[34,41] However unlike the majority of discharged patients in the non-HMR Report group (n=202), the HMR Report group were afforded the opportunity of post discharge medication review. It was during this subgroup's HMR services that the management of both discharge regimen and post discharge changes made after GP consultation, were reviewed, reconciled and reported back to the patient's GP.[16,37-39]

The literature widely supports claims of markedly exacerbated risk from drug interactions and polypharmacy, in particular, for patients prescribed drugs for cardiovascular disease.[16,37-45] When discharged from an Australian hospital back to the community, subjects in this CofCP study were predominantly acute on chronically ill patients treated with cardiovascular drugs.[2,4]

Continuity of care research involving the HMR Report group (Chapter 4), showed the group was exposed to polypharmacy and increased drug-related problems by the nature of their pharmacotherapy when discharged directly to their homes.[4] Liu and Christensen (2002), Triller et al. (2005), Straubhaar et al. (2006) and Buajordet et al. (2011) also found a relationship between polypharmacy, cardiovascular drugs and home discharge.[12,41,44-45]

Alternatively, Hayes et al. (2007) and Robles and Anderson (2011) claimed to have found little research on the association between polypharmacy, cardiovascular drugs, and continuity of care.[46-47] However, Robles stressed the importance of establishing post discharge continuity of care with a specific provider through organised healthcare services.

In this study, organised healthcare services in the community are represented by the provision of HMR services by pharmacists in the patients' homes. No further published research was found which linked acute care pharmacotherapy, cardiovascular patients and their drug related problems after discharge, with the quality of their continuity of care in the community. Hence, the study in this chapter investigated the links between these factors.

7.3 STUDY AIM

To investigate any risk of potentially inappropriate prescribing of specific drugs, for the full cohort, which would cause disruption to discharged patients' continuity of care.

7.3.1 OBJECTIVES

To achieve the aim of the study for the full cohort of research subjects by determining the nature and distribution of any specific drugs:

1) prescribed on discharge from hospital for the full cohort of patients (n=281)
2) shown to be potentially inappropriately prescribed (PIP) for a subgroup of patients (n=79) by application of Beers criteria and Basger indicators, on and after discharge.
3) identified as PIP on discharge from hospital for the full cohort of patients (n=281) by application of Beers criteria.
4) which explain the representativeness in clinical characteristics of the minority subgroup to the majority subgroup, hence to the full cohort.

7.4 OPERATIONAL DEFINITIONS

7.4.1 CONTINUITY OF CARE is a perception of quality health care resulting from the ongoing management of issues which cause disruption to optimal patient care.

In the context of the study reported in this chapter:

Continuity of Care is perceived by the researchers as the timely identification of potentially inappropriate prescribing (PIP) on, and after hospital discharge to manage patients' drug related problems and enhance their wellbeing.

7.4.2 POTENTIALLY INAPPROPRIATE PRESCRIBING (PIP)

In this study the phrases 'potentially inappropriate prescribing or prescriptions', and 'potentially inappropriate medication' are equal in meaning and represented by the abbreviation 'PIP(s)'. Prudent et al. (2008) define 'potentially inappropriate medication' as drugs with an unfavourable risk/benefit ratio when safer or equally effective alternatives are available.[48]

7.5 METHOD

7.5.1 STUDY DESIGN

The study reported in this chapter was a comparative analysis of the quality of prescribing for the subgroups of cardiology patients recruited as a cohort into the prospective Continuity of Care Project (CofCP). The quality of prescribing was examined by determining the nature of the cohort's discharge drugs and investigating any exposure of the cohort to potentially inappropriate prescribing (PIP). In this study, the active ingredients of the cohort's prescribed drugs were determined to describe the nature of their drug regimens. The nature of the drugs prescribed for the subgroups are compared to determine any representativeness of the minority subgroup to the majority

subgroup in clinical characteristics. The patients' hospital discharge summaries and HMR reports were the sources of data for analyses. The provision to the researchers of HMR reports for the patients' GPs, was the end point of data collection for this study.

7.5.2 SUBJECTS AND DATA SOURCES

This study analysed the prescribing of drugs on discharge for patients (n=281) recruited into the Continuity of Care Project (CofCP) (Figure 7.1).[2] All subjects recruited into the project were patients under the care of a cardiovascular team and were discharged from the Cardiology Unit of Westmead Hospital Sydney, to their homes between mid 2004 and 2007. The CofCP cohort was comprised of 162 (57.7%) male and 119 (42.3%) female subjects with median age of 65 (IQR=19:55-74) years. Subjects met the suggested Australian Commonwealth Government's eligibility criteria for HMR referral by a GP, and were discharged from hospital on at least one cardiovascular drug.[19]

In this chapter data sources analysed included the patients' hospital medical records, discharge summaries and accredited pharmacists' HMR reports. Hospital discharge summaries were generated by the attending medical teams for the patients' delivery to their community GP. During the project implementation 'Day Only' patients were not provided with a discharge summary. These patients' drugs and diseases were analysed from their medical records or lists of drugs collated in lieu of a discharge summary. The drug regimen in these lists were included for 'at discharge' data analyses.

A detailed account of the subjects recruited, and sources utilised for data analyses in this chapter appears in Chapter 3, 5 and 6.

7.5.3 DETERMINATION OF COHORT DISCHARGE REGIMENS

Data collated from discharge summaries were for comparative analysis of drugs prescribed by the hospital medical team for 1) full CofCP cohort, 2) HMR Report group and 3) non-HMR Report group. Data were analysed for a) prescribed drugs common to both the HMR and non-HMR Report subgroups and b) prescribed drugs unique to the HMR Report group and c) prescribed drugs unique to the non-HMR Report group.

To conduct the above analyses, units of analysis were based on 1) the number of patients prescribed specific drugs, 2) the number of prescriptions for specific drugs, 3) the nature of the prescribed drugs. In all analyses, any one patient could be counted several times across a range of different drugs however, each drug was counted only once for each patient.

In this study, for the collation and analysis of discharge prescribing, all drugs were counted according to their active ingredients, only. That is, prescriptions for the same active ingredient ordered in different strengths or at different frequencies were counted as the prescription of one drug only. Hence, the number of prescriptions for the cohort or subgroups could vary from numbers reported in previous chapters where all separate prescriptions for an active ingredient were counted.

7.5.4 IDENTIFICATION OF POTENTIALLY INAPPROPRIATE PRESCRIBING (PIP) -POST DISCHARGE IN THE COMMUNITY

To ascertain the difference in prescribing quality between discharge and post discharge in the community, Beers criteria and Basger Indicators were re-applied to the drug regimens of the HMR Report group. In comparison to Chapters 5 and 6, re-application targeted the nature (active ingredient) of identified PIP drugs and any changes made after GP consultation.

7.5.4.1 Re-application of Beers Criteria – HMR Report Group

Beers criteria identify drugs as PIP independent of diagnoses or conditions in 48 criteria (Table 1 in Appendix 5.1) and identify drugs as PIP after considering diagnoses or conditions in 20 criteria (Table 2 in Appendix 5.1).[157] In this chapter, the Beers criterion targeting blood clotting disorders or patients receiving anticoagulant therapy was again divided into two criteria for ease of analysis (No.54 and No.55) and the two tables of criteria were combined and numbered consecutively from 1-69.

In this chapter, the method of application for Beers criteria was consistent with the application of Beers criteria in Chapter 5. However, in this chapter the high or low severity ratings of the identified PIP drugs were not determined

The re-application of Beers criteria to the HMR Report group at discharge and at HMR, was to determine the nature (active ingredient) of specific drugs which were assessed as PIP at these two points in time. Identification of PIP by Beers criteria 'at discharge' was conducted on lists of drugs or diseases in discharge summaries. Identification of PIP by Beers criteria 'at HMR' service was conducted on lists of drugs or diseases in HMR reports written by accredited pharmacists. The pharmacists' comments and recommendations in the report, were not taken into account.

A detailed account of the background to development, format, application process and Beers criteria appear in Chapter 5 and Appendix 5.1.

7.5.4.2 Re-application of Basger Indicators – HMR Report Group.

For a comprehensive identification of PIP, besides the re-application of Beers international criteria, Basger indicators for appropriate prescribing were also re-applied to the HMR Report group (n=79). Unlike Beers criteria, Basger indicators were

customised for application in an Australian healthcare environment to take into account patient characteristics, availability of drugs and local prescribing patterns.[33]

The method adopted for re-application of Basger indicators in this chapter was consistent with the application of Basger indicators in Chapter 6. As in Chapters 5 and 6 the identification of PIP by two distinctly different applications added to a comprehensive analysis of the HMR Report groups' prescribed drugs. The Basger indicators were re-applied in this chapter at discharge and at HMR service. This was to determine the nature (active ingredient) of specific drugs, within therapeutic classifications, which were assessed as PIP at these two points in time.

The identification of PIP by Basger indicators 'at discharge' was conducted on lists of drugs or diseases in discharge summaries. Identification of PIP by Basger indicators 'at HMR' service was conducted on lists of drugs or diseases in HMR reports written by accredited pharmacists. The pharmacists' comments and recommendations in the report were not taken into account.

A detailed account of the background to development, format, application process and Basger indicators appears in Chapter 6 and Appendix 6.1.

7.5.5 IDENTIFICATION OF POTENTIALLY INAPPROPRIATE PRESCRIBING (PIP): AT HOSPITAL DISCHARGE – For the CofCP Cohort

Beers criteria were chosen for the straight forward determination of the quality of prescribing in the drug regimens of the full CofCP cohort on discharge from hospital. The updated Beers criteria, published by Fick et al. (2003), were chosen for identification of PIP for the cohort (n=281).[29,48-51] Beers criteria were developed using a modified Delphi method for formulating group judgements by an expert panel on the

rating of specific drugs prescribed for patients ≥65 years of age.[27,52] The shortcomings, of Beers criteria were discussed in chapter 5, however the criteria have been widely utilised and well validated by published research.[22.30.49.53-55]

In this Chapter, application of Beers criteria facilitates the qualification of the PIP drugs' active ingredients as the 'nature' of the drugs prescribed. In comparison with Basger indicators which predominantly assessed drug interactions between classes of drugs, most Beers criteria named specific drugs as PIP. Beers criteria were utilised in Chapter 5 and were found to be practical for providing an explicit, validated and international approach to identification of PIP in the Australian healthcare environment (Appendix 5.1)[46]

For analyses in this chapter, identified PIP were recorded as 'an instance of PIP' without regard to the severity level allocated by Beers criteria (low or high severity).[56] The explicit division of drugs into these two categories was found, in Chapter 5, to not affect the impact of PIP on the study group.

Hence, as this study adopts a 'worse case scenario' in design and method, this means all drugs identified as PIP at any level of severity, carry the same level of risk to a patients' health. This approach also included the full assessment of drugs prescribed for one patient only, so that patients were not arbitrarily excluded from the study as was apparent in continuity of care (CofC) research systematically reviewed in Chapter 2.[3]

A detailed account of the background to development, format, application process and Beers criteria appears in Chapter 5 and Appendix 5.1.

7.5.6 DATA ANALYSES

All data on prescribed drugs and diseases were coded for analysis, according to the Anatomical Therapeutic Chemical (ATC) classification and International Classification of Disease version 10 (ICD-10), respectively.[57-58] Purpose designed databases were constructed in SPSS Statistics Version 17 and Microsoft Office Excel 2007 programmes.

Data collated from the application of Beers and Basger criteria for the identification of PIP were analysed for the HMR Report group (n=79) at discharge and at HMR service in the community. Drug regimen recorded on discharge summaries were prescribed by the hospital medical team and regimens recorded on HMR reports were drugs currently being taken by patients post discharge, after GP consultation. These analyses allowed comparison of the number of patients' PIP drugs at discharge and at HMR, the number of PIP instances at these times and importantly, the nature of the specific drugs identified as PIP.

All analyses of data 'at discharge' were conducted on lists of drugs or diseases in discharge summaries. Analyses of data post discharge 'at HMR' service, were conducted on lists of drugs or diseases in HMR reports written by accredited pharmacists. The pharmacists' comments and recommendations in the report were not taken into account.

7.6 RESULTS

7.6.1 HOSPITAL DISCHARGE REGIMENS FOR STUDY COHORT (n=281)

Table 7.1, shows the distribution of patients, prescriptions and discharge drugs for the full study cohort (n=281), at discharge. All discharge drug regimens for the cohort are shown by division into the HMR Report group (n=79) and non-HMR Report group (n=202). The table shows the number and nature of the discharge drugs in decreasing frequency for the non-HMR Report group. The relativity of the results to the groups' total discharge data and explanations of the analyses are shown as footnotes to the tables.

The prescription of one drug (e.g. warfarin, insulin) at more than one strength, or in different form, and/or at different daily frequencies was counted as one (only) specific drug response for a patient. That is, in this chapter the active ingredients of drugs describe the nature of the drugs, and are included once only for each patient. Adoption of this method to clarify the nature of patients' drugs resulted in slight differences in prescription counts between analyses or chapters.

7.6.1.2 Discharge Regimens for CofCP Cohort

In Table 7.1, analyses of the cohorts' complete discharge regimens showed a pattern of relatively steady decrease in number and nature of the drugs which were tabulated from the most to least frequently prescribed for the non-HMR Report group.

Aspirin was the most frequently prescribed discharge drug and was prescribed for 54 (68.4%) HMR Report group patients and 128 (63.4%) non-HMR Report group patients. Aspirin prescriptions accounted for 8.1% of total discharge prescriptions, for each subgroup. Clopidogrel followed aspirin in frequency and was prescribed for 40

(50.6%) HMR and 95 (47.0%) non-HMR Report group. Clopidogrel prescriptions accounted for 6.0% of total discharge prescriptions for each subgroup. Atorvastatin was prescribed for 30 (38.0%) HMR and 85 (42.1%) non-HMR Report group patients and prescriptions accounted for 4.5% and 5.4% of total discharge prescriptions, respectively.

For the cohort (n=281), and taking into account prescribed drugs common to and unique to the subgroups, there were 213 different drugs prescribed on discharge (Table 7.1). With the number of discharge prescriptions recorded as prescriptions for active ingredients, total discharge prescriptions averaged 8.0 (SD± 6.6) prescriptions per patient for the cohort. At discharge, a total of 2245 prescriptions was comprised of 670 (29.8%) HMR Report group and 1575 (70.2%) non-HMR Report group prescriptions (Table 7.1).

7.6.1.3 Discharge Prescribing Common to Subgroups

From Table 7.1, analysis of the cohort's discharge regimen for drugs common to the HMR and non-HMR Report groups showed a pattern of steady decrease in the number and nature of the drugs from the most to least frequently prescribed. Aspirin, clopidogrel and atorvastatin were the most frequently prescribed drugs common to both groups.

Table 7.1 shows 104 different drugs were common to both groups on discharge. Common drug prescriptions averaged 8.3 (SD± 3.0) HMR and 7.8 (SD± 4.0) non-HMR Report group prescriptions per patient. These prescriptions averaged 6.1% HMR and 3.7% non-HMR Report group patients per drug. It was found there was little difference in the nature of drugs prescribed, or patterns of prescribing between the HMR and non-HMR Report groups on discharge. The total discharge prescriptions for 'common' drugs for the HMR Report group was 632 (94.3%) of the drugs common to both

subgroups. Total discharge prescriptions for 'common' drugs for the non-HMR Report group were 1389 (88.2%) of drugs common to both subgroups. These findings reinforced the representativeness of the HMR Report group (n=79) in prescribing for the non-HMR Report group (n=202) at discharge.

[Data and analyses to support the above (Section 7.6.1.3) results are separately tabulated and attached in Table A in Appendix 7.1 at the end of this chapter.]

7.6.1.4 Discharge Prescribing Unique to HMR Report Group

Analysis of Table 7.1 shows the distribution of prescriptions and drugs unique to the HMR Report group (n=79), at discharge. The discharge drugs prescribed for this group, showed a constant pattern of prescribing with 1 or 2 prescriptions for all drugs.

