

The Evaluation of Auckland District Health Board's Medicines Use Review Pilot:

The ADMiRE Report

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Executive Summary

Medicines Use Review (MUR) is a new and emerging community based pharmacy-based service designed to help improve medicines use. It aims to educate patients about their medicines and improve medicines adherence as well as identify barriers to proper medicine use and resolve any other medication-related issues. Research indicates that older people are especially at high risk of medication-related problems; they often visit more than one prescriber, take more prescription and non-prescription medicines than the population average and consequently have more complex medicine regimens

In late 2006, ADHB requested pharmacy providers to develop proposals for innovative medication management services. Three contracts were successfully tendered, two for community-based MUR services and one, from a residential care provider, for an annual medicines review (AMR) service. The University of Auckland's School of Pharmacy was contracted to provide an evaluation of the pilot services.

Description of the pilot services

Community-based MUR

The community-based MUR service was delivered by six pharmacists within the ADHB region. They were responsible for recruiting eligible patients to take part, and then conduct an initial visit at the patient's home, with two follow ups three and six months after. Pharmacists recorded all medicines usage, patients' knowledge and adherence to their medicines and other information such as their access to medicines and the patient's quality of life. The pharmacist would use this data and other contextual information to identify issues that the patient might wish to address regarding their medicines usage. At subsequent visits or interviews pharmacists would record progress towards addressing these issues, and other new issues identified. The data was recorded on a standardised data collection form, a similar form was utilised at each follow up.

Residential AMR

The AMR service was piloted with all rest home and hospital residents residing at four sites of a residential care provider, The Selwyn Foundation. A contracted pharmacy, also responsible for dispensing medicines at these sites, provided details of existing prescribed medicines and a summary of recommendations for changes or reviews of medicines. GPs would use this information in conjunction with a patient consultation. An evaluation data collection record (EDR) recorded the prescribed medicines, the pharmacist's recommendations, the GPs' actions and the subsequent prescribed medicines 3 months after the AMR.

Results: Community-based MUR

Recruitment in the community-based contracts were fewer than expected, with only 74 initial interviews (approximately 150 were expected). Nearly three quarters of these patients were female and two thirds identified as 'New Zealand European'. Approximately 60% of patients lived in areas with a NZDep (Social Deprivation score) rating of 5 or more (the scale runs from '1' being low

deprivation to '10' being high deprivation). Of the 74 patients, only 47 patients had a first and second follow up interview. Comparisons between initial and subsequent follow ups were therefore limited to a smaller number of patients. The following key findings are from this comparative data:

- Patients used fewer medicines at the time of the follow ups compared to the initial MUR
- Largest reductions were in the use of calcium channel blockers, sedatives and analgesics
- Pharmacists believed that patients took their medicines 'as directed' more often at the time of follow ups than the initial MUR
- Patient perception of adherence did not appear to improve over time
- Pharmacists perception of patients' overall knowledge of medicines improved over time
- Patients' self rated quality of life improved over time

Issues identified by the community-based MUR

Pharmacists indicated that 'Lacking knowledge of prescribed medicines' and 'medicines not synchronised' were the two most common issues identified (41% and 40% respectively). Missing doses was seen as an issue for 36% of patients, with 29% of patients appearing to have inadequate control of their symptoms via their medications.

On average, each patient had four issues that required action in a medicines management plan. Sixty-three percent of issues from the initial review were resolved at the first follow up, with a similar percentage resolved at follow up 2.

The MUR implementation process

Pharmacists identified a number of challenges to the success of the MUR pilot. It was clear that the additional time required recruiting patients and doing MUR visits was hard to find without dedicated staff, or locum cover.

The training and accreditation process provided via the NZ College of Pharmacists was perceived as necessary, but took far too long and had limited benefit for some pharmacists. In one case, the delay in training and accreditation was seen to hinder recruitment for the pilot. It may be more effective to separate the training and accreditation processes, allowing accreditation to occur prior to contracting any MUR services, and training to be built into requirements for the service contract.

Some pharmacists did not achieve the expected number of recruits because of changes in expectation for the contract holder- the Pharmacy Guild. The loss of some pharmacists early on in the pilot led to a requirement to increase recruitment number for those left.

Providing an MUR service was perceived to benefit pharmacists in a number of different ways:

- Enhanced patient- pharmacist relationship
- Improved GP-pharmacist relationship
- Interesting extension of normal work for the pharmacist
- Greater involvement with patients meant more in-depth knowledge required- stimulates pharmacists need to research.

Improvements were noted as required for the collection of data from patients, mostly in reducing duplication from the initial to subsequent follow ups. The concept of electronic collection, and integration into existing Patient Management Systems was also identified.

Results: Residential AMR

Of the 611 residents at the four Selwyn sites, 240 had evaluation data filled in by the pharmacist and the GP. The remaining 371 had only pharmacist information, and were not included in the evaluation. Just below 74% of the patients were females, and 56% were at rest home level of care, with the remaining 44% in hospital-level care.

The Selwyn contract had identified an intention to measure patient's satisfaction and knowledge of medications as other outcomes of the pilot. It was identified early in planning stages however that such information would not be available, so the evaluation focused upon the use of medicines, falls data from Selwyn residents, hospital data on clinic usage, and GPs' opinions of the AMR pilot.

Medicines usage

Drug group data provided prior to the consultation and approximately 3 months after indicated that there was an increase in the prescription of some preventative medicines, and a decrease in some treatment medicines, for example:

- Aspirin prescriptions for all patients increased from 53% to 61%
- Calciferol prescriptions for all patients increased from 32% to 57%
- Antidepressant prescriptions for all patients reduced from 26% to 23%
- Sedative prescriptions for all patients reduced from 28% to 24%

The AMR made a number of suggestions for the GP to consider. One key question to the evaluation has how often GPs took the pharmacists advice. Overall, when considering comments on the evaluation data record (EDR) GPs agreed with 14% of all suggestions made by the pharmacists. When the level of agreement was assessed at three months, after changes to medications had been actioned, this level of agreement would appear to have been better, with around 26% of prescriptions matching the pharmacist's suggestions.

Falls and hospital data

There appeared to be less falls in the six months after a patient's AMR than before, with 36% of patients falling 1 to 5 times before their AMR and 27% falling 1 to 5 times in the six months after their AMR. The percentage of patients experiencing no falls increased from 57% to 70% of all patients. In a similar manner, the number of inpatient and outpatient admissions also decreased. Given the complex reasons for both falls and hospital admissions, it is not appropriate or possible to make any causal link with the AMR.

GP and pharmacist opinion of the AMR pilot

Seven GPs and one pharmacist (responsible for AMR and EDR data within the pharmacy) discussed aspects of the pilot ADR service. GPs felt the AMR was a useful concept, but needed to have less paperwork associated with it. GPs also indicated some reservations around pharmacists making prescribing change suggestions, as they did not have sufficient information on the patient to make such judgements.

Conclusions and recommendations

Both the community and residential pilot services demonstrated some evidence of benefit to patients and providers. The overall limitations of success were related to the sub optimal execution of the pilots, rather than the pilot services themselves. Proper implementation, from training and accreditation through to data management, would ensure that patients, general practices, pharmacists and DHBs all reap the potential benefits of such a service.

Implementation of an MUR service in the future would require management of DHB boundary and patient eligibility issues. Training and accreditation would also require development, and overarching service awareness in the health community would help recruitment. Pharmacists would benefit from briefer, more focused data collection requirements.

The AMR service piloted across Selwyn residential sites also had merit. GPs perceived that a significantly briefer document that provides overall guidelines on medicines usage with a patient specific list of existing medications would be useful as a 'memory jog' at the time of consultation.

Terminology

MUR	<p>Medicines Use Review</p> <p>A community pharmacy centred service which aims to improve the patient’s understanding of their medicines-related health outcomes by identifying access, adherence, and day-to-day management issues and setting goals with the Service User to resolve these issues.</p>
AMR	<p>Annual Medicines Review</p> <p>A systematic review of a patient’s current medications. In the context of this report, AMRs were for residential service users and were carried out by the residential care provider’s pharmacy.</p>
Patient (in the context of this report)	<p>Also known as ‘client’, ‘service user’, ‘participant’. Refers to those older people living in the community who took part in the MUR pilot.</p>
Residential patient	<p>Refers to all older people who had an AMR completed as part of the Selwyn AMR contract.</p>
Pharmacist	<p>Service provider, contractor. Refers to those pharmacists who recruited and undertook MURs with patients.</p>
ADHB	<p>Auckland District Health Board</p>

Introduction

The development of the Primary Care sector continues to receive significant attention and funding in New Zealand. There are numerous initiatives and strategies at local, regional and national levels that all aim to contribute to the improvement of health service delivery in the community.

The large cohort of 'Baby Boomer' New Zealanders has now reached an age where they can require more intensive and strategic health care to remain living independently in their own community. The wellbeing of older people moves along a continuum of care - from completely independent living through to hospital level residential care. Their progression along the continuum may change frequently and this change may be in direction and rate. Enabling them to make their own decisions along the way requires a significant investment in primary care and community-based support services. Given the increased use of pharmaceuticals and complexity of medication regimens in later life, the careful management of medicines significantly affects their successes and setbacks along the way. The ease of access to community pharmacies around New Zealand makes their potential to contribute to the health of older people, especially related to medicines education and management significant.

Medicines Use Review

Medicines Use Review (MUR) is a new and emerging community-based pharmacy service designed to help improve medicines use. It aims to educate patients about their medicines and improve medicines adherence as well as identify barriers to proper medicine use and resolve any other medication-related issues. Medication-related problems are a significant cause of hospital admissions, morbidity and mortality in the community and the financial cost of these admissions to the individual patient and the healthcare system is substantial[1, 2]

Poor patient adherence to medication regimens also adversely affects health and may result in poor outcomes. Medication-related problems may involve the use of medicines without an indication, untreated indication, improper drug selection, sub-therapeutic dosing, overdosing, adverse drug reactions, drug interactions or failure to receive indicated medication [3]. The potential causes of medication-related problems include patient confusion or misunderstanding, failure to follow doctors' instructions, lack of understanding of potential adverse drug interactions, and prescribers' and/or pharmacists' lack of awareness of all medications that the patient is taking (including herbal or complementary medicines, over the counter preparations or those prescribed by other prescribers in cases where patients attend two or more different prescribers)[1]

Older people are especially at high risk of medication-related problems; they often visit more than one prescriber, take more prescription and non-prescription medicines than the population average and consequently have more complex medicine regimens [4, 5]. Many of these people return to independent living in the community following a hospital or nursing home stay during which changes to their medication regimen may have been made [4]. As a result of such transitions between secondary healthcare and the community, there is the potential for changes in medication regimens,

both intended and unintended, to go unrecognised, greatly increasing the likelihood of major medication mishaps.

It is crucial to identify and implement interventions that improve medicines related health outcomes and which have the potential to lead to better healthcare results and reduce healthcare costs. MUR may be one such intervention, which aims to reduce medication misadventure among high risk individuals by identifying and minimising problems/barriers to effective treatment. This may subsequently improve medication-related outcomes for patients.

Auckland District Health Board and MUR

Auckland District Health Board (ADHB) has been developing the 'Healthy Ageing 2020' strategy which sits under the umbrella of the 'Lifting the Health of Aucklanders' banner. Its vision was to include a key objective of the Healthy Ageing Strategy which will improve the appropriateness of pharmaceutical therapy among the over 65's, preferably using a primary health care team approach. It was also hoped that access to improved pharmacy services and education/information for this group will occur as an outcome of these innovations.

In late 2006 ADHB requested pharmacy providers, acting in close cooperation and consultation with relevant providers and Primary Health Organisations (PHOs), to develop proposals for innovative medication management services. The overarching aims of the proposed services were to:

- Reduce health inequalities by improving the health status of people over the age of 65, with preference given to those with the poorest health and highest health needs, in particular Māori, Pacific peoples, and people of low socio-economic status.
- Improve patient access to pharmacy services and adherence to prescribed regimes through (potentially home or residential care based) pharmacist consultations including advice, education, monitoring and practical assistance.
- Improve medicine utilisation through pharmacist advice and support to general practitioners and rest home clinicians, including reviews of patients' medicine regimens and working with the provider to find solutions to medication problems, particularly with reference to poly-pharmacy.
- Improve disease management and prescribing practices through pharmacist matching of patient records and prescribing with current best practice for the disease state, in conjunction with other primary health professionals.

The outcomes sought from such services include:

- Reduced numbers of adverse reactions and unplanned use of secondary services in the over 65 population, such as acute medical admissions.
- Reduced prescribing of non-indicated medications and increased preventative prescribing.
- Increased patient understanding, satisfaction, and adherence/compliance to their prescribed medicines and resolution of specific medicine problems for patients.

The pilot projects

Three proposals were selected for negotiation towards a contract for MUR provision. These were funded as pilot services. Brief summaries of the three pilot services are detailed below, highlighting their main objectives:

The Pharmacy Guild MUR pilot service was delivered by five pharmacies located in Mt Wellington, Glen Innes, Panmure, Ellerslie and Otahuhu, with the aim of recruiting 100 patients over one year. The patient inclusion criteria for these medication use review services included patients 65 years or older living independently in the community who had risk factors such as complicated medication regimens and were identified as currently experiencing or at a high risk of experiencing medicine related problems. The main objectives of the service included improving patients' quality of life, supporting their independent living in the community (minimising requirements for rest home care or other government funded services) and reducing the risk of hospitalisations or serious health events secondary to medicines related problems. Additional, wider, system-related objectives involve reducing wastage of prescribed medicines, enhancing ongoing professional development for pharmacists and enhancing a team approach to medicines management for patients dwelling in the community to improve continuity of patient care. The pilot proposed to achieve these objectives by assessing medicines use and adherence, identifying types and number of medicine use issues (including OTCs), implementing solutions and making recommendations to a patient's GP where appropriate. An individualised medicines management plan was to be developed with adequate follow up to assess the effectiveness of the implemented changes. Monitoring the risk of falls due to medicines use, patient symptom control and the number of self treated or undiagnosed conditions were also proposed.

The Mt Eden Pharmacy MUR pilot service involved two pharmacies both of which provided domiciliary services to people over the age of 65. This service has already been provided for several years, with community dwelling elderly patients self-funding the service. The pilot's aim was to extend the service to patients of all cultural backgrounds and patients of low socio-economic status who could not afford to pay for such services themselves. Some of the aims were to maximise health outcomes using prescription delivery and pick up, maximise duration of independent living for elderly over 65 years, reduce polypharmacy and display the cost effective use of medicines management, health education and adherence aids. The pharmacist kept a patient medication profile and assessed the patient's needs. The service proposed regular home visits, electronic feedback to prescribers, and monitoring medicine adherence at three monthly intervals with appropriate follow up of health outcomes from the medicine regimen through consultations with patients, caregivers and prescribers.

The Selwyn Foundation Group Annual Medicines Review (AMR) pilot comprised a pharmacist's summary of each patient's current medications, with recommendations for regimen reviews or changes. The summary was to be used by the patient's GP during a consultation. Walls and Roche Pharmacy was contracted to provide pharmaceutical services to residents in four sites in Auckland-

Selwyn Village, Selwyn Heights, Gracedale and Selwyn Oaks. The primary focus was to reduce the number of non indicated medicines, where the original indication has resolved. Other intended benefits included the reduction of falls, reduction of medicine wastage, reducing hospital admissions and increasing patient satisfaction, awareness and adherence to medications. The pilot proposed an annual medication chart reviews of all 850+ residents at the four Selwyn Foundation Group sites. It also proposed medication education for those living independently and for staff members giving medicine to residential care patients.

The service provided by the Selwyn Foundation Group was fundamentally different from the other two pilots as all patients were in residential care. Another area of difference was that the pharmacist reviewed only the medicine chart information and made recommendations to the GP without a pharmacist-patient interaction.

The evaluation project

This current project aimed to evaluate the processes and outcomes of these three pilot services contracted by Auckland District Health Board (ADHB).

This report will provide the ADHB with objective information against which they can assess the three pilots against the intended outcomes of the medication management service proposal. The primary aim of our evaluation is to determine to what extent the three pilot services achieved the overall intentions of the project. The evaluation team set out a number of questions for the evaluation to consider:

- Were providers able to recruit service users from people with the poorest health and highest health needs, in particular Māori, Pacific peoples, and people of low socio-economic status?
- Did patient access to pharmacy services improve?
- Did patients' usage of hospital services change?
- Was patient understanding improved?
- Was patient adherence to prescribed regimens improved?
- Did pharmacists advise and support GPs and rest home clinicians?
- Were pharmacists able to work with other health providers to find solutions to medication problems, particularly with reference to polypharmacy?

It was also intended to evaluate the development, implementation and management processes used during the pilots:

- How did the provider identify or receive referrals for service users?
- Did the demographic profile of service users reflect the intention of the proposal?
- What challenges did the service provider face in recruiting/enrolling service users?
- What information did the provider collect during the initial consultation and subsequent follow ups?
- How was this information recorded and managed?

- Were service providers able to identify and access all the information relating to a service user?
- What resources were needed for the consultation and follow ups?
- Did the service provider contact other primary or secondary care health professionals in relation to a service user?
- Did other health professionals share and act upon advice from the service provider?
- What aspects of the service development and implementation did they believe were most successful?
- What would the service provider choose to do differently?

It was also the intention of the evaluation to collate health data on patients, and interview a sample of patients. Interview topics included:

- What did they think the service would do?
- Did taking part in the medicine management and education service improve the understanding of their medication regimen?
- Did their involvement change the way they thought about their health?
- Did service users believe that the level of care they received was appropriate?
- Was there any aspect of their service they would like to see changed?

Integration of Mt Eden and Pharmacy Guild

During the initial phases of the pilots, the Mt Eden contractor agreed to use the same data collection documents as the Pharmacy Guild contractors. This enabled the evaluators to treat all community-based patients in a similar manner, as the evaluation data extracted from the MUR service documents was the same.

Structure of report

Due to fundamental differences between the Guild/Mt Eden and Selwyn sites, the evaluation undertaken used different methodologies. The report has been divided into three sections: the first two describe the methodology, results and discussion for each type of service (MUR and AMR). The final conclusions section provides comments on both services.

Literature

The role of the Pharmacy Council of New Zealand (PCNZ)

The Pharmacy Council of New Zealand was legally established under the Health Practitioners Competence Assurance Act 2003 (HPCAA) and is responsible for the registration of pharmacists as well as the setting of standards for the level of education, scopes of practice and conduct for all pharmacists practising in New Zealand. The PCNZ set out a Medicines Management Competence Framework in 2006 which encompasses four levels of medicines management services- Levels A, B, C and D- of which Medicines Use Review (MUR) is rated at Level B. The official definition of MUR as given by the Pharmacy Council is as follows:

“Medicines Use Review is a structured, systematic, documented and consultation-based service undertaken by an accredited pharmacist. Medicines Use Review aims to improve the patient’s understanding of their medicines-related health outcomes by identifying access, adherence, and day to day management issues a patient has with their medicines and setting goals with the patient to resolve these issues”.(Pharmacy Council of New Zealand)

Referral of patients to the MUR service may be by a health professional, a local District Health Board (DHB)/Primary Health Organisation (PHO), the patient themselves or their agents/family/caregiver. Medicines Use Reviews involve an initial patient interview where the pharmacist meets with the patient individually to determine their current understanding of and adherence to their medication regimen. The pharmacist identifies any medicine related problems (including prescription medications, over-the-counter medications and herbal and complementary therapies) or other lifestyle issues the patients may have. A crucial component involves assessing patient adherence and health status. The pharmacist then collaborates with the patient’s healthcare team to recommend any changes based on the issues identified from the patient interview. In overview, the ultimate goal of MUR is to optimise medicines-related health outcomes for all patients.

