MEDICATION CHANGES & RECOMMENDATIONS IN A CLINICAL GERONTOLOGY SERVICE

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ABSTRACT

The purpose of this prospective study was to assess medication changes instituted during geriatric assessment and to determine compliance with medication recommendations three months post-discharge. Additional information to be studied included physicians' opinions of a Clinical Gerontology Service (CGS) discharge summary and the impact of the addition of a pharmacist-prepared medication discharge summary.

Patients who underwent geriatric assessment had their medication regimens assessed on admission, discharge, and three months post-discharge. As an intervention, a pharmacist-prepared medication discharge section was added to the multidisciplinary discharge summary. A questionnaire was used to determine referring and primary care physicians' opinions of the CGS discharge summary.

A total of 104 patients (two patients with readmissions, therefore 106 study cases) participated. The mean age of the study population was 80.6 (SD=6.8) years. Patients were admitted on an average of 5.5 (SD=3.3) total medications. They were discharged on an average of 4.3 (SD=2.3) and were again on an average of 5.5 (SD=2.9) total medications by three months post-discharge. There were no significant differences in scheduled medication costs between admission, discharge, and follow-up.

Numerous drug additions, discontinuations, dose and administration interval changes occurred during and after assessment. There were also many changes in the choice of therapeutic agents prescribed. A number of variables were identified which were significantly correlated with the number of medication changes which occurred.

The overall response rate for the questionnaires was 67.5%. For two of the three CGS study sites, physicians reported that discharge summaries were not received within a desirable time period. The overall quality of the discharge summary and the quality of the medication information provided received median rank scores of 4 (on a five point Likert scale labelled as 1=poor and 5=excellent). Physicians rated as "very important" the inclusion of information in discharge summaries about discharge medications along with their therapeutic rationale, changes in dose and reasons for this change, medications discontinued and reasons for the discontinuations, and medications added and reasons for the additions.

The pharmacy discharge summary had no significant impact on decreasing medication numbers, costs, or changes between discharge and follow-up. Because the control group may have been sicker (possible selection bias), it was not possible to determine if polypharmacy occurred less frequently in intervention patients, or whether the more favorable questionnaire responses from physicians of these

patients were actually due to the presence of the pharmacy discharge summary.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ABBREVIATIONS

#:	number
AHFS:	American Hospital Formulary Service
ANOVA:	analysis of variance
CGS:	Clinical Gerontology Service
CNS:	central nervous system
CV:	cardiovascular
DH:	Day Hospital
DH-C:	Day Hospital control
DH-I:	Day Hospital intervention
FIM:	Functional Independence Measure
GAU:	Geriatric Assessment Unit
GAU-C:	Geriatric Assessment Unit control
GAU-I:	Geriatric Assessment Unit intervention
GI:	gastrointestinal
MMSE:	Mini-Mental Status Exam
PC:	Parkridge Centre
PC-C:	Parkridge Centre control
PC-I:	Parkridge Centre intervention
prn:	as needed
prn-OTC:	as needed over-the-counter
prn-Rx:	as needed prescription
OTC:	over-the-counter
RUH:	Royal University Hospital
Rx:	prescription
sch-OTC:	scheduled over-the-counter
sch-Rx:	scheduled prescription
total-meds:	total medications
total-OTC:	total over-the-counter
total-prn:	total as needed
total-Rx:	total prescription
total-sch:	total scheduled

CHAPTER 1

MEDICATION USE IN THE ELDERLY

1.1 Introduction

The proportion of elderly in the Canadian population is increasing. In 1983, 10.0% of the Canadian population and 12.3% of Saskatchewan's population were 65 years of age and older. In 1988, the elderly accounted for 11.1% of the Canadian population and 13.2% of Saskatchewan's population.[1] Results of the 1986 Census of Canada showed that the average annual growth rate from 1976-1986 in Saskatchewan was 2.6% for the population 65 years and over and 2.9% for the population 75 years and over.[2] This growth is of particular importance when prescription drug utilization by the elderly is also reviewed. In 1990-1991, the over 65 age group constituted 14.2% of the Saskatchewan population eligible for prescription drug plan benefits, but received a disproportionate 40.1% of all prescriptions.[3]

1.2 Special considerations

Given the high usage of medications by the elderly, consideration should be given to the potential hazards associated with drug treatment. Altered pharmacokinetic and pharmacodynamic characteristics of drugs, increased susceptibility to side effects and adverse drug reactions, polypharmacy, increased occurrence of drug interactions, and

noncompliance are just some of the problems that may be encountered by the elderly.

Various pharmacokinetic and pharmacodynamic changes occur as a person ages.[4-14] Physiologic changes that can affect absorption include decreased splanchnic blood flow and gastrointestinal motility, delayed gastric emptying, and increased gastric pH. Despite these physiologic changes, there appears to be no appreciable alteration of absorption for most drugs. However, the distribution of many drugs may be altered due to changes in volume of distribution or protein binding. Decreased total body water and lean body weight, and increased body fat can alter the distribution of hydrophilic and lipophilic drugs. Age-related decline of albumin results in decreased binding and increased free-fraction of acidic drugs such as phenytoin and warfarin. Binding of some basic drugs may be increased due to increased alpha-1 acid glycoprotein. Changes in hepatic metabolism (probably more so for Phase I than for Phase II reactions) and declining renal function may prolong a drug's elimination half-life. Cardiac output is also decreased in the elderly resulting in decreased blood flow to some organ systems. Changes in target organ receptor sensitivity have also been noted. Some organ systems exhibit an increased sensitivity to drug effects (e.g. increased central nervous system sensitivity to psychotropic medications), while other organ systems may show decreased responsiveness (e.g.

decreased responsiveness of the cardiovascular system to beta-blockers).[4]

These various age-related pharmacokinetic and pharmacodynamic changes, as well as poor compliance, drug-drug interactions, inappropriate prescribing, and multiple drug use all contribute to increased vulnerability of the elderly to adverse drug reactions and side effects.[15,16,17,18] Adverse drug reactions and side effects, which occur two to three times more frequently in the elderly than in younger populations, account for a significant number of hospital admissions.[12,15,17,19,20,21,22] An estimated 10-25% of all hospital admissions in North American elderly are due to untoward drug effects.[6] In the Geriatric Assessment Unit (GAU) at University Hospital in Saskatoon, Saskatchewan, 19.4% of all admissions were partially or solely attributed to the ill effects of drugs.[23]

Polypharmacy, the prescription of multiple drug therapies, is also more likely to occur in the elderly. This may be due to a higher prevalence of medical illnesses and somatic symptoms.[24,25,26] Other reasons cited for the occurrence of polypharmacy include multi-doctoring, failure to discontinue medications as instructed, sharing of medications with friends, increased hospital admissions, increased physician visits, pharmaceutical advertising, high patient expectations, and failure of physicians to discontinue medications that should only be prescribed for a limited time.[11,24,25,27] Polypharmacy escalates the risk of

adverse drug reactions, drug interactions, patient non-compliance and iatrogenic diseases.[24,28,29,30,31,32] For example, elderly patients admitted for drug-induced illnesses were on more medications (average = 6.3 medications) than elderly patients admitted for other reasons (average = 3.8 medications).[33] Recommendations for ways to decrease polypharmacy include physician review of medications, pharmacist conducted drug regimen reviews, and patient and health care provider education.[24]

Noncompliance is another problem for the elderly. One third to one half of the elderly have been reported to be noncompliant with their medication regimens.[10,12,13,34] Factors contributing to noncompliance include use of multiple prescriptions, impaired memory, complex dosage regimens, and use of medications causing side effects or lacking perceived therapeutic effects.[16,34] Functional limitations which may have an impact on compliance include difficulties opening prescription lids or removing medications from their containers, problems swallowing medications, or inability to differentiate between medications.[35,36] Psychosocial barriers that promote noncompliance include financial limitations, social isolation, environmental and social stresses, and denial of illnesses.[37]

Because of these problems, there is a need for geriatric consultation services. These services will often assess the potential hazards of medication use and optimize drug therapy.

CHAPTER 2

GERIATRIC ASSESSMENT

2.1 Introduction

Geriatric assessment units (GAUs) or geriatric evaluation units[1], geriatric day hospitals, and geriatric rehabilitation facilities are involved in comprehensive geriatric assessment.[38] The National Institutes of Health Consensus Statement has defined comprehensive geriatric assessment as a:

> ... multidisciplinary evaluation in which the multiple problems of older persons are uncovered, described, and explained, if possible, and in which the resources and strengths of the person are catalogued, need for services assessed, and a coordinated care plan developed to focus interventions on the person's problems.[38]

Problems especially amenable to evaluation by geriatric assessment services include: 1) medical complexity and vulnerability, 2) atypical illnesses with obscure presentations, 3) major cognitive, affective and functional problems, 4) vulnerability to iatrogenesis, 5) social isolation and economic deprivation, 6) inappropriate or premature institutionalization, 7) inappropriate utilization of community support services and rehabilitation, and 8)

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[1] Geriatric assessment units or geriatric evaluation units are encompassing terms often used to refer to in-hospital consultation services, inpatient hospital consult wards, outpatient assessment clinics, &/or home visit consults.

excessive use of medications.[29,38,39,40,41,42,43,44] An estimated 10-15% of the elderly may benefit from a specialized geriatric assessment service.[28]

The concept of geriatric assessment began in Great Britain in the 1930's where special care wards were established to address the needs of the elderly.[29,40,45] In the 1940's, the concept of a multidisciplinary team consisting of medicine, nursing, physiotherapy, occupational therapy, and medicosocial workers in a special geriatric unit was described by Dr. Marjory Warren.[46] In Canada, the Department of Veteran Affairs initiated assessment and re-establishment/rehabilitation units across Canada shortly after World War II. With time, these units took on the function of geriatric assessment and rehabilitation for older veterans.[28,41] In the 1970's, the Health Services and Promotion Branch of Health and Welfare (Canada) published guidelines for geriatric units in hospitals and geriatric day hospitals.[28,41] Currently, assessment/evaluation services for the elderly are available in a number of hospitals and care centres throughout every Canadian province.[28,41,47,48]

