A CLINICAL AND ECONOMIC EVALUATION OF
MEDICATION REVIEWS CONDUCTED BY PHARMACISTS
FOR COMMUNITY-DWELLING AUSTRALIANS

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Submitted in fulfilment of the requirements for the degree of Doctor of Philosophy.

School of Pharmacy
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A CLINICAL AND ECONOMIC EVALUATION OF MEDICATION REVIEWS CONDUCTED BY PHARMACISTS FOR COMMUNITY-DWELLING AUSTRALIANS

Volume One
Statements and Declarations

Declaration of Originality

This thesis contains no material which has been accepted for a degree or diploma by the University or any other institution, except by way of background information and duly acknowledged in the thesis, and to the best of the my knowledge and belief no material previously published or written by another person except where due acknowledgement is made in the text of the thesis, nor does the thesis contain any material that infringes copyright.

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Statement of Ethical Conduct

The research associated with this thesis abides by the international and Australian codes on human and animal experimentation, the guidelines by the Australian Government's Office of the Gene Technology Regulator and the rulings of the Safety, Ethics and Institutional Biosafety Committees of the University.

Andrew Cameron Stafford
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“There is no such thing as absolute value in this world. You can only estimate what a thing is worth to you.”

Charles Dudley Warner (1829-1900)
American essayist and novelist
Acknowledgements

I’d imagine that virtually everyone who has seen a PhD through to completion would appreciate that it’s not a solo effort, and I’m definitely no exception. Without the support, guidance, friendship and love (where appropriate) of the following people, I’m certain that this document would have never been completed:

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List of Publications

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Stafford A, Tenni P, Peterson G, Doran C, Kelly W. Home Medicines Reviews - what are the most valuable interventions? Working together to bridge the gaps in disease management. 3-4 September 2010, Grand Hyatt, Melbourne, Victoria, pp. 32-33.

Stafford A, Tenni P, Peterson G. The VALMER study (the Value of Medication Reviews) - what are common drug-related problems, and how do pharmacists resolve them? AACP’s 5th annual consultant pharmacy clinical seminar, 28-31 May 2009, Sanctuary Cove, Queensland.

Conference abstracts (poster)


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An evaluation of pharmacist-conducted medication reviews in home-dwelling Australians

An evaluation of pharmacist-conducted medication reviews in home-dwelling Australians