Pharmacists who undertake MUR must have successfully completed an accredited training programme, be registered as a pharmacist and hold an Annual Practising Certificate (APC).

Medication Issues

MUR uses a structured process to identify and resolve problems related to access, adherence and day to day medication management. Central to this process is an accurate and well-documented medication history. Pharmacists have been shown to carry out more thorough medication histories, including medication doses and dosage schedules, compared to physicians [6-8]. In a study conducted with 55 patients, pharmacists identified 614 medications, whereas only 556 were identified by the physicians ($p < 0.001$) [9].

Lowe et al looked into the effects of a programme combining medication review with in-depth medicines education [10]. The study showed that pharmacy interventions reduced the occurrence of drug related problems (DRPs) in the elderly and reduced suboptimal prescribing. Other studies have demonstrated limited evidence that such interventions reduce morbidity, mortality, health care costs, or other health outcomes [11, 12].

Patient adherence to medication remains a large factor in ensuring adequate and optimal control of their medical condition(s). A systematic review by Roughead et al included eight studies that assessed changes in patient adherence [13]. Of these, two reported improvements in adherence, and despite the fact that one of the studies included in the review reported no overall improvement in adherence, it was noted that a larger proportion of initially non-adherent patients in the intervention arm of that study showed improved medication adherence after receiving a comprehensive pharmaceutical care intervention [13]. In the study by Lowe et al [10], adherence in the intervention group was 91.3%, compared with 79.5% in the control group ($P < 0.0001$); knowledge of medicines also improved significantly more in the intervention group ($P < 0.0005$). In a prospective study investigating the effect of a pharmacy care programme on adherence, it was found that adherence had increased by approximately 35% from baseline after six months [14]. The programme involved medication education, blister packing of medicines and two-monthly follow-ups. Those who were randomised to continue with the programme after the six-month follow-up showed a sustained increase in adherence rate after another six-month interval, whereas those randomised to usual care showed a decrease in adherence rate back to a value similar to that at baseline [14].

Polypharmacy (the prescription of multiple medications) is common amongst the elderly and has traditionally been considered detrimental due to the increase in potential for drug interactions and/or adverse drug reactions, with substantial financial savings possible if the number of medications taken is reduced [15]. Holland et al suggested in a systematic review and meta-analysis that pharmacist-led medication reviews may be able to reduce polypharmacy slightly, which may correlate with the improved patient knowledge and adherence demonstrated in approximately half of the studies included in the systemic review [16]. Some other studies have also found that high numbers of medications are associated with negative health outcomes, but more research is needed to draw conclusions regarding polypharmacy and its detrimental or possibly beneficial influences on health outcomes in elderly [17]. Nevertheless, such misconceptions may need to be corrected because solely focusing on reducing the number of medications prescribed may actually result in poorer health outcomes [15]. In addition, polypharmacy has become almost inevitable as patients increasingly supplement their medicines with complementary products e.g. calcium, vitamin D, fish oils, glucosamine, vitamin B12, folic acid and coenzyme Q10 for the purposes of therapeutic supplementation and prevention [15].

Patient Outcomes

The effectiveness of pharmaceutical care programs designed to improve the health status of patients and health related quality of life has been examined in several studies. A systematic review provided evidence in support of the utilisation of pharmaceutical care services to improve the overall health status of patients [18]. It demonstrated that appropriate drug therapy improved the health status and quality of life of patients suffering from chronic illnesses. Once again, due to the lack of data specifically looking at MUR services, outcomes from these studies involving more complex levels of medicines management must be considered cautiously.

Qualitative measures of patient outcomes following PCP interventions have also been investigated and a significant proportion of patients in the intervention group reported that their medical condition was better controlled during the study than before participation (6 months 87.8%, 12 months 85.1%, 18 months 83.1%) [11].

A randomised controlled trial by Holland et al examining the effects of home based medication review on older people indicated a significantly higher rate of hospital readmission in the intervention group as compared to the control group that received usual care [19]. The authors commented that further research was needed to explain this counterintuitive finding [19]. Another review conducted and led by the same author found that medication reviews seemed to have no effect on the rate of hospitalisation [20].

Despite hospital admission rates being a commonly used outcome measure in evaluating the efficacy of clinical pharmacist interventions and MUR services, a study by Krska et al [21] suggests hospital admissions may not be sufficiently sensitive. The authors comment that the development of hospital admission categories that are medication-related or potentially preventable by pharmacist interventions are likely to serve as more relevant and indicative measures [21].

It is also important to understand that measuring the rate of hospital admissions, as evidenced in these articles, is not the same as determining if the hospitalisation was necessary.

Evidence indicating that pharmacist-led medication reviews are effective in reducing hospital admissions is relatively weak. There is currently no evidence for the effectiveness of interventions which are aimed at reducing admissions or preventable medication related morbidity. More studies of primary care based pharmacist-led interventions are needed to decide whether or not such medicine use review interventions are indeed effective in reducing hospital admissions [22].

Quality of life (QoL) is an important measure when considering the relative success of an intervention such as MUR. Interventions that clinically improve certain aspects of a disease may not necessarily increase a patient's quality of life. For instance, Holland et al reported no significant improvement in terms of quality of life and death rates in the intervention group following the results of a randomised controlled trial investigating the effects of a home based medication review service [19]. Similarly, in another study, no differences between intervention and control groups were identified for the health related quality of life using SF-36 [23]. Several other studies have also

showed limited evidence regarding the value of such interventions affecting QoL [20], especially in patients with chronic illnesses [11].

A systematic review by Roughead et al investigating the effects of pharmaceutical care on patient outcomes also produced equivocal results [13]. In this review, an intervention was considered pharmaceutical care if it involved a one-to-one consultation between patient and pharmacist with the objective of health management or resolution of drug-related problems (DRPs), followed by the development of a care plan and subsequent follow ups of the patient. Quality of life was one of the outcome measures used in sixteen of the studies included and no statistically significant difference between intervention and control groups (standard care with no pharmaceutical care component) were reported in eleven of them. Even though one of the sixteen studies reported a difference between intervention and control, such a difference was perceived by authors as “unlikely to be clinically significant”. Of the sixteen studies, only two reported a statistically significant improvement in quality of life but both studies were specific to patients with asthma, casting a doubt on the generalisability of results to other disease states [13].

However, in a study by Herborg et al, those in the therapeutic outcome monitoring group had better quality of life along with improved symptom status and fewer days of sickness [24]. More definitive results were produced by the evaluation carried out by Urbis Keys Young on an Australia-based Home Medicines Review service. In their evaluation, the generic EQ-5D questionnaire was administered to patients to capture broad effects of HMR on patient quality of life [25]. EQ-5D is a descriptive system that comprises five attributes of life quality, namely mobility, self care, ability, pain and anxiety/depression. Results revealed a highly significant improvement in the mean utility score post-HMR with the greatest improvement reported by patients with regards to the level of anxiety/depression. This closely reflected the fact a substantial number of patients reported feeling better after HMR and were more reassured and confident about their medications [25].

While health improvements have been reported, overall, the benefits of medicines management services in terms of patient outcomes are still inconclusive.

Patient perception of Medicine Use Review (MUR):

Patient perception of MUR services is an important determinant of service success. It has been widely documented that extended patient consultations with healthcare providers are highly valued by patients. Patients have reported a sense of empowerment, perception of safety and increased medication knowledge following a patient medication record review service [26], as well as a sense of satisfaction with the service [11, 23]. Patients have also reported a higher satisfaction with pharmacy services in general compared to before such interventions were implemented [11].

Medicines use review services have been widely implemented in several other countries, including Australia. The Australian Government introduced medicines use review in October 2001 where it is referred to as Home Medicines Review (HMR) [25]. The evaluation of the pharmacy component of the HMR service investigated patients’ perspectives using a consumer survey and found that a large

majority was in favour of HMR [25]. Ninety percent of patients agreed that the HMR service benefited them by boosting their confidence about using their medicines correctly and providing them with a clearer understanding of what and why certain medicines were prescribed for them by their doctors [25]. Seventy-five percent of patients reported improved understanding in one or more of the following areas: medication function and use, knowledge of safe or unsafe medication (or medication-food) combinations, issues relating to storage and expiry of medications. As part of a survey, patients were asked to report frequency of medication-related events both pre- and post-HMR. Results collated from the survey revealed a decline in medication incidents, hospital admissions, number of days in hospital, visits to the emergency department, GP and specialist visits as well as the number of days when patients were unable to carry out usual domestic tasks due to illness [25].

The Community Pharmacy Medicines Management Project [27], which was conducted in the United Kingdom, was a three-year randomised-controlled trial which assessed the implementation of a medicines management intervention via fifty community pharmacies for 1493 patients diagnosed with coronary heart disease. Findings from the trial provided conclusive evidence that 84% of patients were either satisfied or very satisfied with the medicines management service. Similar findings were also reported by community pharmacists involved in delivering the service who expressed positive attitudes towards medicines management. The General Practitioners (GPs) in the study were generally supportive of working more closely with their pharmacist colleagues, although concerns were sometimes expressed about professional boundaries and responsibilities and the potential for duplication of effort. Privacy issues to do with accessing confidential patient information were an additional concern raised.

Cost-effectiveness

Consultations and medication reviews conducted by a trained pharmacist have been shown to produce important cost savings, even after the deduction of the interventions' costs [28]. A growing body of evidence also suggests that workers whose chronic conditions are effectively controlled with medications are more productive at work, which could be translated into potential direct and indirect cost savings for the employers [18]. In a trial looking at medicines review in the community, Sorensen et al reported positive trends in both clinical outcomes (adverse drug reactions and severity of illness) and costs (an ongoing trend towards reduction in healthcare service costs), however the trial was limited to a 6-month intervention time [23]. In another review by Hanlon et al, the cost-effectiveness ratio for an intervention based on cost savings, reduced adverse events and improved health outcomes was found to be small, but it suggested there were cost reductions related to inpatient emergencies and other related medical costs [12]. In essence, this review highlighted that selection of appropriate pharmaceutical agents will help overcome the debilitating outcomes of chronic medical conditions in patients, thus improving health status, saving time and decreasing the usage of higher cost healthcare resources.

Pharmacist perception of Medicine Use Review (MUR):

In Australia, in 2004, a national postal survey was sent out to all HMR participating pharmacists as a means of collecting information of pharmacists' experiences and opinions of such a service [25]. The views reported were generally positive and more than ninety percent of pharmacists believed that HMR should be continued. However, pharmacists also expressed that the full potential of HMR was far from reached and that more effort should be made to increase awareness of HMR amongst the general public and health professionals in order for many more people to benefit from the service [25].

Despite majority of pharmacists expressing their view that the level of monetary remuneration they received for HMR was inadequate, pharmacists surveyed revealed several other non-financial reasons that attracted them to become accredited HMR service providers [25]. Amongst these were the opportunity to play a more active role in patient care and the belief that HMR contributes positively to patients' health. Pharmacists also viewed HMR as a professional and career development opportunity and several female pharmacists cited flexible working hours and possibility of part-time employment as additional reasons. Nevertheless, some pharmacists expressed reluctance or uncertainty about remaining accredited due to the time and costs involved in re-accreditation [25].

In addition to survey findings, positive impacts of HMR on pharmacists' professional relationships with GPs were also reported and pharmacists felt that HMR had the potential to produce many health benefits e.g. identifying undesirable side effects or drug interactions, identifying options for changes in medication or dosages, identifying health, welfare or storage related issues, improving adherence by devising simpler dosage regimens, identifying overuse or inappropriate use of over-the-counter products in addition to prescription medicines [25].

Summary of current literature

This literature review sought to explore the outcomes of medicines management provisions within and outside New Zealand. The majority of the literature covers Medicines Therapy Assessment and other services which comprise higher levels of the Medicines Management Competency Framework, rather than Medicines Use Review (MUR). There are therefore, limitations in extrapolating such findings to MUR where the criteria of the services examined are different to those of an MUR service.

There also appears to be a lack of New Zealand specific data with regards to MUR. This could be attributed to the fact that MUR is a newly emerging service that is gradually being developed. The need for research that applies to our specific cultural diversity is one aspect that contributes to the need for further investigation into the benefits of MUR. There is a need to examine the positive and negative impacts of the service and also to identify any areas where improvements could be made to maximise health benefits.

Aims and objectives

Aim

To evaluate two Medicine Use Review (MUR) pilots contracted by the ADHB, in terms of their impact and efficacy on the health status of community-dwelling people over the age of 65 years and the effect on pharmacists contracted to provide these services.

Objectives

- To investigate both service providers' and patients' views of such services.
- To examine the overall impact the service has on patient understanding and adherence to their medicines.
- To explore the processes involved in MUR service provision.
- To explore the medicines and medical conditions most implicated in medication related problems.
- To verify whether health inequalities were addressed, especially within Māori and Pacific Island ethnicities and others of low socioeconomic status, as specified in Auckland District Health Board's Request for Proposal (RFP).
- To assess the effect of this service on the use of primary and secondary health care.
- To investigate the effect of MUR service provision on the quality of life of patients.
- To evaluate the extent to which issues identified by the pharmacist were resolved.

Part A: Pharmacy Guild and Mt Eden Pharmacy

Method

Eligibility for MUR

The MUR pharmacists (Pharmacy Guild contracted and Mt Eden Pharmacy) recruited older people living within the ADHB region and who met the eligibility criteria for participation in the MUR (Table 1). In view of the ADHB's objective, particular focus was given to elderly over 65 years, but patients under the age of 65 years who met the eligibility criteria were also included in MUR.

Table 1: Eligibility criteria for inclusion into MUR

To be eligible, the patient MUST be: <ul style="list-style-type: none">• Living independently in the community
AND at least ONE of the following: <ul style="list-style-type: none">• Taking three or more prescribed medications or more than twelve doses per day• More than one prescriber• Recent hospital admission (within 4 weeks)• Taking medicines with a high risk of adverse effects or need for monitoring
AND identified or suspected to be experiencing or being at high risk of medicine related problems including, where applicable: <ul style="list-style-type: none">• Medicines non-adherence• Confusion about the medicines regimen• Medicines management issues due to impaired sight, reduced dexterity, literacy or language difficulties, cognitive difficulties• Adverse effects of prescribed medicines• Sub-optimal response to pharmacotherapy

Recruitment

The Pharmacy Guild contract described the recruitment of 100 patients across all sites, while the Mt Eden Pharmacy contract expected approximately 50 patients. The recruitment period was originally planned from the 1st of October 2007 to the end of December 2007. This period was extended significantly to September 2008 due to delays in finalising contracts, slow recruitment and the reduction of pharmacists taking part in the pilot. Only the patients participating in MURs during this time period were included in the evaluation.

Data collection

The evaluation made use of multiple data sources and types. This can be broadly divided into: the

- Quantitative data collected during the MUR visits
- Qualitative data elicited from pharmacists and patients, and the
- ADHB datasets.

MUR visit data

The Pharmacy Guild Data Collection tool was used by MUR pharmacists, both Pharmacy Guild and Mt Eden Pharmacy, to collect relevant patient information on three occasions for each patient. The MUR pilot was designed around the requirements of MUR as interpreted by the Pharmacy Guild contract holders. The expectation was that each patient would be recruited, sign a consent form, and then have a total of three home-based visits by the pharmacist.

The MUR process for each participating patient consisted of communications between pharmacist, patient and other health professionals as well as the three core visits for data collection and planning, as illustrated in Figure 1.

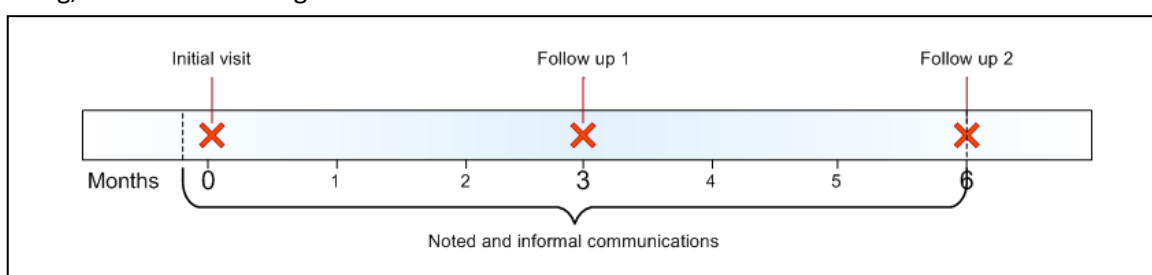


Figure 1: MUR timeline

The initial patient review involved the pharmacist making contact with the patient, identifying medication-related issues and developing a plan to address these issues. Two subsequent follow-ups were performed for each patient. A summary of the patient information collected at each initial and follow-up review is given in Table 2. For full details, refer to Appendix 1.

Table 2: Information collected by pharmacist during MUR visit

Domain	Initial review	Follow up 1 and 2
Patient details	Name, age, gender, NHI, ethnicity, address, inclusion criteria, health conditions, alcohol intake, smoking status.	Health conditions, alcohol intake, smoking status.
Communication record	All communication with the patient or other people regarding the patient's care	
Review details	Date, venue and duration	As for initial review
Current medication	Includes prescription, as required, over-the-counter and complementary medicines as well as dietary supplements	As for initial review
Medicine usage	Patients' perceived therapeutic response, self-adherence, ease of use and access/supply as well as pharmacist perception of patient adherence and knowledge	As for initial review
Quality of life	EuroQoL EQ-5D score and VAS score based on patient self reporting ¹	As for initial review
Medicines use issues identified and Medicines Management Plan	Includes issues of medicines adherence, therapeutic response, practical medicines use, and medicines access/supply/expiry. Subsequent development of medicine management plan and reassessment requirements	

¹ EQ-5D defines health in terms of mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The use of EQ-5D was employed in this evaluation as it was integrated as part of the pre-designed Pharmacy Guild of New Zealand (PGNZ) data collection tool. It was also appropriate because it is a standardised instrument for the measure of health outcomes that can be adjusted to suit the NZ population and is applicable to a wide range of health conditions and treatments. The VAS score uses a visual scale for patients to report their present health state.

Domain	Initial review	Follow up 1 and 2
Follow up issues		Description of issue resolution, and the identification of new issues since initial visit.

Data collection for evaluation project

The Pharmacy Guild data collection tool was designed primarily to facilitate the delivery of MUR. It consequently contained more information than required by the evaluators. The data required for evaluation of MUR were extracted as a subset from the completed forms.