2.2 Goals of geriatric assessment

Goals and objectives of comprehensive geriatric assessment have been outlined in several publications. Such assessment is designed:

1. to improve diagnostic accuracy;

2. to guide the selection of interventions to restore or preserve health;

3. to increase a patient's level of function and independence;

4. to recommend an appropriate placement, ideally, in the community, or at the lowest level of institutional care required;

5. to cooperate with new and existing agencies and facilities to develop an integrated geriatric program for the whole community;

6. to increase the overall quality of care delivered to elderly patients; and

7. to monitor clinical changes over time.[38,41,49,50]

2.3 The assessment process

2.3.1 Content

A detailed assessment addresses a patient's needs in the areas of physical health, mental health, functional status, social functioning, environment, and quality of life.[28,38,41,50] A general assessment of physical health is essential to the process. In addition to the features of acute illness, special attention is directed towards the use of prescription and non-prescription medications, nutritional intake, alcohol consumption, visual or hearing impairment, and conditions contributing to poor mobility and falls. Evaluation of a patient's mental health involves assessing cognitive, behavioral, and emotional status with emphasis on delineating dementia, depression, and delirium. Functional assessment addresses the patient's ability to perform basic activities of daily living (e.g. bathing,

grooming, dressing, feeding, toileting, mobility, and continence), and instrumental activities of daily living (e.g. preparation of meals, shopping, housework, financial management, medication management, and use of transport and telephone). The assessment of a patient's social functioning, environment, and quality of life all contribute to the development of a treatment plan and influences the recommendations for discharge location.

This assessment process differs from the traditional physician consult in that a multidisciplinary team approach is used and all problems (not only medical ones) are emphasized. The core multidisciplinary team typically consists of physicians, nurses, and social workers. Depending on the facility, other health professionals may be consulted. These include physiotherapists, occupational therapists, recreational therapists, pharmacists, dieticians, psychologists, psychiatrists, dentists, optometrists, ophthalmologists, public health nurses, speech pathologists, audiologists, and other medical specialists.[50,51] Assessments by these individuals can often "lead to the discovery of new treatable problems, simplification of overly complex drug regimens, arrangement for needed rehabilitation, and development of a more supportive physical and social living environment to enhance patient functioning."[29]

2.3.2 Treatment/care plan

After the initial assessment, a coordinated treatment/care plan is developed by the multidisciplinary team. The plan should ensure treatment, rehabilitation, primary care, case coordination, and appropriate use of resources.[28] On a regular basis, the plan should be reassessed and modified to reflect the changing needs of the patient.[38,41]

2.3.3 Outcome and follow-up

Successful geriatric assessment programs must be able to ensure compliance with treatment recommendations and must arrange for appropriate follow-up of assessed patients after discharge.[38,40,52] Depending on the setting, the geriatric team may or may not have direct control over the implementation of treatment recommendations. Some strategies suggested to maximize compliance with recommendations include:

1. rapid responses to requests for consultations;
2. priorization and limitation of initial recommendations;
3. specific recommendations made with critical recommendations identified as such;
4. detailed specifications of dosage and duration in recommendations for pharmacologic therapy;
5. emphasis on effective communication and personal contact with the referring physician; and
6. frequent follow-up.[52-58]

Most geriatric services will eventually return the care of the elderly patient to the primary care physician.[28] A close liaison between the geriatric service and the primary care physician must be established to effectively communicate the care plan recommendations.[28,40]

2.3.4 Communication with physicians

2.3.4.1 Methods of communication

Vital aspects of a patient's assessment can be relayed from one physician to another in various ways. Direct face-to-face contact can take the form of personal contact during home or hospital visits, clinical meetings or lectures, or at informal social functions.[59] In practice, this method of communication rarely takes place.

The main means of conveying patient information is via the discharge summary.[59] The Canadian Council on Health Facilities Accreditation requires that each patient's hospital record must contain a discharge summary.[60] In addition to sending a discharge summary from medical records, many services recommend that the hospital physician telephone the patient's general practitioner to discuss follow-up patient care. Nurses may also complete an inter-agency referral form containing information about discharge medications, nursing care required, the patient's current and past medical status, and key family or primary care giver contacts when patients are discharged to other institutions.

2.3.4.2 Inadequacies with the current communication process

Effective communication via discharge summaries is hampered by deficiencies such as: 1) excessive time delay between patient discharge and receipt of the discharge summary, 2) failure to send a discharge summary, 3) poor information or lack of information included in the discharge summary, 4) use of obscure abbreviations, 5) poor access to important information contained in the discharge summary, and 6) failure to record information and prognosis given to the patient.[59,61,62,63,64]

A common problem is the excessive time delay between patient discharge and receipt of the discharge summary. Although "an initial summary should arrive within three to four days (at most) of the patient's discharge... [and] final reports ... as soon as possible and not more than two weeks after patient discharge"[61], Long and Atkins[59] found that over 40% of discharge letters did not reach the general practitioner within one week of patient discharge and 33% of the discharge letters were received at a date considered unsatisfactory by the general practitioner. The excessive time lag between patient discharge and receipt of the discharge summary by the general practitioner has been attributed to dictation, typing, and postal delays.[65]

Failure to send a discharge summary is also a problem. An audit of the extended care geriatric unit in St. Boniface General Hospital in Winnipeg, Manitoba showed that only 20%

of the records of discharged patients stated that a summary had been forwarded to the patient's family physician.[66]

Although discharge summaries may be sent, information is often missing. Tulloch et al. found that in almost half of initial summaries and in 40% of final reports, there were no references to treatment on discharge, and drug reactions were also under-reported.[61]

All of these inadequacies in discharge summaries may be the result of the delegation of responsibility for preparing discharge summaries to more junior staff who frequently receive no formal training on their proper preparation.[64,67,68]

2.4 Benefits of geriatric assessment

It can be stated with moderate to high confidence that comprehensive geriatric assessment followed by ongoing implementation of the resulting care plan is effective.[38] Some of the beneficial outcomes reported include: 1) improved diagnostic accuracy [31,53,69-75], 2) prolonged survival[30,44,71,76,77], 3) reduced annual medical care costs[71], 4) reduced length of hospital stay[32,78,79], 5) reduced use of nursing homes and improved placement location[44,52,69,70-72,75,76,78,80-82], 6) increased use of health and social services delivered in home[30,66,74], 7) improved affect and cognition[30,71], and 8) improved functional status[44,70-72,75,76,81]. However, studies have also demonstrated no statistically significant benefits to patients who have undergone geriatric

assessment.[83-90]

Effectiveness of geriatric assessment has been most convincingly demonstrated by inpatient geriatric assessment units, and the combined geriatric assessment and rehabilitation units.[38] In the home, ambulatory, and hospital inpatient consultation settings, the effectiveness of comprehensive geriatric assessment has been proven less consistently.[38] In the inpatient geriatric unit and rehabilitation unit, the geriatrician has direct control over patient care, whereas in other settings, other physicians are responsible for following through with recommendations. Compliance rates with geriatric consultations have ranged from 33-72%.[31,32,53] Targeting of elderly patients appropriate for geriatric assessment may also be important in demonstrating effectiveness.[91-94] According to Rubenstein, patients from lower socioeconomic groups, with poor social supports and inadequate medical care, and on the verge of requiring institutionalization are most likely to benefit.[45] The composition and training of the members of the assessment team may also play a role in determining effectiveness.

2.4.1 Modification of medications

In addition to the documented benefits previously outlined, a number of studies have shown the effectiveness of geriatric assessment in decreasing number of medications,

simplifying drug regimens, and improving drug therapy.

In a retrospective chart review of 74 patients admitted to a geriatric evaluation unit at Sepulveda Veterans Administration (VA) Medical Centre, Rubenstein et al. demonstrated a 32% reduction in the mean daily number of drugs prescribed per patient, and a 43% reduction in the total number of drug doses.[70] The ability of the service to decrease medications may be attributed to three factors:

1. special attention was paid to improving drug regimens;
2. additional time was spent in hospital during which the patient's medical disorders might be stabilized and require fewer drugs; and
3. drug regimens prescribed at time of admission to the geriatric evaluation unit might not have been intended as final regimens since physicians on the general wards knew the patient would remain hospitalized.

A later retrospective chart review of the Sepulveda VA geriatric evaluation unit showed continued reduction of drug use.[72] For 255 patients admitted over a four year period, the mean number of drugs was reduced by 34% per patient (from 4.26 to 2.82) and the mean number of daily drug doses was reduced by 36% per patient (from 7.64 to 4.88). This reduction occurred even with the identification of an average of over three new diagnoses per patient.

In 1987, Rubenstein published the descriptive results from the operation of the first 6 years (June 1979 - June 1985) of the Sepulveda VA Medical Centre geriatric evaluation unit.[73] Medical records of 416 discharged

patients were reviewed and, on average, there was a 24% reduction in the mean number of drugs taken (3.86 to 2.94, $p<0.05$). The mean number of daily doses per patient decreased from 6.92 to 4.62 ($p<0.05$), a reduction of 33%.

Applegate et al., in a prospective uncontrolled descriptive study of the first 100 admissions to a ten-bed inpatient geriatric assessment and rehabilitation unit located in Memphis, Tennessee, documented a reduction of medications per patient from 4.3 on admission to 3.5 upon discharge.[75] An average of 1.9 medications were discontinued and an average of 1.2 medications were started.

In another study by Applegate et al. the medical costs over one year of 77 control (received no geriatric assessment) and 78 intervention (received geriatric assessment) patients were compared.[88] Geriatric assessment patients had statistically higher overall medical costs, however, there was a trend towards lower medication charges in the geriatric assessment group ($539 versus $731, $p=0.06$). The data on medical charges were based on patient entries into a notebook.