It was noted that 1 patient in the HMR Report group was prescribed sibutramine (hydrochloride monohydrate) by the hospital medical team at discharge in 2007. At date of these analyses of cohort discharge regimens, the marketing, supply or availability of sibutramine (in particular), had been restricted or withdrawn in Australia, Europe and the United States of America (USA).

There were 29 drugs unique to the HMR Report group at discharge. Nine different drugs were prescribed for 2 (2.5%) HMR Report group and each drug accounted for 0.3% total discharge prescriptions. Prescriptions numbers ranged between 1– 2 prescriptions per drug. On average, there were 0.4% HMR Report group patients prescribed each drug. These unique drug prescriptions comprised just 38 (5.7%) total discharge prescriptions and this small proportion further reinforced the representativeness of the bulk (94.3%) of the discharge prescriptions common to both groups.

[Data and analyses to support the above (Section 7.6.1.4) results are separately tabulated and attached in Table B in Appendix 7.1 at the end of this chapter.]

7.6.1.5 Discharge Prescribing Unique to non-HMR Report Group

Table 7.1 also shows the distribution of drugs, unique to the non-HMR Report group (n=202), which were prescribed at discharge. Analysis of the discharge drugs prescribed for this group, showed a pattern of steady decrease in the number and nature of the drugs from the most to least frequently prescribed.

Tramadol was the most frequently prescribed drug unique to the non-HMR Report group at discharge and was prescribed for 12 (5.9%) patients and accounted for 0.8% total discharge prescriptions. Codeine with paracetamol was prescribed for 11 (5.4%) non-HMR Report patients and accounted for 0.7% total discharge prescriptions. There were 81 different discharge drugs prescribed for this group only, and numbers ranged between 1 – 12 prescriptions per drug. On average, there were 0.5% non-HMR Report group patients prescribed each drug and prescriptions for drugs unique to this group comprised 186 (11.8%) total discharge prescriptions.

[Data and analyses to support the above (Section 7.6.1.5) results are separately tabulated and attached in Table C in Appendix 7.1 at the end of this chapter.]

Table 7.1$_a$ Distribution of specific drugs prescribed for the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge.

Specific Drugs prescribed	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number pre-scriptions	% total pre-scriptions	% Patients	Number pre-scriptions	% total pre-scriptions	% Patients
Aspirin	54	8.1	68.4	128	8.1	63.4
Clopidogrel	40	6.0	50.6	95	6.0	47.0
Atorvastatin	30	4.5	38.0	85	5.4	42.1
Glyceryl trinitrate[a]	28	4.2	35.4	76	4.8	37.6
Metoprolol	24	3.6	30.4	65	4.1	32.2
Frusemide	32	4.8	40.5	53	3.4	26.2
Warfarin	13	2.0	16.5	40	2.5	19.8
Perindopril arginine[b]	16	2.4	20.3	38	2.4	18.8
Digoxin	19	2.8	24.1	34	2.2	16.8
Isosorbide mononitrate	13	1.9	16.5	35	2.2	17.3
Pantoprazole	19	2.9	24.1	35	2.2	17.3
Simvastatin	26	3.9	32.9	30	1.9	14.9
Potassium Chloride	12	1.8	15.2	28	1.8	13.9
Carvedilol	10	1.5	12.7	26	1.6	12.9
Ramipril	7	1.0	8.9	25	1.6	12.4
Omeprazole	10	1.5	12.7	24	1.5	11.9
Glyceryl trinitrate alternate form [c]	9	1.3	11.4	24	1.5	11.9
Spironolactone	7	1.0	8.9	24	1.5	11.9
Magnesium aspartate	10	1.5	12.7	22	1.4	10.9
Gliclazide	8	1.2	10.1	21	1.3	10.4
Enoxaparin	4	0.6	5.1	21	1.3	10.4
Diltiazem	10	1.5	12.7	18	1.1	8.9
Salbutamol	5	0.7	6.3	18	1.1	8.9
Paracetemol	4	0.6	5.1	18	1.1	8.9
Nicorandil	6	0.9	7.6	17	1.1	8.4
Amiodarone	1	0.2	1.3	17	1.1	8.4
Sotalol	3	0.4	3.8	16	1.0	7.9
Cephalexin	1	0.1	1.3	16	1.0	7.9

[a]Glyceryl trinitrate: sublingual tablets only, also see alternate form[c] [b] also see Perindopril with indapamide[d] [c]Glyceryl trinitrate: includes transidermal patch (8,23), spray (1,0) and ointment (0,1)

Table 7.1$_b$ Distribution of specific drugs prescribed for the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued.

Specific Drugs prescribed	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number pre-scriptions	% total pre-scriptions	% Patients	Number pre-scriptions	% total pre-scriptions	% Patients
Irbesartan	12	1.8	15.2	15	1.0	7.4
Docusate sodium	9	1.3	11.4	14	0.9	6.9
Allopurinol	8	1.2	10.1	14	0.9	6.9
Esomeprazole	3	0.4	3.8	14	0.9	6.9
Pravastatin	5	0.8	6.3	12	0.8	5.9
Prednisolone	4	0.6	5.1	12	0.8	5.9
Tramadol	0	0	0	12	0.8	5.9
Oxycodone	1	0.2	1.3	11	0.7	5.4
Codeine with Paracetamol	0	0	0	11	0.7	5.4
Metformin	11	1.6	13.9	9	0.6	4.5
Calcium carbonate	7	1.0	8.9	9	0.6	4.5
Atenolol	6	0.9	7.6	9	0.6	4.5
Metoclopramide	0	0	0	9	0.6	4.5
Thyroxine	10	1.5	11.4	10	0.6	5.0
Tiotropium bromide	4	0.6	5.1	10	0.6	5.0
Folic acid	3	0.4	3.8	8	0.5	4.0
Fluticasone with salmeterol[e]	1	0.1	1.3	8	0.5	4.0
Thiamine	1	0.1	1.3	8	0.5	4.0
Fluticasone[f]	6	0.9	7.6	7	0.4	3.5
Ferrous sulphate	4	0.6	5.1	7	0.4	3.5
Insulin	4	0.6	5.1	7	0.4	3.5
Rabeprazole	1	0.1	0.2	7	0.4	3.5
Chloramphenicol eye drops	0	0	0	7	0.4	3.5
Polyethylene glycol combinations	0	0	0	7	0.4	3.5
Trimethoprim	0	0	0	7	0.4	3.5
Senna glycosides	0	0	0	6	0.4	3.0
Candesartan	3	0.4	0.5	5	0.3	2.5
Prazosin	3	0.4	3.8	5	0.3	2.5
Bisoprolol	2	0.3	2.5	5	0.3	2.5

[e]see Fluticasone[f] [f]see Fluticasone with salmeterol[e]

Table 7.1$_c$ Distribution of specific drugs prescribed for the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued

Specific Drugs prescribed	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number pre-scriptions	% total pre-scriptions	% Patients	Number pre-scriptions	% total pre-scriptions	% Patients
Celecoxib	2	0.3	2.5	5	0.3	2.5
Ipratropium bromide	2	0.3	2.5	5	0.3	2.5
Ezetimbe	2	0.3	2.5	5	0.3	2.5
Telmisartan	2	0.3	2.5	5	0.3	2.5
Amoxicillin with clavanulate	1	0.1	1.3	5	0.3	2.5
Budesonide	1	0.1	1.3	5	0.3	2.5
Acetazolamide	0	0	0	5	0.3	2.5
Dextran eye drops	0	0	0	5	0.3	2.0
Ergocalciferol	0	0	0	5	0.3	2.5
Gabapentin	0	0	0	5	0.3	2.5
Verapamil	5	0.7	6.3	4	0.3	2.0
Ranitidine	4	0.6	5.1	4	0.3	2.0
Enalapril	3	0.4	3.8	4	0.3	2.0
Amlopidine	2	0.3	2.5	4	0.3	2.0
Aluminium combinations	2	0.3	2.5	4	0.3	2.0
Perhexaline	2	0.3	2.5	4	0.3	2.0
Roxithromycin	2	0.3	2.5	4	0.3	2.0
Amitriptyline	1	0.1	1.3	4	0.3	2.0
Amoxicillin	1	0.1	1.3	4	0.3	2.0
Colchicine	1	0.1	1.3	4	0.3	2.0
Lisinopril	1	0.1	1.3	4	0.3	2.0
Cinchocaine and zinc oxide	0	0	0	4	0.3	2.0
Citalopram	0	0	0	4	0.3	2.0
Nicotine transdermal	0	0	0	4	0.3	2.0
Perindopril with indapamide[d]	8	1.2	10.1	3	0.2	1.5
Nifedipine	4	0.6	5.1	3	0.2	1.5
Alendronate	3	0.4	3.8	3	0.2	1.5
Ciprofloxacin	1	0.1	1.3	3	0.2	1.5
Darbepoetin alfa	1	0.1	1.3	3	0.2	1.5

Table 7.1$_d$ Distribution of specific drugs prescribed for the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued

Specific Drugs prescribed	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number pre-scriptions	% total pre-scriptions	% Patients	Number pre-scriptions	% total pre-scriptions	% Patients
Fluoxetine	1	0.1	1.3	3	0.2	1.5
Lactulose	1	0.1	1.3	3	0.2	1.5
Quinine	1	0.1	1.3	3	0.2	1.5
Acetylcysteine	0	0	0	3	0.2	1.5
Cephazolin	0	0	0	3	0.2	1.5
Clindamycin	0	0	0	3	0.2	1.5
Diclofenac	0	0	0	3	0.2	1.5
Felodipine	0	0	0	3	0.2	1.5
Flecainide	0	0	0	3	0.2	1.5
Morphine	0	0	0	3	0.2	1.5
Sodium chloride	0	0	0	3	0.2	1.5
Trandolapril	0	0	0	3	0.2	1.5
Captopril	2	0.3	2.5	2	0.1	1.0
Fosinopril	2	0.3	2.5	2	0.1	1.0
Indomethacin	2	0.3	2.5	2	0.1	1.0
Amphoteracin	1	0.1	1.3	2	0.1	1.0
Cadexomer iodine	1	0.1	1.3	2	0.1	1.0
Indapamide	1	0.1	1.3	2	0.1	1.0
Risedronate	1	0.1	1.3	2	0.1	1.0
Sodium Citrate /tartrate	1	0.1	1.3	2	0.1	1.0
Ascorbic acid	0	0	0	2	0.1	1.0
Baclofen	0	0	0	2	0.1	1.0
Dexamethasone eye drops	0	0	0	2	0.1	1.0
Domperidone	0	0	0	2	0.1	1.0
Dothiepin	0	0	0	2	0.1	1.0
Haloperidol	0	0	0	2	0.1	1.0
Ispaghula	0	0	0	2	0.1	1.0
Metronidazole	0	0	0	2	0.1	1.0
Mirtazapine	0	0	0	2	0.1	1.0
Quinapril	0	0	0	2	0.1	1.0
Vitamin compounds	0	0	0	2	0.1	1.0

[d]see Perindopril arginine[b]

Table 7.1$_e$ Distribution of specific drugs prescribed for the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued.

Specific Drugs prescribed	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number pre-scriptions	% total pre-scriptions	% Patients	Number pre-scriptions	% total pre-scriptions	% Patients
Clotrimazole	5	0.7	6.3	1	0.1	0.5
Sodium bicarbonate	4	0.6	5.1	1	0.1	0.5
Carbamazepine	3	0.5	3.8	1	0.1	0.5
Glimepiride	3	0.4	3.8	1	0.1	0.5
Rosiglitazone	3	0.4	3.8	1	0.1	0.5
Famotidine	2	0.3	2.5	1	0.1	0.5
Flucloxacillin	2	0.3	2.5	1	0.1	0.5
Methotrexate	2	0.3	2.5	1	0.1	0.5
Temazepam	2	0.3	2.5	1	0.1	0.5
Calcitriol	1	0.1	1.3	1	0.1	0.5
Cetamacrogol cream	1	0.1	1.3	1	0.1	0.5
Diazepam	1	0.1	1.3	1	0.1	0.5
Glipizide	1	0.1	1.3	1	0.1	0.5
Hypromellose combinations	1	0.1	1.3	1	0.1	0.5
Ibruprofen	1	0.1	1.3	1	0.1	0.5
Imipramine	1	0.1	1.3	1	0.1	0.5
Latanoprost	1	0.1	1.3	1	0.1	0.5
Oestrogens	1	0.1	1.3	1	0.1	0.5
Paraffin and wool fat	1	0.1	1.3	1	0.1	0.5
Phenytoin	1	0.1	1.3	1	0.1	0.5
Valproate	1	0.1	1.3	1	0.1	0.5
Aluminium hydroxide	0	0	0	1	0.1	0.5
Betamethasone	0	0	0	1	0.1	0.5
Biperiden	0	0	0	1	0.1	0.5
Calcium with vitamin D comb.[g]	0	0	0	1	0.1	0.5
Carbimazole	0	0	0	1	0.1	0.5
Chlorhexidine gluconate	0	0	0	1	0.1	0.5
Clodronate	0	0	0	1	0.1	0.5
Cyclizine	0	0	0	1	0.1	0.5

[g]comb=combinations

Table 7.1$_f$ Distribution of specific drugs prescribed for the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued.

Specific Drugs prescribed	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number pre-scriptions	% total pre-scriptions	% Patients	Number pre-scriptions	% total pre-scriptions	% Patients
Cyclosporine oral	0	0	0	1	0.1	0.5
Diphenoxylate atropine	0	0	0	1	0.1	0.5
Eplerenone	0	0	0	1	0.1	0.5
Fluconazole	0	0	0	1	0.1	0.5
Fluorouracil	0	0	0	1	0.1	0.5
Gentamycin	0	0	0	1	0.1	0.5
Hydro-chlorothiazide	0	0	0	1	0.1	0.5
Hydroxy-chloroquine	0	0	0	1	0.1	0.5
Hyoscine N-butyl bromide	0	0	0	1	0.1	0.5
Lansprazole	0	0	0	1	0.1	0.5
Lignocaine Oral	0	0	0	1	0.1	0.5
Lithium carbonate	0	0	0	1	0.1	0.5
Loperamide	0	0	0	1	0.1	0.5
Mesalazine	0	0	0	1	0.1	0.5
Mometasone	0	0	0	1	0.1	0.5
Nystatin	0	0	0	1	0.1	0.5
Oxazepam	0	0	0	1	0.1	0.5
Paraffin emulsion	0	0	0	1	0.1	0.5
Paroxetine hydrochloride	0	0	0	1	0.1	0.5
Phenindione	0	0	0	1	0.1	0.5
Polyvinyl alcohol with providone	0	0	0	1	0.1	0.5
Prednisolone eye drops	0	0	0	1	0.1	0.5
Prochlorperazine	0	0	0	1	0.1	0.5
Propanolol	0	0	0	1	0.1	0.5
Rofecoxib	0	0	0	1	0.1	0.5
Silver sulfadiazine	0	0	0	1	0.1	0.5
Sodium picosulphate with magnesium	0	0	0	1	0.1	0.5

Table 7.1$_g$ Distribution of specific drugs prescribed for the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued.