The data that were extracted for the purposes of this evaluation fall into four main categories: population measures, interdisciplinary approach to comprehensive health care, process measures and outcomes of care. Table 3 below provides an overview of these four categories and the data used to inform each area.

Table 3: Description of data used in the evaluation

Category	Data
Population measures	<ul style="list-style-type: none"> Age, ethnicity, gender, NZ Deprivation Index (NZDep)², medical condition(s), number and type of prescribed medications³ Patient mobility, sight and hearing problems
Multidisciplinary approach to comprehensive healthcare	<ul style="list-style-type: none"> Source of referral Level of communication between health professionals Pharmacists' reported experience of multidisciplinary care Patients' reported attitudes to pharmacy vs. GP care
Process measures ⁴	<ul style="list-style-type: none"> Number of reviews Timeliness of initial and subsequent reviews Venue and duration of MUR
Outcomes of care	<ul style="list-style-type: none"> Medication related issues Quality of life (QoL)- EQ 5D and Visual Analogue Scale (VAS) Patient adherence Patient understanding and perception Rate of hospitalisation Use of hospital services, both planned and unplanned

Interviews with pharmacists

All Pharmacists taking part in either the Pharmacy Guild or Mt Eden Pharmacy contracts were interviewed two or three times. These face-to-face interviews were conducted by the Project

² See page 28

³ The drugs are classified according to the Anatomical Therapeutic Chemical (ATC) classification system developed by the WHO International Working Group for Drug Statistics Methodology (33). The classes used for this study are at the therapeutic (2nd) level of the ATC classification system.

⁴ These process measures were taken from the MUR data as well as Patient and pharmacist interviews, allowing some further 'triangulation' of information.

Manager using a semi-structured format. The initial interviews elicited information regarding the pharmacist’s previous service experience as well as their expectation and preparation for the MUR pilot. Later interviews focused more on the successes and barriers experienced during the pilot. These interview schedules can be found in Appendix 2. Interview data was collected by detailed note-taking.

Interviews with patients

Patients gave their permission to be contacted by the evaluators on their consent form. The evaluators carried out semi-structured phone interviews with 27 patients. The interviewer filled out a paper-based questionnaire with their responses. The interview comprised of a mixture of open-ended questions about their experience of the MUR process, and some fixed response questions intended to elicit more quantifiable measures. All interviews were completed in December 2008, when all patients had been engaged in the pilot long enough for most 6 month follow ups to have occurred.

District Health Board data

Auckland District Health Board was also able to provide anonymised data on all patients. The evaluators provided patients’ National Health Index (NHI), date of birth and the date of the initial interview. The data extracted covered the period of time six months prior and six months after that date. Table 4 provides a summary of the data provided, although not all variable were used in the analyses.

Table 4: ADHB dataset description

Category	Data
Admission data	<ul style="list-style-type: none"> • Date • Ward • Diagnosis related Group (DRG) • Diagnoses • Procedures • Admission type • Admission source • Arrival mode
Referral	<ul style="list-style-type: none"> • Referral reason • Referrer
Discharge	<ul style="list-style-type: none"> • Discharge date • Discharge type
Demographics	<ul style="list-style-type: none"> • Domicile (area and postcode only) • Deprivation scale and score • Gender and ethnicity.

New Zealand Deprivation Index (NZDep)

The NZDep is a social deprivation index determined from available census data[29]. It provides a score of area deprivation between ‘1’ least deprived areas to ‘10’ most deprived areas. Deprivation is based upon factors including the number of people in the area who receive a means tested

benefit, unemployment, access to a telephone, access to a car and if they own their own home. It is important to note that the NZDep refers to an area being deprived, rather than an individual person.

Data entry

Quantitative data from the Pharmacy Guild MUR record were manually entered into a purpose-built database. Data were then extracted to statistical software packages in order for summative or other analyses to be undertaken.

Qualitative data from both the pharmacist and patient interviews were entered into simple spreadsheets to enable content analysis by researchers.

An electronic EQ-5D summary index calculator was employed to convert the raw five-digit score into a summary index. The summary index obtained falls between a value of '1' indicating optimal health and '0' indicating worst possible health. The calculator provided the option to use NZ validated data to calculate the summary index from reported dimensions of health. This was used to ensure results would be generalisable to the MUR patients.

The Visual Analogue Scale (VAS) score is a patient-reported estimation of his/her quality of life on a scale of 0-100 at the time of reporting, with 100 being the best imaginable health state and 0 being the worst.

Data analysis

Where appropriate, paired sample t-tests were used to determine if significant differences were present between the initial and last review data. Non-parametric tests to detect significant differences were also used where the sample size and characteristics made such tests more appropriate. Often however, there was not sufficient data to provide statistically significant tests between the initial and subsequent review data points. For this reason, primarily summative analyses were used. Qualitative data were analysed using a general inductive approach [30]. This allows research findings to emerge from the common, dominant or significant themes inherent in raw data, without the restraints imposed by structured methodologies.

Ethics approval

Prior to this project, the project manager sought and received a letter of confirmation from the Northern Regional Ethics Committee confirming the project's status. As the present evaluation project is purely an audit of health services as part of a larger study, it was not a requirement for ethical approval to be re-obtained. (Reference number: NTX/07/01/EXP).

Results

Number of patients

As described in the methodology section, the MUR pilot was expected to recruit approximately 150 patients across the Pharmacy Guild pilot and the Mt Eden pilot combined. The number actually recruited was less than this, and the number of patients interviewed during the 1st and 2nd follow ups was also diminished. These reasons and limitations are explored in the Discussion section. Table 5 below provides the number of interviews completed at each site.

Table 5: Number of interviews/visits completed

Pharmacy	Initial	Follow up 1	Follow up 2
C	3	1	1
D	8	6	7
E	9	6	1
G	5	4	2
N	24	24	23
W	1		
Mt Eden	24	13	13
Grand Total	74	54	47

Patient characteristics

Tables 6 and 7 provide basic demographic information of the 74 patients enrolled in the MUR pilot. Nearly three quarters of patients were female and just over one fifth were aged 81 to 85 (21% of the sample). The cumulative percentage demonstrates that 21% of the participants were 65 or younger. Two thirds of all patients identified as New Zealand European, with a higher proportion within women than men (71% vs. 51%, respectively).

Table 6: Age and gender of patients

Age band	Female (n=53)	Male (n=21)	Total (%)	Cumulative %
36-40	1		1 (1.9%)	1.0%
46-50	2		2 (2.7%)	4.1%
51-55	1	2	3 (4.1%)	8.2%
56-60	3	1	4 (5.5%)	13.7%
61-65	4	2	6 (6.8%)	20.5%
66-70	8	2	10 (13.7%)	34.2%
71-75	3	1	4 (5.5%)	39.7%
76-80	4	4	8 (11.0%)	50.7%
81-85	9	6	15 (20.5%)	71.2%
86-90	10	3	13 (17.8%)	89.0%
91-95	4		4 (5.5%)	94.5%
96-100	2		2 (2.7%)	97.3%
No response	2		2 (2.7%)	100.0%

Table 7: Ethnicity of patients

Ethnicity	Female n (% of female)	Male n (% of male)	Total n (%)
New Zealand European	37 (71.2%)	11 (52.4%)	48 (65.8%)
Māori	4 (7.7%)	4 (19.0%)	8 (11%)
Cook Island Māori	2 (3.8%)	-	2 (2.7%)
Samoan	2 (3.8%)	2 (9.5%)	4 (5.5%)
Tongan	2 (3.8%)	3 (14.3%)	5 (6.8%)
Chinese	1 (1.9%)	-	1 (1.4%)
Indian	1 (1.9%)	-	1 (1.4%)
Niuean	1 (1.9%)	-	1 (1.4%)
Other	2 (3.8%)	1 (4.8%)	3 (4.1%)
No response	1 (1.9%)		

Table 8 summarises the frequency of inclusion criteria. As is evident, number and frequency of prescribed medications were the most common criteria, (as independent living is a presumed criterion for all). Multiple prescribers and high risk medications were both reported in nearly a quarter of all patients. In relation to other medicines problems over 50% were identified as confused about their regimen and 40% with some indication of non-adherence issues. On average, patients had three qualifying criteria in addition to living independently.

Table 8: Inclusion criteria

Criteria	n (%)
Living independently in the community	73(97.3%)
AND at least ONE of the following:	
Taking three or more prescribed medications or more than 12 doses per day	72 (96.0%)
More than one prescriber	17 (22.7%)
Recent hospital admission (within 4 weeks)	9 (12.0%)
Taking medicines with a high risk of adverse effects or need for monitoring	17 (22.7%)
AND identified or suspected to be experiencing or being at high risk of medicines related problems:	
Medicines non – adherence	30 (40.0%)
Confusion about the medicines regimen	43 (57.3%)
Medicines management issues dues to impaired sight, reduced dexterity, literacy or language difficulties, cognitive difficulties	24 (32.0%)
Adverse effects of prescribed medicines	8 (10.7%)
Sub-optimal response to pharmacotherapy	8 (10.7%)

During each visit, pharmacists also recorded any general health conditions. Table 9 shows that a close to 90% of patients had some form of cardiovascular disease. ‘Other’ conditions included depression and Parkinson’s Disease.

Table 9: Health conditions identified during initial visit

Condition	n (%)
Cardiovascular Disease	65 (87.8%)
Muscular/skeletal/incl. arthritis	24 (32.4%)
Respiratory disease	17 (23.0%)
Diabetes	23 (31.1%)
Other	30 (40.5%)

Table 10 provides the prevalence of factors that may influence medicines use or effectiveness. Mobility was the most common, indicated for 59% of patients with hearing and sight registering at 27% and 39% respectively. Table 11 describes patients' smoking status. Table 12 shows current alcohol consumption with over three quarters of patients consuming two or less drinks per week. There were some significant outliers, with three reporting 25 or more drinks per week.

Table 10: Factors affecting medicines use

	Mobility n (%)	Sight n (%)	Hearing n (%)
Yes	44 (59.5%)	20 (27.0%)	29 (39.2%)
No	22 (29.7%)	42 (56.8%)	38 (51.4%)
No response	8 (10.8%)	12 (16.2%)	7 (9.5%)

Table 11: Smoking status

Smoking Status	n (%)
Current	10 (13.5%)
Ex	29 (39.2%)
Never	33 (44.6%)
No Response	2 (2.7%)

Table 12: Alcohol consumption per week

Drinks per week	n (%)
0-4	55 (74.3%)
5-9	8 (10.8%)
10-14	2 (2.7%)
15-19	1 (1.4%)
20-24	1 (1.4%)
25-29	2 (2.7%)
30-34	1 (1.4%)
No response	4 (5.4%)

Table 13 provides a breakdown of patients by ethnicity and NZDep. These data were extracted from existing ADHB data using patients' NHI numbers. The final number included (56) was due to a number of patients not having data present in the four year window used for extraction. The data have an approximately bi-modal appearance with 32% of patients residing in NZDep 3-4 and 34% in NZDep 7 to 8 areas. The breakdown by ethnicity indicated that New Zealand European patients

appeared to have a relatively broad spread according to NZDep, but the numbers in other ethnicities are very low, and true comparison is not possible.

Table 13: Ethnicity by NZDep area

Ethnicity	NZ Deprivation index					Total
	Least deprived		Most deprived			
	1-2	3-4	5-6	7-8	9-10	
Chinese					1	1
Cook Island Māori					2	2
Māori		2		1	2	5
New Zealand European	3	12	7	9	3	34
Other				1		1
Other European		4		2		6
Samoan				3		3
Tongan			1	3		4
Total n(%)	3 (5.3%)	18 (32.1%)	8 (14.3%)	19 (33.9%)	8 (14.3%)	56

Communication

During the pilot pharmacists were required to record the time taken communicating with patients and others outside of the review visits. Pharmacists recorded communications relating to 57 patients only. As expected pharmacists had the most communications with their patient, and this communication had the longest average duration. Communications between the patient's doctor and the pharmacist was the next most common (see Table 14).

Table 14: Communication

Type of communication	Number of communications (N=57)	Average duration (minutes)
Pharmacist to Patient	120	27
Patient to Pharmacist	23	12
Pharmacist to Doctor	17	12
Pharmacist to Family Member	13	10
Doctor to Pharmacist	6	6
Pharmacist to health professional	5	6
Family Member to Pharmacist	3	42
Pharmacist to Other	2	5
Doctor to Patient	1	

Venue and duration

Pharmacists were expected to conduct most interviews during a home visit, or if not possible, in a private consultation space in the pharmacy. As indicated in Table 15 most initial interviews were carried out at the patient's home. The decrease in home-based interviews between initial and follow up interviews was matched by an increase in pharmacy based and other venues- typically over the telephone. The duration of visits also dropped, as expected from an average of 56 minutes down to 22 minutes for the 1st follow up and 15 minutes for the 2nd follow up.

Table 15: Visit venues and durations

Venue: initial visit	n (%)	Average duration in minutes
Patient's Home	62 (83.8%)	55
Pharmacy	9 (12.2%)	67
Other	1 (1.4%)	
No venue	2 (2.7%)	60
Total	74	56
Venue: 1st follow up		
Patient's Home	21 (39.6%)	25
Pharmacy	17 (32.1%)	22
Other	15 (28.3%)	15
Total	53	22
Venue: 2nd follow up		
Patient's Home	16 (37.2%)	17
Pharmacy	12 (27.9%)	13
Other	15 (34.9%)	14
Total	43	15

Medication usage

Medication usage formed a significant section of the data collected by pharmacists during the initial and subsequent visits or interviews. As indicated by qualitative interviews, and the completeness of data, the recording of medication data on the follow up visits was not as assiduous as the initial interview. Pharmacists recorded basic information about each medicine the patient was prescribed. They also collected data on some complementary and over the counter medicines, as well as those prescribed to be take only as required. Table 16 provides a summary of the overall usage of medicines. Wilcoxon signed ranked test analyses were used to see if the number of medicines per patient was statistically different between the Initial and 1st Follow up, and the Initial and 2nd Follow up.

Table 16: Summary of medicines data

		Initial	Follow up 1	Follow up 2
Total number of patients		74	54	43
Patients with medicines data		72	53	42
Prescription medicines	Total	621	366	265
	Median (range)	8 (3-18)	7 (1-13) ⁵	6 (1-16) ⁶
As required medicines	Total	104	94	70
	Median (range)	2 (1-8)	2 (1-6)	3 (1-5)
Over the counter medicines	Total	58	13	11
	Median (range)	2 (1-8)	1 (1-7)	1 (1-6)
Total of all medicines	Total	783	473	346
	Median	5 (1-18)	4 (1-13) ⁷	4 (1-16) ⁸

Medicines by drug class

All medicines were coded using the standard Pharmac drug codes, with 102 classes identified across all three data points. For ease of analysis, only the 'top 40' drug classes are considered here, that is, any drug recorded 10 or more times from all three visits. It is possible for patients to have more than one drug from each class prescribed. Therefore, Table 17 provides the number of patients who were prescribed at least one drug from that class. This allows a percentage of the number of patients using any particular class, without multiple usage distorting the information. The final column 'total amount' indicates how many times the class was prescribed in total. Where the 'total number' exceeds the 'total' this indicates that some patients were prescribed more than one drug from that class.

⁵ Significantly fewer prescription medicines at follow up 1 when compared to initial, p= 0.000

⁶ Significantly fewer prescription medicines at follow up 2 when compared to initial, p= 0.001

⁷ Significantly fewer total number of medicines at follow up 1 when compared to initial, p= 0.001

⁸ Significantly fewer total number of medicines at follow up 2 when compared to initial, p= 0.000

Table 17: Number of patients prescribed medications by class

Class	Initial (N=72)	Follow up 1 (N= 53)	Follow up 2 (N=42)	Total	Total number
Antiplatelet agents	54	36	28	118	131
HMG CoA reductase inhibitors (statins)	38	28	23	89	89
Non-opioid analgesics	39	29	17	85	86
Beta adrenoceptor blockers	38	25	17	80	81
Proton pump inhibitors	33	21	16	70	70
ACE inhibitors	27	21	19	67	67
Oral hypoglycaemic agents	18	15	14	47	66
Calcium homeostasis	24	14	10	48	64
Opioid analgesics	15	10	8	33	40
Loop diuretics	14	13	8	35	35
Vitamin D	18	10	7	35	35
Other calcium channel blockers	16	8	6	30	32
Dihydropyridine calcium channel blockers	19	8	4	31	31
Nitrates	14	7	5	26	29
Thyroid and antithyroid agents	15	8	4	27	27
Inhaled corticosteroids	15	4	5	24	25
Anti-inflammatory non steroidal drugs	10	6	6	22	25
Osmotic laxatives	10	7	4	21	23
ACE inhibitors with diuretics	11	6	4	21	21
Cyclic and related agents	12	5	4	21	21
Sedatives and hypnotics	14	5	2	21	21
Angiotensin II antagonists	11	7	2	20	21
Faecal softeners	10	6	4	20	20
Insulin - intermediate-acting preparations	8	6	6	20	20
Oral anticoagulants	9	5	5	19	20
Alpha adrenoceptor blockers	9	5	4	18	18
Hyperuricaemia and antigout	7	7	4	18	18
Device disposables	7	6	3	16	16
Inhaled beta-adrenoceptor agonists	8	5	3	16	16
Control of epilepsy	6	4	2	12	16
Corticosteroids and related agents for systemic use	7	2	3	12	15
Selective serotonin reuptake inhibitors	7	4	2	13	13
Megaloblastic	7	4	1	12	12
Thiazide and related diuretics	6	3	3	12	12
Dopamine agonists and related agents	2	1	2	5	11
Antihistamines	5	4	1	10	10
Antinausea and vertigo agents	6	3	1	10	10
Multivitamin preparations	6	2	2	10	10
Potassium sparing diuretics	4	3	3	10	10
Antiarrhythmics	3	2	2	7	10

Change in usage of medications by class was determined by calculating the percentage of patients using the medication and then tracking changes across the three visits. Again, multiple class usage

per patient was not used, as this tended to skew the order of change dramatically in a small number of cases. Changes ranged from a 16% decrease to a 8% increase. Table 18 shows these changes ordered by amount of decrease.