In a prospective uncontrolled study by Barker et al. from January to June 1982 in six acute care hospitals in Munroe County, New York, the impact of a geriatric consultation team on elderly patients awaiting long-term placement was studied.[32] The project focused on 366 hospitalized patients aged 70 and older who were deemed at

high risk for experiencing prolonged hospital stays. In 30% of consultations, medication change was recommended but only 51% of these medication recommendations were followed. No information was provided as to the types of medication changes recommended.

Katz et al. conducted a prospective uncontrolled study at the Buffalo Veterans Administration Medical Centre to determine compliance with physician administered multifaceted assessments performed on 51 consecutive consultation requests.[31] Recommendations resulted in the simplification of drug regimens or elimination of potentially harmful drug interactions in 45% of cases. Problems identified as potentially due to drug therapy included hypotension (supine or upright), confusional state, extrapyramidal syndrome/falls, hazardous drug-drug interactions, and altered bowel/bladder habits.

Lichtenstein and Winograd in a review of 81 geriatric consultations performed by a geriatric fellow and a faculty geriatrician at San Francisco General Hospital found that adverse medication effects were commonly diagnosed.[69] The most frequent recommendation of the service, for 62% of patients, was for the adjustment of medications.

As part of a prospective randomized controlled study of the effectiveness of a geriatric consultation team at the Durham (North Carolina) Veterans Administration Medical Centre from November 1983 to December 1984, Allen et al.

analyzed compliance with drug therapy recommendations.[53] In the 92 intervention group patients, 68.4% of recommendations for drug addition, 74.7% of recommendations for drug reduction, and 46.7% of recommendations for assessment of medication need were initiated by the house staff. In this study, compliance rates for medication and diagnostic recommendations were similar.

Alexander et al. compared admission and discharge medications in two elderly groups, one group admitted to an acute care geriatric medicine ward in Scotland and the other group admitted to an acute care general medicine ward in the United States.[95] The charts of the first ten patients per month, 65 years of age and older, admitted over a six-month period between May to October 1982 were used to arrive at 60 Scottish and 60 American patients. Neither group showed a significant change in the number of drugs from admission to discharge. However there were significant changes between admission and discharge in the types of medications prescribed for the Scottish group but not for the American group. In the Scottish group, there was a significant decrease in the use of narcotic analgesics and a significant increase in the number of bowel medications prescribed between admission and discharge.

At the Victoria General Hospital in Halifax, a prospective randomized controlled trial of the effect of a geriatric consultation service on the management of elderly

patients (greater than or equal to 75 years of age) in an acute care hospital was conducted from August to November 1984.[30] Fifty-seven patients were assigned to the intervention group (received geriatric consultation) and 56 to the control group (did not receive geriatric consultation). Intervention group patients received statistically fewer medications by discharge ($p<0.05$).

The results of a retrospective chart review of 170 patients admitted to the Geriatric Assessment Unit (GAU) of the Department of Clinical Gerontology at University Hospital in Saskatoon, Saskatchewan published in 1987 demonstrated that the mean number of drugs prescribed decreased from 5.3 on admission to 3.7 upon discharge.[23] There were also marked changes in the types of therapeutic agents prescribed. Gastrointestinal drugs replaced central nervous system drugs as the most commonly prescribed therapeutic class. There were also significant reductions in usage of cardiovascular and electrolyte preparations. In 19.4% of patients, admission to hospital was partially or solely due to adverse reactions to drug therapy.

In another chart review of 100 consecutive admissions to the GAU at University Hospital between 1988 and 1989, an average of 5.15 drugs on admission was decreased to 3.67 per patient upon discharge.[96] It was also noted that 55% of the study patients were on more than four drugs on admission. From admission to discharge there were also substantial

reductions in the occurrence of dosage inaccuracies, drug-drug interactions, and inappropriate usage of medications.

A prospective randomized controlled trial of patients 70 years and older was undertaken in an Australian hospital where 97 patients were assigned to the geriatric assessment unit while 170 were assigned to two general medicine wards.[89] On admission, the number of drugs per patient was 2.6 in the geriatric assessment unit group, and 2.7 in the general medicine group ($p<0.74$). By discharge, there was a statistically significant difference in medication numbers between the two groups ($p<0.04$). Patients in the geriatric assessment group were discharged on an average of 2.6 drugs while this figure was 3.1 for the general medicine patients.

The Owens et al. (Senior Care) study was a prospective randomized controlled trial that addressed not only changes in the number of medications after intervention by a geriatric assessment consultative team but also the appropriateness of the pharmacotherapy.[97] A clinical pharmacist was a member of their assessment team. Patients (215 control, 221 assessment) were interviewed to determine their medication regimens at a home visit at 6 weeks and via a telephone interview at 3 months post-study entry. Fewer medications were used by geriatric assessment patients than by control group patients by the third day after randomization but there were no differences between groups in the number of medications used at 6 weeks or at 3 months.

In this study, the effect of intervention on medication use did not persist after hospital discharge. The authors concluded that 20% of the intervention group and 37% of the control group patients received one or more inappropriate medication choices ($p<0.005$). However, a potential problem of this study was that the clinical pharmacists who contributed to the recommendations for the intervention group also evaluated the appropriateness of the drug therapy.

Kruse et al. performed a prospective drug surveillance study of 276 patients, 75 years and older, admitted to a geriatric clinic in the Federal Republic of Germany.[98] Patients whose pharmacotherapy had not recently been evaluated were randomly selected. Medication regimens were determined on admission, at discharge, and at 3, 6, and 18 months after discharge. Non-prescription medications were excluded. During hospitalization in the geriatric clinic there was a 34% reduction in medications with the mean number of prescriptions per patient falling from 4.3 on admission to 2.8 on discharge. Polypharmacy, defined as the concomitant use of 5 or more drugs, detected in 43% of the study population on admission was found in only 17% of the study population by discharge. Simplification of dosage regimens and changes in therapeutic agents also occurred. Follow-up at 3 and 6 months showed that the frequency of medication use was similar to that noted pre-admission.

Follow-up at 18 months showed that the number of drugs used had increased by 15% as compared to admission and polypharmacy was detected in 54% of patients.

The majority of these studies focused on how medication regimens were modified during the geriatric assessment process. Only the Owens et al. and Kruse et al. studies evaluated medication regimens post-discharge.[97,98] Both these studies showed that changes in medication use did not persist after patient discharge. Although the two published studies conducted on the GAU at University Hospital showed benefits in reducing and altering drug therapy, no studies have been performed to determine if such medication changes are maintained post-discharge.[23,96]

2.5 Role of the pharmacist as a member of the geriatric assessment multidisciplinary team

In a publication on health care in the elderly, the World Health Organization has encouraged the active involvement of pharmacists in geriatric medicine.[94] As previously discussed, altered pharmacokinetics and pharmacodynamics, increased susceptibility to side effects and adverse drug reactions, polypharmacy, and noncompliance have been identified as some of the potential hazards of drug treatment in the elderly.[16,39,70,100,101] These hazards may be exacerbated when general practitioners are not aware of over one-third of the prescribed medications their elderly patients are taking.[101-104] A very important aspect of

comprehensive geriatric assessment is the review, modification, and optimization of drug therapy. This is where the pharmacist has played a key role in the assessment process.[16]

A recent Canadian publication outlined the contribution and role of the pharmacist as a member of the multidisciplinary team.[105] Functions of the pharmacist included assessment of past and current prescription and non-prescription drug use (including compliance, adverse drug reactions, and allergies), development of drug-related therapeutic goals, selection, individualization, monitoring and evaluation of medication treatment, provision of drug information and counselling, and the development and implementation of self-medication programs.

Owens et al. have also outlined the role of the pharmacist as a member of the assessment team.[106] These authors recommended that the pharmacist conduct patient interviews to obtain drug histories and review charts to obtain the patients' medical histories plus pertinent lab data prior to team conferences. During the conference, the pharmacist can obtain information regarding the patient's current medical and functional problems, the patient's mental status to determine how this might impair judgement regarding safe medication use, and the influence of caregivers on the patient's medication use. With this knowledge, the pharmacist can then recommend the best

therapeutic agents at correct doses. As well, the pharmacist should monitor for the success of therapy and for potential adverse drug reactions, and educate patients about their medications.

The role of the pharmacist in assessing functional skills required for self-medication management by geriatric assessment unit patients has also been described.[36] Skills tested included the ability to read a prescription label, to open and close a child-resistant and non-child-resistant cap, to remove tablets, to describe the meaning of a "tid" (three times a day) regimen, and to differentiate colors. Data generated through this functional assessment were useful in deciding who to start on self-medication, who needed simplification of their drug regimens, and who required patient education. In addition, this information allowed for coordination of care and for treatment planning.

In a study assessing the need for a clinical pharmacist in two geriatric day care centres in the Boston area, the total number of medications and the frequency of drug administration was decreased as a result of interventions by a pharmacist.[107] However, only 54.5% of the pharmacist's suggestions for medication changes were implemented by physicians, even though the pharmacist's recommendations were deemed "definitely" or "probably" significant in almost two-thirds (61.3%) of the cases. The day centres were not staffed by house physicians and all clients had their own

private doctors. Therefore, the low physician acceptance rate might be attributed to the physicians' lack of familiarity with the pharmacist's skills and interventions, as well as the short 32 day duration of the study.

In a study conducted in a geriatric assessment and rehabilitation centre in Calgary, Alberta, the importance of the pharmacist in identifying obstacles to self-medication and in predicting the patient's ability to self-medicate was demonstrated.[108] Fifty-one consecutive patients were assessed on admission by a doctor, nurse, and pharmacist on their ability to self-medicate. The patient's actual ability was then determined by follow-up home visits 3 months post-discharge or by the inpatient self-medication program. This study showed that the pharmacist was able to identify more obstacles to self-medication (0.96 obstacles/patient) than either nurses (0.58 obstacles/patient) or physicians (0.63 obstacles/patient). The pharmacist identified more auditory, knowledge, comprehension and motivational deficits that would hinder the process. The pharmacist also made more compliance and drug related recommendations and was more successful in predicting the patient's ability to self-medicate.