Specific Drugs prescribed	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number pre-scriptions	% total pre-scriptions	% Patients	Number pre-scriptions	% total pre-scriptions	% Patients
Sorbitol & Sodium comb.[g]	0	0	0	1	0.1	0.5
Sucralfate	0	0	0	1	0.1	0.5
Sulindac	0	0	0	1	0.1	0.5
Terbinafine	0	0	0	1	0.1	0.5
Testosterone	0	0	0	1	0.1	0.5
Theophylline SR	0	0	0	1	0.1	0.5
Timolol	0	0	0	1	0.1	0.5
Triamcinolone-Orabase	0	0	0	1	0.1	0.5
Tribolone	0	0	0	1	0.1	0.5
Urea	0	0	0	1	0.1	0.5
Voriconazole	0	0	0	1	0.1	0.5
Xylometazoline	0	0	0	1	0.1	0.5
Erythropoietin	2	0.3	2.5	0	0	0
Lercandipine	2	0.3	2.5	0	0	0
Nofloxacin	2	0.3	2.5	0	0	0
Omega-3-triglycerides	2	0.3	2.5	0	0	0
Raloxifene	2	0.3	2.5	0	0	0
Venlafaxine	2	0.3	2.5	0	0	0
Zolpidem	2	0.3	2.5	0	0	0
Bupropion	1	0.2	1.3	0	0	0
Cephalexin	1	0.1	1.3	0	0	0
Codeine linctus	1	0.1	1.3	0	0	0
Cyanocabalamin	1	0.1	1.3	0	0	0
Cyproterone	1	0.1	1.3	0	0	0
Doxepin	1	0.1	1.3	0	0	0
Eformoterol	1	0.1	1.3	0	0	0
Eprosartan	1	0.1	1.3	0	0	0
Framycetin	1	0.1	1.3	0	0	0
Hydroxyethyl-rutosides	1	0.1	1.3	0	0	0
Medoxy-progesterone with oestrogen	1	0.1	1.3	0	0	0

Table 7.1$_h$ Distribution of specific drugs prescribed for the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued.

Specific Drugs prescribed	**DISCHARGE: HMR Report Group n = 79**			**DISCHARGE: non-HMR Report Group n = 202**		
	Number pre-scriptions	**% total pre-scriptions**	**% Patients**	**Number pre-scriptions**	**% total pre-scriptions**	**% Patients**
Meloxicam	1	0.1	1.3	0	0	0
Pholcodine	1	0.1	1.3	0	0	0
Pioglitazone	1	0.1	1.3	0	0	0
Quinapril	1	0.1	1.3	0	0	0
Sertraline	1	0.1	1.3	0	0	0
Sibutramine	1	0.1	1.3	0	0	0
Tamoxifen	1	0.1	1.3	0	0	0
Thalidomide	1	0.1	1.3	0	0	0
Ticarcillin with clavulanic acid	1	0.1	1.3	0	0	0
Discharge drugs for HMR group n=132, non-HMR group n=184	**670**	**100.0%**	***6.4%**	**1575**	**100.0%**	***4.2%**

*Final averages for '% patients' took into account the total number of discharge drugs for each subgroup. Slight differences in % totals result from rounding errors.

7.6.2 IDENTIFICATION OF POTENTIALLY INAPPROPRIATE PRESCRIBING (PIP) FOR THE HMR REPORT GROUP

7.6.2.1. Re-application of Beers criteria

Table 7.2 shows the re-application of Beers criteria to the HMR Report group (n=79) to determine patient distribution, number of PIP instances and in particular, the nature of PIP drugs. Patients' drug regimen were analysed at discharge and at HMR. Two drugs accounted for a high proportion of the PIP instances identified by Beers criteria and these are tabled in decreasing order of prescribing frequency at HMR service in Table 7.2.

Clopidogrel was prescribed for 40 (50.6%) patients at discharge and prescribed for 31 (39.2%) patients at HMR. Clopidogrel accounted for 35.7% PIPs at discharge and 31.0% PIPs at HMR. At HMR, this was a reduction of 9 (11.4%) patients who were potentially inappropriately prescribed clopidogrel.

Aspirin was prescribed for 31 (39.2%) patients at discharge and 29 (36.7%) patients at HMR. Aspirin accounted for 27.7% PIPs at discharge and 29.0% PIPs at HMR. At HMR, this was a reduction of 2 (2.5%) patients who were potentially inappropriately prescribed aspirin.

Amiodarone was prescribed for 1 (1.3%) patient at discharge and prescribed for 5 (6.3%) patients at HMR. Amiodarone accounted for 0.9% PIPs at discharge and 5.0% PIPs at HMR. At HMR, this was an increase of 4 (5.1%) patients who were potentially inappropriately prescribed amiodarone.

Table 7.2 shows there were 28 different PIP drugs identified at discharge and 23 at HMR. Analysis showed 12 (5.2%) patients experienced a reduction of 10.7% PIPs between discharge and HMR. After two opportunities for regimen reconciliation, at discharge and GP consultation, Beers criteria still identified 100 PIP instances recorded on HMR reports. That is, an average of 1.3 PIP instances per patient.

7.6.2.2 Re-application of Basger Indicators

Table 7.3 shows application of Basger indicators to the HMR Report group (n=79) to determine patient distribution, number of PIP instances and in particular, the nature of drugs associated with PIP instances. Patients' data were analysed from the same documents analysed for the application of Beers criteria. When tabled in decreasing order of prescribing frequency at HMR service, there were four predominant PIP situations identified by Basger indicators.

The most frequent PIP situation at discharge and HMR service was identified by Indicator No. 48 which required no change in medications within 90 days of assessment at discharge and HMR service. Medication change affected 79 (100.0%) patients and accounted for 31.0% and 27.9% PIP instances at discharge and HMR, respectively.

The second most frequent PIP situation at HMR service was identified by Indicator No. 4 which required patients with ischaemic heart disease (IHD); a history of myocardial infarction (MI); non-haemorrhagic stroke or transient ischaemic attack (TIA) to be taking an antiplatelet agent unless taking an oral anticoagulant. The PIP omission of essential antiplatelet or oral anti-coagulant drugs was identified for 16 (20.3%) patients at discharge and 35 (44.3%) patients at HMR. Antiplatelet agents and oral anticoagulants routinely prescribed for other patients in the group included clopidogrel, aspirin (<325mg/day), phenindione and warfarin. The omissions accounted for 6.5% PIP instances at discharge and 12.4% PIP instances at HMR. At HMR, an increase of 19 (24.1%) patients in the specified diagnoses related group (DRG) were not prescribed antiplatelet or anti-coagulant drugs.

The third most frequent PIP situation at HMR service was identified by Indicator No. 2 which required patients with at high risk of a cardiovascular event to be taking a 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase inhibitor (statin). The PIP

omission of these statins for patients in this DRG was identified for 22 (27.8%) patients at discharge and 25 (31.6%) patients at HMR. Statins routinely prescribed for other patients in the group included atorvastatin, simvastatin and pravastatin. At HMR, a slight increase of 3 (3.8%) patients in the specified DRG were not prescribed a statin.

The fourth most frequent PIP situation at HMR was identified by Indicator No. 24 which required that patients with risk factors for impaired renal function were not taking a non-steroidal anti-inflammatory drug (NSAID). The PIP addition of NSAIDs for patients with these risk factors was identified for 10 (12.7%) and 24 (30.4%) patients at discharge and HMR, respectively. The NSAIDs prescribed for these patients included celecoxib, ibuprofen, indomethacin, and meloxicam. At HMR an increase of 14 (17.7%) patients with these risk factors were prescribed an NSAID.

The drug related situations listed in Table 7.3, illustrate the complexity of reporting the PIP of specific drugs within a therapeutic classification or drug-related situation named by Basger indicators. Analyses of PIP drug-related situations 'at HMR' service were conducted on lists of drugs and diseases in the HMR reports written by accredited pharmacists. Their comments and recommendations were not taken into account. However, the predominant PIP situations reported above show the inclusion or omission of acetylsalicylic acid/aspirin and clopidogrel as the active ingredients with the most frequent potential for inappropriate prescribing.

Table 7.3 shows there were 25 different PIP situations identified at discharge and 24 at HMR, and an increase of 11.0% PIP instances at HMR. After two opportunities for medication reconciliation at discharge and GP consultation, Basger indicators identified as many as 283 PIP instances in the 79 HMR reports assessed.

Table 7.2 Drugs identified as PIP by Beers criteria, for patients in the HMR Report group (n=79) at discharge and at HMR.[36]

Specific drugs or dose identified as PIP by Beers criteria	**DISCHARGE: patients n = 79**			**HMR: patients n = 79**		
	Number PIPs	**% total PIPs**	**% Patients**	**Number PIPs**	**% total PIPs**	**% Patients**
Clopidogrel	40	35.7	50.6	31	31.0	39.2
Aspirin	31	27.7	39.2	29	29.0.	36.7
Amiodarone	1	0.9	1.3	5	5.0	6.3
Digoxin exceeding >0.125 µg daily (except atrial arrhythmias)	3	2.7	3.8	3	3.0	3.8
Indomethacin	2	1.8	2.5	3	3.0	3.8
Mineral oil	0	0	0	3	3.0	3.8
Nifedipine (Short acting)	4	3.6	5.1	2	2.0	2.5
Sodium bicarbonate	2	1.8	2.5	2	2.0	2.5
Amitriptyline	1	0.9	1.3	2	2.0	2.5
Bupropion	1	0.9	1.3	2	2.0	2.5
Phentermine	0	0	0	2	2.0	2.5
Diclofenac	0	0	0	2	2.0	2.5
Ketoprofen	0	0	0	2	2.0	2.5
Sodium citrate/ tartrate	1	0.9	1.3	2	2.0	2.5
Sodium picosulphate	0	0	0	2	2.0	2.5
Valproate	2	1.8	2.5	1	1.0	1.3
Diazepam	1	0.9	1.3	1	1.0	1.3
Doxepin	1	0.9	1.3	1	1.0	1.3
Imipramine	1	0.9	1.3	1	1.0	1.3
Meloxicam	1	0.9	1.3	1	1.0	1.3
Sertraline	1	0.9	1.3	1	1.0	1.3
Paracetamol	0	0	0	1	1.0	1.3

Table 7.2 Drugs identified as PIP by Beers criteria, for patients in the HMR Report group (n=79) at discharge and at HMR, continued.[36]

Specific drugs or dose identified as PIP by Beers criteria	DISCHARGE: n = 79 patients			HMR: n = 79 patients		
	Number PIPs	% total PIPs	% patients	Number PIPs	% total PIPs	% Patients
Theophylline	0	0	0	1	1.0	1.3
Docusate sodium combinations	5	4.5	6.3	0	0	0
Ipratropium	2	1.8	2.5	0	0	0
Magnesium aspartate	2	1.8	2.5	0	0	0
Metoprolol	2	1.8	2.5	0	0	0
Carbamazepine	1	0.9	1.3	0	0	0
Ferrous sulphate >325 mg/day	1	0.9	1.3	0	0	0
Fluoxetine	1	0.9	1.3	0	0	0
Ibuprofen	1	0.9	1.3	0	0	0
Oestrogens	1	0.9	1.3	0	0	0
Perindopril	1	0.9	1.3	0	0	0
Sibutramine	1	0.9	1.3	0	0	0
Temazepam >15mg dose	1	0.9	1.3	0	0	0
PIP drugs at discharge n=28 and at HMR n=23	**112**	**100.0%**	***5.3%**	**100**	**100.0%**	***5.5%**

PIPs = potentially inappropriate prescriptions. *Final averages for '% patients' took into account the total number of PIP drugs identified at discharge and HMR. Slight differences in % totals result from rounding errors.

Table 7.3$_a$ Drug related situations identified as PIP by Basger indicators, for patients in the HMR Report group (n=79) at discharge and at HMR.[35]

Drug related situation identified as appropriate prescribing by Basger Indicators. **(All drug examples have been prescribed for ≥1 patient)**	**DISCHARGE: n = 79 patients Indicators not satisfied**			**HMR: n = 79 patients Indicators not satisfied**		
	Number PIP instances	**% total PIP instances**	**% patients**	**Number PIP instances**	**% total PIP instances**	**% patients**
No. 48 Patient has not had significant change in medications in the previous 90 days.	79	31.0	100.0	79	27.9	100.0
No. 4 Patient with IHD or a history of MI is taking an antiplatelet agent unless taking an oral anticoagulant (c).	16	6.3	20.3	35	12.4	44.3
No. 2 Patient at high risk of a cardiovascular event (b) is taking an HMG-CoA reductase inhibitor (statin)	22	8.6	28.9	25	8.8	32.1
No 24 Patient with risk factors for impaired renal function (l) is not taking an NSAID	10	3.9	0	24	8.5	30.4
No. 36 Patient using a salbutamol (albuterol) or terbutaline inhaler more than three times per week for reversible airways disease has been prescribed an inhaled corticosteroid.	4	1.6	5.1	15	5.3	19.0
No. 33 Patient taking a PPI is not taking a medication that may cause dyspepsia (r) [e.g. betamethasone, fluticasone, perindopril, ramipril, diltiazem, ferrous sulphate >325 mg daily, alendronic acid, amlopidine, budesonide, verapamil]	25	9.8	31.6	13	27.9	16.5
No. 3 Patient with IHD or a history of MI is taking a β-blocker (β-adrenoceptor antagonist)	16	6.3	20.3	12	12.4	15.2

Table 7.3$_b$ Drug related situations identified as PIP by Basger indicators, for patients in the HMR Report group (n=79) at discharge and at HMR, continued.[35]

Drug related situation identified as appropriate prescribing by Basger Indicators. **(All drug examples have been prescribed for ≥1 patient)**	**DISCHARGE: n = 79 patients Indicators not satisfied**			**HMR: n = 79 patients Indicators not satisfied**		
	Number PIP instances	**% total PIP instances**	**% patients**	**Number PIP instances**	**% total PIP instances**	**% patients**
No 16 Patient with diabetes at high risk of a cardiovascular event is taking an antiplatelet agent unless taking an anticoagulant (c)	10	3.9	12.7	10	3.5	12.7
No. 13 Patient with cardiovascular disease is *not* taking an NSAID [e.g. aspirin, celecoxib, ibuprofen, indomethacin, meloxicam]	6	2.4	7.6	8	2.8	10.1
No 22 Patient taking analgesics(s) does not have pain (j) that interferes with daily activities	30	11.8	38.0	7	2.5	8.9
No. 23 Patient taking an opioid (k) is taking prophylactic treatment for constipation.	1	0.4	1.3	7	2.5	8.9
No. 6 Patient with heart failure is taking an ACE inhibitor or ARB.	7	2.7	8.9	5	1.8	6.3
No. 9 Patient with AF is taking an oral anticoagulant.	4	1.6	5.1	5	1.8	6.3
No 37 Patient with asthma is not taking a medication that may worsen asthma (s)	2	0.8	2.5	5	1.8	6.3
No. 42 Patient with osteoporosis who is not receiving at least 600IU vitamin D daily from dietary sources is receiving supplementation with vitamin D (u)	2	0.8	2.5	5	1.8	6.3
No. 5 Patient with heart failure is taking a β-blocker	8	3.1	10.1	4	1.4	5.1

Table 7.3$_c$ Drug related situations identified as PIP by Basger indicators, for patients in the HMR Report group (n=79) at discharge and at HMR, continued.[35]

Drug related situation identified as appropriate prescribing by Basger Indicators. **(All drug examples have been prescribed for ≥1 patient)**	**DISCHARGE: n = 79 patients Indicators not satisfied**			**HMR: n = 79 patients Indicators not satisfied**		
	Number PIP instances	**% total PIP instances**	**% patients**	**Number PIP instances**	**% total PIP instances**	**% patients**
No. 17 Patient with diabetes is *not* taking a medication that may increase or decrease blood glucose concentration [e.g. prednisolone]	0	0	0	4	1.4	1.4
No. 7 Patient with heart failure is *not* taking medications that may exacerbate heart failure (d) [e.g. sotalol, carbamazepine, quinine, nifedipine, verapamil, rosiglitazone]	2	0.8	2.5	3	1.1	1.1
No 11 Patient with a history of non-haemorrhagic stroke or TIA is taking an antiplatelet agent unless taking an anticoagulant (c)	1	0.4	1.3	3	1.1	1.1
No. 32 Patient is *not* taking more than one medication with anticholinergic activity (q) [e.g. amitriptyline + prochlorperazine; imipramine + tiotropium bromide + doxepin; imipramine +tiotropium bromide]	1	0.4	1.3	3	1.1	1.1
No. 44 Patient with osteoporosis is receiving anti-osteoporotic medication (w)	1	0.4	1.3	3	1.1	1.1
No. 12 Patient with risk factors for myopathy (f) is not taking ≥40mg/day of simvastatin or atorvastatin.	0	0	0	2	0.7	0.7
No. 21 Patient with OA pain interfering with daily activities has been trialled on paracetamol (acetaminophen) 2-4g/day.	1	0.4	1.3	2	0.7	0.7