Table 18: Change in medicine usage

Class	Change from initial to follow up 1	Change from initial to follow up 2
Dihydropyridine calcium channel blockers	-11.3%	-16.9%
Sedatives and hypnotics	-10.0%	-14.7%
Non-opioid analgesics	+0.6%	-13.7%
Beta adrenoceptor blockers	-5.6%	-12.3%
Thyroid and antithyroid agents	-5.7%	-11.3%
Angiotensin II antagonists	-2.1%	-10.5%
Calcium homeostasis	-6.9%	-9.5%
Inhaled corticosteroids	-13.3%	-8.9%
Antiplatelet agents	-7.1%	-8.3%
Vitamin D	-6.1%	-8.3%
Other calcium channel blockers	-7.1%	-7.9%
Proton pump inhibitors	-6.2%	-7.7%
Nitrates	-6.2%	-7.5%
Megaloblastic	-2.2%	-7.3%
Cyclic and related agents	-7.2%	-7.1%
Antinausea and vertigo agents	-2.7%	-6.0%
ACE inhibitors with diuretics	-4.0%	-5.8%
Selective serotonin reuptake inhibitors	-2.2%	-5.0%
Antihistamines	0.6%	-4.6%
Osmotic laxatives	-0.7%	-4.4%
Faecal softeners	-2.6%	-4.4%
Inhaled beta-adrenoceptor agonists	-1.7%	-4.0%
Control of epilepsy	-0.8%	-3.6%
Multivitamin preparations	-4.6%	-3.6%
Alpha adrenoceptor blockers	-3.1%	-3.0%
Device disposables	+1.6%	-2.6%
Corticosteroids and related agents for systemic use	-5.9%	-2.6%
Opioid analgesics	-2.0%	-1.8%
Thiazide and related diuretics	-2.7%	-1.2%
Oral anticoagulants	-3.1%	-0.6%
Loop diuretics	+5.1%	-0.4%
Hyperuricaemia and antigout	+3.5%	-0.2%
Anti-inflammatory non steroidal drugs	-2.6%	+0.4%
Antiarrhythmics	-0.4%	+0.6%
Potassium sparing diuretics	0.1%	+1.6%
Dopamine agonists and related agents	-0.9%	+2.0%
HMG CoA reductase inhibitors (statins)	+0.1%	+2.0%
Insulin - intermediate-acting preparations	+0.2%	+3.2%
ACE inhibitors	+2.1%	+7.7%
Oral hypoglycaemic agents	+3.3%	+8.3%

The data were also analysed by number of medicines per patient, (see Table 19). While there clearly are some outliers, on average patients were using two fewer medicines at their last follow up (either follow up 1 or 2, using the latest one available).

Table 19: Change in number of medications prescribed

Number of medicines changed	Number of patients
-15	1
-14	1
-10	1
-9	3
-8	3
-6	1
-5	1
-4	4
-3	4
-2	8
-1	10
0	7
1	5
2	3
4	1
5	1
6	1
average	2 fewer medicines
median	1 fewer medicine
mode	1 fewer medicine

Regimen

For all prescribed medicines the regimen (strength, form and frequency) was recorded as well as the patient's knowledge of each medicine, and adherence to the prescribed regimen. A simple tick box by each medicine showed if the patient used the prescribed regimen, or not. Table 20 indicates that of the number of medicines used as per the regimen increased as a percentage across the three measures. Over the counter medicines were excluded from this and following tables, as there was no record required for the medicines regimen or adherence.

Table 20: Number of medicines taken as directed

Regimen	Initial (N=63)		Follow up 1 (N=44)		Follow up 2 (N=36)	
	Number of meds	%	Number of meds	%	Number of meds	%
Regimen as directed	480	67.1%	329	72.8%	272	83.4%
Regimen differs from directed	235	32.9%	123	27.2%	54	16.6%
Total	715	100.0%	452	100.0%	326	100.0%

Adherence

Adherence was rated by the pharmacist on each individual medicine. They scored the patient's adherence on a scale of 1 to 4 where 1 = "always miss a dose", 2= "often miss a dose", 3= "seldom miss a dose" and 4="never miss a dose". As with other areas of the data entry, there were numerous medicines where no adherence information was recorded. Table 21 below indicates the amount of data recorded.

Table 21: data completion for adherence and knowledge

	Initial (n=715)	Follow up 1 (n=452)	Follow up 2 (n=326)	Total (N=1493)
Adherence rating	565 (79.0%)	305 (67.5%)	238 (73.0%)	1108 (74.2%)
No adherence rating	150 (21.0%)	147 (32.5%)	88 (27.0%)	385 (25.8%)
Knowledge rating	659 (92.2%)	365 (80.8%)	296 (90.8%)	1320 (88.4%)
No knowledge rating	56 (7.8%)	87 (19.2%)	30 (9.2%)	173 (11.6%)
Total	715	452	326	1493

The percentage of adherence ratings for all medicines across the three visits can be seen in Figure 2. The percentages appear to improve across the visits, with the combination of those medicines for which doses were "often" or "always" missed reduced from 14% on the initial visit down to 4% for the 2nd follow up.

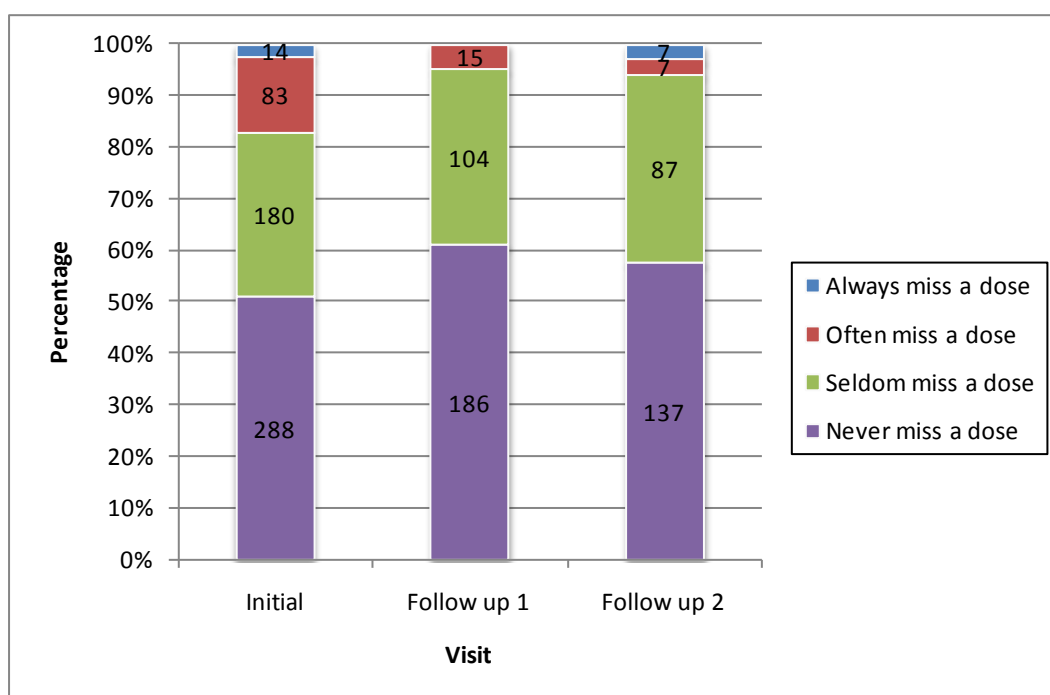


Figure 2: Adherence to medicines

Self reported adherence

As well as the individual medicine adherence measures determined by the pharmacist, patients also provided a self-reported measure of adherence using the Morisky Scale[31]. The four item 5-point responses give a total score out of 16 (0 being the best adherence and 16 being the poorest). A score equal to or less than three is the common threshold for 'good' adherence. A total score of >3 was taken to indicate non-adherence. The raw scores at each time point, with subtotals are provided in Table 22. It would appear that overall adherence may have dropped at the follow up 2 point, although a significant 'clump' of patients scoring 4 account for this difference.

Table 22: Patient self-rated medicines adherence

Score	Initial	Follow up 1	Follow up 2
0	15	18	7
1	7	14	5
2	11	2	2
3	2	3	2
Total "Good" adherence	35 (66%)	37 (71%)	16 (37%)
4	4	10	18
5	2	1	4
6	0	1	0
7	3	0	0
8	3	1	0
9	0	2	0
10	0	0	0
11	1	0	1
12	4	0	1
13	0	0	0
14	0	0	0
15	1	0	0
16	0	0	3
Total "Not good" adherence	18(34%)	15 (29%)	27 (63%)

Knowledge of medicines

Pharmacists also rated the patient’s knowledge of each medicine. A score of 1= “no knowledge”, 2= “some knowledge”, 3= “good knowledge” and 4= “excellent knowledge”. The proportion of medicines rated as patients’ having an “excellent “knowledge did not change over the three time points. “Good knowledge” did increase, while “some” or “no knowledge” both reduced. In all, patients’ ‘excellent’ or ‘good’ knowledge of all medicines prescribed appeared to have increased from a combined percentage of 50% to 75%.

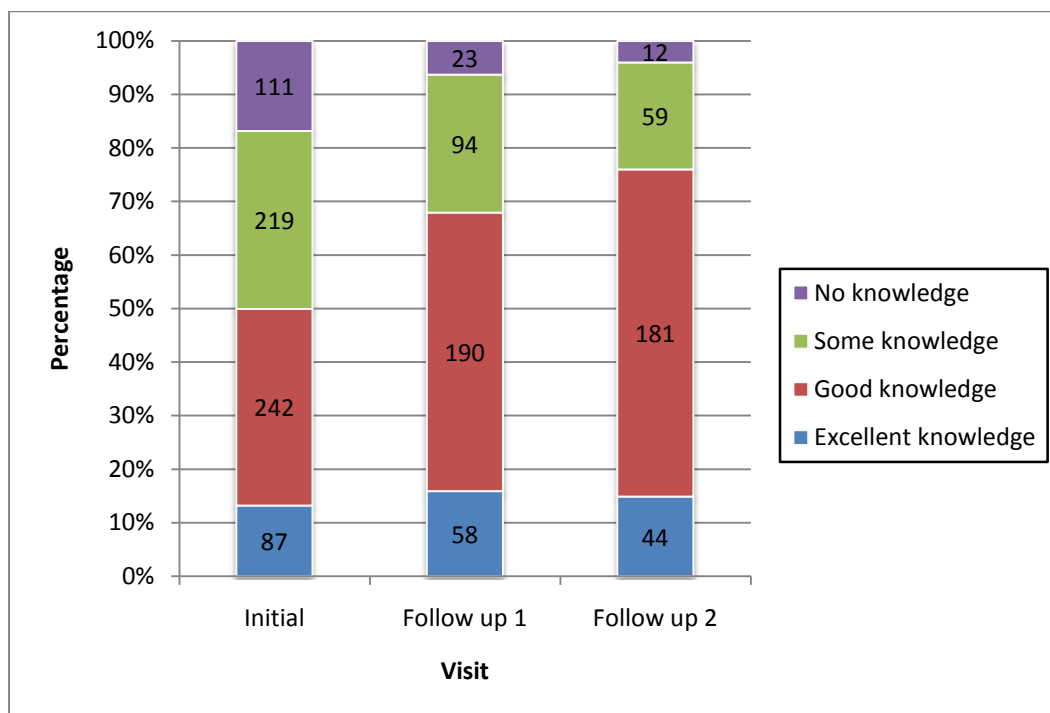


Figure 3: Knowledge of medicines

Pharmacists’ rating of patients’ overall knowledge

Pharmacists also provided an overall rating for their patients at each visit. They rated the patient on a scale of 1 to 4, where 1 = ‘No knowledge’, 2= ‘Some knowledge’, 3= ‘Good knowledge’ and 4= ‘Excellent knowledge’. The three questions are included in Table 23. An overall total score was calculated by adding the three scores for each patient.

Table 23: Pharmacist ratings of patients’ overall medicines knowledge

Question	Mean value		
	Initial (N=68)	Follow up 1 (N=46)	Follow up 2 (N=38)
Why their medicines have been prescribed	2.6	2.8	2.9
The patient knows when to take their medicines	3.1	3.6	3.8
The patient knows how to take/use their medicines	2.9	3.4	3.7
Overall score	8.6	9.7	10.3

Using a paired samples non-parametric test (Wilcoxon signed rank test) the differences between the three scores and the overall score were analysed, based on available pairs from the initial and 2nd follow up data, 37 patients in all. As can be seen in Table 24, the small increase in knowledge was significant in all but the 2nd question relating to knowledge regarding when to take medicines.

Table 24: Test for change in knowledge score.

	Question 1	Question 2	Question 3	Overall score
Z	-2.998	-.241	-4.262	-4.407
Asymp. Sig. (2-tailed)	.003	.809	.000	.000

Therapeutic response

Patients were asked if they believed their medicines were working for them, which pharmacists recorded (along with any specific issues). The patient was then asked to rate their level of agreement with a statement regarding their medicines, as seen in Table 25. From the initial interview around 83% of patients either ‘agreed’ or ‘strongly agreed’ that their medicines worked well. This percentage increased to 88.5% for the first follow up and 86.4% for the second follow up.

Table 25: Self reported therapeutic response

“The medicines my doctor prescribes work well for me”	Initial (N=72)	Follow up 1 (N=52)	Follow up 2 (N=44)
Strongly Disagree	1 (1.4%)	1(1.9%)	4 (9.1%)
Disagree	2 (2.8%)	-	-
Neither Agree or Disagree	9 (12.5%)	5 (9.6%)	2 (4.5%)
Agree	39 (54.2%)	33 (63.5%)	29 (65.9%)
Strongly Agree	21 (29.2%)	13 (25.0%)	9 (20.5%)

Practical aspects and access and supply

Using a similar structure to the previous question, practical aspects of medicine usage, and access/supply were also measured. These have been summarised in Table 26 and 27. Patients reported high levels of agreement regarding the practical aspects of taking medicines, with over 90% of patients either ‘agreeing’ or ‘strongly agreeing’ that they could easily take their medicines at the initial visit, leaving little room for measurement of improvement in subsequent follow ups.

In terms of access to medicines and supply of medicines a similarly higher proportion of patients ‘agreed’ or ‘strongly agreed’ that they could easily order and collect their medicines (91.6% at the initial visit). This did appear to drop slightly at the 2nd follow up.

Table 26: Self reported opinion of practical aspects of taking medicines

“I can easily take or use my medicines”	Initial (N=72)	Follow up 1 (N=52)	Follow up 2 (N=44)
Strongly Disagree	1 (1.4%)	2 (3.8%)	4 (9.1%)
Disagree	2 (2.8%)	2 (3.8%)	1 (2.3%)
Neither Agree or Disagree	2 (2.8%)	2 (3.8%)	-
Agree	39 (54.2%)	25 (48.1%)	29 (65.9%)
Strongly Agree	28 (38.9%)	21 (40.4%)	10 (22.7%)

Table 27: Self reported opinion of access to and supply of medicines

“ I can easily order and collect my medicines ”	Initial (N=72)	Follow up 1 (N=50)	Follow up 2 (N=45)
Strongly Disagree	1 (1.4%)	1 (2.0%)	6 (13.3%)
Disagree	3 (4.2%)	1 (2.0%)	-
Neither Agree or Disagree	2 (2.8%)	3 (6.0%)	-
Agree	41 (56.9%)	29 (58.0%)	32 (71.1%)
Strongly Agree	25 (34.7%)	16 (32.0%)	7 (15.6%)

Expired medicines

A particularly useful aspect of the MUR pharmacist’s visit with patients in their home was an opportunity to identify and remove any expired or unwanted medicines. Nearly 40% of patients had such medications to be removed, with an additional 9% and 4% of each follow up also yielding more unwanted/expired medicines.

Quality of Life: EuroQoL 5D

Quality of Life as measured by the EuroQoL 5D (EQ-5D) tool is calculated from responses to five health-based statements. New Zealand norms for this tool are available so that calculations using the raw scores are comparable to the rest of the population. Patients were not included in the analysis where they had not recorded a response to all items at the initial and final 2nd follow up. This limited the number of patients to 43. The resulting score falls between 0 (worst health scenario) and 1 (best health scenario). At the initial interview this yielded an average score of 0.648 compared to 0.730 at the 2nd follow up. A paired sample t-test using these 43 patients indicated that the increase (albeit small) was significant ($p= 0.004$). Moreover, a scatter plot comparing the two scores demonstrates the slight increase. Figure 3 shows a red dotted line at the ‘scores equal’ plot. Where the data point falls above the red line the patient’s score was higher at the 2nd follow up. The black line is calculated from the difference between each pair of scores, and as it is above the red line, shows how on average most scores had increased.

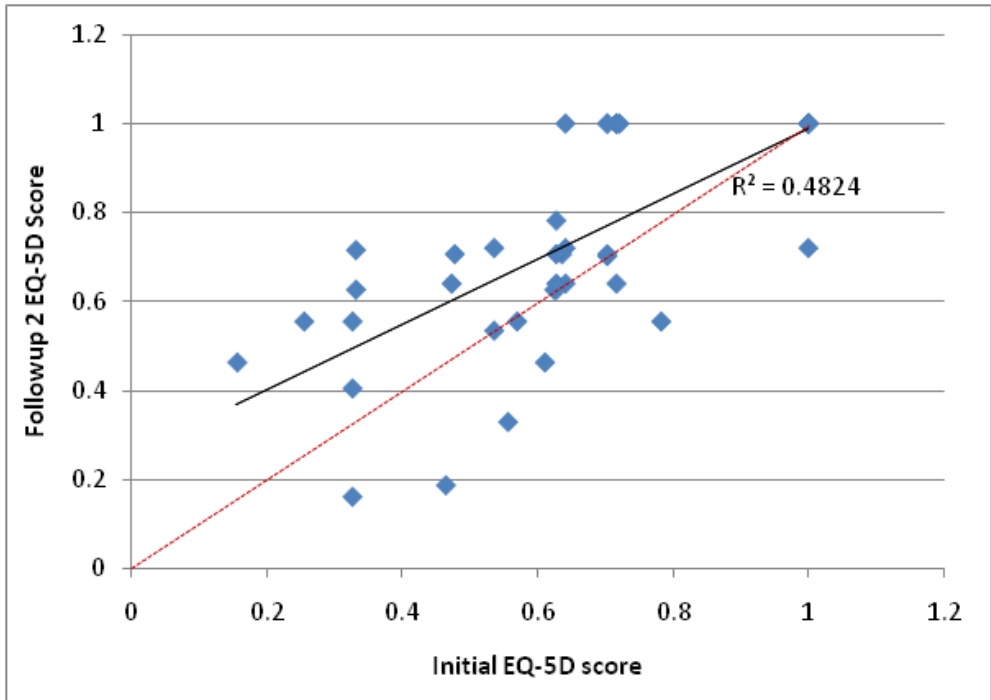


Figure 4: Correlation of EQ-5D scores

Quality of Life: Visual Analogue Scale (VAS)

A second Quality of Life measure commonly used was also employed. The VAS gets the patient to mark on a line (between 0 and 100) where they perceive their current health state. Table 28 provides the mean score at each visit. A paired samples t-test indicated that the small improvement in VAS score between the initial and follow up 2 score was significant⁹.

Table 28: Quality of Life measured by Visual Analogue Scale

	N	Mean	sd	Minimum	Maximum
VAS Initial	71	68.14	18.093	20	100
VAS follow up 1	52	69.27	18.083	30	100
VAS follow up 2	46	71.50	17.966	30	100

⁹ Significant different between VAS Initial and VAS Follow up 2 ($p=0.004$), but not VAS Initial and VAS Follow up 1 ($p= 0.673$).

Issues identified

Using all of the information gathered during the initial interview pharmacists would then indicate what issues had been identified for their patients. Lacking knowledge of prescribed medicines and medicines not synchronised were the two most common issues reported (41% and 40% respectively). Missing doses was seen as an issue for 36% of patients, with 29% of patients appearing to have inadequate control of their symptoms via their medications.