2.6 Clinical Gerontology Service at Royal University Hospital in Saskatoon, Saskatchewan

In July 1978, the Department of Geriatric Medicine at University Hospital in Saskatoon, Saskatchewan was established.[49,109] On October 1979, the service opened a temporary 10-bed Geriatric Assessment Unit (GAU) and 5-place Day Hospital (DH). This was later increased to an 18-bed GAU and 20-place DH in July 1980 when the service moved to its current purpose-renovated location. In 1986, the Department of Geriatric Medicine became the Section of Clinical Gerontology Services (CGS) under the Department of Medicine. In 1987, the CGS expanded its service to include a geriatric rehabilitation unit located at another site in Saskatoon, Parkridge Centre (PC). Currently the CGS provides a GAU with 18 inpatient beds, a DH serving a maximum of 15 patients per day, an outpatient consultation service, an inpatient consultation service, service outreach (home visits, visits to nursing homes and hospitals), and access to a 20-bed geriatric rehabilitation unit at PC.

The CGS statement of purpose is to "provide an interdisciplinary approach to the assessment, treatment, and rehabilitation of the elderly person who has experienced a breakdown in health or in the capacity for continued independent living."[109] The following are the objectives of the GAU at Royal University Hospital in Saskatoon, Saskatchewan:

1. to help elderly persons to live independently

in the community for as long as possible;

a. to assess and intervene when breakdown in independent living has occurred or is threatened;

b. to maintain and improve locomotor, physical and mental function;

c. to recommend appropriate use of community support services (such as Home Care, day centres, etc.) to maintain the elderly in their own home, and reduce strain on their supporters;

d. to offer advice in maintaining or improving the health and independence of older persons wherever they may be living;

2. to recommend appropriate long term accommodation at the least level of dependency when return home is not possible;

3. to cooperate with new and existing agencies and facilities to develop an integrated geriatric program in Saskatoon;

4. to provide educational opportunities for students and practitioners in health care and related disciplines, and to participate in public education in aging and health of the elderly; and

5. to provide a research setting for clinical, social, and health care research in Clinical Gerontology Services.[109]

The objectives of the DH at Royal University Hospital are:

1. to provide ambulatory services for elderly persons residing in the City of Saskatoon and immediate rural area;

2. to assess the medical, social, psychological and functional status of patients referred to the program;

3. to provide individualized programs designed to maintain and improve health and the

capacity for independent living;

4. to provide personal care services and supervision of prescribed medications to patients during the hours of attendance at the DH;

5. to provide therapeutically oriented activity programs designed to promote socialization, motivation and to enhance the quality of life of the patients;

6. to provide relief for the supporters of disabled elderly persons living in the community; and

7. to cooperate with existing and new agencies and facilities in the Saskatoon health care district to ensure comprehensive patient care.[109]

The core multidisciplinary team consists of geriatricians, internal medicine and family medicine residents, nurses, physiotherapists, occupational therapists, recreational therapists, social workers, pharmacists (at Royal University Hospital), and speech therapists (in PC). Other disciplines (e.g. other medical specialists, dieticians, dentists) can be consulted on an as-needed basis.

Admission to the GAU and DH requires that all patients must be 65 years of age or older, that they be referred by a physician, and that a discharge location will be available upon completion of the assessment. Additional admission criteria for the Parkridge geriatric rehabilitation unit patients is that the patient must be capable of comprehending and cooperating with the rehabilitation

procedures, that the patient has recovered from the acute phase of illness, and has completed all high technology investigations and treatment. [110]

The responsibility for a patient's care is transferred from the family doctor to the geriatrician when the patient is admitted. The assessment process of the CGS follows that outlined in Section 2.3.

Upon discharge, patient care is returned to the family doctor. In most cases, except for patients discharged to institutions, a one month prescription is written for medications.

CHAPTER 3

THE PRESENT INVESTIGATION

A cited benefit of geriatric assessment is the reduction, simplification, and optimization of drug therapy. A previous retrospective study performed on the Geriatric Assessment inpatient Unit (GAU) at University Hospital in Saskatoon looked at the nature of medication changes in 170 consecutive case records.[23] The results of this study showed a decrease in the average number of medications from 5.3 to 3.7. However, this study raised some interesting questions:

1) if a prospective study was performed, would similar results be obtained?

2) does medication reduction also occur in the Day Hospital (DH) and Parkridge Centre Geriatric Rehabilitation Unit (PC) sites?

3) are these medication changes maintained post-discharge when the care of the patient is transferred from the geriatrician back to the general practitioner?

4) are there ways to improve physician compliance with medication recommendations (i.e. by incorporation of information explaining the rationale for instituted medication changes)?

As previously discussed, the consultative nature of geriatric assessment units requires an optimum communication link between the geriatrician and the referring physician to maintain efficient patient care.[59,111] The most common means

of communication from the consultant to the general practitioner is the discharge letter.[59] This communication process is hampered by numerous deficiencies (see Section 2.3.4.2). For every discharged patient, the Clinical Gerontology Service (CGS) currently sends out a multidisciplinary summary containing information from the geriatrician, nurse, physiotherapist, occupational therapist, recreational therapist, and social worker. No previous attempts have been made to obtain feedback on the referring physicians' opinions of the CGS discharge summaries.

3.1 Objectives of the study

In an attempt to address some of these issues, the objectives of this research project are:

1. to determine the nature of medication changes instituted by the CGS for their GAU inpatients, DH, and PC patients.

2. to ascertain patients' medication regimens three months post-discharge to determine if medication changes instituted during geriatric assessment are maintained.

3. to evaluate if the occurrence of medication changes three months post-discharge are influenced by any of the following factors:

   -patient demographics on admission
   -mental status of the patient
   -number of admission medications
   -where assessment was performed (inpatient GAU, DH, or PC)
   -which geriatrician treated the patient
   -duration of assessment
   -patient's discharge or follow-up location
   -number of discharge medications

-cost of discharge medications
-inclusion of pharmacy section in CGS discharge summary
-primary physician's anticipated need for medication changes
-number of years since primary care physician graduated
-geriatrician to referring physician contact
-number of physician visits post-discharge
-continuing care by the CGS
-hospitalizations
-development of new medical conditions
-primary care physician's rating of the rationale for medication changes.

4. to compare physician compliance with recommendations after implementation of a modified discharge summary containing a pharmacy section with information explaining the medication changes instituted during the assessment.

5. to evaluate physicians' opinions about the CGS discharge summary pre and post-intervention.

CHAPTER 4

METHODOLOGY

4.1 Approval of the study

Approval for the study was granted by the University of Saskatchewan Advisory Committee on Ethics in Human Experimentation (Behaviourial Sciences). Approval was then obtained from the Royal University Hospital Administrative Executive and Parkridge Centre Ethics Committees.

4.2 Study population

All patients of the Clinical Gerontology Service Geriatric Assessment Unit (GAU), Day Hospital (DH), and Parkridge Centre Geriatric Rehabilitation Unit (PC) were eligible for the study provided that the patient, or family member/primary caregiver/legal guardian of cognitively impaired patients consented to participate.

Certain criteria must be met by patients before admission to the Clinical Gerontology Service (CGS). Patients must be at least 65 years of age, be referred by a physician, and have a discharge location available upon completion of the assessment. Additional admission criteria for PC patients are that they must be capable of comprehending and cooperating with the rehabilitation procedures, that they have recovered from the acute phase of illness, and that they have completed all high technology

investigations and treatment.

All CGS patients recruited during the first 1.5 months of the study constituted the control group. The intervention group consisted of patients recruited in the subsequent 1.5 months.

4.3 Study duration

This prospective controlled study was of six months duration. The first three months were utilized for patient recruitment (first 1.5 months = control group, subsequent 1.5 months = intervention group). In the remaining three months the participants were followed up.

4.4 Study protocol/measurement techniques

Each participant was monitored prospectively during the study period. During this period, five study forms were completed.

The admission study form (Appendix A) was completed upon initiation of the study or shortly after a patient's admission. This study form contained each participant's baseline demographic information, Folstein Mini-Mental State exam score[111], disease states, name of the family and/or referring physician(s), and a comprehensive medication profile. Medication information was derived by having patients bring in their medications, from the nursing and physician's admission data bases, from the physician's

outpatient clinic report, and in the case of DH patients, from home visit data. For patients transferred from other institutions, the inter-agency referral form was used as the information source.

Just prior to discharge, the patient was approached regarding participation in the study. For cognitively impaired patients, the patient's next of kin was approached for consent (Appendix A). Once consent was obtained, the following procedures occurred.

The discharge and nursing discharge study forms (Appendix A) were completed. The discharge study form was utilized to provide information regarding a patient's medication regimen upon discharge, the duration of the assessment, current diseases or disorders, repeat mental status score, and discharge location. Information about discharge medications was derived from the patient's medication administration record for GAU and PC patients and from the nursing records for DH patients. The nursing discharge study form, completed by the head nurse, provided additional information on diseases or disorders, discharge location, and the Functional Independence Measure (FIM) score.

FIM is a disability instrument that assesses self care, sphincter management, mobility, locomotion, communication, and social cognition.[113] Each of the 18 FIM items is measured on a seven-level scale with seven representing

complete independence and one indicating total assistance. The highest possible total score is 126 and the lowest possible is 18. Developed by a Task Force for Medical Rehabilitation, FIM documents the severity of patient disability and the outcomes of medical rehabilitation. It was designed to be discipline-free, therefore, it can be used by any clinician. At the Parkridge site, information on FIM was derived from the chart as nursing, physiotherapy, occupational therapy, and recreational therapy are responsible for completing their own sections of the FIM. At the DH, FIM was completed by the head nurse.

Upon discharge, a multidisciplinary (+/- pharmacy section) discharge summary and questionnaire A (for GAU-control, DH, & PC patients) or questionnaire B (for GAU-intervention patients) were sent to family and referring physicians (see sections 4.5 and 4.6). Follow-up of patients occurred approximately three months later.