Table 7.3$_d$ Drug related situations identified as PIP by Basger indicators, for patients in the HMR Report group (n=79) at discharge and at HMR, continued.[35]

Drug related situation identified as appropriate prescribing by Basger Indicators. **(All drug examples have been prescribed for ≥1 patient)**	**DISCHARGE: n = 79 patients Indicators not satisfied**			**HMR: n = 79 patients Indicators not satisfied**		
	Number PIP instances	**% total PIP instances**	**% patients**	**Number PIP instances**	**% total PIP instances**	**% patients**
No. 25 Patient is *not* concurrently taking an ACE inhibitor or ARB, diuretic and NSAID (excluding low-dose aspirin (acetylsalicylic acid)) [e.g. perindopril, ramipril, telmisartan, irbesartan with frusemide or spironolactone and indomethacin]	3	1.2	3.8	2	0.7	2.5
No 29 Patient taking an SSRI is not concurrently taking medications known to increase the risk of gastrointestinal bleeding (o) [e.g. fluoxetine + warfarin]	2	0.8	2.5	1	0.4	1.3
No. 43 Patient with osteoporosis who is not receiving at least 1200mg calcium daily from dietary sources is receiving calcium supplementation.	1	0.4	1.3	1	0.4	1.3
No 30 Patient taking an SSRI is not currently taking other medications that may contribute to serotonin toxicity (p).	1	0.4	1.3	0	0	0
PIP situations at discharge n=25 and HMR n= 24	**255**	**100.0%**	***12.9%**	**283**	**100.0%**	***14.9%**

PIPs = potentially inappropriate prescriptions. *Final averages for '% patients' took into account the total number of PIP situations at discharge and HMR. Slight differences in % totals result from rounding errors. (a)-(w) = see appendix 7.2
ACE = angiotensin converting enzyme. ARB = angiotensin receptor blocker. AF = atrial fibrillation. CV = cardiovascular. IHD = ischaemic heart disease. MI = myocardial infarction. NSAIDs = non-steroidal anti-inflammatory drugs. PPI = proton pump inhibitor. SSRI = selective serotonin reuptake inhibitor. TIA = transient ischaemic attack.

7.6.3 IDENTIFICATION OF POTENTIALLY INAPPROPRIATE PRESCRIBING (PIP) FOR CofCP COHORT

Tables 7.4, 7.5, and 7.6 show the results of application of Beers criteria, for the identification of PIP, to the regimens of the full study cohort (n=281) at discharge. These tables show the distribution of patients, PIP drugs, and the nature of those drugs by their division into the HMR Report group (n=79) and non-HMR Report group (n=202).

The identified PIP drugs are tabulated to show drugs common to both groups, and drugs prescribed for the HMR or non-HMR Report groups only. For comparison, the tables show the number and nature of the PIP drugs in decreasing prescription frequency for the non-HMR Report group. These three tables show the relativity of results to the groups' total PIP data and to the total number of drugs prescribed at discharge. Explanations of the analyses are shown as footnotes to the tables.

7.6.3.1 Potentially Inappropriate Prescriptions (PIPs) for Drugs Common to Subgroups

In Table 7.4, analysis of the cohort's discharge regimen identified the predominance of three PIP drugs common to both the HMR and non-HMR Report groups.

Aspirin was the most frequently prescribed PIP drug common to both groups and was prescribed for 31 (39.2%) HMR Report group patients and 128 (63.4%) non-HMR Report group patients. Aspirin prescriptions accounted for 27.2% and 27.8% of total PIPs, respectively. The ratio of aspirin prescriptions to total discharge prescriptions was 4.6% HMR and 8.1% non-HMR Report group discharge prescriptions.

Clopidogrel followed aspirin in frequency as a common PIP drug and was prescribed for 40 (50.6%) HMR and 95 (47.0%) non-HMR Report group patients. Clopidogrel accounted for 35.1% and 20.6% of total PIPs, respectively. The ratio of

clopidogrel prescriptions to total discharge prescriptions was 6.0% discharge prescriptions for both subgroups.

Metoprolol as a common PIP drug, was prescribed for 2 (2.5%) HMR and 65 (32.2%) non-HMR Report group patients. Metoprolol prescriptions accounted for 1.8% and 14.1% of total PIPs, respectively. The ratio of metoprolol prescriptions to total discharge prescriptions was 0.3% HMR and 4.1% non-HMR Report group discharge prescriptions. This result showed a markedly higher prescribing rate for the non-HMR Report group.

In Table 7.4 the HMR Report group showed a total of 108 PIPs for drugs common to both subgroups and the non-HMR Report group showed 411 PIPs for drugs common to both subgroups at discharge. There were 24 different PIP drugs identified as common to both groups. On average, 4.7% HMR and 4.8% non-HMR Report patients were exposed to these common PIP drugs.

Of the PIPs for drugs common to both subgroups, and although imprecise, the HMR Report group averaged between 1.0 and 2.0 PIPs per patient and the non-HMR Report group averaged 2.0 PIPs per patient. Prescriptions for PIP drugs common the both subgroups accounted for 94.7% and 89.2% total PIPs, respectively. The ratio, of PIPs for drugs common to both groups to total discharge prescriptions for each group, was 16.1% HMR Report group and 26.1% non-HMR Report group.

7.6.3.2 Potentially Inappropriate Prescriptions (PIPs) for Drugs Unique to the HMR Report Group

In Table 7.5 analysis of the cohort's discharge regimen identified very few PIP drugs unique to the HMR Report group only. Venlafaxine was prescribed for 2 (2.5%) HMR Report group patients and was 1.8% of total PIPs with a ratio of 0.3% PIPs to total

discharge prescriptions. The remainder of the drugs were prescribed for 1 (1.3%) HMR Report Group patient and each drug accounted for just 0.9% total PIPs. The ratio, of each of these PIPs to total discharge prescriptions, was 0.1%.

Table 7.5 shows a total of 6 prescriptions and 5 different PIP drugs unique to the HMR Report group. On average, 0.3% HMR Report group patients were exposed to these drugs and prescriptions accounted for 5.3% total PIPs. The ratio, of PIPs for drugs unique to the HMR Report group to their total discharge prescriptions, was 0.9%.

7.6.3.3 Potentially Inappropriate Prescriptions (PIPs) for Drugs Unique to the non-HMR Report Group

In Table 7.6 analysis of the cohort's discharge regimen identified one PIP drug which was predominant and unique to the non-HMR Report group. Tramadol was the most frequently identified PIP drug prescribed for the non-HMR Report group only, at discharge. Tramadol was prescribed for 12 (5.9%) non-HMR patients and accounted for 2.6% total PIPs. The ratio of tramadol prescriptions to total discharge prescriptions was 0.8%.

Table 7.6 shows a total of 50 prescriptions and 18 different PIP drugs unique to the non-HMR Report group. On average, 0.6% non-HMR Report group patients were exposed to these drugs and prescriptions accounted for 10.8% total PIPs. The ratio, of PIPs for drugs unique to the non-HMR Report group to the group's total discharge prescriptions, was 3.2%.

7.6.3.4 Potentially Inappropriate Prescriptions (PIPs) for the CofCP Cohort

The results in Tables 7.4, 5 and 6 for PIP drugs common to the subgroups and unique to each subgroup, give an overview of the potentially inappropriate prescribing for the CofCP

cohort. Application of Beers criteria to the discharge regimen of the full study cohort (n=281) revealed the predominance of aspirin and clopidogrel for both subgroups followed by metoprolol for the non-HMR Report group as the most frequent PIP drugs for the CofCP cohort. Taking into account the PIP drugs which were common and unique to the subgroups, there were 47 different PIP drugs identified on discharge for the cohort.

As shown in Figure 7.1, the HMR Report group ratio of 114 PIPs to 670 discharge prescriptions was 17.0%. For the non-HMR Report group, the ratio of 461 PIPs to 1575 discharge prescriptions was 29.3%. Total PIPs for the cohort averaged 2.0 PIPs per patient. For the CofCP cohort, the ratio of total 575 PIPs to total 2245 discharge prescriptions was 25.6%.

Table 7.4. Distribution of patients and PIPs for specific drugs identified by Beers criteria and common to both the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge.[36]

Specific drug or dose identified by Beers criteria as PIP	DISCHARGE: HMR Report Group n = 79 patients n= 670 discharge prescriptions				DISCHARGE: non-HMR Report Group n = 202 patients n = 1575 discharge prescriptions			
	Number PIPs	% total PIPs*	% Patients	% ratio PIPs to discharge prescriptions	Number PIPs	% total PIPs*	% Patients	% ratio PIPs to discharge prescriptions
Aspirin	31	27.2	39.2	4.6	128	27.8	63.4	8.1
Clopidogrel	40	35.1	50.6	6.0	95	20.6	47.0	6.0
Metoprolol	2	1.8	2.5	0.3	65	14.1	32.2	4.1
Perindopril	1	0.9	1.3	0.1	30	6.5	14.9	1.9
Magnesium aspartate	2	1.8	2.5	0.3	22	4.8	10.9	1.4
Docusate sodium	5	4.4	6.3	0.9	17	3.7	8.4	1.1
Amiodarone	1	0.9	1.3	0.2	17	3.7	8.4	1.1
Digoxin >0.125mg daily except in atrial arrhythmias	3	2.6	3.8	0.4	7	1.5	3.5	0.4
Amitriptyline	1	0.9	1.3	0.1	4	0.9	2.0	0.3
Ipratropium bromide	2	1.8	2.5	0.3	5	1.1	2.5	0.3
Ferrous sulphate>325mg/d	1	0.9	1.3	0.1	3	0.7	1.5	0.2
Fluoxetine	1	0.9	1.3	0.1	3	0.7	1.5	0.2
Nifedepine (short acting)	4	3.5	5.1	0.6	3	0.7	1.5	0.2
Indomethacin	2	1.8	2.5	0.3	2	0.4	1.0	0.1
Sodium bicarbonate	2	1.8	2.5	0.3	1	0.2	0.5	0.1
Valproate	2	1.8	2.5	0.3	1	0.2	0.5	0.1
Bupropion	1	0.9	1.3	0.1	1	0.2	0.5	0.1
Carbamazepine	1	0.9	1.3	0.1	1	0.2	0.5	0.1

Table 7.4. Distribution of patients and PIPs for specific drugs identified by Beers criteria and common to both the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued.[36]

Specific drug or dose identified by Beers criteria as PIP	DISCHARGE: HMR Report Group n = 79 patients n= 670 discharge prescriptions				DISCHARGE: non-HMR Report Group n = 202 patients n = 1575 discharge prescriptions			
	Number PIPs	% total PIPs*	% Patients	% ratio PIPs to discharge prescriptions	Number PIPs	% total PIPs*	% Patients	% ratio PIPs to discharge prescriptions
Diazepam	1	0.9	1.3	0.1	1	0.2	0.5	0.1
Ibuprofen	1	0.9	1.3	0.1	1	0.2	0.5	0.1
Imipramine	1	0.9	1.3	0.1	1	0.2	0.5	0.1
Oestrogens	1	0.9	1.3	0.1	1	0.2	0.5	0.1
Sodium citrate/tartrate	1	0.9	1.3	0.1	1	0.2	0.5	0.1
Temazepam >15mg dose	1	0.9	1.3	0.1	1	0.2	0.5	0.1
PIP drugs common to HMR and non-HMR group n=24	**108**	**94.7%**	****4.7%**	**16.1%**	**411**	**89.2%**	****4.8%**	**26.1%**

*% PIPs are relative to total PIPs for the subgroup at discharge i.e. HMR group n=114 or non-HMR group n=461. **Final averages for '% patients' took into account the total number of PIP drugs identified for each subgroup i.e. HMR group n=29 or non-HMR group n=42. Slight differences in % totals result from rounding errors.

Table 7.5. Distribution of patients and PIPs for specific drugs identified by Beers criteria and unique to the HMR Report group (n=79), on discharge.[36]

Specific drug or dose identified by Beers criteria as PIP	**DISCHARGE: HMR Report Group n = 79 patients n = 670 discharge prescriptions**			
	Number PIPs	**% total PIPs***	**% Patients**	**% ratio PIPs to discharge prescriptions**
Venlafaxine	2	1.8	2.5	0.3
Doxepin	1	0.9	1.3	0.2
Meloxicam	1	0.9	1.3	0.2
Sertraline	1	0.9	1.3	0.2
Sibutramine	1	0.9	1.3	0.2
PIP drugs for HMR group only n=5	**6**	**5.3%**	****0.3%**	**0.9%**

*% PIPs are relative to total PIPs for the subgroup at discharge i.e. HMR Report group n=114. **Final averages for '% patients' took into account the total number of PIP drugs for the subgroup i.e. HMR Report group n=29. Slight differences in % totals result from rounding errors.

Table 7.6 Distribution of patients and PIPs for specific drugs identified by Beers criteria and unique to the non-HMR Report group (n=202), on discharge.[36]

Specific drug or dose identified by Beers criteria as PIP	**DISCHARGE: non-HMR Report Group n = 202 patients n = 1575 discharge prescriptions**			
	Number PIPs	**% total PIPs***	**% Patients**	**% ratio PIPs to discharge prescriptions**
Tramadol	12	2.6	5.9	0.8
Diltiazem	6	1.3	3.0	0.4
Celecoxib	5	1.1	2.5	0.3
Citalopram	3	0.6	1.5	0.2
Diclofenac	3	0.6	1.5	0.2
Ezetimbe	3	0.6	1.5	0.2
Prazosin	3	0.6	1.5	0.2
Amlodipine	2	0.4	1.0	0.1
Dothiepin	2	0.4	1.0	0.1
Felodipine	2	0.4	1.0	0.1
Metoclopramide	2	0.4	1.0	0.1
Hyoscine N-butyl bromide	1	0.2	0.5	0.1
Mirtazapine	1	0.2	0.5	0.1

Table 7.6 Distribution of patients and PIPs for specific drugs identified by Beers criteria and unique to the non-HMR Report group (n=202), on discharge, continued[36]

Specific drug or dose identified by Beers criteria as PIP	**DISCHARGE: non-HMR Report Group n = 202 patients n = 1577 discharge prescriptions**			
	Number PIPs	**% total PIPs***	**% Patients**	**% ratio PIPs to discharge prescriptions**
Oxazepam >60mg	1	0.2	0.5	0.1
Paroxetine	1	0.2	0.5	0.1
Prochlorperazine	1	0.2	0.5	0.1
Sulindac	1	0.2	0.5	0.1
Theophylline SR	1	0.2	0.5	0.1
PIP drugs for non-HMR group only n=18	**50**	**10.8%**	****0.6%**	**3.2%**

*% PIPs are relative to total PIPs for the subgroup at discharge i.e. non-HMR Report group n=461. **Final averages for '% patients' took into account the total number of PIP drugs for the subgroup i.e. non-HMR group n=42. Slight differences in % totals result from rounding errors.