Table 29: Issues identified

Issue	n (%)
Prescribed Medicines Adherence	
Poor Adherence	20 (27%)
Missed Doses (unintentional)	26 (36%)
Skipped/Changed Doses (intentional)	14 (19%)
Confusion about regimen	18 (25%)
Concerns about medicines	17 (23%)
Other adherence	3 (4%)
Therapeutic Response (patient perception)	
Lack of Confidence in Rx Medicines	14 (19%)
Lack of Knowledge in Rx Medicines	30 (41%)
Inadequate control of symptoms	21 (29%)
Taking OTC meds or supplements to augment Rx meds	2 (3%)
Other therapeutic response	2 (3%)
Practical Medicines Use	
Vision-reading labels	13 (18%)
Manual dexterity – opening containers or removing medicine from packaging	18 (25%)
Understanding label instructions	5 (7%)
Literacy/English Skills	5 (7%)
Using dosage forms	5 (7%)
Other practical	2 (3%)
Access/Supply	
Ordering repeats or collecting medicines	7 (10%)
Medicines not synchronised	29 (40%)
Hoarding of medicines	6 (8%)
Prescription costs	5 (7%)
Other access or supply	-
Expired/Unwanted Medicines	
Expired Medicines	11 (15%)
Unwanted Medicines	16 (22%)
Unidentifiable Medicines	
Average number of issues	4
Median number of issues	3
Minimum, maximum number of issues	0,13

Management plan- identified actions

From the issues identified, the pharmacists then indicated which would be acted upon and made part of the medication management plan. Table 30 shows that education and counselling-type interventions were most common, (54% and 70% respectively) with blister packaging also common (54% of patients). Table 31 indicates the number of actions or interventions used per patient, ranging between 0 and 8. Forty-two percent of patients had 3 or 4 actions in their medicine management plan.

Table 30: Identified actions

Identified action or intervention	N=70* n (%)
Education	38 (54%)
Counselling	49 (70%)
Written information	18 (26%)
Demonstration	16 (23%)
Other Education	2 (3%)
Blister packaging	38 (54%)
Adherence Monitoring	29 (41%)
Medicine packaging, or labelling change	6 (9%)
Removal of unwanted/expired medicines	26 (37%)
Referral to other service, or health practitioner	25 (36%)
Other	14 (20%)

*Four patients with no identified actions recorded

Table 31: Number of actions per plan

Number of actions or interventions	N=70* n (%)
0	3 (4%)
1	7 (10%)
2	9 (13%)
3	16 (23%)
4	13 (19%)
5	9 (13%)
6	4 (6%)
7	5 (7%)
8	4 (6%)

*Four patients with no identified actions recorded

Issues followed up

In follow up visits the pharmacist would review existing issues and identify any new issues that needed to be addressed. Table 32 below provides an overall summary of this information. The data shows how many patients had a particular number of issues, for example at Follow up 1, 17 patients had 2 issues that pharmacists indicated were from the initial MUR. It was apparent from this data that the number of issues appeared to have reduced from the first follow up to the second, with the average number of issues reducing in each of the 'initial' or 'new' categories, as well as overall. It would also appear that the average number of issues identified had dropped from the initial visit, an average of 4 issues.

Table 32: Issues identified at follow up 1 and 2

Number of issues	Initial (n=70)	Follow up 1 (n= 54)		Follow up 2 (n= 44)	
		From initial	New	From initial	New
0		2(3.7%)	2(3.7%)	1(2.3%)	-
1		6(11.1%)	12(22.2%)	11(25.0%)	8(18.2%)
2		17(31.5%)	5(9.3%)	15(34.1%)	1(2.3%)
3		19(35.2%)	3(5.6%)	9(20.5%)	-
4		7(13.0%)	1(1.9%)	7(15.9%)	-
5		3(5.6%)	-	1(2.3%)	-
Average		2.7	1.7	2.3	1.1
Overall average (median)	4(3)	3.2 (3)		2.5 (2)	

By analysing pharmacists' descriptions of actions it was possible to code if issues were resolved. Where an issue was resolved the coding was 'yes'; where an issue was not resolved the coding was 'no'; where an issue required ongoing monitoring and was not resolved it was coded 'ongoing'; and where the outcome description was either blank or not clearly any other code, it was 'unclear'. As shown in Table 33, this data indicated that 63% of issues from the initial review were resolved at the first follow up, with a similar percentage resolved at follow up 2. New issues tended to be 'ongoing' as the pharmacist was not often able to both identify and resolve the issue at the same visit.

Table 33: Resolution of issues

	Resolved	Follow up 1	Follow up 2
Issue from initial review	Yes	89 (63.6%)	65(64.4%)
	No	21 (15.0%)	13(12.9%)
	Ongoing	13(9.3%)	10(9.9%)
	Unclear	17(12.1%)	13(12.9%)
New issue	Yes	6(17.1%)	3(30.0%)
	Ongoing	24(68.6%)	7(70.0%)
	Unclear	5(14.3%)	
		175	111

Pharmacist interview results

As mentioned, the Pharmacy Guild was successful in their tender to provide pilot MUR services for ADHB. In early 2008 the Pharmacy Guild contracted six pharmacies with distinct geographical areas of potential recruitment within the ADHB region. Of these, two withdrew from the project, leaving four pharmacies to complete the pilot. An additional pharmacy was recruited in late 2008 in an attempt to increase patient numbers in the pilot. Mt Eden Pharmacy contracted directly with ADHB, and as their service used a similar MUR structure, they were interviewed using the same question schedule (Appendix 2). The interviews with participating pharmacists were conducted before, during and after the pilot. The results of these interviews are presented below.

Description of pharmacists

The location of these pharmacies represented a broad cross section of Auckland. As indicated in Table 13, their client base, and hence participants, covered all socioeconomic groups. Appendix 3 provides an NZ Deprivation map of Auckland. The pharmacies were located within Mt Eden, Panmure, Ellerslie, Mt Wellington, Glenn Innes and Otahuhu, as indicated on the map. Pharmacists ranged in age and experience, ranging from 4 years post-registration to over 30 years. Table 34 provides some additional information on staffing levels.

Table 34: Lead pharmacist and staff numbers.

Gender	Age	Years registered	Years in community pharmacy	Staffing
Female	27	4	4	2 fulltime pharmacists, including lead, 2 locums, 1 intern, 1 technician, 2 pharmacy assistants
Male	46	24	24	1 fulltime pharmacist, including lead, 1 tech 2 retail staff
Female	50	30	30	2 full time pharmacists, including lead, 2 part time Pharmacists, 1 Intern 1 Tech -2 full time shop staff
Male	53	31	31	4 pharmacists, including lead, and 2 interns

*Two pharmacies did not provide summative staff information

Pilot preparation

All pharmacists expressed interest in the pilot, and saw the opportunity it provided as a means to provide a better service to their patients, and enhance their and their staff's careers:

"...a new challenge, natural progression, career development, a good service to offer, if they [patients] know they need extra help it is good to be able to help."

While all pharmacists had varying staffing levels, only one employed a locum pharmacist to cover the time required to do the initial and follow up MUR visits and associated paperwork. Unfortunately however, a combination of staff changes and local retail competition led to all staff being retained on the dispensing floor, and any MUR work was sidelined:

"The extra person in the afternoons was intended to take the extra load, but work increase [and] competition across the way meant we were all busy".

During the pilot phase all participating pharmacists were required to commence their MUR accreditation. The NZ College of Pharmacists provided the accreditation process, which was available in late 2008. The training provided participants, (including all pilot pharmacists), with information regarding these topics: compliance / adherence, context, privacy, culture, peer support, CPD, quality, communication, process and documentation. Importantly, it also aided in "...the formation of peer support groups, which are seen as a necessary mechanism for the profession to achieve a sustainable and high quality service. The College aims to facilitate this development as an encouraging network that will benefit those pharmacists taking up the MUR initiative."

Pharmacists' reported different perspectives on this training programme:

"...accreditation too lengthy, too hard having a group project to finish off."

"simplified accreditation would be good"

"...the training formalised it, good that it happened...best part was reinforcing getting the patient to do the talking, sensitive to what's going on in [their] life..."

"accreditation set too high for what was wanted"

In terms of the pilot MUR project, the MUR accreditation training was in most cases the only formal preparation that pharmacists undertook. The issue of accreditation will be explored further in the discussion section.

Pharmacists were questioned further on additional resource preparation including additional staff, access to fax machines, transport and appropriate space for patient interviews in the pharmacy. No additional preparation was noted, and while having a private consultation space was a requirement for the MUR service, not all had such space available, meaning all interviews needed to occur at the person's home in such cases.

The MUR contract

Most of the pharmacists also reported that there were significant delays in the contracting process. They were referring to the period of time between the Pharmacy Guild asking for expressions of interest from members to provide MUR pilot services, through to the time where the contract was available for signing. The remuneration level was reported as “quite good” by some and “a little light” by one pharmacist.

Patient recruitment

Pharmacists tended not to use a particularly systematic approach to the recruitment of patients for MURs. Most would look at their patients as they turned up for scripts:

“...as people came in...[I would] always look at [medical] history- triggered recruitment.”

“...ad hoc process, but some systematic working through computer records, called on the phone. First one worked but a lot were out of the catchment area- DHB areas a problem...”

“Patients recruited on a ‘as needed’ basis rather than strict inclusion criteria”

Hospital admissions, (indicated by post-discharge scripts), recent changes in medications, irregular pick up of medications would also prompt pharmacists to pursue their patients as potential participants. One pharmacist sent a letter to their local GP clinics outlining the service and asking for potential referrals, this elicited three referrals.

Recruitment targets and barriers

The Pharmacy Guild had a target of 100 participants to be recruited for the pilot. Mt Eden pharmacy indicated they would look at recruiting approximately 50 patients from existing extended services and new patients. As evident from the previous section, these targets were not met, and all pharmacists were asked whether the target had been appropriate and what steps may have assisted in reaching it. One pharmacist felt that the reduction in participating sites (from six to four) impacted negatively, as there was an expectation that recruitment for the remaining sites would compensate:

“...originally it was only doing 10 or 12. The increase to 25 was way too much for my sole practice- wasn’t the target I signed up to.”

A pharmacist from one of the larger sites commented:

“...25 was realistic overall, but would have struggled if I was on my own.”

The staffing level also appeared to impact upon the success of recruitment. Those with the lower level of staffing tended to have lower recruitment success.

Also for those pharmacists close to the DHB boundaries a number of patients may have been eligible but resided in an adjacent DHB and were consequently not eligible to take part.

The delay in availability of MUR training was also raised by one pharmacist as a significant barrier to recruitment. The training occurred in December of 2008, which coupled with staff holidays, impacted on the pharmacy to achieve their expected recruitment levels. Other pharmacists

experienced high rates of declines, but were not able to explain what may have been behind this. One pharmacy in a lower socio-economic area had staff safety issues regarding the home visits. The MUR accredited pharmacists at this pharmacy were young women, and were not comfortable agreeing to interview some potential participants in their homes unaccompanied. The pharmacy appeared to be unable to solve this issue. Finally, three pharmacists all suggested that referrals through GPs were needed to achieve targets:

"...need an independent person to go to doctors and say what it's about, feed them the plan"

"District Nurses and GPs could have trigger points for referrals"

Other challenges identified during the MUR pilot

All pharmacists reported that paperwork associated with the pilot was done predominantly 'after hours'. This often led to a delay in the completion of planning after the interview, and added to the work load of pharmacists, especially those working as sole practitioners.

Patient benefits

All pharmacists reported that the MUR pilot had greatly improved outcomes for some of their patients. Compliance/adherence was cited by all pharmacists as a common area of improvement. This was achieved through the use of practical devices, such as blister packs, but also education regarding the impact of disease:

"Slowly improved their level of understanding of what they were taking. Didn't realise potential damage to eyes and kidneys [diabetes]-taken things more seriously and they can see the results."

Another pharmacist commented upon how the pilot allowed a strengthening of the GP-patient-pharmacist relationships. Home visits were also cited as beneficial to both the patient and pharmacist. They allowed pharmacists to see environmental clues to areas of need- e.g. organisation of medications, access to medications and the capacity of the patient to manage personal cares. One patient for example felt comfortable showing the pharmacist a skin condition on her lower legs at home, but was not forthcoming in the pharmacy (despite a private consultation room being available).

Pharmacist and practice benefits

Professional benefits were also apparent. These were reported in terms of enhancing their professional practice, by qualifying for additional skills and services, as well as the opportunity to take more time attending to a patient's needs:

"...get to talk and concentrate on one person...not rushed with this type of counselling, not annoyed by patient's questions, a positive challenge, I get to teach them."

With this increase in time to discuss issues came the need for more in-depth understanding of the patient's medicines, and one pharmacist commented how the MUR pilot improved their own understanding of disease process and medicines as they had to read up more in order to adequately answer their patients concerns.

Another pharmacist, with an existing home delivery service appreciated the added structure and systems of the MUR:

“The home visits and medicine management was part of usual care, but the added structure set up and systems has been useful. The paperwork helps fine-tune communications with doctor.”

As also highlighted above, the MUR structure was also seen to improve professional relationships with other health professionals. Two pharmacists indicated a level of interaction with GPs regarding MUR outcomes or aims.

As described earlier, the accreditation training course was also responsible for setting up peer support groups for all participating pharmacists. This support was appreciated by most pharmacists, although the frequency of meetings was too frequent for some (monthly).

Improvements to the existing MUR data collection tool

The existing paper-based tool was seen to be too repetitive, especially considering the collection of all medicines information at the 1st and 2nd follow ups. Most would have preferred to note any changes in medication since their last visit, but in general the content was approved of:

“Initial one is good. Follow ups could be abbreviated, you know the answers are the same.”

Changes that were recommended included more space to describe changes in the patient’s health, or a more broad discussion box. The review content was appreciated as a good way to abbreviate the visit information. Most would like to see an electronic form developed, ideally linking into existing medical data held within the pharmacy database.

Patient interviews results

A sample of 27 patients was interviewed on the phone regarding their experiences of the MUR pilot.

Sample composition

The majority (70%) of participants were female, and two thirds (67%) were aged 75 years and over. Table 35 summarises the demographic profile of respondents.

Table 35: Respondent demographics

Age	Male	Female	Total
45-54	0	2	2 (7%)
55-64	2	3	5 (18%)
65-74	1	1	2 (7%)
75-84	3	8	11 (41%)
85+	2	5	7 (26%)
Total	8 (30%)	19 (70%)	27 (100%)

Key findings

Only one respondent found out about the MUR through their GP, all others were informed via their pharmacist. The majority of respondents were quite happy to have a review, with one having no strong feelings either way and another who was a bit hesitant or concerned about the process. Following a discussion about the MUR, most reported that they had a clear understanding of what it involved. Whilst many felt that it could be helpful to them, several were either unsure or couldn't recall what they thought at the time.

When probed further on why they thought it might be helpful, a number of interviewees commented on the potential for gaining further understanding of their current medication. This was in terms of why particular medicines had been prescribed, as well as information on when and how these should be taken:

"Sometimes I take many tablets and forget which to take, when."

"Taking them [the medicines] in the right way, and finding out about any side effects. Also finding out more about why taking what medicines."

One participant saw the review as a "check" that she was taking her medication correctly, and another was pleased that the "chemist" was taking an interest in their wellbeing. A couple of interviewees were interested in the review process itself, with one commenting they thought their experience "might be helpful to others."

In terms of how the review was undertaken, most were able to recall how many times the questionnaire was administered (n=5 participants were unsure). Of those who answered the question, the majority reported that the pharmacist went through the MUR data collection form one time, with slightly less having gone through it twice. Five respondents said they had completed it three times.

A pharmacist known to patients had visited three quarters of the participants at home to talk about their medications. Thus, most knew the health professional before they arrived to undertake the review, and were comfortable having them visit them in their own home. Those who completed the MUR at a different location had either done so at the pharmacy, or over the phone. This was generally due to it being more convenient – e.g. one interviewee lived next door to the pharmacy and another “spontaneously” decided to do the questionnaire when they were visiting the pharmacist for other reasons.

The first visit had lasted less than 30 minutes for around one third of respondents, with only two people reporting that it had lasted longer than an hour. A breakdown of the duration of interviews is presented in Table 36.

Table 36: Respondent's recollection of the first interview duration

Duration	Frequency	%
Less than 30 minutes	10	37%
30 – 45 minutes	9	33%
46 - 60 minutes	5	19%
61-75 minutes	2	7%
Can't recall	1	4%
Total	27	100%

Nearly all respondents felt they had enough time to discuss relevant issues with the pharmacist, and of those who had questions, the majority felt that the pharmacist answered them adequately. All, bar one who could not remember, reported that they were either told to bring their medication or that the pharmacist asked to see it.

Only three respondents were aware of having issues or problems with a particular medication at the time of MUR, and all discussed this with the pharmacist when they met up. All but one interviewee said that they were happy with the way the pharmacist conducted the visits (the other person was ‘not sure’).

Respondents were asked what topics were discussed during the MUR. As displayed in Table 37, those most often covered were ‘the range of medications used’, ‘when and how medicines are taken’ and ‘remembering what to take when’. Less common topics included ‘side effects of medications’, ‘interactions between medications’ and ‘use of equipment, such as puffers, spacers’.

Table 37: Topics the pharmacist discussed with respondent

Topic	n*(% recalled topic)
The range of medications used	25 (100%)
When and how medicines are taken	23 (92%)
Remembering what to take when	21 (84%)
Function or effect of various medications	13(52%)
What can happen if medications are not used correctly	7 (28%)
Side effects of medications	3 (12%)
Interactions between medications	1 (4%)
Storage of medications	4 (16%)
Use of equipment, such as puffers, spacers.	1 (4%)

*Two respondents with missing data for these questions

Participants were asked if they had learned anything, or got clear information about anything from their discussion. Around two thirds stated that they had, with the remainder indicating that they were unsure. For those who felt that they had gained knowledge from the review, a key area of learning related to the correct way to take medication. This included, for example, when and how to take prescribed medicines, and pointers for overcoming any potential problems:

“About how to take the calcium tabs by cutting it into two and take with yoghurt, so as not to choke.”

“Which tabs are best to take, when and how – i.e. In med packs four times daily, instead of all in one go, one time per week.”

As evident in the following feedback from one participant, this new information had proved useful in overcoming a problem they had previously had with forgetting to take their medication:

“Learned that okay to take daily meds in one hit. Had been taking them in two hits prior to the review, and sometimes forgot one intake during the day.”

Others reported that they had gained more background knowledge on their medication, including why it had initially been prescribed, and effects they may experience:

“Mainly what was the point of taking so many tablets and why taking them so long.”

“Why I’m taking the medication I take and the importance of that medication.”

A small number also stated that they had learned more about their pharmacist and the kind of relationship that they could expect:

“That the chemist is kind and helpful”

“I know now if I can’t remember what I’m taking I can ask for medical help. Ask the chemist or the doctor.”

Several people reported that they had gained either *specific* or *general health* benefits from their participation in the MUR, as displayed in Table 38. The vast majority also reported that there had not been anything negative about the review, or anything they would have liked done differently.