For Saskatoon patients residing in their own homes, a telephone call was made to the study participant or their next of kin approximately 2-3 days prior to the patient's three month follow-up date. Patients were reminded about the nature of the study and were asked if they would allow a home visit. Follow-up information was obtained over the telephone for those who did not consent to a home visit. For Saskatoon patients living in nursing homes or private care homes, the director of care or private care home

operator was contacted to arrange for an appropriate time to visit the facility.

Follow-up information was obtained over the telephone for participants living outside of Saskatoon. A letter preceded all the follow-up telephone calls. The letter was sent to the study participant/next of kin (Appendix B) if the patient was discharged home, to the director of care (Appendix B) if the patient was discharged to a nursing home, and to the private care home operator (Appendix B) if the patient was discharged to a private care home.

Information sources for the follow-up study form included the patient, family/friends, director of care/nurses, private care home operators, and the patient's medical chart. Completion of the follow-up study form (Appendix A) required information about a participant's living arrangement, development of new diseases or disorders, the number of physician visits post-discharge, status as a CGS patient, and medications.

The computer coding form (Appendix C) was completed after follow-up to record information regarding medication numbers, changes, and cost. The number of "total prescription", "total over the counter (OTC)", "scheduled prescription", "as needed (prn) prescription", "scheduled OTC", and "prn OTC" medications each patient was receiving upon admission, discharge, and follow-up were determined.

Medication changes between admission and discharge, between discharge and follow-up, and between admission and follow-up were documented. Medication changes were classified as: addition of drug, discontinuation of drug, change of drug within therapeutic class (American Hospital Formulary System[114]), dose increase, dose decrease, more frequent administration, less frequent administration, change of route of administration, and addition of an administration device. Separate totals of medication changes for both prescription and OTC items were calculated from this information.

The daily costs of scheduled prescription and scheduled OTC medications were also determined. For prescription items, calculations employed the Saskatchewan Formulary (January 1992) cost price without mark-up or dispensing fee.[115] The cost for OTC items was determined using the cost prices from Prairieland Wholesalers (January 1992).[116] The prices quoted for both prescription and OTC products represent the cheapest cost of the generic product available. For medications scheduled less than once daily (e.g. monthly), the daily cost calculated included that item.

4.5 Development of the pharmacy section of the discharge summary

It is standard CGS practice to have sections for the following disciplines in a patient's discharge summary: medical, nursing, physiotherapy (PT), occupational therapy (OT), recreational therapy (RT), and social work (SW). In the intervention phase of the study, a pharmacy section (Appendix D) was also included. The following information was included in the pharmacy section:

1. patient's name, date of birth, & Saskatchewan hospitalization number;
2. patient's admission and discharge dates;
3. medication changes (discontinuations, additions, changes in dose, interval, or route of administration) implemented during the assessment and the reasons for the alteration;
4. drug levels;
5. notable side effects experienced;
6. medications on discharge, their indications, anticipated duration of use, and if an administration aide was supplied.

All pharmacy medication discharge summaries were approved and signed by the attending geriatrician prior to being sent to the primary care and referring physicians.

4.6 Development of the questionnaire

The questionnaires utilized in this study have not been used by other investigators. To ensure the clarity of this instrument, a family medicine intern, two pharmacy

professors with previous questionnaire research experience, a hospital pharmacy clinical coordinator, and graduate pharmacy students were asked to critique the original questionnaire. Suggested changes were incorporated

An introductory cover letter (Appendix E), the questionnaire, a stamped return envelope, and the patient's multidisciplinary discharge summary were sent to family and referring physicians. Questionnaire A (Appendix F) was sent to the physicians of DH (control and intervention groups), PC (control and intervention groups), and GAU (control group) patients. In the DH and PC, it was standard practice for the multidisciplinary (nursing, PT, OT, RT, & SW) summary to include the geriatrician's summary. However in the GAU, the multidisciplinary summary was sent at a different time, usually earlier, than the geriatrician's summary. During the intervention phase at the GAU, the pharmacy discharge summary was sent with whichever summary (multidisciplinary or geriatrician) was mailed first. Therefore, it was necessary to make some modifications to the questionnaires sent to physicians of GAU intervention patients (Questionnaire B - Appendix F).

The questionnaire used a five point Likert scale to address the referring and primary care physicians' opinions of the:

1. overall quality of the CGS discharge summary.
2. quality of the medication information provided by the discharge summary (for questionnaire B, this

question was divided into quality of medication information provided by the geriatrician-prepared summary and the quality of medication information provided by the pharmacy section).

3. rationality of medication changes implemented during the assessment.

4. availability of information on reasons for changes in medication.

5. need for more information explaining the rationale for medication changes.

6. importance of including the following items in discharge summaries (physicians were asked to rank each item):

    -list of pre-admission medications

    -change(s) of dose of pre-admission medications
      -reason(s) for the change

    -change(s) of dosing interval of pre-admission medications
      -reason(s) for the change

    -change(s) of route of administration of pre-admission medications
      -reason(s) for the change

    -medications discontinued during the assessment
      -reason(s) for the discontinuation

    -medications instituted during assessment
      -reason(s) for the addition

    -any side effects of medications noted during the assessment period

    -blood levels of medications

    -medication aid supplied (e.g. aerochamber, compliance aids)

    -list of discharge medications
      -therapeutic rationale for discharge medications.

7. importance of the gerontology consultant contacting the recipient of the questionnaire to discuss the patient's medication therapy.

8. quality of the medication information received between patient discharge and receipt of the discharge summary (optional question to be answered only if interim information was received).

9. importance of receiving medication information between patient discharge and receipt of the discharge summary.

Other questionnaire items addressed:

10. whether the gerontology consultant had contacted the recipient of the questionnaire to discuss the patient's medication therapy.

11. the questionnaire recipient's feelings about the actual and desired duration between patient discharge and receipt of the discharge summary (for questionnaire B, these questions were split into the receipt of the geriatrician-prepared discharge summary and the multidisciplinary-prepared discharge summary).

12. whether the recipient of the questionnaire had received any interim medication information between patient discharge and receipt of the discharge summary, and if so, the means by which this information was conveyed.

13. if there were any anticipated changes to the patient's medication regimen over the next three months and if so, the nature of anticipated change(s).

A second mailing of the questionnaire accompanied by an explanatory cover letter (Appendix E) was sent if no response was received within three weeks of the first questionnaire mailing.

4.7 Blinding

Upon initiation of the study, three CGS geriatricians were informed that a study looking at medication changes during CGS assessment was being undertaken but they were not provided with any further details about the study. Upon initiation of the intervention phase, the geriatricians were informed about the study protocol (with the exception of the existence of the questionnaire), and were asked to cooperate with reviewing, approving, and signing pharmacy medication discharge summaries. Throughout the study, the head of the CGS was aware of all aspects because of his involvement in planning and approving the study protocol.

4.8 Pre-study calculation of required sample size

Based on statistics from the CGS from January to April 1991, the following number of patients were expected:

Control group:

GAU	: 19/month X 1.5 months	=29
DH	: 12/month X 1.5 months	=18
		47

Intervention group:

GAU	: 19/month X 1.5 months	=29
DH	: 12/month X 1.5 months	=18
		47

Based on these statistics, a total of 94 GAU and DH patients were predicted to be eligible to participate over a three month recruitment period. Estimates for the number of expected PC patients were unavailable when sample size calculations were made.

A required sample size of 28 patients was calculated if any statistically significant medication changes between discharge and three months post-discharge were to be detected (power=0.80, alpha=0.05) (Appendix G).

Increased power (0.90) would require a sample size of 38 patients to detect statistically significant medication changes between discharge and three months post-discharge (Appendix G).

Therefore, a study period of three months was selected as feasible.

4.9 Data analysis

Data were entered using the SPSS data entry program and analyzed using the SPSS-X program package on a VAX/VMS computer system.[117]

Descriptive statistics (frequencies, mean, and standard deviation) for participants' demographic and medication data were calculated. Chi-square analyses were utilized for nominal variables to determine the significance of differences between the control and intervention groups within each study site. Cells of contingency tables with dimensions greater than 2 X 2 were collapsed when more than 20% of the cells had an expected frequency of less than five. For 2 X 2 tables, the Fisher exact test was used if the total number of observations was less than 20, or between 20 and 40 and there were cells with expected frequencies less than five. For all other cases, Chi-square corrected for continuity was utilized.

T-tests and ANOVA were used to compare interval or ratio variables between two groups and three groups, respectively. Two-way ANOVA and repeated measures ANOVA with two between-subjects factors were used when there were more than two groups to compare. If significant results were demonstrated with any ANOVA tests, Tukey's post-hoc test was used to locate the differences. The nonparametric Cochran Q test was used to compare the frequencies of polypharmacy and certain drug classes on admission,

discharge, and follow-up.

Multiple linear regression was used to identify variables that were significantly correlated with the number of medication changes which occurred (see Appendix K for variables studied). The nominal variables, site and geriatrician, had to be represented by more than one indicator variable (with the number of indicator variables equal to the number of categories of the variable minus one). Because these variables were represented by more than one indicator variable, their significance could not be tested using stepwise regression. Multiple-partial F tests[124] were used to test their significance. Development of the final regression model occurred in three stages.

In the first stage, stepwise forward regression was performed to identify which variables (excluding group, site, and geriatrician) were statistically significant. Then, to test for the significance of the geriatrician variables, the multiple-partial F test[124] was used to compare a model containing only the significant variables (as identified in the previous stepwise regression procedure) with a model containing the significant variables plus the indicator variables for geriatrician.

In the second stage, the multiple-partial F test[124] was used to determine if there were any significant interactions between group or site and the variables identified in the first stage. Because no interactions were detected,

analysis proceeded to the third stage.