### Abbreviations

<table>
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<th>Description</th>
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<tbody>
<tr>
<td>AACP</td>
<td>Australian Association of Consultant Pharmacy</td>
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<tr>
<td>ABDI</td>
<td>Australian Burden of Disease and Injury</td>
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<tr>
<td>ACE</td>
<td>Angiotensin Converting Enzyme</td>
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<td>ADE</td>
<td>Adverse Drug Event</td>
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<tr>
<td>ADR</td>
<td>Adverse Drug Reaction</td>
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<tr>
<td>ALOS</td>
<td>Average Length of Stay</td>
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<tr>
<td>AR-DRG</td>
<td>Australian Refined Diagnosis Related Group</td>
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<tr>
<td>ASCEPT</td>
<td>Australasian Society of Clinical and Experimental Pharmacologists and Toxicologists</td>
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<tr>
<td>ATC</td>
<td>Anatomic Therapeutic Chemical</td>
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<tr>
<td>BCPS</td>
<td>Certification as a Pharmacotherapy Specialist</td>
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<tr>
<td>BEACH</td>
<td>Bettering the Evaluation and Care of Health</td>
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<tr>
<td>CBA</td>
<td>Cost-Benefit Analysis</td>
</tr>
<tr>
<td>CCA</td>
<td>Cost-Consequence Analysis</td>
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<tr>
<td>CEA</td>
<td>Cost-Effectiveness Analysis</td>
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<tr>
<td>CEAC</td>
<td>Cost-Effectiveness Acceptability Curve</td>
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<tr>
<td>CGP</td>
<td>Certification as a Geriatric Pharmacy Specialist</td>
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<tr>
<td>CI</td>
<td>Clinical Intervention</td>
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<tr>
<td>CMA</td>
<td>Cost Minimisation Analysis</td>
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<tr>
<td>CMPMMP</td>
<td>Community Pharmacy Medicines Management Project</td>
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<tr>
<td>COX</td>
<td>Cyclo-oxygenase</td>
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<tr>
<td>CUA</td>
<td>Cost-Utility Analysis</td>
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<tr>
<td>DAA</td>
<td>Dosage Administration Aid</td>
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<tr>
<td>DALY</td>
<td>Disability-Adjusted Life-Year</td>
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<td>DMRR</td>
<td>Domiciliary Medication Management Review</td>
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<tr>
<td>DRP</td>
<td>Drug-Related Problem</td>
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<td>DTP</td>
<td>Drug-Therapy Problems</td>
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<td>DVA</td>
<td>Australian Government Department of Veterans' Affairs</td>
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<td>EQ-SD</td>
<td>EuroQOL-SD</td>
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<tr>
<td>GBD</td>
<td>Global Burden of Disease</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GP</td>
<td>General Practitioner</td>
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<tr>
<td>HMG-CoA</td>
<td>Hydroxymethylglutamyl-Coenzyme A Reductase</td>
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<tr>
<td>HOMER</td>
<td>Home-Based Medication Review Study</td>
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<tr>
<td>ICER</td>
<td>Incremental Cost-Effectiveness Ratio</td>
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<td>ICPC2-PLUS</td>
<td>International Classification of Primary Care Version 2 Plus</td>
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<td>MAI</td>
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<tr>
<td>MBS</td>
<td>Medicare Benefits Schedule</td>
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<td>MCQ</td>
<td>Multiple-Choice Question</td>
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<td>MCS</td>
<td>Microscopy Culture and Sensitivity</td>
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<td>MDC</td>
<td>Major Diagnostic Criteria</td>
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<td>MMA</td>
<td>Medicare Modernisation Act</td>
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<tr>
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<td>Medication Management Review</td>
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<td>MTM</td>
<td>Medication Therapy Management</td>
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<tr>
<td>MTP</td>
<td>Medication-Therapy Problems</td>
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<tr>
<td>MUR</td>
<td>Medicines Use Reviews</td>
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<tr>
<td>NHS</td>
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<td>NICE</td>
<td>National Institute for Clinical Excellence</td>
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<td>NPS</td>
<td>National Prescribing Service</td>
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<tr>
<td>NSAID</td>
<td>Non-Steroidal Anti-Inflammatory Drugs</td>
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<td>PBS</td>
<td>Pharmaceutical Benefits Scheme</td>
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<td>Pharmacy Accessibility/Remoteness Index of Australia</td>
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<td>PRN</td>
<td>When-Required</td>
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<td>PSA</td>
<td>Probabilistic Sensitivity Analysis</td>
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<td>PTO</td>
<td>Person Trade-Off</td>
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<tr>
<td>QALY</td>
<td>Quality-Adjusted Life-Years</td>
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<td>QOL</td>
<td>Quality of Life</td>
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<tr>
<td>QUM</td>
<td>Quality Use of Medicines</td>
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<tr>
<td>QUMCIT</td>
<td>Quality Use of Medicines In The Community Implementation Trial</td>
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<tr>
<td>RACF</td>
<td>Residential Aged Care Facility</td>
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<tr>
<td>RCT</td>
<td>Randomised Controlled Trial</td>
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<tr>
<td>RMMR</td>
<td>Residential Medication Management Review</td>
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<tr>
<td>SF-36</td>
<td>Short-Form 36 Health Survey</td>
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<tr>
<td>SG</td>
<td>Standard Gamble</td>
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<tr>
<td>SHPA</td>
<td>Society of Hospital Pharmacists of Australia</td>
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<tr>
<td>SMART</td>
<td>Seniors Medication Assessment Research Trial</td>
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<tr>
<td>TTO</td>
<td>Time Trade-Off</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<td>--------------------------------------------------</td>
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<tr>
<td>IMSANZ</td>
<td>Internal Medicine Society of Australian and New Zealand</td>
</tr>
<tr>
<td>INR</td>
<td>International Normalised Ratio</td>
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<tr>
<td>IQR</td>
<td>Interquartile Range</td>
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Abstract

Introduction: There is a high prevalence of drug-related problems (DRPs) in community-dwelling residents which results in increased morbidity, mortality and healthcare expenditure. The Australian government has reimbursed pharmacists to identify and prevent or resolve DRPs through Home Medicines Reviews (HMRs) in these patients since 2001. Funding for the HMR program was based on studies undertaken prior to its implementation that indicated HMRs would be cost-effective due to reductions in drug costs and health service utilisation. Since the introduction of the program, there has been limited Australian research into the economic outcomes of HMRs. Furthermore, the results of international studies have questioned the clinical and cost-effectiveness of pharmacist-led medication reviews. The overall aim of the research described in this thesis was to investigate the clinical and cost-effectiveness of HMRs. To achieve this aim, the following objectives were formulated and addressed:

- to investigate novel methods for assessing the clinical and cost-effectiveness of HMRs;
- to investigate the characteristics of the DRPs identified in HMRs, including the drugs and conditions involved, and the recommendations made to resolve or prevent DRPs;
- to estimate the clinical effectiveness and cost-effectiveness of HMRs; and
- to investigate potential avenues to optimise the clinical effectiveness and cost-effectiveness of HMRs.