Table 38: Were specific or general health benefits noted?

	n (%)
No specific health benefits	4 (15%)
Specific health benefits noted	8 (30%)
Not indicated in answer	15 (56%)
No general benefits	3 (12%)
General benefits noted	12 (46%)
Not indicated in answer	11 (42%)
Response missing	1

Further questioning on both the specific health benefits and more general benefits from the MUR generated similar responses to previous questions on the nature and type of knowledge gained from the review. Thus, people spoke about better understanding their medication and how to take it, and an improved relationship with their pharmacist:

“It was helpful both specifically and generally because I am not sure we really understood what we were doing and why.”

“It feels as though they [the pharmacist] are supporting you.”

For a number of respondents, this had resulted in an increased confidence – both in relation to their own behaviour with regard to taking their medicine, and the medication itself:

“More confident now, felt happier knowing that what I was doing was okay.”

“There was one medication that I hadn’t felt confident taking, but I was after the visit – became confident as a result of the review.”

Further to this, respondents were presented with a range of statements about the MUR and its potential impact on their level of understanding of their medication. As presented in Table 39, 90% of the sample either agreed or strongly agreed with the statement “I am pleased that I had an MUR”, and around three quarters either agreed or strongly agreed that “I better understand the reasons for taking my medicines”. Similar numbers were in agreement with statements relating to a better understanding of how and when to take medicines.

Table 39: Attitude to MUR and awareness of medications

	Strongly agree	Agree	Neutral	Not sure N/A
Pleased that I had an MUR	13 (48%)	12 (44%)	1 (4%)	1 (4%)*
Better understand the reasons for taking my medicines	6 (22%)	14 (52%)	6 (22%)	1 (4%)*
Better understand when to take my medicines	8 (30%)	13 (48%)	5 (19%)	1 (4%)*
Better understand how to take my medicines	10 (37%)	11 (41%)	5 (19%)	1 (4%)*

*same respondent unsure of their overall satisfaction with the MUR

Overall levels of satisfaction with the MUR were high, with most people reporting that they were either ‘very satisfied’ or ‘satisfied’ with the review. As displayed in Table 40, there were no respondents who claimed to be dissatisfied with the process, and only one who expressed a neutral view:

Table 40: Overall satisfaction with the MUR

	n (%)
Very satisfied	17 (63%)
Satisfied	8 (30%)
Neither satisfied nor dissatisfied	1 (4%)
Not sure	1 (4%)

Whilst a third of interviewees stated that they were more likely to go to their pharmacist since the MUR if they noticed a change in their health, around half indicated that the likelihood of approaching their pharmacist in this situation had not changed (see Table 41). Only four individuals said that they were more likely to go to their GP.

Table 41: Likelihood to see Pharmacist and GP

	n (%)
More likely to go to Pharmacist	9 (33%)
Less likely to go to Pharmacist	1 (4%)
About the same	14 (52%)
Not sure	3 (11%)
More likely to go to your GP	4 (15%)
About the same	21 (78%)
Not sure	2 (7%)

Those who stated they were more likely to go to their pharmacist were asked the reasons for this. Nearly all commented upon the closer nature of their relationship with their pharmacist since the review, which meant that they felt more comfortable approaching them about a wider range of health issues:

“Really thorough at the medication review, and caring.”

“Feel more comfortable to discuss any health issues. We have a relationship now.”

“As a port of call the chemist is very good. They are very approachable.”

The small number of interviewees who said they were more likely to go to their GP since their review made reference to the fact that this was more appropriate when health issues were of a more serious nature:

“Would still go to GP unless advice re: cold or rash or something like that.”

Another commented that their GP knew them well, and they therefore saw them as being in the best position to advise on health matters.

Auckland District Health Board data

ADHB secondary care usage results

Data extracted from ADHB datasets provided the number and duration of admission for all patients enrolled in the MUR pilot. The extraction was based upon all events recorded six months before the initial visit and six months after this date. Table 42 provides a summary of admission types, accident related events, and admission ward for outpatient events. Of all NHI numbers submitted for data extraction, only 33 patients had inpatient events before or after their MUR visit. It was not clinically meaningful to do more than summarise the data. In general terms there was no indication of any differences between the before and after MUR periods in terms of inpatient hospital admissions.

Table 42: Inpatient usage

Admission type	Before (N=22)		After (N=21)	
	n*	%	n*	%
Acute	26	59.1%	26	74.3%
Arranged Admission	10	22.7%	7	20.0%
Waiting List	8	18.2%	2	5.7%
Accident related				
No	39	88.6%	28	79.9%
Unknown	1	2.3%	1	2.9%
Yes	4	9.1%	6	17.2%
Mode of arrival				
Ambulance	17	38.7%	20	57.0%
Own Transport	22	49.9%	14	40.1%
Unknown	5	11.4%	1	2.8%
Admission ward				
Acute Eye Services	1	2.29%	4	11.56%
Admission and Planning	6	13.6%	3	8.6%
Emergency Department	19	43.1%	21	59.9%
AKCH OR Day Admit Level 8	3	6.8%	1	2.8%
Eye Day Stay	1	2.3%	2	5.8%
Rangitoto Ward	3	6.9%	1	2.8%
Remuera Ward	2	4.6%	2	5.7%
Cardiology Day Unit	6	13.6%		0.0%
Wards 61, 65, 75.	3	6.9%	1	2.8%

*as patients had more than one admission during the 12 months, the number of events is greater than the number of patients.

The following Table 43 provides a summary of outpatient clinic usage and the average duration of visits. Of the 74 NHIs submitted, only 49 were identified as using outpatient services in the 12 month window around their initial MUR visit. Again, there was no substantive evidence of differences between the two time periods.

Table 43: Outpatient usage

Outpatient clinic	Before (N=40)		After (N=34)	
A Plus Links	3	2.2%	2	1.5%
Allied Health	1	0.7%		0.0%
Audiology	2	1.5%	3	2.2%
Cardiology	21	15.7%	28	20.4%
Dermatology	2	1.5%	7	5.1%
Diabetes	15	11.2%	7	5.1%
Endocrinology	3	2.2%	1	0.7%
Gastroenterology	3	2.2%	8	5.8%
General Medicine		0.0%	1	0.7%
General Surgery	1	0.7%	2	1.5%
Gynaecology	3	2.2%	1	0.7%
Haematology		0.0%	5	3.6%
Liver Resections	3	2.2%	1	0.7%
Neurology		0.0%	1	0.7%
Nutrition	3	2.2%	1	0.7%
Ophthalmology	17	12.7%	14	10.2%
Oral Health	1	0.7%		0.0%
ORL	4	3.0%	6	4.4%
Orthopaedics	8	6.0%	7	5.1%
Physiotherapy	18	13.4%	17	12.4%
Renal Medicine	6	4.5%	7	5.1%
Respiratory Medicine	15	11.2%	11	8.0%
Rheumatology	1	0.7%	1	0.7%
The Auckland Regional Pain Service	2	1.5%	5	3.6%
Vascular Surgery	2	1.5%	1	0.7%
Grand Total	134	100.0%	137	100.0%
Average number of events per patient	3.3		4.0	
Average duration of clinic event	28 min.		30 min.	

Discussion

The following discussion will explore how well the objectives identified in the methodology and the specific evaluation questions were addressed during the Pharmacy Guild and Mt Eden MUR pilot.

Was the demographic profile of patients as expected?

The overriding intention of this pilot was for ADHB to determine if and how a Medicines Use Review (MUR) service may improve the health status of older people. A specific focus was placed upon the needs of those groups who may have the poorest health and the highest health needs, specifically Māori, Pacific Peoples and those of low socioeconomic status.

Firstly then, did the pilot focus upon those groups in particular? As indicated in the results, recruitment overall fell well short of the pilot targets. Achieving a greater recruitment rate may have ensured selection criteria were better satisfied. Only around 25% of patients indicated they were of Māori or Pacific ethnicity. However, 75% of all patients lived in areas with a deprivation rating between 5 and 10 (where 10 was the most deprived). If MUR services are to be targeted in this way, then consideration would need to be placed upon where the services are made available and secondly how recruitment within the selected areas is managed. The Pharmacy Guild pharmacists were all located in high deprivation areas, while Mt Eden Pharmacy had a more diverse client base.

Recruitment processes would appear to have been responsible for the higher proportion of NZ European patients in the sample: pharmacists acknowledged that recruitment was 'ad-hoc' and often motivated by walk-ins and opportunistic screening at the time a script was filled in. Given that lower socio-economic groups have lower incomes and tend to have less access to health services in the first place, their arrival in a pharmacy to fill a prescription or purchase over the counter medicines might not be as frequent as other groups. Better levels of recruitment would be achieved with referral support from other primary care health providers in the community, such as GPs.

Clearly then should an MUR service be extended, a more systematic approach to recruitment, where service remuneration is based upon meeting patient selection criteria and recruitment levels would be required.

Did patients have better access to services?

For those patients involved in the MUR pilot there was some evidence that their access to pharmacy related services had improved. Financially, the pilot enabled patients to access enhanced pharmacy services such as blister packaging of medications. Also, 30% of patients interviewed indicated they were more likely to seek advice from their pharmacist in the future. Both pharmacists and patients acknowledged how the pilot gave an opportunity for rapport and relationship building between them. As such, it is likely that patients would seek help from pharmacists more readily, and that pharmacists would be more aware of other areas where additional care or services would be appropriate for the patient. It is encouraging to see that most of the initial MUR visits (85%) took place in the patients' homes. Pharmacists gained further insight into patients' lifestyles that may

have helped identify factors potentially affecting medicine use and facilitating subsequent implementation of appropriate recommendations or interventions.

Was patient understanding of their medicines improved?

It was apparent from the inclusion criteria that lack of knowledge of medicines was an issue of concern- confusion about medicines regimen was recorded for over half of the patients, and medicine management issues were also of concern for around a third of patients. At the initial MUR visit, both the summative knowledge rating from individual medicines and the pharmacists' ratings of patients overall knowledge backed up this concern; with close to half of the patients having only some or no knowledge of their medicines.

Evidence from quantitative and qualitative data does support some increase in knowledge of their medicines as well as other practicalities of the 'how and when' to take them. Specifically, pharmacists' overall rating of patients' knowledge increased significantly between the initial and 2nd follow up. Additionally, almost all patients interviewed recalled talking about the range of medications they took as well as when and how to take them. Over three quarters of these interviewees also agreed that they better understood the reasons for taking their medicines, as well as when and how to take them.

Was patient adherence to prescribed regimens improved?

Adherence to a medication regimen depends upon patients wanting to take the prescribed medications, their motivation to do so and their ability to comply with the regimen. Maximising these factors to increase adherence would appear to rely upon a combination of education, monitoring and practical assistance.

A simple analysis of data from the adherence measure of individual medicines and the self-rated Morisky scale does not appear to support an improvement in adherence. The summative scale derived from adherence measures of all medicines remained fairly static, although there was a drop in those rated as 'often missing a dose'. The Morisky scale reflected an improvement in self-rated adherence between the initial and 1st follow up and a fall in 'good' adherence (a score of 3 or less) from the initial to 2nd follow up. This fall however related to a group of patients scoring '4'- just over the threshold. When the results are closely scrutinised, it is apparent that the loss to follow up may explain the change. It would appear that almost all patients without follow up 2 data had 'good' or improving self-rated adherence scores at the initial and/or 1st follow up. It was possible that pharmacists did not push hard for a complete collection of data on the 2nd follow up as they perceived the requirement was not so great from these patients. This would also explain why patients' perceived adherence appeared to drop, while pharmacists' ratings stayed the same.

Was there a reduction in adverse reactions and use of secondary care services?

It was not possible to gather data on adverse drug events, and no definitive conclusion of this can be made. It should be noted that around 40% of the patients had expired or unwanted medications removed from the household. Such actions may well ultimately contribute to a reduction in any adverse drug events based upon the usage of such medications.

Data collected on secondary care services (i.e. hospital-based) found no significant change in the number of inpatient or outpatient events, either based upon the total number, or the number per patient.

Were there changes or reduction in prescribing?

When considering medication use by class, the most commonly used classes of medicines were as might be expected in this cohort of patients (see Table 18). This included medications such as antiplatelets, statins and antihypertensive agents, used for managing cardiovascular risk, either primary prevention targeted at patients at high risk or secondary to a cardiovascular event such as a myocardial infarction or angina. Also ranked highly were medicines associated with the treatment of diabetes, again this is to be expected given the high prevalence of this condition within the cohort.

This evaluation did not aim to assess the clinical appropriateness of changes in therapy since that is not an aim of MUR. MUR, as defined in the DHBNZ framework, is predicated on the assumption that the treatment the patient is prescribed is clinically appropriate. MUR aims to improve patient understanding of their treatment and address issues of access and adherence. However, the pharmacist undertaking an MUR consultation has a clear ethical and moral responsibility to address issues of inappropriate selection, prescribing or use of medicines if they are identified. It is interesting to speculate what may drive the changes seen in medication use (see table 18) but it should be emphasised that the data collected as part of this service and evaluation is inadequate to fully evaluate appropriateness of either pharmacists' recommendations or prescribers' changes to treatment on an individual patient basis.

The largest percentage changes between the initial assessment and the second follow-up, 6 months later, were; dihydropyridine calcium channel blockers (CCBs), sedatives and hypnotics (including benzodiazepines), non-opioid analgesics (including paracetamol) and beta blockers. Over the same period the greatest percentage increases were in patients on oral hypoglycaemic medications, ACE inhibitors, insulin and statins. Some of the *possible* explanations for these changes are discussed below. Dihydropyridine CCBs are commonly associated with minor side-effects such as ankle oedema and worsening symptoms of GORD and are no longer recommended as first-line therapy for hypertension, although they are effective when used – particularly in isolated systolic hypertension often seen in the elderly. These may have been changed to ACE inhibitors which are now recommended as first-line therapy, thus accounting for the fall in CCB prescribing and increase in ACE inhibitor use. Sedatives and hypnotics are associated with a higher rate of falls in the elderly

and therefore may have been stopped to reduce this risk. Furthermore, it is common but not recommended, for patients to be prescribed these agents long term in primary care so the pharmacists may have requested they be discontinued if they were no longer necessary or the patient was not using them.

On average, patients were taking medications in two fewer classes after their last follow up. Whilst, as outlined above, MUR is not targeted at rationalizing therapy, this is an expected outcome and was an expectation of the RFP issued by ADHB. Whilst traditionally reducing polypharmacy has been viewed by many to be an outcome in itself - due to the association between polypharmacy and the risk of ADEs, ADRs, interactions - this fails to recognise that reducing polypharmacy does not accurately correlate with improved health outcomes. In fact, polypharmacy is not always a bad thing (14, 15) and, with multiple medication treatment becoming the standard for management of many chronic conditions, it is likely that polypharmacy may actually be inevitable (44, 50). Rather than considering the change in the number of medicines it may be more useful to consider the appropriateness of prescribing but this requires clinical knowledge of the patient outside the scope of this evaluation.

Was there an improvement in patients' overall health and quality of life?

The impact of the MUR service on patients' quality of life (QoL) was explored, as improvement in QoL was deemed a good indicator of both service success and health status- one of the areas ADHB had hoped to see improvement in. Both components of the EuroQoL model (EQ-5D and VAS) demonstrated a small but significant increase between the initial review and 2nd follow up. Other evidence shows a similar trend, from the 27 patients interviewed- 46% of patients noted 'general benefits' from the MUR and 30% a 'specific health benefit'. The fact that pharmacists also resolved many of the initial issues identified during the MUR also confirms the likely improvement of a patient's health. Qualitative data from pharmacists relating to patients with diabetes demonstrated a direct link between the MUR and improvement in their health. This related to increasing a patient's knowledge of the disease and associated risks, as well as management of the condition, in terms of self-monitoring blood sugar and regulation. There is also a likelihood that outside of such clear instances of morbidity that many patients were in fact not suffering significantly poor health or quality of life.

What challenges did the pharmacists face in the implementation of the MUR pilot?

Pharmacists appeared to have most difficulties where they did not plan or allocate time specifically for MUR service delivery and paper work. The difficulty in time management possibly had a two-fold effect. Firstly by discouraging pharmacists from recruiting more patients, and hence increasing their workload further, and secondly delaying the proper completion of MUR paperwork and medicines management planning for the patient.

The delay in training (via the Pharmacy College accreditation process) had a detrimental effect. As indicated earlier, pharmacists found this process delayed recruitment, as the process took a significant amount of commitment in time by itself, and some were not prepared to recruit at all until accreditation was completed. It would be necessary to invest some time and funds into developing two aspects of professional development for MUR service delivery. Firstly, that accreditation of MUR service pharmacists could be separate to the MUR specific training. Secondly, that the initial and ongoing training/support for MUR services focuses upon providing pharmacists with a clear set of directions and guidelines regarding all aspects of the service delivery. For example, the time and resources required, recruitment processes, visit protocols and data management. Separating the training and accreditation processes, would allow accreditation to occur prior to contracting any MUR services, and training to be built into requirements for the service contract.

Documentation systems used during the pilot were also not those an ongoing service would require. The paper-based and repetitive nature of data collection and the inclusion of evaluation measures such as quality of life scales would clearly need revision. Such refinements would have a significantly positive effect on the time required to both train for and implement an MUR service.

Part B: Selwyn Foundation

Method

Project purpose

The Selwyn Foundation Group (Selwyn) has four sites in Auckland where independent living and residential care is provided for over 850 people aged 65 or older.

These residents often have complicated persistent, advanced and multiple chronic clinical conditions and frequently have complicated medication regimens as well. This may be due to historical prescribing (they have always been on that medication), chronic conditions (such as epilepsy), multiple chronic conditions and increased need for preventative prescriptions (e.g. bone protection for osteoporosis, cardiovascular risk reduction with anti-hypertensives, statins and aspirin, renal protection with ACEI and ARB).

Using a combination of annual medication reviews (AMRs), robotically packaged medication and patient/staff education Selwyn intended to improve residents' healthcare. The current project was intended to provide the Auckland District Health Board (ADHB) with objective evaluation data about the Selwyn pilot against which the intended outcomes of the medication management service could be measured.

Project aims and objectives

The primary aim of the evaluation was to determine to what extent the pilot annual medicine review (AMR) service achieved the overall intentions of the Selwyn contract. A number of specific questions were addressed during the evaluation, linked to the overall aim. These concerned the processes of the AMR (e.g. set-up and implementation) and the outcomes of the AMRs. Furthermore, the objectives of the evaluation were:

- To investigate what influence the pharmacists' AMR recommendations had on GPs' prescribing actions.
- To examine the consequence of the patients' preventative and treatment medications as a result of AMRs conducted by pharmacists.
- To explore the benefits and detriments of the pilot AMR system observed by GPs.

Eligibility

All long term residents living in rest home, hospital or dementia care at any of the Selwyn Foundation locations involved in the pilot were eligible. Independent living residents who chose to receive their prescriptions via the pilot pharmacy were also eligible.