In the third stage, stepwise forward regression was repeated with group included as a potential independent variable. Then, to test for the significance of the site variable, the multiple-partial F test[124] was used to compare a model containing only the significant variables (as identified in the stepwise regression procedure) with a model containing the significant variables plus the indicator variables for site. Final results identified variables that significantly affected the regression.

Descriptive statistics (frequencies, mean, standard deviation, median, and range) were also calculated for data derived from the questionnaire. Chi-square analyses were performed to detect differences between groups for all categorical variables. A physician's first and second responses on identical questions, and desired and actual discharge summary receipt times were compared using Wilcoxon signed ranks tests. Two-way ANOVA was used to examine differences between control and intervention groups, between study sites, and for an interaction between treatment and site for the rating of Likert scale variables[2]. Statistically significant results with two-way ANOVA were further tested using Tukey's post-hoc test. The phi

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[2] Ideally, a nonparametric test should be performed since the Likert scale is not truly a continuous scale. However, due to the lack of a comparable nonparametric test, the parametric two-way ANOVA was used.

coefficient for 2 X 2 tables was utilized to measure the correlation between nominal variables.

For all tests, the two-tailed significance level was set at $p \leq 0.05$.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 Patient population

A total of 105 patients were discharged during the study period. All but one patient consented to participate. The total study population therefore consisted of 104 patients. Two patients were discharged twice from the service during the study period. One control patient was discharged from the Geriatric Assessment Unit (GAU), followed in Day Hospital (DH), and subsequently discharged as a DH-control (DH-C) patient. Another patient was discharged, readmitted, then discharged again from the GAU. She was identified as a GAU-intervention (GAU-I) patient after both discharges. Therefore, the total number of study cases was 106.

Between February 10, 1992 and March 22, 1992, 53 cases were discharged and recruited into the control group. From March 23, 1992 to May 1, 1992, 53 intervention cases were recruited and discharged. Patient assessments were performed at three different study sites. Fifty-one (24 control & 27 intervention) assessments occurred in the GAU, 24 (14 control & 10 intervention) in the DH, and 31 (15 control & 16 intervention) at Parkridge Centre (PC).

5.1.1 Demographic data

Approximately 68% (71 patients) of the study population were female and 32% (33 patients) were male (Table 5.1). There was no statistically significant difference in the proportion of females to males between the control and intervention groups (Chi-square $p>0.05$).

The percentage of females recruited in this study is similar to the 64.7% and the 66.0% reported in two previous Royal University Hospital (RUH) GAU studies.[23,96] However, it is greater than the reported 55.4% of Saskatchewan seniors (≥65 years old) who were female in 1988.[1]

The average age for the entire study population was 80.6 years (SD=6.8), 80.2 (SD=8.1) for males and 80.8 (SD=6.1) for females (Table 5.1). Patients ranged in age from 67.4 to 96.5 years. The majority of females (54.9%) were 75-84 years old, 26.8% were older than 85 years, and 18.3% were in the young elderly (65-74) category. For males, individuals were more equally distributed in the three age categories: 30.3% were 65-74 years, 33.3% were 75-84 years, and 36.4% were older than 85 years. There were no statistically significant differences in age among the study groups (control versus intervention) or sites (GAU, DH, PC) (two-way ANOVA $p>0.05$).

The average age of 80.6 years of this population is similar to the mean age of 80.0 years and 79.7 years reported in two previous RUH GAU studies.[23,96]

Table 5.1
Demographic Data (104 patients)*

	Total study population	Control group	Intervention group
Sex			
Male	33	17	16
Female	71	35	36
	104	52	52
Mean age in years (SD)	80.6 (6.8)	81.4 (6.5)	79.8 (7.0)
Age group (in years)			
Males:			
65-74	10	5	5
75-84	11	5	6
85+	12	7	5
	33	17	16
Females:			
65-74	13	3	10
75-84	39	22	17
85+	19	10	9
	71	35	36
Marital status			
Married	36	17	19
Widowed	57	31	26
Single	11	4	7
	104	52	52
Race			
White	104	52	52
English speaking			
Yes	101	50	51
No	1	1	0
Partial	2	1	1
	104	52	52

*: Unless otherwise stated, values are for the number of patients.

The largest percentage of the study population (54.8%) were widowed, 34.6% were married, and 10.6% were single (Table 5.1). There was no statistically significant difference between the control and intervention groups in the proportion of subjects who were married versus those not married (Chi-square $p>0.05$).

All study participants were white. However, not all were English-speaking. One patient spoke no English and two were only partially fluent in English (Table 5.1).

5.1.2 Evaluation on admission

Admission status was classified as first assessment, follow-up, or readmission. Follow-up status was assigned to those patients who had been discharged from one Clinical Gerontology Service (CGS) site and immediately admitted to another. Readmission patients were those with a time period between CGS admissions. In the total study population, 74.5% (79 cases) were first assessments, 12.3% (13 cases) were follow-up cases, and 13.2% (14 cases) were readmissions (Table 5.2). The proportion of cases in each of the admission classifications was not significantly different between the control and intervention groups (Chi-square $p>0.05$).

Table 5.2
Evaluation on Admission*

Admission status	Total study population	Control group	Intervention group
First assessment	79	37	42
Follow-up	13	9	4
Readmission	14	7	7
	106	53	53
Mean admission MMSE score (SD)	22.8 (4.6)	22.7 (5.2)	22.8 (4.1)
MMSE scores			
24-30	42	22	20
18-23	32	13	19
0-17	9	5	4
	83	40	43
Mean Admission FIM score (SD) [n]	83.0 (28.2) [55]	82.4 (28.7) [29]	83.7 (28.1) [26]

*: Unless otherwise stated, values are for the number of study cases.

Mental status of each patient was measured by the Folstein Mini-Mental Status Exam (MMSE), a cognition instrument scored out of 30, which tests for orientation, registration, attention and calculation, recall, and language.[112] An average score of 22.8 (SD=4.6) was documented for 83 study patients (Table 5.2). A score of 24-30 is classified as no cognitive impairment, 18-23 as mild cognitive impairment, and 0-17 as severe cognitive

impairment (Table 5.2).[118] There were no statistically significant differences in MMSE scores between control and intervention groups or between study sites (two-way ANOVA $p>0.05$). Since one of the admission criteria for PC is that patients must be capable of comprehending and cooperating with rehabilitation procedures, it is interesting to note that PC patients did not have statistically higher MMSE scores.

FIM (Functional Independence Measure) is a standardized medical rehabilitation instrument scored out of 126 (see Section 4.4). FIM scores were documented for all DH and PC patients. A FIM score was not obtained for GAU patients because FIM is not a standard instrument used during GAU assessment and insufficient GAU personnel time prevented the head nurse from completing this instrument for the study. The average FIM score was 83.0 (SD=28.2) and was similar in control and intervention patients (two-way ANOVA $p>0.05$) (Table 5.2). However, DH patients [average FIM =104.4 (SD=14.1)] had a statistically higher average FIM score than PC patients [average FIM = 66.5 (SD=25.1)] (two-way ANOVA $p<0.001$). Given the rehabilitation focus of PC, this result was not unexpected.

5.1.3 Pre-admission living arrangements

For the 106 study cases, 37.7% (40 cases) were admitted from home, 44.3% (47 cases) were admitted from another hospital unit, 3.8% (4 cases) were admitted from private care homes, and the remaining 14.2% (15 cases) came from nursing home facilities (Table 5.3). Prior to hospital admission, 39.6% (42 cases) lived alone, 36.8% (39 cases) lived with family members, 4.7% (5 cases) lived with an attendant, and 18.9% (20 cases) did not fit into the above three classifications (Table 5.3). The majority of study patients (67.0%, 71 cases) were from Saskatoon, 5.7% (6 cases) were from other cities, 10.3% (11 cases) were from towns, and 17.0% (18 cases) were from rural communities with a population of less than 1000 (Table 5.3).

There were no statistically significant differences in living arrangements (1. home versus institutionalized, 2. alone versus with others, and 3. Saskatoon versus other communities) between the control and intervention groups for each study site ($p>0.05$ for all Chi-square tests).

Table 5.3
Pre-admission Living Arrangements*

	Total study population	Control group	Intervention group
Admitted from:			
-Home	40	15	25
-Acute unit			
-RUH	17	10	7
-another hosp.	30	17	13
-Private care home	4	2	2
-Nursing home	15	9	6
	106	53	53
Live:			
-Alone	42	20	22
-With family	39	19	20
-With attendant	5	3	2
-With other	20	11	9
	106	53	53
Centre:			
-Saskatoon	71	36	35
-Other city	6	3	3
-Town	11	8	3
-Rural	18	6	12
	106	53	53

*: values are for the number of study cases.

5.2 Discharge from the service and follow-up contact

5.2.1 Assessment duration with the Clinical Gerontology Service

For the entire study population, the average duration between CGS admission and discharge was 49.2 days (SD=42.9) (Table 5.4). The duration did not differ between the control and intervention groups [two-way ANOVA p=0.88 (group)] but DH patients had a longer period between admission and discharge than GAU patients [two-way ANOVA p<0.001 (site); Tukey's p<0.05].

Table 5.4
Duration of Patient Stay with the CGS

	All study patients	GAU		DH		PC	
		C	I	C	I	C	I
Mean duration of stay in days (SD)	49.2 (42.9)	39.2 (62.8)	30.4 (20.2)	68.9 (37.6)	84.2 (48.1)	49.3 (21.6)	56.4 (32.5)
Median duration of stay in days	35.0	23.0	26.0	61.5	75.5	42.0	49.5
Range of duration of stay in days	6-327	9-327	6-96	22-145	30-192	23-90	20-137
Mean number of DH visits (SD)				14.0 (6.3)	20.4 (11.0)		

C = control group
I = intervention group

Patient turnaround was fastest in the GAU. GAU control (GAU-C) patients stayed a mean of 39.2 (SD=62.8) days with this figure being inflated by one patient who was on the unit for 327 days. The median for this group was 23.0 days. GAU intervention (GAU-I) patients stayed an average of 30.4 (SD=20.2) days. Assessment duration was longest in the DH. DH control (DH-C) and DH intervention (DH-I) patients were discharged an average of 68.9 (SD=37.6) and 84.2 (SD=48.1) days after admission and had a mean of 14.0 (SD=6.3) and 20.4 (SD=11.0) DH visits, respectively. Of the three study sites, PC patients had an intermediate duration of assessment and rehabilitation, an average of 49.3 (SD=21.6) days for PC control (PC-C) patients and 56.4 (SD=32.5) days for PC intervention (PC-I) patients.