7.7 DISCUSSION

The aim of this study was achieved by determining the nature and appropriateness of drug regimen prescribed for patients in the CofCP cohort (n=281) who were discharged from an acute care cardiology unit. The CofC cohort was comprised of the HMR Report group (n=79) and non-HMR Report group (n=202). The concept underlying the aim of research in this chapter, centred around revealing any risks to patients wellbeing and any discontinuity in their care on and after hospital discharge.[3,59]

After assessment of the discharge regimen prescribed for the full CofCP cohort (n=281), this study found that aspirin and clopidogrel were the drugs of first choice for treatment of many patients in the cardiology unit at Westmead hospital. The HMR and non-HMR Report subgroups were both prescribed aspirin at 8.0%; clopidogrel at 6.0%; and atorvastatin at 5.0% total discharge prescriptions.

The subgroups showed a highly comparable, gradual reduction from the most to least frequent prescription of the same drugs. These results suggest the majority non-HMR Report group's drug regimens follow the same general patterns of prescribing established for the minority HMR Report group (Ellitt et al. 2010) and reported in Chapter 3.[8,215] That research showed the larger proportion (53.4%) of drugs for the subgroup were prescribed for chronic co-morbidities, and markedly increased the cardiovascular patients' exposure to polypharmacy and their potential for drug related problems.[4,41]

During research on drug-drug interactions (DDIs) Buajordet et al (2001) specifically named antithrombotic drugs such as aspirin, warfarin, heparins and drugs for treating coronary heart disease and heart failure, as problematic. Problematic drugs also included e.g. diuretics, nitrates, ACE inhibitors and calcium channel blockers, which were reported as responsible for 50.4% of identified drug related, fatal adverse events.[41] A clear correlation between multiple comorbidity and polypharmacy was apparent and Buajordet et al. suggested fatalities resulted from inappropriate drug prescribing, especially at hospital discharge.[41-42]

In the literature, polypharmacy is claimed to exacerbate the high risk of adverse reaction to cardiovascular drugs and is reported as the prescribing of ≥5 drugs which increases the number of potential drug interaction combinations per patient.[40,44-45] Hence in this study, the discharge prescribing of 8.0 prescriptions per patient evidenced the level of polypharmacy and risk experienced by the full cohort of cardiovascular patients.[43,60-61]

This level of prescribing in a similar cardiovascular cohort was evidenced by Straubhaar et al.[44] Analysis of drugs prescribed on discharge and common to the subgroups showed the prescribing representativeness of the minority subgroup in

discharge prescription frequency and drug nature. In addition to the minimal number of unique drugs identified, 94.3% HMR Report group's discharge prescriptions were for identical drugs prescribed for the non-HMR Report group at discharge.

In this study, a comprehensive assessment of drug regimen for the HMR Report subgroup by re-application of Beers criteria identified unacceptable levels of PIP.[26,33,36] These were identified on the group's discharge from hospital and again, after consultation with their GP, at an arranged HMR service.[26,33,45]

Analysis of data 'at discharge' was conducted on lists of drugs or diseases in discharge summaries and 'at HMR' service on lists of drugs or diseases in HMR reports written by accredited pharmacists. The pharmacists' comments and recommendations in the report, were not taken into account. Beers criteria revealed the inclusion of clopidogrel and aspirin in the subgroup's drug regimen was by far the most frequent PIP drugs identified by international prescribing criteria.[26,48,46]

It was noted that re-application of Beers criteria, with emphasis on analysis of the nature of identified PIP drugs, revealed prescription of sibutramine which was withdrawn from the Australian market in October 2010.[227] Also in 2010, sibutramine was no longer available in the USA and was suspended by the European Medicines Agency. [62-64]

When prescribed for a patient in the HMR Report group at hospital discharge, sibutramine as an appetite suppressant for weight loss,[64] was grouped within 'anorexic agents' in Beers criteria No 27 in Chapter 5. It was only apparent that this drug had been prescribed at discharge and discontinued at HMR service when the nature (active ingredients) of specific drugs within therapeutic classifications were targeted in this chapter.

Basger indicators were re-applied 'at discharge' and 'at HMR' service to lists of drugs or diseases in discharge summaries or HMR reports written by accredited pharmacists, respectively. The pharmacists' comments and recommendations in the report, were not taken into account.

Re-application of Basger indicators, developed for the Australian healthcare system, re-identified recent changes in medicines as the most frequently encountered PIP. This outcome was consistent with research by Straubhaar et al. (2006). These researchers found 739 (63.1%) potential drug-drug interactions (DDIs) resulted from medication change in a Swiss cohort of cardiovascular patients.[44] These potential DDIs were 190 (16.2%) total DDIs at discharge.

In this chapter, the re-application of Basger indicators showed medication change was only marginally more frequent than the omission of antiplatelet or oral anti-coagulant drugs. These were reported as essential to the treatment of cardiovascular disease in Australia and, in the study cohort, were identified as low dose aspirin and clopidogrel.[33,65-66]

The re-application of Basger indicators to determine the nature of identified PIP did not reveal the prescription of sibutramine which was detected by re-application of Beers criteria in this chapter. Although sibutramine was listed as a drug to avoid in Basger Indicator No. 30, sibutramine was not identified as being PIP at discharge. Indicator No 30 required that patients taking a selective serotonin reuptake inhibitor (SSRI) were *not* currently taking other medications that may contribute to serotonin toxicity. Sibutramine was included in the list of other medications (Appendix 6.1).[33] On checking the regimen of the patient prescribed sibutramine it was found the patient was not prescribed an SSRI and attracted no further assessment by this indicator.

In this study it was found, that regardless of whether aspirin and clopidogrel were potentially inappropriately included or omitted, analyses clearly indicated the need for patient focussed vigilance in considering their prescription.[41,44] That is, at both hospital discharge and GP consultation. After discharge, application of Beers criteria to HMR reports revealed a 10.7% decrease from 112 PIP instances and Basger showed a 15.5% increase from 245 PIP instances, after GP consultation. Notably within those differences, aspirin and clopidogrel still dominated the high level of PIP drugs requiring, at least, the opportunity for identification of potential risk by pharmacists during medication review in the community.[16,67]

After re-application of Beers criteria and Basger indicators to the subgroup, the application of Beers criteria to the CofCP cohort (n=281) identified the PIP drugs that were common and unique to the HMR and non-HMR Report subgroups.[31-32,68] Analysis of drugs prescribed on discharge and PIP drugs common to both subgroups showed the marked dominance of prescriptions for aspirin 159 (56.6%) patients and clopidogrel 137 (48.8%) patients. These drugs were shown to expose the full cohort to the potential risk of inappropriate prescribing at discharge from an Australian teaching hospital when analysed by explicit international criteria.

In Switzerland, Straubhaar et al. (2006) conducted potential DDI research using a 'sensitive' computerized drug interaction program which like Beers criteria, was predominantly drug, not class specific.[44] Straubhaar et al. found aspirin and clopidogrel were prescribed for 193 (48.3%) of 400 cardiovascular patients discharged from a Swiss University hospital.

Although the combination of these two drugs was identified by Straubhaar et al. in the ten most prevalent potential DDI combinations, out of 739 identified DDIs, it was rated as of minor severity. In the Swiss cohort, the prescription of ACE inhibitors with

potassium sparing diuretics was found to be the most frequently prescribed combination with potential for inappropriate prescribing for 64 (16.0%) patients. [44]

Identification of PIP for the CofCP cohort, reinforced the representativeness of the smaller HMR Report group (n=79) to the larger non-HMR Report group (n=202) in PIP frequency and drug nature. This was evidenced by the minimal number of PIP prescriptions and drugs identified as unique to the subgroup on discharge. Representativeness of the HMR Report group was further evidenced by results showing 94.7% PIPs at discharge were for identical PIP drugs prescribed for the non-HMR Report group.

The full study cohort of 281 patients was written 670 prescriptions for drugs with the potential for inappropriate prescription which was 25.6% of their total discharge prescriptions. Aspirin and clopidogrel were the two most frequently, and predominantly prescribed discharge drugs and were identified as the most frequent PIP drugs identified for both subgroups. At discharge, the majority non-HMR Report group of patients were shown to be exposed to 60.3% more instances of PIP than the minority HMR Report group. Importantly and in addition to this increased risk, the non-HMR Report group lacked the opportunity for medication reconciliation at HMR.[16,24,39,69]

7.8 STUDY STRENGTHS AND LIMITATIONS

Many of the specific drug related findings of this study, for a recently discharged Australian cohort of cardiovascular patients, cannot be generalised to elderly subjects in different DRGs or countries. These findings on the prescribing appropriateness of specific drugs were influenced by the availability of drugs and prescribing practices in Australia and were, in part, assessed by international criteria. In this research, the

problem was addressed by the parallel application of prescribing criteria developed for the Australian healthcare system.

However, the general findings applicable to the accuracy and completeness of hospital discharge protocols and the need for integrated, interdisciplinary transfer of patients from hospital to community care, apply to all healthcare systems. It was not possible to check the accuracy and completeness of all documentation in medical records, discharge summaries and HMR reports used as data sources. Hence, these data were accepted at face value as a reflection of the documentation in the current Australian healthcare environment.

7.9 CONCLUSION

The study in this chapter showed how cardiovascular patients were exposed to the risks associated with PIP and, in detail, the nature of specific drugs prescribed for them at discharge by the hospital medical team. It was found the outcomes of PIP investigation was markedly influenced by the design of the tool chosen for its identification. However both Beers criteria and Basger indicators revealed unacceptable levels of PIP at both discharge and at HMR service. Further, both methods identified clopidogrel and aspirin, either prescribed or omitted, as potentially inappropriate prescribing.

The first objective of this chapter study was to determine the nature and distribution of drugs prescribed at discharge from hospital, for the full CofCP cohort. The extent of polypharmacy (≥8.0 drugs), the number of prescriptions, and specific nature and pattern of discharge prescribing was shown to be a clinical characteristic replicated in the subgroups. The prescription of clopidogrel and aspirin was shown to dominate the cohort's discharge regimens.

It was found that 94.3% of the drugs prescribed for the HMR Report group were also prescribed for the non-HMR Report group at discharge. The prescription of drugs unique to the minority subgroup only, was negligible. Hence, the HMR Report group was shown as representative of the cohort for discharge prescribing. The level of polypharmacy compromised the ongoing wellbeing of the 281 patients at discharge.

The second objective of this study was to identify the extent and, in particular, the active ingredient as the nature of any PIP for the HMR Report group on and after discharge. The re-application of Beers criteria and Basger indicators re-identified the subgroups' high number of PIP instances at both discharge and at HMR in terms of the specific drugs prescribed.

It was found the clear potential for inappropriate prescribing of clopidogrel and aspirin undermined the safe management of the HMR Report group's drug regimens, even after GP consultation in the community. It was opportune that this subgroup had the benefit of post discharge HMR service for their potential drug-related problems to be managed and reported to the patients' GPs.

The third objective was to identify any PIP on discharge from the hospital for the CofCP cohort. It was shown that 25.6% of the cohorts' discharge prescriptions were for drugs identified by Beers criteria as being potentially inappropriately prescribed. It was also shown that the safe management of the full cohorts' drug regimens was undermined by the identified PIP of clopidogrel and aspirin.

To satisfy the fourth objective of the study, the representativeness of PIP for the minority HMR Report group to the majority non-HMR Report group was also shown. It was evident in the extent of polypharmacy, and the nature and pattern of prescribing of PIP drugs at discharge. The evidenced representativeness of the HMR Report group at discharge reinforced a proposal that all patients in the cohort would also experience

the subgroup's drug-related problems as barriers to their continuity of care post discharge, in the community.

Data analyses in this chapter has evidenced the levels of potentially inappropriate prescribing in a quaternary care, cardiology unit within the Australian healthcare system. The levels were identified by both international and Australian criteria in both tertiary and primary care. There is concern for the health and safety of the patients involved and for the lack of opportunity for risk reduction, especially post discharge.

This study has evidenced polypharmacy and potential prescribing problems which is preferable to an anecdotal awareness of them. The ready acceptance of primary care services for relevant and constructive medication review after hospital discharge would greatly enhance the safety and continuity of integrated care for *all* discharged patients.

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CHAPTER 7.0

Appendix 7.1

Analysis of data in Table 7.1

Distribution of drugs prescribed for the HMR Report group and non-HMR Report group, on discharge:

Table A Discharge drugs common to both subgroups
Table B Discharge drugs unique to the HMR Report group (n=79)
Table C Discharge drugs unique to the non-HMR Report group (n=202)

Table A$_a$ Distribution of specific drugs common to both the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge.

Specific discharge drugs common to both groups	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number prescriptions	% total prescriptions*	% Patients	Number prescriptions	% total prescriptions*	% Patients
Aspirin	54	8.1	68.4	128	8.1	63.4
Clopidogrel	40	6.1	50.6	95	6.0	47.0
Atorvastatin	30	4.5	38.0	85	5.4	42.1
Glyceryl trinitrate[a]	28	4.2	35.4	76	4.8	37.6
Metoprolol	24	3.6	30.4	65	4.1	32.2
Frusemide	32	4.8	40.5	53	3.4	26.2
Warfarin	13	1.9	16.5	40	2.5	19.8
Perindopril arginine[b]	16	2.4	20.3	38	2.4	18.8
Isosorbide mononitrate	13	1.9	16.5	35	2.2	17.3
Pantoprazole	19	2.8	24.1	35	2.2	17.3
Digoxin	19	2.8	24.1	34	2.2	16.8
Simvastatin	26	3.9	32.9	30	1.9	14.9
Potassium Chloride	12	1.8	15.2	28	1.8	13.9
Carvedilol	10	1.5	12.7	26	1.6	12.9
Ramipril	7	1.0	8.9	25	1.6	12.4
Glyceryl trinitrate alternate form[c]	9	1.3	11.4	24	1.5	11.9
Omeprazole	10	1.5	12.7	24	1.5	11.9
Spironolactone	7	1.1	8.9	24	1.5	11.9
Magnesium aspartate	10	1.5	12.7	22	1.4	10.9

[a]Glyceryl trinitrate: sublingual tablets only, see alternate form[c] [b]see Perindopril with indapamide[d] [c]Glyceryl trinitrate: includes transiderm patch (8,23), spray (1,0) and ointment (0,1); see sublingual tablets[a]

Table A_b Distribution of specific drugs common to both the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued.

Specific discharge drugs common to both groups	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number prescriptions	% total prescriptions*	% Patients	Number prescriptions	% total prescriptions*	% Patients
Enoxaparin	4	0.6	5.1	21	1.3	10.4
Gliclazide	8	1.2	10.1	21	1.3	10.4
Diltiazem	10	1.5	12.7	18	1.1	8.9
Paracetamol	4	0.6	5.1	18	1.1	8.9
Salbutamol	5	0.7	6.3	18	1.1	8.9
Amiodarone	1	0.1	1.3	17	1.1	8.4
Nicorandil	6	0.9	7.6	17	1.1	8.4
Cephalexin	1	0.2	1.3	16	1.0	7.9
Sotolol	3	0.5	3.8	16	1.0	7.9
Irbesartan	12	1.8	15.2	15	1.0	7.4
Allopurinol	8	1.2	10.1	14	0.9	6.9
Esomeprazole	3	0.5	3.8	14	0.9	6.9
Pravastatin	5	0.8	6.3	12	0.8	5.9
Prednisolone	4	0.6	5.1	12	0.8	5.9
Docusate sodium	9	1.3	11.4	14	0.9	6.9
Oxycodone	1	0.2	1.3	11	0.7	5.4
Thyroxine	10	1.5	12.7	10	0.6	5.0
Tiotropium bromide	4	0.6	5.1	10	0.6	5.0

Table A_c Distribution of specific drugs common to both the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued.