Data collection

An Annual Medicines Review document (AMR, see example Appendix 4) was completed by a pharmacist for each eligible Selwyn resident. The evaluation data record (EDR, see Appendix 5) was

the primary data collection tool for all quantitative and some qualitative data used in the evaluation. The EDR was a single page summary of the longer form AMR document, and was also completed by the pharmacist.

The EDR included basic demographic information, baseline medicines usage differentiated into classes (aspirin, calciferol, β -blockers, ACE inhibitors or ARBs, bisphosphonates, calcium, fibre, sedatives, tricyclic antidepressants, other antidepressants, psychotropics, statins, PPIs, warfarin and flixotide), and the pharmacist’s recommendations regarding changes to medication usage (classified into ‘no change’, ‘start’, ‘stop’, ‘review’, ‘increase’, ‘decrease’, ‘no comment’ or ‘change route’).

The pharmacist recorded on the EDR if the patient’s allergy status was known both at the time of conducting the AMR. They also recorded whether a blood test was recommended and whether the GP ordered a blood test.

Both the AMR and EDR were then sent to the GP before a GP-patient consultation. After the GP had recorded on the EDR their response to any pharmacist recommendations, the EDR was returned to the pharmacist.

Finally, three months after the AMR, the pharmacist would record on the EDR the action taken by the GP, based upon the latest medicine chart information. Table 44 provides a brief comparison of the two documents.

Table 44: Comparison of AMR and evaluation data record

AMR document (AMR)	Evaluation data record (EDR)
Name, DOB, NHI, Allergies, Area	ID# ¹⁰ DOB, NHI, Allergies, Selwyn Area, Patient’s GP
Latest medication chart attached	Event record including dates of AMR, consultation and 3 month post AMR medication changes
Interactions	
Blood tests/labs relevant to medications	Blood test and knowledge of allergy status (yes/no)
New medication potentially indicated	<ul style="list-style-type: none"> • Medications prescribed (by class). • Pharmacist’s recommendation (fixed choice) • GP’s response to recommendation (open ended response) • 3 month post AMR- was recommendation acted upon (fixed choice)
Current medications with potential for review	
Overview	

¹⁰ Generated by pharmacist during AMR. Only the pharmacist could match name to ID.

GP interview data

A semi-structured questionnaire (see Appendix 6) was also used to elicit both quantitative and qualitative information from GPs who used the AMR and filled in the Evaluation Data Record. Information included their opinion of both documents in terms of usefulness for the review and consultation as well as potential for future service use. Information collected included:

- Number of patients in their care
- % of AMR sheet and EDR sheets received
- Use of the AMR sheet and EDR sheet
- Opinions of pharmacist's recommendations
- Perceived benefits of AMR for patients and GPs

Falls data

Selwyn Foundation was able to provide falls data on all patients enrolled in the AMR pilot. The number of falls was collated for six months prior to and six months after the date of the AMR consultation.

District Health Board data

Auckland District Health Board was also able to provide anonymised data on all residential patients. The evaluators provided patients' National Health Index (NHI), date of birth and the date of the AMR. The data extracted covered the period of time six months prior to, and six months after that date. Table 45 provides a summary of the data provided.

Table 45: ADHB dataset for residential patients

Category	Data
Admission data	<ul style="list-style-type: none">• Date• Ward• Diagnosis related Group (DRG)• Diagnoses• Procedures• Admission type• Admission source• Arrival mode
Referral	<ul style="list-style-type: none">• Referral reason• Referrer
Discharge	<ul style="list-style-type: none">• Discharge date• Discharge type
Demographics	<ul style="list-style-type: none">• Gender and ethnicity.

Data entry

All the data collected from the EDR were entered into a spreadsheet. Since the GPs' actions were described in open-ended text, it was necessary to classify them prior to analysis. They were grouped into "Agree with the pharmacist's recommendations", "No action conducted at this point in time", "Disagree with the pharmacist's recommendations", or "No comment".

Qualitative data elicited from the GP questionnaires was entered into a simple spreadsheet as well.

Data analysis

GPs' actions relative to the pharmacist's recommendations were analysed using a Pearson's chi-square (χ^2) test for independence. Other data, both from the EDR and GP interviews were further analysed for summative purposes only.

Qualitative data from the GP interviews was analysed using a general inductive approach (as described in the previous methodology section).

Ethics approval

Ethical approval was contained within the expedited review already described.

Outcome and process evaluation data

Basic outcome data from the evaluation data record, Selwyn records and ADHB data included:

- Pre and post review use of medication
- Fall rates for six months pre review and post review.
- Hospital admission rates pre review and post review.
- The rate of implementation of review and the on-going monitoring.

Additional areas of evaluation were addressed by interviews with the Selwyn contract holder, GPs who did AMRs and the pharmacist who provided the AMR and EDR information. Questions included:

- What involvement did the pharmacist have with the AMRs?
 - Did the pharmacist produce the AMRs for all residents?
 - Did they have adequate information to conduct the AMR?
- What involvement did the GPs have in the AMR review pilot?
 - Did consultations with residents occur after the AMR was sent?
 - Did the GP use the AMR in conjunction with the consultation?
- What processes were set up to manage the flow of information to and from the pharmacist and the GPs?

Results

Rate of AMR and EDR completion

The number of beds available across the Selwyn sites at the time of the pilot was estimated to be approximately 611. Of these, 240 EDRs were also fully completed, just under 42 % of the total residential population. Table 46 provides a breakdown of return rate based upon the four sites.

Table 46: Evaluation data record return rate

Selwyn Area	AMR completed	EDR completed	% completed
Selwyn Village	332	170	51.2%
Selwyn Heights	175	71	40.6%
Gracedale	38	15	39.5%
Selwyn Oaks	66	49	0.0%
Total	611	240	41.9%

Participant characteristics

The median age of these patients was 87 years old, ranging from 61 years old to 107 years old. The type of residence was almost even with slightly more patients under rest home care with 135 patients. Overall, there were almost three times more female participants (177 vs. 63 male). Table 47 provides a full summary of these demographics.

Table 47: Basic demographic information

Type of residence	Males	Females	Total
Rest home	38 (15.83%)	97 (40.42%)	135 (56.25%)
Hospital	25 (10.42%)	80 (33.33%)	105 (43.75%)
Total	63 (26.25%)	177 (73.75%)	240 (100.00%)

Timing of AMR and patient consultation

The time delay between the GP receiving the AMR and the occurrence of the GP-patient consultation was recorded. A summary of this time gap is provided, as well as an overall summary of how many patient/GP consultations occurred before the 3 month post AMR review of medicines done by the pharmacist. It was expected that all consultations would occur within a month of the AMR, that is before the three month point. The three month point falls at approximately 84 days after the AMR.

Table 48: Number of days between AMR and consultation

Number of days	N	%
0-14 days	33	13.8%
15 to 28 days	23	9.6%
29 to 42 days	35	14.6%
43 to 56 days	35	14.6%
57 to 84 days	22	9.2%
85 to 112 days	5	2.1%
113 to 140 days	7	2.9%
141 to 182 days	4	1.7%
183 days or more	31	12.9%
N/A	45	18.8%
Consultations before 3 month review	148	76%*
Consultations after 3 month review	47	24%*

*based on N=195, that is excluding the 45 where date information was not provided.

Tests and allergies

Pharmacists noted if they recommended a blood test and if the allergy status of the patient was recorded on their prescription information. GP were expected to then indicate if they ordered a blood test. Pharmacists would also indicate if allergy status was known at the three month mark. Blood tests were recommended for all patients by the pharmacist. GPs ordered blood tests for 32 patients, 21 indicated they did not order a blood test, while the vast majority (187) did not indicate if blood tests were ordered or not. At the time of the initial AMR, 194 of the 240 patients had a known allergy status (80%). At the three month medicine review this increased to 207 (86%) See Table 49 for details.

Table 49: Occurrence of blood tests and allergy status

	Blood test recommended in AMR	GP ordered a blood test	Allergy status available for AMR	Allergy status available at 3 month follow up
Yes	239 (99.58%)	32 (13.33%)	194 (80.83%)	175 (72.92%)
No		21 (8.75%)	45 (18.75%)	26 (10.83%)
No Comment	1 (0.42%)	187 (77.92%)	1 (0.42%)	39 (16.25%)
Total	240 (100.00%)	240 (100.00%)	240 (100.00%)	240 (100.00%)

Medications prescribed to patients

The EDR had a summative list of all medications the patient was prescribed at the time of their AMR. Table 50 provides a summary of medications prescribed before the AMR and then 3 months after the AMR. Aspirin was the most frequently prescribed medication at both the pre and post AMR points. The McNemar test was used to determine whether the initial response rate equalled the final response rate; that is, if the difference between prescription rates was statistically significant. Where the significance falls below the 0.05 percentile, it is presumed to be a statistically significant difference. According to this, the increase in prescriptions for aspirin, calciferol and calcium were all significant. Similarly, decreases in the prescribing of beta blockers, sedatives, other antidepressants, psychotropics and PPIs were also statistically significant.

Table 50: Medications prescribed

Drug group	Pre AMR (N=240)		Post AMR (N=240)			Test statistic	
	n	%	n	%	Unclear	Asymp. Sig. p =	Exact Sig. (2-tailed) p =
Aspirin	128	53.3%	147	61.3%		0.001	
Calciferol	77	32.1%	136	56.7%	2	0.000	
BBlocker	76	31.7%	66	27.5%	2		0.013
ACEI or ARB's	93	38.8%	85	35.4%	-		0.057
Bisphosphonates	47	19.6%	49	20.4%	1		0.774
Calcium	69	28.8%	95	39.6%	5	0.000	
Fibre	27	11.3%	31	12.9%	-		0.219
Sedatives	67	27.9%	58	24.2%	2		0.004
Antidepressants- tricyclics	20	8.3%	16	6.7%	-		0.125
Antidepressants- other	62	25.8%	55	22.9%	-		0.016
Psychotropics	29	12.1%	21	8.8%	-		0.008
Statins	64	26.7%	64	26.7%	-		1.000
PPI's	101	42.1%	85	35.4%	2	0.003	
Warfarin	14	5.8%	14	5.8%	-		1.000
Flixotide	14	5.8%	14	5.8%	-		1.000

Pharmacist’s recommendations relating to a patient’s medications were indicated on the EDR. GPs were then encouraged to describe their actions in response to the recommendation. These open ended comments were coded into one of four categories as described in the methodology: “Agree with the pharmacist’s recommendations”, “No action conducted at this point in time”, “Disagree with the pharmacist’s recommendations”, or “No comment”. Table 51 summarises the GPs’ agreements with pharmacists’ recommendations.

Table 51: The agreement between the pharmacists’ recommendations against the GPs’ actions between different classes of medications

Medication class	n	Agree	No Action	Disagree	No Comment
Aspirin	212	29.2%	11.8%	13.2%	45.8%
Calciferol	226	31.9%	18.1%	13.3%	36.7%
β-blockers	101	5.9%	33.7%	19.8%	40.6%
ACEi’s or ARB’s	114	7.9%	36.8%	14.9%	40.4%
Bisphosphonates	136	3.7%	46.3%	7.4%	42.6%
Calcium	237	19.4%	20.3%	35.9%	24.5%
Fibre	158	12.7%	13.3%	44.3%	29.7%
Sedatives	67	7.5%	40.3%	6.0%	46.3%
Antidepressants – tricyclics	24	8.3%	37.5%	25.0%	29.2%
Antidepressants – other	65	21.5%	44.6%	7.7%	26.2%
Psychotropics	29	41.4%	31.0%	3.4%	24.1%
Statins	239	4.2%	36.4%	40.2%	19.2%
PPIs	111	17.1%	28.8%	8.1%	45.9%
Warfarin	16	0.0%	37.5%	12.5%	50.0%
Flixotide	30	10.0%	33.3%	30.0%	26.7%
Average agreement		14.5%	29.8%	21.8%	33.9%

Overall, less than 15% of recommendations made by the pharmacists were accepted by the GPs. The acceptance value ranged from 0.0% (for warfarin) to 41.4% (for psychotropics). There were more agreements rather than disagreements for aspirin, calciferol, sedatives, other antidepressants, psychotropics, and PPI’s. Over one third of recommendations were not commented upon, while nearly 30% were not acted upon at that time.

It was also possible to compare the EDR recommendation by the pharmacist with the post-AMR status of the medication. This comparison essentially ignores the GPs comments on their actions and looks instead at the status of the medication prescription three months after the initial AMR and EDR data was collected. This allows for the time often taken for changes in prescription to take place and is potentially a more accurate measure of agreement. These results are presented in Table 52. Overall, around 26% of pharmacist recommendations were matched by the subsequent action (or inaction, where no change was suggested) of the prescriber. Disagreement appears greatest in relation to antidepressants and statins. In the case of antidepressants these

disagreements reflect the pharmacist's suggestions to review the medications and the subsequent indication that 'no change' was made to the medication 3 months later. This may not in fact be a disagreement, but strictly speaking where a review was requested, it was an indication of potential change. In the case of statins the majority of disagreements (145 of the 200) were where the pharmacist recommended starting statins and 'no change' was indicated at the three month review. A further 52 disagreements related to the pharmacist's recommendation to review the statins, with 'No change' being the subsequent three month measure.

Table 52: Comparison between AMR recommendations and post-AMR actions

Drug group	Agreement					
	Yes	%	No	%	Unclear	%
Aspirin	135	63.7%	56	26.4%	21	9.9%
Calciferol	130	57.5%	74	32.7%	22	9.7%
BBlocker	19	18.8%	66	65.3%	16	15.8%
ACEI or ARB's	24	21.1%	79	69.3%	11	9.6%
Bisphosphonates	39	16.6%	167	71.1%	29	12.3%
Calcium	80	33.8%	130	54.9%	27	11.4%
Fibre	24	15.2%	115	72.8%	19	12.0%
Sedatives	14	20.9%	46	68.7%	7	10.4%
Antidepressants- tricyclics	5	20.8%	18	75.0%	1	4.2%
Antidepressants- other	14	21.5%	47	72.3%	4	6.2%
Psychotropics	10	34.5%	16	55.2%	3	10.3%
Statins	13	5.4%	200	83.7%	26	10.9%
PPI's	27	24.3%	65	58.6%	19	17.1%
Warfarin	5	31.3%	7	43.8%	4	25.0%
Flixotide	4	13.3%	22	73.3%	4	13.3%
Total	543	29.1%	1108	59.4%	213	11.4%
Average		26.7%		61.4%		11.9%

Falls data

The Selwyn Foundation documents all known falls of its patients. Table 53 shows how the overall number of falls reduced in the group of 240 patients for whom EDR data was available. These results should be interpreted with caution as nearly 100 'before AMR' falls can be attributed to three individuals. If we instead look at those individuals who fell one to five times in the six month period before and after their AMR, then there were 87 such patients (36%) before their AMR and 65 after (27%) - a more modest decrease. Also of note was the fact that the number of patients experiencing no falls increased from 57% to 70% of the patients.

Table 53: Number of falls 6 months either side of the AMR date

Number of falls	Before AMR (N=240)		After AMR (N=240)	
	Number of patients	Percentage of patients	Number of patients	Percentage of patients
0	137	57.1%	168	70.0%
1	41	17.1%	47	19.6%
2	23	9.6%	8	3.3%
3	10	4.2%	5	2.1%
4	9	3.8%	2	0.8%
5	4	1.7%	3	1.3%
7	2	0.8%	1	0.4%
8	4	1.7%		
9	1	0.4%		
10	1	0.4%	1	0.4%
12	1	0.4%	1	0.4%
14			1	0.4%
15	1	0.4%		
16	1	0.4%	1	0.4%
		0.0%	1	0.4%
20	1	0.4%		
21	1	0.4%		
23			1	0.4%
26	1	0.4%		
36	1	0.4%		
38	1	0.4%		
Total falls	422		202	

ADHB Data

Data on hospital stays outside of the Selwyn setting were collected, based upon inpatient and outpatient usage. These are presented in Tables 54 and 55 respectively. Again, a six month window either side of the AMR date was used. The number of inpatient admissions would appear to be lower after the AMR than before, most noticeably so in terms of AED admissions.

Table 54: ADHB Hospital inpatient usage

Ward/Unit	Before AMR*		After AMR*	
	Number of admissions	Percentage of admissions	Number of admissions	Percentage of admissions
Admission and Planning Unit	8	11.6%	6	21.4%
Adult Emergency Department (AED)	37	53.6%	12	42.9%
AKCH OR Day Admit Level 8	1	1.4%	1	3.6%
Dermatology Day Stay	2	2.9%	-	
Eye Day Stay	2	2.9%	-	
Fraser McDonald Unit	-		1	3.6%
Haematology Day Stay	-		1	3.6%
Orthopaedic	1	1.4%	-	
Rangitoto Ward	2	2.9%	1	3.6%
Remuera Ward	3	4.3%	1	3.6%
Short Stay Surgical Unit	2	2.9%	1	3.6%
Other Wards	11	15.9%	4	14.3%
Grand Total	69	100.0%	28	100.0%

*multiple admissions per patient occurred

When looking at outpatient clinic usage, there appeared to be no significant difference between usage before and after the AMR. Cardiology was the most common outpatient event in both cases.

Table 55: ADHB outpatient usage

Ward/Unit	Before AMR*		After AMR*	
	Number of admissions	Percentage of admissions	Number of admissions	Percentage of admissions
A Plus Links	2	1.7%	1	1.0%
Anaesthesia	1	0.9%	-	
Cardiology	20	17.2%	22	22.7%
Dermatology	5	4.3%	13	13.4%
Diabetes	2	1.7%	1	1.0%
Endocrinology	6	5.2%	4	4.1%
Gastroenterology	1	0.9%	2	2.1%
General Surgery	10	8.6%	12	12.4%
Gynaecology	1	0.9%	-	
Haematology	2	1.7%	-	
Immunology	-		1	1.0%
Neurology	1	0.9%	1	1.0%
Neurosurgery	1	0.9%	1	1.0%
Nutrition	-		1	1.0%
Oncology	13	11.2%	1	1.0%
Ophthalmology	23	19.8%	14	14.4%
Oral Health	3	2.6%	-	
ORL	5	4.3%	5	5.2%
Orthopaedics	12	10.3%	6	6.2%
Renal Medicine	-		1	1.0%
Respiratory Medicine	2	1.7%	4	4.1%
Rheumatology	-		1	1.0%
Urology	6	5.2%	4	4.1%
Vascular Surgery		0.0%	2	2.1%
Grand Total	116	100.0%	97	100.0%

*multiple admissions per patient occurred

GP questionnaires and interviews

A brief questionnaire was sent to the 13 GPs with patients who had AMRs completed. Of these, only seven questionnaires were returned by the end of this study. It should be noted that some questionnaires were not adequately completed, and thus the amount of information collected was quite limited. Table 56 provides the responses for each of the GPs.

Of these seven GPs, four ‘always’ read the AMR. Three indicated they were ‘slightly’ or ‘moderately’ useful and another three GPs found them ‘very’ or ‘extremely’ useful. When asked to explain the usefulness of the AMR one GP reported that:

“As elderly people will have changing medical conditions, multiple medical conditions and many drug interactions. So frequent review of medications in any form is very useful and appropriate, as they hardly complain and their care is somewhat comprehensive”

As GPs also used the summative information on the Evaluation sheets (EDRs), similar questions were asked regarding their usefulness; three found them ‘moderately’ useful and two ‘very’ useful.