GAU and PC patients were hospitalized for the duration of their stay. DH patients, on the other hand, attended daily from 9:30 am to 3:30 pm. The frequency of DH attendance varied among patients; some attended once weekly, others, more or less frequently. Therefore for DH patients, the number of DH visits represents the number of days of CGS assessment.

5.2.2 Evaluation on discharge

An average discharge MMSE score of 22.6 (SD=5.3) was recorded for 11 patients. There was no statistically significant change in MMSE scores between admission and

discharge (repeated measures ANOVA $p>0.05$).

Discharge average FIM scores were 102.4 (SD=17.4) for DH-C patients, 110.7 (SD=7.1) for DH-I patients, 89.4 (SD=30.7) for PC-C patients, and 85.2 (SD=29.2) for PC-I patients [$p<0.001$ (site), $p=0.53$ (group), two-way repeated measures ANOVA]. FIM scores for PC patients increased from an average of 66.5 (SD=25.1) on admission to 87.2 (SD=29.9) by discharge ($p<0.001$ repeated measures ANOVA). Differences in FIM scores between admission and discharge were not significant for DH patients. Because PC is a rehabilitation unit, improvements in FIM scores, which demonstrate functional gains, were expected.

5.2.3 Discharge living arrangements

The majority of patients were discharged home (55.7%) or to private care homes (13.2%) rather than to institutions (3.8% to hospitals and 27.4% to nursing homes, respite, or rehabilitation facilities) (Table 5.5). On admission, 39.6% of patients had been living alone, whereas only 27.4% were discharged to locations where they would live alone (Table 5.5). The majority (69.8%) of patients were discharged to locations within Saskatoon. Discharge living arrangements (1. home versus institutionalized, 2. alone versus with others, and 3. Saskatoon versus other communities) were similar for control and intervention groups within each study site ($p>0.05$ for all Chi-square tests).

Table 5.5
Discharge Living Arrangements*

	Total study population	Control group	Intervention group
Discharged:			
-Home	59	29	30
-Acute unit			
-RUH	0	0	0
-another hosp.	4	3	1
-Private care home	14	6	8
-Nursing home	25	15	10
-Respite	2	0	2
-Rehab. facility	2	0	2
	106	53	53
Live:			
-Alone	29	15	14
-With family	30	14	16
-With attendant	14	6	8
-With other	33	18	15
	106	53	53
Centre:			
-Saskatoon	74	38	36
-Other city	7	4	3
-Town	11	7	4
-Rural	14	4	10
	106	53	53

*: values are for the number of study cases.

5.2.4 Three month follow-up

Study patients were contacted by "home visit" (28 patients each), telephone (18 control and 23 intervention patients), return visit to the CGS, hospital visit, or correspondence by mail (Table 5.6). Between discharge and follow-up, three patients, all from the GAU-C group, died. One patient from the DH-intervention (DH-I) group refused to allow a home interview and was unwilling to answer questions over the telephone. One patient from the GAU-C group was lost to follow-up despite mailings to his home and more than ten telephone calls. Therefore, follow-up was possible for 101 of the 106 study cases.

An average of 85.6 (SD=6.7) days elapsed between patient discharge and follow-up. The duration between discharge and follow-up did not differ between control and intervention groups or between study sites (two-way ANOVA $p>0.05$).

Follow-up information was derived from five potential sources: the patient, the family member or friend, the nurse/director of care, the private care home operator, and/or from the medical chart (Table 5.6). Although nurses and directors of care provided information from the patient's medical chart, the category "chart" was assigned only to situations where the investigator actually had an opportunity to review the chart.

Table 5.6
Method and Source of Follow-up Information

Method of Follow-up	n
Residence	53
Phone call	35
Return visit to CGS	5
Mail	1
Hospital visit	1
Residence & phone call	3
CGS return visit & call	1
Phone & mail	1
Phone & hospital visit	1
Source of Information	**n**
Patient	25
Family/friend	12
Nurse/Director of care (DOC)	19
Private care home (PCH) operator	5
Medical chart	1
Patient & family/friend	12
Patient & chart	6
Patient & nurse/DOC	3
Patient & PCH operator	6
Family/friend & chart	1
Family/friend & PCH operator	1
Chart & nurse/DOC	4
Patient, family, & chart	3
Patient, family & nurse/DOC	1
Patient, nurse/DOC, & PCH operator	1
Family, chart, & nurse/DOC	1

5.2.5 Utilization of medical services and development of new medical conditions

At the three month follow-up, only 10 of 101 patients were still receiving care from the CGS, three each from the GAU-C and GAU-I groups, one each from the DH-C and DH-I groups, and two from the PC-control (PC-C) group. The proportion of patients receiving continuing CGS care was similar for control and intervention groups within the individual study sites ($p>0.05$ for all Chi-square tests).

Nineteen cases reported no contact with either their family doctor or a specialist after discharge from the CGS. In the three months post-discharge, the average number of visits to doctors was 3.1 (SD=3.9), a mean of 2.6 (SD=3.7) to family practitioners, and 0.4 (SD=1.2) to specialists (Table 5.7). No statistically significant differences in total number of physician visits were noted between control and intervention groups or between study sites (two-way ANOVA $p>0.05$).

Twenty patients were hospitalized during the period between discharge and follow-up (Table 5.7). More control than intervention group patients were hospitalized (Chi-square $p=0.02$).

Table 5.7
Post-discharge Utilization of Medical Services
and Development of New Medical Conditions

	Total study population n=101	Control group n=49	Intervention group n=52
Mean # of total physician visits (SD)	3.1 (3.9)	3.2 (3.5)	2.9 (4.3)
-mean # of family physician visits (SD)	2.6 (3.7)	2.9 (3.6)	2.5 (3.9)
-mean # of specialist visits (SD)	0.4 (1.2)	0.4 (0.8)	0.4 (1.5)
	n (%)	n (%)	n (%)
# of patients requiring hospitalization post-discharge	20 (19.8)	15 (30.6)	5 (9.6)
	n (%)	n (%)	n (%)
# of patients developing new medical conditions	37 (36.6)	20 (40.8)	17 (32.7)

Of the 101 study cases, 37 reported that they had developed at least one additional medical condition after discharge (Table 5.7). A variety of different conditions were reported with "falls" occurring most frequently (Table 5.8). Control and intervention groups within each study site did not differ in reporting development of new medical conditions ($p>0.05$ for all Chi-square tests).

Ideally the information regarding physician visits, hospitalizations, and the development of new medical conditions should have been derived from and/or corroborated via chart review or health data base verification. This was not possible during this study due to a lack of sufficient funding.

Table 5.8
Reported New Medical Conditions between Discharge and Follow-up

Conditions	n
Angina	1
Arthritis	1
Back pain	1
Bursitis	1
Cataract surgery	1
Cellulitis	1
Congestive heart failure	2
Constipation	2
Cough	1
Depression	1
Dermatologic condition - not yet diagnosed	1
Dysentery	1
Dystrophy of hand	1
Fall	6
GI bleed & pneumonia	1
Hip pinning	1
Leg edema	1
Lumpectomy	1
Myocardial infarct	1
Obstructed tear duct	1
Osteomyelitis	1
Parathyroid surgery	1
Pneumonia & urinary tract infection	1
Sinusitis	1
Syncope	1
Ulcer	1
Upper respiratory tract infection	1
Urinary retention	1
Urinary tract infection	1
Vaginal atrophy	1

5.2.6 Follow-up living arrangements

On follow-up, 54.5% were residing at home, 5.9% in hospitals, 12.9% in private care homes, and 26.8% in nursing homes and respite facilities (Table 5.9). More GAU-I than GAU-C group patients were living at home than were institutionalized on follow-up (Chi-square $p=0.02$). Living arrangements on follow-up were similar for control and intervention groups in the other two study sites ($p>0.05$ for both Chi-square tests). Between admission, discharge, and follow-up, the probability of a patient living at home or in a private care home instead of in an institution increased (Cochran Q $p<0.001$); i.e., more patients were living at home or in a private care home on discharge and follow-up than on admission.

The percentage of patients living alone on follow-up (26.7%) and on discharge (27.4%) were similar. On follow-up, an essentially equal proportion of control and intervention patients within each study site lived alone (Chi-square $p>0.05$). However, fewer patients were living alone on discharge and follow-up than on admission (Cochran Q $p<0.001$).

Between discharge and follow-up, there was little change in the percentage of patients living in Saskatoon (69.8% on discharge versus 69.3% on follow-up). On follow-up, similar proportions of control and intervention patients within each study site resided in Saskatoon ($p>0.05$ for all

Table 5.9
Follow-up Living Arrangements*

	Total study population	Control group	Intervention group
Living at:			
-Home	55	24	31
-Acute unit			
-RUH	1	1	0
-another hosp.	5	4	1
-Private care home	13	5	8
-Nursing home	26	15	11
-Respite	1	0	1
	101	49	52
Live:			
-Alone	27	13	14
-With family	28	11	17
-With attendant	13	5	8
-With other	33	20	13
	101	49	52
Centre:			
-Saskatoon	70	37	33
-Other city	6	3	3
-Town	11	6	5
-Rural	14	3	11
	101	49	52

*: values are for the number of study cases.

Chi-square tests). Between admission, discharge, and follow-up, there was no change in the proportions of study participants residing in Saskatoon versus elsewhere (Cochran Q p=0.65).