Method: A methodology that used expert opinion to predict the outcomes of HMRs was developed, based on previous research of interventions undertaken in community pharmacies. The development of this methodology necessitated two studies to be undertaken whereby the healthcare system costs and quality of life effects of numerous common clinical conditions resulting from medication use were estimated using a combination of expert opinion and literature values.

To evaluate HMRs, an observational cohort study was conducted across all states in Australia. Pharmacists accredited to perform HMRs submitted a random sample of HMRs that they had undertaken in 2008. Information from the HMR referral, report
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and outcomes of the HMR were classified according to standardised systems and entered into an electronic database for analysis. A panel of experts reviewed a sample of the HMRs and estimated the clinical outcomes of the recommendations made in the HMRs. A cost-consequence and cost-utility analysis was performed to evaluate the cost-effectiveness of HMRs from an Australian government perspective.

A sub-study was undertaken that investigated the relationship between cost-effective HMRs and factors that prior research suggested may influence the cost-effectiveness of HMRs.

**Results:** A “consequences table” was developed whereby estimates of healthcare system costs and quality of life effects of 51 common clinical consequences were evaluated at three levels of severity. The estimates of these parameters appeared to be plausible and reasonable, and demonstrated moderate to high validity and reliability where testing was possible.

Six hundred and sixty-one HMRs were submitted by one hundred and forty-nine pharmacists. The HMR reports documented 2323 DRPs, of which the most common were *Condition not adequately treated* (16.5% of DRPs), *Therapy required* (11.3%) and *Toxicity evident* (10.6%). The most common DRP was inadequate pain management which was identified in 118 (17.9%) patients. The drug groups most commonly involved in DRPs were antithrombotics, peptic ulcer and oesophageal reflux therapies, and lipid modifying agents.

The pharmacists made 2727 recommendations to resolve the DRPs. The most frequently made recommendations included performing laboratory monitoring, commencing a new medication, or ceasing another. Information relating to the outcomes of the recommendations made to resolve the DRPs was available for 66% of the data (1801 recommendations). Of these recommendations, 1565 (87%) required the prescriber to act on the recommendations to implement them. Approximately three quarters of the DRPs documented in the HMRs were potentially resolved or managed.

On average, each HMR was estimated to result in a saving to the health system of $85.79, which was insufficient to offset the cost of the HMR ($323.80). Savings
resulted from predicted reductions in health resource utilisation (general practitioner and specialist visits, medical investigations and hospitalisations ($P<0.001$)). A trend in reduced drug costs was also observed ($P=0.070$). Significant reductions in the risk of arrhythmias, confusion and myopathy were predicted to occur as a result of the HMRs ($P<0.001$). Quality of life was estimated to improve minimally (0.001 QALYs per patient, $P<0.001$), and the cost per QALY gained (incremental cost-effectiveness ratio) was $177,566. Extensive sensitivity analysis was undertaken, which indicated minimal likelihood that HMRs were cost-effective using a threshold of $50,000 per QALY. A majority of the potential savings to the healthcare system occurred in a small number of HMRs.

A sub-study of the factors associated with cost-effective HMRs identified that the pharmacists who had performed cost-effective HMRs had undertaken more continuing education ($P=0.006$) and performed more HMRs in total ($P=0.041$) than the pharmacists who had not performed cost-effective HMRs. A greater proportion of HMR referrals that contained recent and relevant pathology/laboratory data resulted in cost-effective HMRs compared to referrals that did not ($P=0.03$).

Limitations resulting primarily from the methodology employed to assess the HMRs may have resulted in the study underestimating the cost-effectiveness of HMRs. Had a longer time horizon than 12-months been used, then greater cost savings to the healthcare system and improvements in quality of life would have been realised. The inclusion of other costs to the healthcare system not considered in the study also may have resulted in HMRs demonstrating greater cost-effectiveness.

**Conclusion:** DRPs are frequently identified and reported in HMRs. However, the economic and clinical benefits of addressing most of them are minor in the 12 months following the HMR. Future research should focus on the identification of predictors of cost-effective HMRs and increasing the uptake of HMRs using these factors if funding for the program is to continue.
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