Agreement with, and action upon, recommendations was not always in accordance- as indicated in Table 56. GPs commented that:

“The patients' families were not keen on any medication changing”

“If there are a lot (of actions recommended) can't do them all at once. Often not timely to patient- either on arrival (to residential care) or serious (illness) and needs to be stable”

Table 56: GP usage of AMR and EDR sheets

GP #	1	2	3	4	5	6	7
# of patients	1	2	4	1	1	blank	blank
Read AMR summaries	Frequently	Always	Always	Occasionally	Occasionally	Always	Always
Usefulness of AMR summaries	Extremely	Very	Slightly	Moderately	Very	Slightly	Not at all
Filled in Evaluation sheets	Never	Rarely	Not sure/NA	blank	Frequently	Occasionally	Frequently
Usefulness of Evaluation sheets	Very	Slightly	Not sure/NA	Moderately	Very	Moderately	Moderately
Agreed with recommendations	Always	Frequently	blank	Occasionally	Frequently	Occasionally	Occasionally
Acted on recommendations	Frequently	Never	blank	Not sure/NA	Frequently	Occasionally	Occasionally

GPs then went on to rate their opinion of AMRs regarding the benefit to patients and to themselves. These results are summarised in Table 57. The majority of GPs who returned questionnaires agreed that AMRs would lead to the stopping of non-indicated medications, would increase preventative prescribing, and reduce wastage of medications. They were more equivocal regarding the reduction of hospital admissions, an increase in patient awareness, satisfaction or compliance/adherence, or reduction of falls.

Regarding statements of usefulness to GPs, most saw it as a useful overview of medications. The value of the AMR as a reminder for contraindications or as a communication tool between patient or pharmacist was not seen to be apparent. Two GPs commented that:

“Can’t change meds without consultation with patient, so it forced communication anyway”.

“Most patients [are] demented so no real communication anyway”.

Table 57: GP’s opinion regarding patient benefits and GP usage

How much do you agree that these were benefits of AMR for patients:						
	Strongly Agree (n)	Agree (n)	Neither agree or disagree (n)	Disagree (n)	Strongly disagree (n)	Blank (n)
Stopping of non-indicated medication	3	2	0	1	0	1
Increased preventative prescribing	2	3	1	0	0	1
Reduced number of hospital admissions	2	1	0	2	0	2
Increased patient awareness	1	1	2	2	0	1
Increased patient satisfaction	1	0	3	1	0	2
Increased patient compliance/adherence	1	1	1	0	0	4
A decrease in the total number of falls	1	0	2	2	0	2
A reduction in wastage of medication	3	1	0	1	0	2
How much do you agree that AMRs were for GPs:						
A valuable overview of current medications	3	2	1	0	0	1
A valuable reminder of drug contraindications	2	1	1	2	0	1
A useful communication tool between Pharmacist and GP	3	0	2	1	0	1
A useful communication tool between patient and GP	0	3	2	1	0	1

All GPs indicated that they would like the completion of AMRs to be continued, and provided additional feedback on what changes might be useful to the form. These recommendations were related to reducing the size of the report to a single page, and including a list of current medications.

A group interview with two of the GPs further explored their impressions of the AMR process and any changes that may be recommended. There was a firm belief that the 'tick box' approach of the Evaluation Data Record (EDR) was in fact a preferred format over the long form Annual Medicines Review (AMR):

"If it was a single sheet and attached to drug sheet then probably would find it useful"

"Should be a checklist to check there are no gaps, not to influence prescribing."

Further to the discussion the purpose of a medicines review was clarified as ideally focusing on two aspects of medications. Firstly, as a reminder for GPs to check on the preventative aspects of current or additional medications, and secondly to look at chronic health medications and check on the continuation of these.

Pharmacist interview

An additional semi-structured face-to-face interview was conducted with the pharmacist responsible for overseeing the creation and management of the AMRs for all Selwyn sites. In her opinion a redesign of the AMR into a shorter format similar to the EDR document would also be preferable. The longer form AMR was also perceived as repetitive and time consuming to complete from the pharmacist's perspective. Doing the AMRs was seen to be of some professional benefit, both in terms of knowledge and increasing interactions with patient's GPs:

"...did learn a bit, helped solidify knowledge...got some great feedback [from GPs on the form], solidified relationship, usually only get scripts"

The pharmacist also identified areas where an AMR implementation might be improved. The pilot was conducted ward by ward. As doctors often were responsible for whole wards, this meant they were swamped by a large number of reviews all at the same time, leading to delays in reading and commenting on the AMR information.

The process of document management was also commented upon, as the pharmacist spent a significant amount of time chasing up non-returned evaluation data records (EDRs). The AMR and EDR sheets were sent to the respective GP, but this often meant being managed at the location by lead nursing staff or clinical administrators. The potential for paper-based records to go astray was high, and closer integration of review records with medicine chart data, possibly electronically, could be of great benefit.

Discussion

The following section discusses what was achieved during the Selwyn Annual Medicines Review (AMR) pilot in comparison to the intended objectives and outcomes as identified in the proposal and evaluation plan.

Determining the success of the AMR pilot was of course dependent upon isolating the effect of the AMR from other interventions or procedural changes. It must be remembered that the use of the AMR was part of an overall strategy including the introduction of robotically managed drug dispensing, and the centralisation of pharmacy services to a single provider. As such, the impact of AMRs upon outcomes such as patient compliance and medication wastage were influenced by all aspects of the pilot service, not just the Annual Medicines Review. The evaluation was not intended to review the impact of the robotics dispensing system.

The evaluation was also not able to gather data on individual patient knowledge of, compliance to, or satisfaction with, medicines. In the residential care environment, the measurement of such parameters is very dependent upon the ability of the patient to communicate and to provide informed consent to give such information. Given the range of cognitive status within the population, it was not seen to be reliable or appropriate for the evaluators to collect such data. The fact that adherence data were not collected should not be seen as a significant limitation to the pilot, as the level of medication control (i.e. compliance) in such environments is closely controlled by clinical staff.

The original intention of the pilot was to include independent living residents who did manage their own medications. These in effect would have been an important sub-sample to evaluate in terms of adherence and satisfaction rates. However, it was not possible to include such residents unless they used the Selwyn medical centre, and their pharmacist agreed to take part, or where residents changed to the Selwyn pilot pharmacist. These factors were seen to preclude any such recruitment by the contract holder, and so no independent living residents were included. The pilot plan included educational sessions with residents regarding medicine use. No educational sessions occurred with residents, as this again was seen as more useful for independent living residents.

How successful was the recruitment of patients and completion of reviews?

Patient medicine reviews were implemented prior to the finalisation of the evaluation data record. Understandably, with around 600 patients potentially contained within the review pilot, the pharmacy had to conduct a significant number of medicines reviews per week to achieve complete coverage of all sites. The result however was a large number of evaluation records were completed retrospectively by the pharmacist, well after the AMR had been completed and sent to the GP. Such delays impacted at the GP end as well, and unfortunately meant a large percentage of EDRs were not completed.

What influence did the pharmacists' AMR recommendations have on GPs' prescribing actions?

The AMR and EDR documents provided a large number of recommendations regarding medications to review and change. As noted in the small amount of feedback from GPs, these were seen to be mostly useful, but the results from analysis of the actual AMR data would appear to indicate a relatively low level of agreement with recommendations. It is important however to appreciate the difference between what a GP says he or she thinks of a recommendation, and what action is taken in the three month window prior to reassessing the patient's medication chart. Nearly 30% of all three month post-AMR drug charts reflected the pharmacist's recommendation, as opposed to about 15% of agreement between the recommendation and the GPs stated intentions. The difference may well be contained within the small number of cases where no comment was made, or the agreement was unclear. It is also not possible to determine from the data collected if GPs were making prescribing changes that they would not have independently made anyway. Certainly the comments made during interviews and questionnaires would support the notion that on the whole the review was a very good reminder of what to think about when considering medications. But the specific indications by pharmacists regarding which medications might be stopped, increased or decreased was probably not required. This is further backed up by the pharmacist as well, in that they have limited information about patients on which to base any such recommendations. With only a history of drug prescriptions, and no complete picture of a patient's health condition it is not possible to always make coherent recommendations.

Possibly adding to the challenge of pharmacist's recommendations being considered is the traditional pecking order of health professionals. One GP did comment that:

"...pharmacists do have a shared knowledge base, but no clinical skill"

Such a comment must not be seen as a representative statement of all GPs, but this would indicate that while GPs may be happy to have current medicines information available to make decisions, the notion of 'recommendations' per se may not be what they want.

What changes to patients' preventative and treatment medications were a result of AMRs conducted by pharmacists?

Whether changes in medications were a direct consequence of the AMR is not possible to quantitatively determine, as some prescribing changes would invariably occur whether such a review was in place or not. However, changes in medication usage were observed, and feedback from the seven GPs who did provide qualitative data indicated a belief that the AMR was responsible for stopping non-indicated medicines, increasing preventative prescribing and reducing medicine wastage. Certainly the increase in calciferol usage is evidence of an increase in preventative prescribing, and the changes in sedatives and psychotropics can be seen as a reduction in what may have been non-indicated medicines. In terms of medicine wastage, possibly the overall reduction in average number of medicines may favour such a conclusion, but wastage should not be presumed to equate to sheer numbers of medicines. This last point, however, relates more to the introduction of

robotic packaging, and falls outside the scope of our evaluation. That said, the fact that a robotics system dispenses for a shorter period of therapeutic use invariably means that prescription changes will lead to less wastage. For example, a robotic two week dispensing pattern versus a manual four week pattern would potentially save two weeks of medications wastage, should medicine changes be out of sync with the monthly prescription.

Benefits of the AMR pilot

Regular medicine reviews would appear to have potential for improving patient outcomes, as well as the level of communication between pharmacists and GPs. It was clearly identified that a systematic medicines reminder for GPs when reviewing a patient's record was a useful tool. How this translates into patient outcomes is harder to determine as previously mentioned. It is interesting that quantitative measures of expected and unexpected hospital visits, as well as falls in the residential setting decreased in the post AMR phase. The hospital data while positive cannot be directly linked to the AMR, as there are too many mitigating factors to consider. Moreover the experimental design to determine such a benefit would need to be dramatically different to even infer causality; with an older patient group, the changes over time may be due to any number of factors, and a randomised treatment/control design with greater sample sizes would be required. Even with such a design, the impact of normal care in a control group may well mitigate any effect of the AMR upon such outcomes. The falls data are also potentially confounded, in that the nature of older people falling is not just related to their medicine regimen, and that unrelated environmental changes, such as a transfer to another ward, use of restraint systems or more appropriate footwear could all possibly be more influential than changes to medications.

Conclusions and recommendations

Both the community and residential pilot services demonstrated some evidence of benefit to patients and providers. The overall limitations of success were related to the sub optimal execution of the pilots, rather than the pilot services themselves. Proper implementation, from training and accreditation through to data management, would ensure that patients, general practices, pharmacists and DHBs all reap the potential benefits of such a service.

Community pharmacist based medicines use review

The evaluation identified a number of factors for consideration, should an MUR service be provided:

Systemic factors

For pharmacies close to DHB boundaries, eligibility based upon a patient's domiciliary address will remain problematic. Claw-back arrangements or eligibility based upon a pharmacist's location would need to be considered, or Auckland metropolitan-wide availability of MUR.

DHB-wide awareness of an MUR service would also be an important step towards ensuring the service is utilised by those patients who need it most. This would be strengthened by a DHB-led communications strategy to ensure primary care and assessment services (e.g. Needs Assessment Services Coordination) are aware MUR exists.

Components of the MUR service

Data collection should focus upon baseline data with later reviews or follow ups identifying what has changed rather than replicating existing information. Timing of follow ups would be better based upon patient or pharmacist need, rather than fixed intervals of time.

Developing an electronic data management system may solve many of these issues. Should such a system be able to link with existing patient management systems (PMS), then collating medicines information and tracking MUR activity would be significantly enhanced.

Support for pharmacists

Training and MUR accreditation needs to be timely and relevant. Ongoing peer support is very important, but must not be onerous. DHB or contract-based project coordination would help interested pharmacists identify set-up needs and service fit with existing pharmacy practice. Such coordination would also be required to keep pharmacists on task at times and manage ongoing evaluation and audit requirements.

Residential care based annual medicines review

Annual medicines review (AMR) in a residential care setting could help residential patients' GPs to systematically check medicines and highlight areas for prescription change. The success of such a system would be enhanced by:

- Timing of AMR to be occur approximately 3 months after residential placement
- Process management systems to follow review document and consultation progress
- AMR documentation to not exceed a single page and be bullet point/check box style
- A steering group that regularly (e.g. 6-monthly) ratifies what medicines usage criteria are to be included in the AMR template
- Pharmacist input to be limited to a list of current medication

References

1. Urbis JHD Group, *Evaluation of the Home Medicines Review Program - Pharmacy Component*, in *Contract*. 2005.
2. Ministry of Health, *Medicines New Zealand: Contributing to good health outcomes for all New Zealanders*, in *Contract*. 2007: Wellington, New Zealand.
3. Pharmaceutical Society of Australia, *Guidelines and Standards for the Collaborative and Pharmacist Residential Medication Management Review (RMMR) Program and Associated Quality Use of Medicines (QUM) Services*. 2006, Pharmaceutical Society of Australia.
4. Frey, D. and A. Rahman, *Medication Management: an evidence based model*. Home Healthcare Nurse, 2003. **21**(6): p. 404-412.
5. Hunter, K.A., E.R. Florio, and R.G. Langberg, *Pharmaceutical care for home-dwelling elderly persons: a determination of need and program description*. The Gerontologist, 1996. **36**(4): p. 543-548.
6. Bond, C., *Clinical Pharmacy service, pharmacy staffing and the total cost of care in the United States Hospitals*. Pharmacotherapy, 2000. **20**: p. 609-21.
7. Dodds, L., *An objective assessment of the role of the pharmacist in medication and compliance history taking*. British Journal of Pharmaceutical Practice, 1982.
8. Akwagyriam, I., *Drug history taking and the identification of drug related problems in an accident and emergency department*. J Accid Emerg Med, 1996. **13**: p. 166-168.
9. Mutnick, A. and T. Reeder, *Pharmacist- versus physician-obtained medication histories*. American Journal of Health-System Pharmacy, 2008. **65**(9): p. 857-860.
10. Lowe, C.J., et al., *Effects of a medicine review and education programme for older people in general practice*. Br J Clin Pharmacol, 2000. **50**: p. 172-175.
11. Sturgess, I.K., et al., *Community pharmacy based provision of pharmaceutical care to older patients*. Pharmacy World & Science, 2003. **25**(5): p. 218-226.
12. Hanlon, J.T., C.I. Lindblad, and S.L. Gray, *Can Clinical Pharmacy Services Have a Positive Impact on Drug-Related Problems and Health Outcomes in Community-Based Older Adults?* The American Journal of Geriatric Pharmacotherapy, 2004. **2**(1).
13. Roughead, E.E., S.J. Semple, and A.I. Vitry, *Pharmaceutical care services: A systematic review of published studies, 1990 to 2003, examining effectiveness in improving patient outcomes*. International Journal of Pharmacy Practice, 2005. **13**(1): p. 53-70.
14. Lee, J.K., K.A. Grace, and A.J. Taylor, *Effect of a pharmacy care program on medication adherence and persistence, blood pressure, and low-density lipoprotein cholesterol: A randomized controlled trial*. Journal of the American Medical Association, 2006. **296**(21): p. 2563-2571.
15. Gowan, J., *Home Medicine Reviews and the aged*. Complementary Medicine, 2006.
16. Holland, R., et al., *Does pharmacist-led medication review help to reduce hospital admissions and deaths in older people? A systematic review and meta-analysis*. British Journal of Clinical Pharmacology, 2008. **65**(3): p. 303-316.
17. Hajjar, E.R., A.C. Cafiero, and J.T. Hanlon, *Polypharmacy in elderly patients*. The American Journal of Geriatric Pharmacotherapy, 2007. **5**(4): p. 345-351.
18. Goldfarb N, W.C., Hartmann C, Crawford A, Howell J, Maio V, Clarke J, and Cobb N. , *Impact of Appropriate Pharmaceutical Therapy for Chronic Conditions on Direct Medical Costs and Workplace Productivity: A Review of the Literature*. DISEASE MANAGEMENT, 2004. **7**(1): p. 61-75.
19. Holland, R., et al., *Does home based medication review keep older people out of hospital? The HOMER randomised controlled trial*. British Medical Journal, 2005. **330**(7486): p. 293-295.
20. Holland, R., R. Smith, and I. Harvey, *Where now for pharmacist led medication review?* Journal of Epidemiology and Community Health, 2006. **60**(2): p. 92-93.

21. Krska, J., et al., *Is hospital admission a sufficiently sensitive outcome measure for evaluating medication review services? A descriptive analysis of admissions within a randomised controlled trial.* International Journal of Pharmacy Practice, 2007. **15**: p. 85-91.
22. Royal S, S.L., Avery A, Hurwitz B and Sheikh A, *Interventions in primary care to reduce medication related adverse events and hospital admissions:systematic review and meta-analysis.* Qual. Saf. Health Care, 2006. **15**: p. 23-31.
23. Sorensen, L., et al., *Medication reviews in the community: Results of a randomized, controlled effectiveness trial.* British Journal of Clinical Pharmacology, 2004. **58**(6): p. 648-664.
24. Herborg, H., et al., *Improving Drug Therapy for Patients with Asthma -- Part 1.* Journal of American Pharmaceutical Association, 2001. **41**(4): p. 539-550.
25. UrbisJHD Group, *Evaluation of the Home Medicines Review Program – Pharmacy Component.* 2005.
26. Renberg T, L.K., Tully M., *Exploring subjective outcomes perceived by patients receiving a pharmaceutical care service.* Research in Social and Administrative Pharmacy, 2006. **2**: p. 212-231.
27. Bond C et al, *Community Pharmacy Medicines Management - A Resource Pack for Community Pharmacists.* 2003, University of Aberdeen; University of Keele and the University of Nottingham.
28. Davis, R.G., et al., *Retrospective evaluation of medication appropriateness and clinical pharmacist drug therapy recommendations for home-based primary care veterans.* American Journal Geriatric Pharmacotherapy, 2007. **5**(1): p. 40-47.
29. Salmond, C., P. Crampton, and J. Atkinson, *NZDep2006 Index of Deprivation.* 2007, Department of Public Health, University of Otago: Wellington, New Zealand.
30. Thomas, D.R., *A General Inductive Approach for Analyzing Qualitative Evaluation Data.* American Journal of Evaluation, 2006. **27**(2): p. 237-246.
31. Morisky, D.E., L.W. Green, and D.M. Levine, *Concurrent and predictive validity of a self-reported measure of medication adherence.* Medical Care, 1986. **24**(1): p. 67-74.