Specific discharge drugs common to both groups	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number prescriptions	% total prescriptions*	% Patients	Number prescriptions	% total prescription*s	% Patients
Atenolol	6	0.9	7.6	9	0.6	4.5
Calcium carbonate	7	1.1	8.9	9	0.6	4.5
Metformin	11	1.6	13.9	9	0.6	4.5
Fluticasone with salmeterol	1	0.1	1.3	8	0.5	4.0
Folic acid	3	0.5	3.8	8	0.5	4.0
Thiamine	1	0.1	1.3	8	0.5	4.0
Ferrous sulphate	4	0.6	5.1	7	0.4	3.5
Fluticasone	6	0.9	7.6	7	0.4	3.5
Insulin	4	0.6	5.1	7	0.4	3.5
Rabeprazole	1	0.1	1.3	7	0.4	3.5
Amoxicillin with clavanulate	1	0.1	1.3	5	0.3	2.5
Bisoprolol	2	0.3	2.5	5	0.3	2.5
Budesonide	1	0.1	1.3	5	0.3	2.5
Candesartan	3	0.4	3.8	5	0.3	2.5
Celecoxib	2	0.3	2.5	5	0.3	2.5
Ezetimbe	2	0.3	2.5	5	0.3	2.5
Ipratropium bromide	2	0.3	2.5	5	0.3	2.5
Prazosin	3	0.4	3.8	5	0.3	2.5
Telmisartan	2	0.3	2.5	5	0.3	2.5

Table A_d Distribution of specific drugs common to both the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued.

Specific discharge drugs common to both groups	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number prescriptions	% total prescriptions*	% Patients	Number prescriptions	% total prescriptions*	% Patients
Amitriptyline	1	0.1	1.3	4	0.3	2.0
Amlopidine	2	0.3	2.5	4	0.3	2.0
Amoxicillin	1	0.1	1.3	4	0.3	2.0
Aluminium combinations	2	0.3	2.5	4	0.3	2.0
Colchicine	1	0.1	1.3	4	0.3	2.0
Enalapril	3	0.4	3.8	4	0.3	2.0
Lisinopril	1	0.1	1.3	4	0.3	2.0
Perhexaline	2	0.3	2.5	4	0.3	2.0
Ranitidine	4	0.6	5.1	4	0.3	2.0
Roxithromycin	2	0.3	2.5	4	0.3	2.0
Verapamil	5	0.7	6.3	4	0.3	2.0
Alendronate	3	0.4	3.8	3	0.2	1.5
Captopril	2	0.3	2.5	2	0.1	1.0
Ciprofloxacin	1	0.1	1.3	3	0.2	1.5
Darbepoetin alfa	1	0.1	1.3	3	0.2	1.5
Fluoxetine	1	0.1	1.3	3	0.2	1.5
Lactulose	1	0.1	1.3	3	0.2	1.5
Nifedipine	4	0.6	5.1	3	0.2	1.5
Perindopril with indapamide	8	1.2	10.1	3	0.2	1.5
Quinine	1	0.2	1.3	3	0.2	1.5

Table A_e Distribution of specific drugs common to both the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued.

Specific discharge drugs common to both groups	DISCHARGE: HMR Report Group n = 79			DISCHARGE: non-HMR Report Group n = 202		
	Number prescriptions	% total prescriptions*	% Patients	Number prescriptions	% total prescriptions*	% Patients
Amphoteracin	1	0.1	1.3	2	0.1	1.0
Cadexomer iodine	1	0.1	1.3	2	0.1	1.0
Fosinopril	2	0.3	2.5	2	0.1	1.0
Indapamide	1	0.1	1.3	2	0.1	1.0
Indomethacin	2	0.3	2.5	2	0.1	1.0
Risedronate	1	0.1	1.3	2	0.1	1.0
Sodium citrate/ tartrate	1	0.1	1.3	2	0.1	1.0
Calcitriol	1	0.1	1.3	1	0.1	0.5
Cetamacrogol cream	2	0.3	2.5	1	0.1	0.5
Carbamazepine	3	0.4	3.8	1	0.1	0.5
Clotrimazole	5	0.7	6.3	1	0.1	0.5
Diazepam	2	0.3	2.5	1	0.1	0.5
Famotidine	2	0.3	2.5	1	0.1	0.5
Flucloxacillin	2	0.3	2.5	1	0.1	0.5
Glimepiride	3	0.4	3.8	1	0.1	0.5
Glipizide	1	0.1	1.3	1	0.1	0.5
Hypromellose combinations	1	0.1	1.3	1	0.1	0.5
Ibruprofen	1	0.1	1.3	1	0.1	0.5
Imipramine	1	0.1	1.3	1	0.1	0.5
Latanoprost	1	0.1	1.3	1	0.1	0.5

Table A_f Distribution of specific drugs common to both the HMR Report group (n=79) and non-HMR Report group (n=202) on discharge, continued.

Specific discharge drugs common to both groups	**DISCHARGE: HMR Report Group n = 79**			**DISCHARGE: non-HMR Report Group n = 202**		
	Number prescriptions	**% total prescriptions***	**% Patients**	**Number prescriptions**	**% total prescriptions***	**% Patients**
Methotrexate	2	0.3	2.5	1	0.1	0.5
Oestrogens	1	0.1	1.3	1	0.1	0.5
Paraffin and wool fat	1	0.1	1.3	1	0.1	0.5
Phenytoin	1	0.1	1.3	1	0.1	0.5
Sodium bicarbonate	4	0.6	5.1	1	0.1	0.5
Rosiglitazone	3	0.4	3.8	1	0.1	0.5
Temazepam	2	0.3	2.5	1	0.1	0.5
Valproate	1	0.1	1.3	1	0.1	0.5
Discharge drugs common to HMR and non-HMR groups n=103	**632**	**94.3%**	****6.1%**	**1389**	**88.2%**	****3.7%**

*% prescriptions are relative to total subgroup prescriptions at discharge i.e. HMR Report group n=670 or non-HMR Report group n=1575 (Table 7.3h). **Final averages for '% patients' took into account the total number of subgroup discharge drugs i.e. HMR group n=132 or non-HMR group n=184. Slight differences in % totals result from rounding errors.

Table B Distribution of drugs prescribed for patients in the HMR Report group (n=79) only, on discharge.

Specific discharge drugs prescribed	**DISCHARGE: HMR Report Group n = 79**		
	Number prescriptions	**% total prescriptions***	**% Patients**
Erythropoietin	2	0.3	2.5
Insulin protamine	2	0.3	2.5
Lercandipine	2	0.3	2.5
Nofloxacin	2	0.3	2.5
Omega-3-triglycerides	2	0.3	2.5
Raloxifene	2	0.3	2.5
Sodium bicarbonate	2	0.3	2.5
Venlafaxine	2	0.3	2.5
Zolpidem	2	0.3	2.5
Bupropion	1	0.1	1.3
Cephalexin	1	0.1	1.3
Codeine linctus	1	0.1	1.3
Cyanocobalamin	1	0.1	1.3
Cyproterone	1	0.1	1.3
Doxepin	1	0.1	1.3
Eformoterol	1	0.1	1.3
Eprosartan	1	0.1	1.3
Framycetin	1	0.1	1.3
Hydroxyethyl rutosides	1	0.1	1.3
Medoxyprogesterone with oestrogen	1	0.1	1.3
Meloxicam	1	0.1	1.3
Pholcodine	1	0.1	1.3
Pioglitazone	1	0.1	1.3
Quinapril	1	0.1	1.3
Sertraline	1	0.1	1.3
Sibutramine	1	0.1	1.3
Tamoxifen	1	0.1	1.3
Thalidomide	1	0.1	1.3
Ticarcillin with clavulanic acid	1	0.1	1.3
Discharge drugs for HMR group only n=29	**38**	***5.7%**	****0.4%**

*% prescriptions are relative to total subgroup prescriptions at discharge i.e. HMR Report group n=670 (Table 7.3h). **Final averages for '% patients' took into account the total number of subgroup discharge drugs i.e. HMR Report group (n=132). Slight differences in % totals result from rounding errors.

Table C_a Distribution of drugs prescribed for patients in the non-HMR Report group (n=202) only; on discharge.

Specific discharge drugs prescribed	**DISCHARGE: non-HMR Report Group n = 202**		
	Number prescriptions	**% total prescriptions***	**% Patients**
Tramadol	12	0.8	5.9
Codeine with paracetemol	11	0.7	5.4
Metoclopramide	9	0.6	4.5
Chloramphenicol eye drops	7	0.4	3.5
Polyethylene glycol combinations	7	0.1	0.5
Trimethoprim	7	0.4	3.5
Senna glycosides	6	0.4	3.0
Acetazolamide	5	0.3	2.5
Ergocalciferol	5	0.3	2.5
Dextran eye drops	5	0.3	2.0
Gabapentin	5	0.3	2.5
Cinchocaine & Zinc oxide	4	0.2	1.5
Citalopram	4	0.3	2.0
Nicotine transdermal	4	0.3	2.0
Acetylcysteine	3	0.2	1.5
Cephazolin Infusion	3	0.2	1.5
Clindamycin	3	0.2	1.5
Diclofenac	3	0.2	1.5
Felodipine	3	0.2	1.5
Flecainide	3	0.2	1.5
Morphine	3	0.2	1.5
Sodium chloride	3	0.2	1.5
Trandolapril	3	0.2	1.5
Ascorbic acid	2	0.1	1.0
Baclofen	2	0.1	1.0
Dexamethasone eye drops	2	0.1	1.0
Domperidone	2	0.1	1.0
Dothiepin	2	0.1	1.0
Haloperidol	2	0.1	1.0
Metronidazole	2	0.1	1.0
Mirtazapine	2	0.1	1.0
Quinapril	2	0.1	1.0
Aluminium hydroxide	1	0.1	0.5
Testosterone	1	0.1	0.5

Table C_b Distribution of drugs prescribed for patients in the non-HMR Report group (n=202) only; on discharge, continued.

Specific discharge drugs prescribed	**DISCHARGE: non-HMR Report Group n = 202**		
	Number prescriptions	**% total prescriptions***	**% Patients**
Betamethasone	1	0.1	0.5
Biperiden	1	0.1	0.5
Calcium with vitamin D combinations	1	0.1	0.5
Carbimazole	1	0.1	0.5
Chlorhexadine gluconate	1	0.1	0.5
Clodronate	1	0.1	0.5
Cyclizine	1	0.1	0.5
Cyclosporine oral	1	0.1	0.5
Diphenoxylate atropine	1	0.1	0.5
Eplerenone	1	0.1	0.5
Fluconazole	1	0.1	0.5
Fluorouracil	1	0.1	0.5
Gentamycin	1	0.1	0.5
Hydrochlorothiazide	1	0.1	0.5
Hydroxychloroquine	1	0.1	0.5
Hyoscine N-butyl bromide	1	0.1	0.5
Ispaghula	2	0.1	0.5
Lansoprazole	1	0.1	0.5
Lignocaine Oral	1	0.1	0.5
Lithium carbonate	1	0.1	0.5
Loperamide	1	0.1	0.5
Mesalazine	1	0.1	0.5
Mometasone	1	0.1	0.5
Nystatin	1	0.1	0.5
Oxazepam	1	0.1	0.5
Paraffin emulsion	1	0.1	0.5
Paroxetine hydrochloride	1	0.1	0.5
Phenindione	1	0.1	0.5
Polyvinyl alcohol with providone	1	0.1	0.5
Prednisolone eye drops	1	0.1	0.5

Table C_c Distribution of drugs prescribed for patients in the non-HMR Report group (n=202) only; on discharge, continued.

Specific discharge drugs prescribed	**DISCHARGE: non-HMR Report Group n = 202)**		
	Number prescriptions	**% total prescriptions***	**% Patients**
Prochlorperazine	1	0.1	0.5
Propranolol	1	0.1	0.5
Rofecoxib	1	0.1	0.5
Silver sulfadiazine	1	0.1	0.5
Sodium picosulphate with magnesium	1	0.1	0.5
Sucralfate	1	0.1	0.5
Sulindac	1	0.1	0.5
Terbinafine	1	0.1	0.5
Theophylline SR	1	0.1	0.5
Timolol	1	0.1	0.5
Triamcinolone-Orabase	1	0.1	0.5
Tribolone	1	0.1	0.5
Urea	1	0.1	0.5
Vitamin compounds	1	0.1	0.5
Vitamins with minerals	1	0.1	0.5
Voriconazole	1	0.1	0.5
Xylometazoline	1	0.1	0.5
Discharge drugs for non-HMR group only n=81	**186**	**11.8%**	****0.5%**

*% prescriptions are relative to total subgroup discharge prescriptions i.e. non-HMR Report group n=1575 (Table 7.3h). **Final averages for '% patients' took into account the total number of subgroup discharge drugs i.e. non-HMR Report group drugs n=184. Slight differences in % totals result from rounding errors.

CHAPTER 8.0
How Integrated Care Enhances Continuity of Care

Synthesis of Concepts, Empirical Research and Data Analyses

Chapter 8.0

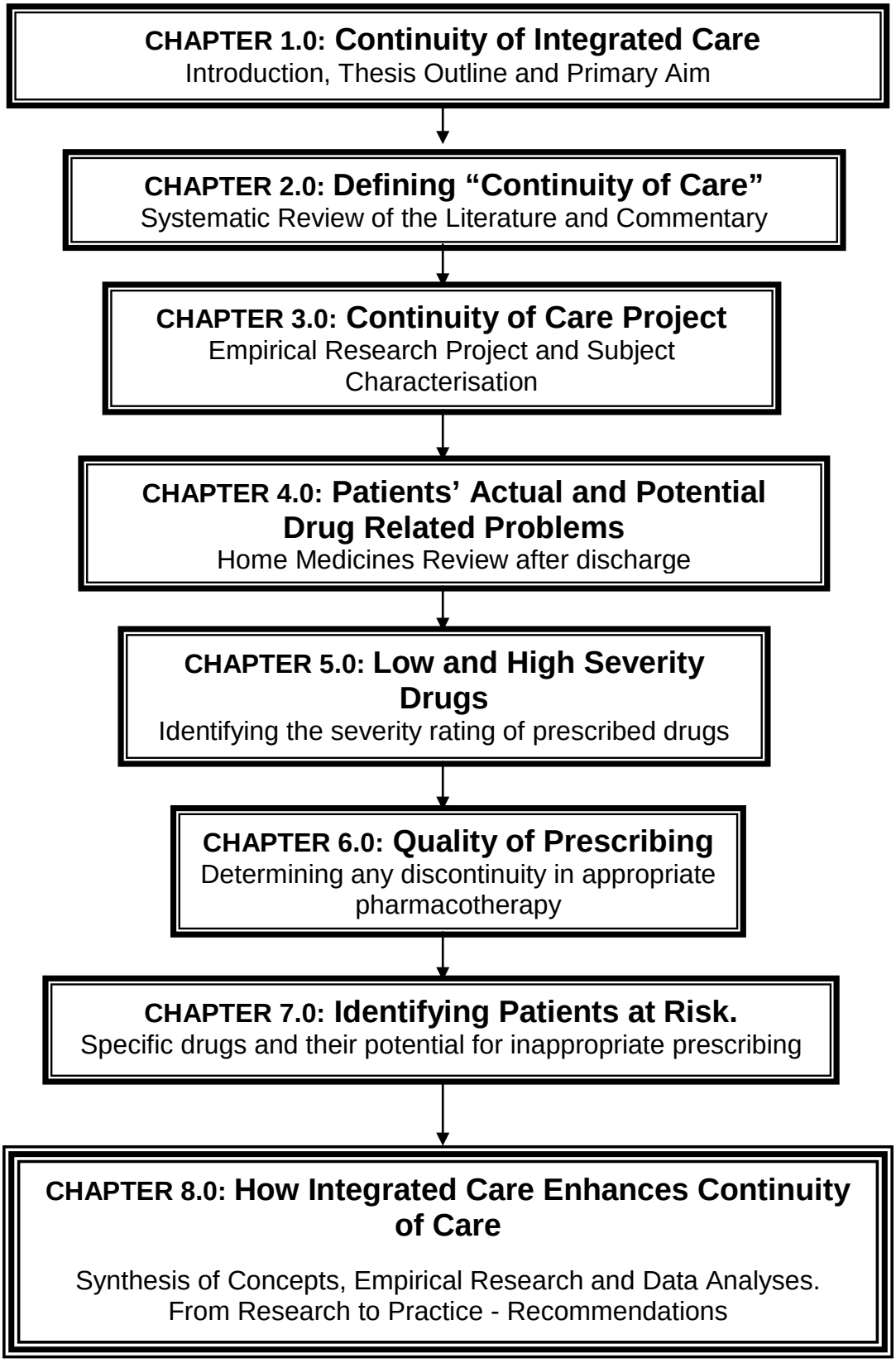

Figure 8.1 Chapter 8.0 Flowchart

CHAPTER 8.0 HOW INTEGRATED CARE ENHANCES CONTINUITY OF CARE (CofC)

Synthesis Of Concepts, Empirical Research and Data Analyses

8.1 CHAPTER SUMMARY

In the outline of this thesis in Chapter 1, overtly simple questions shaped the objectives to be addressed in achieving the primary research aim. In this chapter, those questions are answered and the objectives are addressed. The questions and objectives are qualified by showing how the concept of continuity of care (CofC) was explained and operationalised in the context of each chapter study (Figure 8.1). The analyses of primary data followed its collection by the in-hospital recruitment of 281 chronically ill cardiovascular patients into the Continuity of Care Project (CofCP).

The end point of data collection for this research was the provision to the researcher, of HMR reports written by accredited pharmacists for the patients' GPs. Across all chapters, analyses of data 'at discharge' was conducted on lists of drugs and diseases in discharge summaries. Analyses of data 'at HMR' service was conducted on lists of drugs and diseases in HMR reports written by accredited pharmacists. The pharmacists comments and recommendations were taken into account for identification of drug-related problems (DRPs) but were not taken into account for identification of potentially inappropriate prescribing (PIP).

All outcomes from group comparisons and analyses confirmed the representativeness of the minority HMR Report group (n=79) to the majority non-HMR Report group (n=202), hence for the CofCP cohort (n=281). These outcomes also evidenced the full cohort's need for integrated CofC on, and after discharge.

C O N C E P T S

8.2 CONTINUITY OF CARE

What is the meaning of 'Continuity of Care'?

8.2.1 RESEARCH OBJECTIVE 1) Developing an approach to defining the phrase 'Continuity of Care' so its use in any context, was meaningful and transparent.

8.2.1.1 Defining Continuity of Care (CofC)

Chapter 2 included a systematic literature review on CofC and a commentary on the meaning of CofC. In the literature review the lack of consensus in the literature on how to define CofC, was addressed by the development of a working definition. The working definition was used as a baseline for assessment of how the phrase was used in articles on pharmacists' roles in CofC research. The review of 21 articles found patients who were disadvantaged by cultural, personal or cognitive impairments were further disadvantaged by exclusion from CofC research. The opportunity to identify, assess and manage their drug related problems was overlooked.

Further to the review, the literature showed a lack of consensus across time and healthcare profession in defining the concept of CofC. Use of the working definition in the review showed flexibility and practicality for assessment of its four important components. The commentary on CofC and the use of the working definition as a template suggested it should be followed by a description of the concept in the context of its use. This format was followed throughout the thesis and it provided clarity and meaning of CofC in each chapter study. Explanation of the phrase in a particular context was found to be essential.

Application of the developed template for CofC to the (overall) research in this thesis :

CONTINUITY OF CARE is a perception of *quality* health care resulting from the *ongoing management of issues* which cause disruption to *optimal* patient care.

In the context of the research in this thesis:

Continuity of care was perceived by the researcher as *quality* health care which resulted in support and benefits to patients, especially on transfer between tertiary and primary care. Also, the *ongoing* nature of the care necessary for chronically ill cardiovascular patients required a sustained effort by interdisciplinary caregivers in *management* of patients' drug-related issues. Further, that *optimal care* included focussed care which identified patients at risk of these issues.

EMPIRICAL RESEARCH

8.3 CONTINUITY OF CARE PROJECT

Did patients need CofC after hospital discharge?

8.3.1 RESEARCH OBJECTIVE 2) Conducting a 'real' world, empirical research project in a large, acute care teaching hospital

8.3.1.1 Implementation of the CofC Project (CofCP)

Chapter 3 reported the implementation of the CofCP, in a quaternary care hospital for cardiovascular disease in Australia. Recruitment resulted in a research cohort of 281 patients. The discretionary referral by patients' GPs for post discharge HMR service, resulted in 87/281 patients receiving the service. The availability of HMR reports, as confirmation of the conduct of the service, resulted in the randomised division of the cohort into an HMR Report group (n=79 patients) and non-HMR Report group (n=202 patients).

8.3.2 RESEARCH OBJECTIVE 3) Identifying and taking into account the patients' personal, clinical and drug-related characteristics, and their responses to quality of life surveys

8.3.2.1 CofCP cohort Characteristics and CofC needs

Assessment of the personal, clinical and health-related quality of life (HRQL) characteristics of these acute on chronically ill patients showed a significant predominance

of male patients in a cohort with a median age of 65 years and a mean of 13.9 days length of stay (LOS).

Validation of the responses to a comprehensive HRQL survey of the full cohort showed, apart from increased age, there were no significant differences between responders and non-responders. Also, there were there no significant differences in the high response rates between the two identified subgroups. Further, the comparisons established the absence of any significant confounders to subsequent investigations of any differences in drug-related problems between the subgroups.

The CofCP cohort was shown to experience extensive polypharmacy at discharge which would exacerbate their potential for DRPs and it was a clear indication of the full cohort's need for CofC.

DATA ANALYSES

8.4 ACTUAL and POTENTIAL DRUG RELATED PROBLEMS (DRPs)

Why did patients need CofC after hospital discharge?

8.4.1 RESEARCH OBJECTIVE 4) Analysing any identified drug related problems (DRPs), polypharmacy or exposure to potentially inappropriate prescribing (PIP) at discharge and in the community

8.4.1.1. Identification of Drug Related Problems (DRPs) Post Discharge

In Chapter 4, following the identification of the cohort's potential for DRPs, instances of post discharge DRPs were investigated in the HMR Report group (n=76). The HMR service reports written for the patients' GPs were the primary source of DRP data. The comments and recommendations made by the accredited pharmacists interviewing the patient at HMR service, not only the listed diseases and drugs, were taken into account.

A total of 398 DRPs were recorded for 71/76 (93.3%) of the group showing a mean of 5.6 problems per patient. It was shown the most frequent problem (32.0%) to be actual, patient related uncertainty about the aims of specific drugs, followed by potential drug-drug interactions and adverse drug reactions.. Polypharmacy and a broad range of comorbidities requiring non-cardiovascular drugs exacerbated the group's DRPs. Polypharmacy was confirmed by means of 8.7, 8.9 and 10.8 drugs in regimen recorded in discharge summaries; GP referrals and HMR reports, respectively.

It was found the hospital's practice of not issuing discharge summaries to short stay patients, was a barrier to their CofC. From the HMR Report group's reports they were shown to average over 5 DRPs per patient and it was opportune that the most frequent of these problems could receive timely resolution.

Polypharmacy and the high level of DRPs still existent at the time of HMR service was an indication of the HMR Report group's need for CofC after hospital discharge.

DATA ANALYSES continued

8.5 PATIENT TRANSFER FROM TERTIARY TO PRIMARY CARE

When did the need for CofC arise?

8.5.1 RESEARCH OBJECTIVE 4 cont.) Analysing any identified drug related problems (DRPs), polypharmacy or exposure to potentially inappropriate prescribing (PIP) at discharge and in the community

8.5.1.1 When Did Patients need CofC – Determined by International Criteria

Chapter 5 reports how the high levels of DRPs and polypharmacy identified in the HMR Report group (n=79) post discharge, prompted further investigation. International criteria were utilised to determine the severity of drugs potentially inappropriately prescribed (PIP) between discharge and HMR service. All data analysed 'at discharge' were collated from discharge summaries and data analysed 'at HMR' service were collated from drugs and diseases listed in HMR Reports. The pharmacists' comments and recommendations were not taken into account.

Application of Beers explicit criteria to drug regimen showed there was a highly beneficial and significant decrease of 20.4% in the severity rating of drugs prescribed between discharge and HMR service. Instances of PIP relative to routine drug prescription decreased, but were not significantly different with 127 (19.3%) at discharge and 115 (14.3%) at HMR.

When assessed, 127 PIP instances at discharge and 115 PIP instances at HMR service showed means of 1.6 instances and 1.4 instances per patient, respectively.

In the HMR Report group the most frequently prescribed high severity drugs included aspirin, clopidogrel, NSAIDS, dipyridamole and ticlopidine in combination with an anticoagulant for 73 (92.4%) patients at discharge and 71 (89.9%) patients at HMR. Polypharmacy was confirmed as a contributing barrier to the HMR Report group's CofC.

Reductions in drug severity, and instances of PIP indicated by Beers criteria at HMR service, inferred a positive intervention by GPs post discharge. The criteria allocated an explicit 'high severity' rating for the prescription of aspirin and clopidogrel regardless of patient diagnoses. Hence, the frequent prescription of this combination for patients discharged from the cardiology unit of Westmead Hospital resulted in a high PIP count.

Beers criteria identified unacceptable levels of PIP at both discharge and after GP consultation, at HMR service. As determined by international criteria for potentially inappropriate prescribing, the need for CofC in medication management arose at discharge.

When did the need for CofC arise? continued

8.5.1.2 When Did Patients need CofC – Determined by Australian Indicators

Chapter 6 reports further identification of PIP utilising customised Australian indicators. Further identification was conducted to augment the assessment by Beers criteria in the HMR Report group's (n=79) drug regimens. Basger indicators were applied to listed drugs and diseases in discharge summaries and HMR Reports and the accredited pharmacists' recommendations were not taken into account.

Confirmation of high numbers of drugs prescribed for the subgroup at discharge and at HMR service again indicated exposure to polypharmacy. Basger indicators showed the HMR Report group was exposed to a concurrent, significant 11.3% decrease in appropriate prescribing instances at HMR and a significant 29.0% increase in PIP instances at HMR.

When assessed, 250 PIP instances at discharge and 399 PIP instances at HMR showed means of 3.1 instances and 5.1 instances per patient. The ratio of PIP to prescribed drugs was 38.2% and 49.6% at discharge and HMR, respectively.

The Basger indicator most frequently not satisfied and indicating PIP, showed 100% HMR Report group had changes to their drug regimen within 90 days prior to both discharge and HMR service. The second indicator showing frequent PIP at both discharge and HMR, required patients at high risk of a cardiovascular event to be taking a statin and 22 (28.9%) patients at discharge and 25 (32.1%) patients at HMR were not.

Application of the Basger indicators indentified a strong, adverse impact of increased PIP at HMR which reflected reduced patient centred care after GP consultation in the community. However, the HMR Report group were advantaged by the opportunity for identification of their PIP instances at HMR service.

Basger indicators identified unacceptable levels of PIP at both discharge and after GP consultation, at HMR service. When determined by customised Australian indicators for appropriate prescribing, the need for CofC in medication management arose at discharge.

DATA ANALYSES continued

8.6 THE EXTENT OF NEED FOR CONTINUITY OF CARE (CofC)

Were all patients in need of CofC?

8.6.1 RESEARCH OBJECTIVE 5) Determining, analysing and comparing any specific drugs identified as PIP in the full cohort's drug regimens.

In Chapter 7 analysis of the CofCP cohort's drug regimens targeted identification of the nature (active ingredients) of the drugs and of any PIP drugs. All results were presented in decreasing order of prescribing frequency. In all analyses, the active ingredients of drugs were counted once only for each patient which produced a slight variation in prescription numbers, from previous chapter outcomes.

8.6.2 DRUG REGIMENS AT DISCHARGE – Subgroups and Cohort

HMR Report Group (n=79): At discharge, this subgroup averaged 8.3 prescriptions per patient. Prescriptions for the 103 drugs common to both subgroups numbered 632 (94.3%) total subgroup prescriptions. Prescriptions for the 29 drugs unique to this subgroup numbered 38 (5.7%) total subgroup prescriptions with 1 or 2 prescriptions per drug. The small proportion of drugs unique to this minority subgroup further strengthened its representativeness in prescribing at discharge.

non-HMR Report Group (n=202): At discharge, this subgroup averaged 7.8 prescriptions per patient. Prescriptions for the 103 drugs common to both subgroups numbered 1389 (88.2%) total subgroup prescriptions. Prescriptions for the 81 drugs

unique to this subgroup numbered 186 (11.8%) total subgroup prescriptions with tramadol and codeine with paracetemol the most frequently prescribed drugs.

CofCP Cohort (n=281): At discharge, the cohort averaged 8.0 prescriptions per patient from a total of 2245 prescriptions for 213 different drugs. Aspirin was the most frequently prescribed drug for 182 (64.8%) patients, clopidogrel was prescribed for 135 (48.0%) patients and atorvastatin was prescribed for 115 (40.9%) patients. These three drugs accounted for 8.1%, 6.0% and ~5.0% of total discharge prescriptions respectively, for *both* the subgroups at discharge. The corresponding percentages between the subgroups further reinforced the representativeness of the minority HMR Report group in discharge prescribing.

8.6.3 PIP AT DISCHARGE AND HMR SERVICE – HMR Report group

HMR Report Group (n=79): Beers criteria and Basger indicators were re-applied to target the nature (active ingredients) of the specific PIP drugs identified at discharge and at HMR service. Also the re-application at two points in time, clarified any changes to the nature of identified PIP drugs after GP consultation in the community.

Beers Criteria: Re-application showed Clopidogrel at discharge was PIP for 40 (50.6%) patients and was reduced at HMR service by 9 (11.4%) patients. Aspirin at discharge was PIP for 31 (39.2%) patients and was reduced at HMR by 2 (2.5%) patients. Reduced PIPs after GP consultation post discharge benefited 11 patients. However, there still remained 31 (39.2%) patients prescribed clopidogrel and 29 (36.7%) patients prescribed aspirin, at risk of PIP after GP consultation post discharge.

Basger Indicators: Re-application re-affirmed repeated changes in medications to be the most frequent PIP situation identified at both discharge and HMR service. The second

most frequent PIP situation at HMR service, identified 16 (20.3%) patients at discharge; and 35 (44.3%) patients at HMR service, had not been prescribed essential antiplatelet or anticoagulant drugs. There was an increase of 19 (24.1%) 'at risk' patients not prescribed essential clopidogrel or aspirin (<325mg/day) after GP consultation post discharge

The outcomes from the two very different assessment tools, were in agreement that clopidogrel and aspirin were the most frequently identified or omitted PIP drugs, in particular, at HMR service.

8.6.4 PIP AT DISCHARGE – Subgroups and Cohort

HMR Report Group (n=79): At discharge, this subgroup averaged between 1 and 2.0 PIPs per patient. Prescriptions for the 24 PIP drugs common to both subgroups numbered 108 (94.7%) total subgroup PIPs. Aspirin was PIP for 31 (39.2%); clopidogrel for 40 (50.6%); and metoprolol for 2 (2.5) patients. Prescriptions for the 5 drugs unique to this subgroup numbered 6 (5.3%) total subgroup PIPs. Venlafaxine was prescribed for 2 patients.

non-HMR Report Group (n=202): At discharge, this subgroup averaged 2.0 PIPs per patient. Prescriptions for the 24 PIP drugs common to both subgroups numbered 411 (89.2%) total subgroup PIPs. Aspirin was PIP for 128 (63.4%); clopidogrel for 95 (47.0%); and metoprolol for 65 (32.2%) patients. Prescriptions for the 18 drugs unique to this subgroup numbered 50 (10.8%) total subgroup PIPs. Tramadol was prescribed for 12 (5.9%) patients.

CofCP Cohort (n=281): At discharge, the cohort averaged 2.0 PIPs identified from their 8.0 discharge prescriptions per patient. There was a total of 575 PIPs for the 47 different

PIP drugs identified.. Aspirin and clopidogrel were most frequently PIP for both subgroups and accounted for 51.1% total PIPs. The ratio of total PIPs to total discharge prescriptions was 25.6%.

The high ratio of PIP to discharge drugs showed the full CofCP cohort were in need of patient focussed CofC at discharge.

RESEARCH STRENGTHS and LIMITATIONS

8.7 STRENGTH IN EXTRAPOLATION OF DATA OUTCOMES

Can the CofC needs of a minority subgroup predict those of the majority subgroup?

8.7.1 RESEARCH OBJECTIVE 6) Investigating whether minority subgroup outcomes can be extrapolated to predict the medication management necessary for safe, continuous patient care.

8.7.1.1 ANALYSIS OF HMR REPORT GROUP DATA

In the chapter studies, the extrapolation of post discharge outcomes for the minority subgroup to predict outcomes for the majority subgroup, and hence the full cohort, was proposed. Post discharge data generated in the community, and analysed 'at Home Medicines Review' (HMR) after GP consultation, was not available for the majority of patients in the CofCP cohort.

Research utilising or trialling this method of predicting outcomes for a cohort of patients, and especially for those with cardiovascular disease, was not found in the literature. Converse to this research, all articles retrieved from a search discussed the majority group as predictor for the minority group.[1] However, it is suggested that the outcome of using this method of prediction in this research, has been successful.

In the chapter studies the minority HMR Report group was identified as having a marked level of DRPs post discharge and a clearly demonstrated, ongoing exposure to PIP after GP consultation, post discharge. Other than a predominance of males in the majority subgroup, this minority subgroup was shown to have no other statistically significant

differences in many important variables, to the majority non-HMR Report group. Across this research the HMR Report group was shown to be representative of the CofCP cohort.

Hence, it was proposed that the majority non-HMR Report group would experience at least, the same high impact of DRPs and exposure to PIP as the HMR Report group after GP consultation in the community. In addition, it was shown the majority of the patients (n=202) in the CofCP cohort were disadvantaged by not having the opportunity for resolution of their drug-related problems at medication review after discharge.

All patients recruited into the CofCP were shown to have the same need for safer clinical management of their medications and improved CofC starting at discharge and ongoing into the community.

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8.8 LIMITATIONS TO GENERALISING THE DATA and PROCESS OUTCOMES

8.8.1 DOCUMENTATION of HOME MEDICINES REVIEW (HMR) REPORTS

It was found throughout all CofCP chapter studies that in general, documentation of drugs and diseases in HMR reports was inadequate,[1] not necessarily inaccurate, for the information of GPs and for some data analyses. This latter finding was in contrast to Australian research by Castelino et al. (2009) whose research also analysed the data in HMR reports. That data was sufficiently well documented to enable Castelino et al. to conclude the majority of actions recommended by pharmacists in HMR reports were consistent with evidence based guidelines.[2]

However, the CofCP finding of HMR report inadequacy was consistent with other research conducted in Australia in 2008 and in New Zealand (NZ) in 2010. These researchers found GPs questioned the quality and usefulness of community pharmacists' reporting and recommendations in medication reviews. Difficulties were also reported by GPs, in accepting the encroachment of Pharmacists' expertise on GPs prescribing experience and decisions.[3-4]

8.8.2 PROVISION OF HOSPITAL DISCHARGE SUMMARIES

It was routine ward practice, for the CofCP cohort, that hospital discharge summaries were not produced for 'Day Only' (DO) patients regardless of their cardiovascular health status or complexity of their drug regimens.[5] Data analysis in this CofCP research was not constrained as DO patient information was collected from medical records. However, on discharge there were no readily transferable records of patients' diseases, treatments, or

drug regimens recorded to show medication change, cancellation or continuation of pre-existing drug prescriptions for these patients.

In Ireland it was found the potential for reduced medication safety arising from inadequate discharge documentation, was consistent with outcomes of research on cardiovascular drugs conducted by Grimes et al. (2010) in Ireland.[6] In Australia Wong et al. (2011) researched the barriers to effective discharge planning and concluded that inadequate documentation, poor communication and lack of coordination across various healthcare providers were barriers to quality discharge processes.[7] In the context of this CofC research, the non-provision of discharge summaries was shown to be a barrier to safer clinical management of medicines and to the patients' continuity of care post discharge.

8.8.3 INFORMATION TRANSFER and HOSPITAL DISCHARGE PROTOCOLS

This CofCP research found there was insufficient transfer of information to the patient in general and in particular, on the nature and aim of their discharge medications.[5] For the CofCP cohort, there was no routine transfer of discharge information by the hospital to community pharmacies and hence, no transfer to accredited pharmacists. Further, for those patients who received an HMR service, reliable transfer of medication information to accredited pharmacists from pharmacies and GPs was not routine.

The CofCP research also showed the clinical management, patient education and reconciliation of discharge drugs by hospital medical, nursing and pharmacy staff was not co-ordinated for the CofCP cohort's benefit. Researchers from the USA (2010) investigated the key principles of making inpatient medication management and reconciliation, best practice. They concluded that patient safety and patient centred care were the two principal drivers required. These two drivers ensured patients received the

most appropriate management, information and medications regardless of when, where or by whom they were treated across the continuum of care.[8-9]

8.8.4 INTEGRATION OF PATIENT CARE

In their research on integration of patient care, Bryant et al. (2010) in NZ., investigated the expectation that pharmacists might be perceived as crossing a clinical boundary between the work of the GP and that of pharmacists. Bryant et al. agreed with findings by Campbell et al. (2008) in Australia, and both concluded that GPs had high regard for pharmacists' skills. However, they also found GPs discriminated in support of activities that were acceptable to GPs, against those that encroached on GP's territory.[3-4]

This CofCP research also found the care necessary for the welfare of patients in the cohort was not integrated across healthcare disciplines or sustained for safe transfer from the hospital to the community. In the past, Paul Lefkovitz (1995) expounded the need for 'a broad and fluid continuum of services for quality and efficient care' (p260), and criticised the inequality of importance between tertiary and primary care.[10] He recognised powerful systemic and healthcare practitioner attitudes as barriers to care.

Lefkovitz extended his (mental health) findings to general hospital settings and presented an integrated continuum model of care. His research showed that a chief challenge would be to maximise continuity and integration in a system without sacrificing care cohesion and the patients' trust.[10]

Recently, Béland and Hollander (2011) investigated the lack of integrated models of care for the chronically ill and frail elderly by interdisciplinary providers. These researchers reviewed only models which espoused patient-centred care delivery and one Australian model was reviewed. [11-12] Béland and Hollander concluded that one common

characteristic required by all the models reviewed, was a coordinated continuum of integrated care for transition between different types of healthcare services.[13]

Across the years Lefkovitz, Béland and Hollander (1995-2011) called for evidence of patients' specific needs and the practice changes required to add to the quality, integration and continuity of patient care. The implementation of this CofCP and data analyses have provided this evidence.

The foregoing consideration of generalisation limitations was recorded in support of the following recommendations for transfer of research to practice. In this CofCP research, it was found the inadequacy of data documentation, hospital protocols and healthcare practices in the community markedly reduced the quality and continuity of patient care investigated in this research.

RESEARCH TO PRACTICE

8.9 RECOMMENDATIONS FOR PRACTISING INTEGRATED CARE

How can CofC be integrated and practised, on and after discharge?

8.9.1 RESEARCH OBJECTIVE 7) Recommendations for transferring the research and process outcomes into practice.

8.9.1.1 . TERTIARY CARE PRACTICE – IN THE HOSPITAL

a) Medical Staff

- Documentation or supervision of patients' drug regimens in discharge summaries by more senior members of the medical team or at least, pharmacist assistance in the process.
- Provision of a discharge summary for all patients regardless of their diagnosis, clinical state; or length of stay; for both the patients' GPs and community pharmacies.
- **Cardiovascular Patients:** Patient focussed consideration in the prescribing or omission of antiplatelet or anticoagulant drugs or NSAIDs; especially clopidogrel and aspirin.
- Recording on all discharge summaries – a request to the patients' GPs for an HMR service referral for all patients. The request should appear automatically on the e-template for discharge summaries in an 'opt-out' format which would require removal by the medical officer signing the discharge summary.

b) Pharmacists

- Support to the medical team recording drug regimens in discharge summaries.
- For all patients, provision of a hardcopy list of all medicines and associated administration instructions for drugs prescribed on discharge
- **Cardiovascular Patients:** Patient focussed reconciliation of discharge drugs for the timely identification of PIP antiplatelets, anticoagulants, or NSAIDs such as clopidogrel and aspirin.
- Reconciliation of all discharge drugs, and identification of inadequacies in discharge summaries before dispensing prescribed discharge regimens.

c) Pharmacists and Nursing Staff

- Certainty for the patient, and accountability for the overall integration of the patients' needs at discharge.
- Provision of clear verbal information to the patient, with emphasis on the aim of each drug, alongside patients' hard copy list and their discharge drugs,.

8.9.1.2 PRIMARY CARE PRACTICE – IN THE COMMUNITY

d) General Practitioners

- Positive consideration of requests for medication review for all recently discharged patients.
- Recording of all currently prescribed drugs and the indicators for their prescription on medication review referral forms
- A clear indication of dissatisfaction with inadequate HMR reports.. Closer liaison with community pharmacies and accredited pharmacists conducting medication reviews.

- **Cardiovascular Patients:** Post discharge, patient focussed drug reconciliation of diagnosis indicated antiplatelets, anticoagulants, or NSAIDs such as clopidogrel and aspirin.

8.10 FROM RESEARCH TO RESEARCH: RECOMMENDATIONS FOR INTERDISCIPLINARY CO-OPERATION:

e) Investigation of general practitioners' reasons for non-referral of chronically ill patients with cardiovascular disease, for post discharge medication review.

f) Reproduction of the CofCP research design in a cohort large enough to control and test the practicality of the recommendations made for transfer into practice of the thesis research and process outcomes.

g) Investigation of the clinical outcomes for patients with cardiovascular disease who were and who were not, referred for post discharge medication review.

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CHAPTER 9.0

THESIS CONCLUSION

CHAPTER 9.0

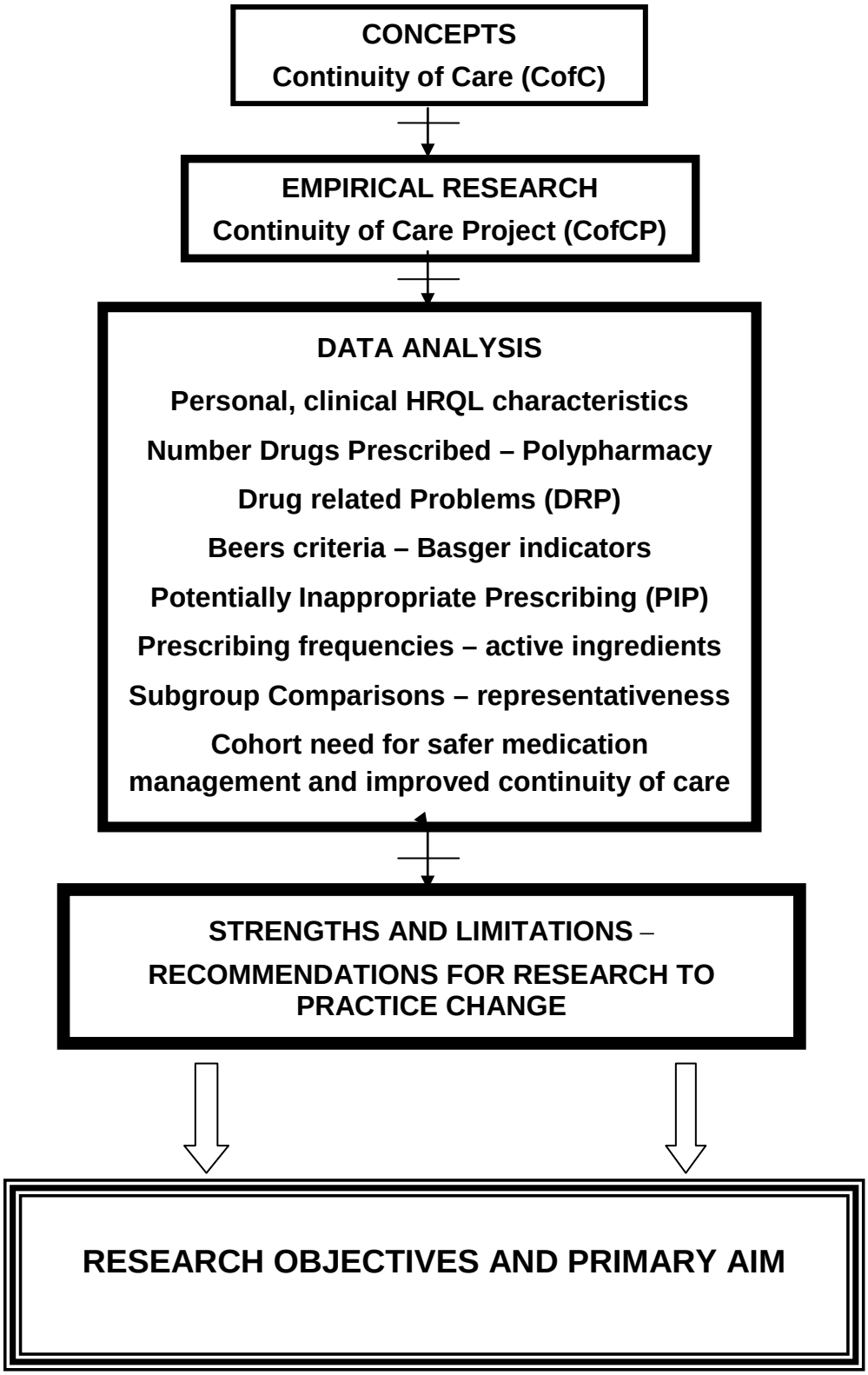

Figure 9.1 Thesis Conclusion

THESIS C O N C L U S I O N

PRIMARY RESEARCH AIM

To investigate the need for safer clinical management of medications for beneficial continuity and integrated patient care, on and after hospital discharge

As shown in Figure 9.1, the synthesis of the concepts, empirical research, data analysis and consideration of the research limitations framed the recommendations for practice change. The objectives of the research were comprehensively met and, the primary aim of the research was successfully achieved.

The need for safer clinical management of the CofCP cohort's medications was shown in the identification of their exposure to polypharmacy, drug related problems (DRPs) and potentially inappropriate prescribing (PIP). It was found for safer clinical management of medications, that evidence for the 'potential' and preventable aspect of inappropriate prescribing was by far the most important. That is, more important for the patients' immediate and ongoing health and wellbeing than the delayed evidence of actual inappropriate prescribing.

Post discharge medication review was shown to be beneficial to continuity of care for those patients referred for Home Medicines Review (HMR) service. The service facilitated the post discharge identification and an opportunity for resolution, of the minority subgroup's DRPs and PIP. The research showed PIP at hospital discharge was

perpetuated post discharge in the community, regardless of the tool used to identify it. Practice changes within, and between tertiary and primary healthcare sectors for the integration of patient care, were found to be essential.

In achieving the primary aim of the research, it is concluded that all 281 patients in the CofCP cohort were disadvantaged by the lack of medication reconciliation on their discharge from hospital. In addition, 202/281 patients were further disadvantaged by the lack of medication review after discharge. The evidenced representativeness of the minority subgroup meant their unacceptable level of DRPs and PIPs post discharge, could be predicted for the full cohort of patients. That is, all patients in the CofCP cohort have been shown to need safer clinical management of their medications for beneficial continuity and integrated care, on and after their discharge.

APPENDIX 10.0

Dartmouth Co-operative Functional Assessment Charts'

(COOP Quality of Life Charts 1 - 9)

Full set of English Version

First Page only of:

Spanish
Chinese
Slovac
Arabic