Besides improvements in functional status, another of the cited benefits of geriatric assessment is decreased institutionalization. This study supports this improvement. Prior to CGS assessment, 38% of patients were living at home and 58% were admitted from nursing homes and hospitals. After CGS assessment, the percentage of patients discharged home increased to 56% and only 31% were discharged to institutions. By follow-up, the percentage of patients residing at home was 55% and 33% were living in institutions.

5.3 Number of medications

Reductions and improvements in drug therapy have been cited as benefits of the geriatric assessment process. However, most studies have provided very little information about how drug therapy has been improved or what types of medications have been altered. Whether these medication reductions and improvements are maintained post-discharge has only been addressed in three studies.[97,98,99] The present study analyzed medication changes during geriatric assessment and medication regimens three months post-discharge.

Medications were classified as "prescription" (Rx) or "over-the-counter" (OTC), and as "scheduled" (sch) or "as-needed" (prn). The following categories were used to differentiate medications:

-total prescription (total-Rx) medications

-total over-the-counter (total-OTC) medications

-scheduled prescription (sch-Rx) medications

-as-needed prescription (prn-Rx) medications

-scheduled OTC (sch-OTC) medications

-as-needed OTC (prn-OTC) medications.

To ensure accuracy, the "total" categories (total-Rx and total-OTC) were not simply derived by combining scheduled and as-needed categories. The "total" categories represent the total number of prescription medications used by a patient regardless of how the drugs were administered.

For example, a prescription product administered to a patient on both a scheduled and prn basis would be counted as "one" in each of the three categories: total-Rx, sch-Rx, and prn-Rx.

To derive grand totals for all medications, scheduled medications, and as-needed medications, categories were combined as follows:

- -total number of medications = total-Rx + total-OTC (total-meds)
- -total number of scheduled medications = sch-Rx + sch-OTC (total-sch)
- -total number of as-needed medications = prn-Rx + prn-OTC. (total-prn)

In this study, polypharmacy was defined as the daily use of five or more scheduled medications (i.e. total-sch $\geq$ 5).

5.3.1 Admission medications

5.3.1.1 Average number of medications

A total of five patients (4.7%), two from the DH-C group and one each from the PC-C, GAU-I, and DH-I groups, were receiving no medications on admission. In earlier GAU studies, Asthana and Sood[23] and Desai et al.[96] reported that 2.9% and 9% of patients, respectively were receiving no medications on admission.

In the current study, the average number of total-meds on admission for all patients was 5.5 (SD=3.3). Most of these were scheduled medications [average = 4.1 (SD=2.7)] (Table 5.10).

Other geriatric assessment studies have reported averages of 2.6-5.3 admission medications per patient (Table 5.11).[23,30,70,72,73,75,89,95-98] The slightly higher average number of total medications (5.5) in our CGS study population might have been caused by differences in the types of medications counted. Some studies, such as the Kruse et al. study[98] did not include OTC medications. Only Rubenstein et al. reported the number of OTC medications separately; on admission, their patients were receiving an average of 3.7 drugs including an average of 2.0 OTC medications.[70] The latter is similar to the average of 2.3 (SD=2.1) OTC medications per patient documented in the current study. In all other studies, it was not possible to determine whether the figures reported were for prescription, OTC, or combined prescription and OTC medications, or whether "as-needed" medications were included. The higher average number of admission medications reported in the current study might also be due to the multiplicity of sources used to obtain accurate admission medication information and to differences in study setting and design.

Table 5.10
Average Number of Admission Medications

Drug type	Total study cases n=106 (SD)	Group		Site		
		Control n=53 (SD)	Inter-vention n=53 (SD)	GAU n=51 (SD)	DH n=24 (SD)	PC n=31 (SD)
Total-Rx	3.2 (2.0)	3.5 (1.8)	2.9 (2.2)	3.4 (2.1)	2.9 (1.8)	3.1 (2.1)
Total-OTC	2.3 (2.1)	2.8 (2.4)	1.8[a] (1.7)	2.4 (2.2)	1.1 (1.1)	3.2[b] (2.2)
Sch-Rx	2.9 (1.9)	3.2 (1.8)	2.6 (2.1)	3.1 (2.0)	2.6 (1.7)	2.8 (2.1)
Sch-OTC	1.2 (1.3)	1.4 (1.5)	1.1 (1.2)	1.3 (1.4)	0.5 (0.7)	1.7[c] (1.4)
Prn-Rx	0.4 (0.7)	0.4 (0.7)	0.3 (0.6)	0.4 (0.7)	0.4 (0.7)	0.4 (0.7)
Prn-OTC	1.1 (1.4)	1.4 (1.6)	0.7[a] (0.9)	1.1 (1.5)	0.5 (0.8)	1.4[c] (1.4)
Total-meds	5.5 (3.3)	6.2 (3.3)	4.8[a] (3.3)	5.7 (3.7)	4.0 (2.3)	6.3[b] (3.2)
Total-sch	4.1 (2.7)	4.5 (2.6)	3.7 (2.7)	4.3 (2.9)	3.1 (1.8)	4.5 (2.8)
Total-prn	1.4 (1.7)	1.8 (1.8)	1.0[a] (1.3)	1.4 (1.8)	0.9 (1.3)	1.8 (1.5)

a: $p<0.05$ for differences between groups, two-way ANOVA

b: $p<0.05$ for differences between sites, two-way ANOVA; $p<0.05$ for differences between PC & DH, and between DH & GAU, Tukey's

c: $p<0.05$ for differences between sites, two-way ANOVA; $p<0.05$ for differences between PC & DH, Tukey's

Table 5.11
Summary of Results from Geriatric Assessment Studies

Investigator	Sample Size	Setting & Design	Average adm. meds per patient	Average DC meds per patient	% ↑ or ↓*	Follow-up**
Rubenstein et al.[70]	74	GAU[1]	3.7	2.5	↓ 32%	No
Rubenstein et al.[72]	255	GAU[1]	4.26	2.82	↓ 34%	No
Rubenstein et al.[73]	423	GAU[1]	3.86	2.94	↓ 24%	No
	63 vs. 60	GAU vs. acute wards[2]	4.25 vs. 4.33	3.51 vs. 3.65	↓ 17.2% vs. ↓ 15.7%	No
Applegate et al.[75]	100	GAU & GRU[3]	4.3	3.5	↓ 18.6%	No
Alexander et al.[95]	120	GAU vs. acute ward[1]	3.82 vs. 3.60	3.93 vs. 3.97	↑ 2.9% vs. ↑ 10.3%	No
Hogan et al.[30]	113	GCS[2]	3.7	-	-	No
Asthana & Sood[23]	170	GAU[1]	5.26	3.67	↓ 30.2%	No
Desai et al.[96]	100	GAU[1]	5.15	3.67	↓ 28.7%	No
Harris et al.[89]	267	GAU vs. acute ward[2]	2.6 vs. 2.7	2.6 vs. 3.1	0% vs. ↑ 14.8%	No
Kruse et al.[98]	276	Ger. clinic[3]	4.3	2.8	↓ 34.9%	Yes
Owens et al.[97]	436	GCS[2]	4.4-4.5	-	-	Yes
Chan et al.	106	GAU, DH & GRU	5.5	4.3	↓ 22%	Yes

* % increase or decrease in average medication # between admission & discharge

** Follow-up to ascertain medication regimens

Study setting: GAU = geriatric assessment (evaluation) unit
GRU = geriatric rehabilitation unit
GCS = geriatric consult service
DH = day hospital

Study design: 1 = retrospective chart review
2 = prospective randomized control trial
3 = prospective uncontrolled descriptive study

5.3.1.2 Polypharmacy

In the present study, polypharmacy (5 or more scheduled medications) was detected in 38.7% of the total study population on admission. The control and intervention groups at DH and PC did not differ in the proportion of patients experiencing polypharmacy ($p>0.05$ for both Chi-square tests). However, a greater proportion of the GAU-C group (58.3%) exhibited polypharmacy than did the GAU-I group (25.9%) (Chi-square $p=0.03$).

Applying a similar definition of polypharmacy (5 or more scheduled medications) to the statistics reported in the Asthana and Sood study, a higher percentage, 55.9% of their study population, exhibited polypharmacy on admission.[23] Polypharmacy was documented in 43% of patients in a study by Kruse *et al*. who defined polypharmacy as concurrent use of $\geq$ 5 scheduled prescription (but not OTC) medications.[98] If their definition of polypharmacy had been used in the current study, a lower frequency of polypharmacy (24.5%) would have been documented. Polypharmacy (five or more admission medications) was less common (20%) in the American and Scottish geriatric populations studied by Alexander *et al*.[95]

5.3.1.3 Comparisons between sexes, age groups, and living locations

The mean number of admission medications in males versus females, for specific age groups, and in those living at home versus those institutionalized were analyzed using t-tests and one-way ANOVA (Table 5.12). Ideally, three-way ANOVA should have been used to test for interactions between sex, age group, and living location. However, strata in the three-way ANOVA were of unequal sizes and would have affected the accuracy of the results. In future studies, stratified random sampling based on sex, age group, and living location should be incorporated into the study design to ensure adequate representation within each strata and facilitate appropriate data analysis.

In the current study, females received more total-OTC medications on admission than males (t-test p=0.05). This finding is consistent with findings in the Johnson and Pope[119], Asthana and Sood[23], and Alexander et al. American[95] populations. In the Johnson and Pope study of the relationship of demographic, socioeconomic, sociopsychologic, and health status characteristics on nonprescription drug use, being female was the most important demographic variable that identified the frequent OTC user. In the Asthana and Sood and the American Alexander et al. study populations, medication (not specifically OTC medication) use was higher in females.[23,95]

Table 5.12
Number of Admission Medications by
Sex, Age Group, and Living Location

Drug type	Males n=34 Mean (SD)	Females n=72 Mean (SD)	p value (t-test)
Total-Rx	3.4 (2.1)	3.1 (2.0)	0.51
Total-OTC	1.7 (2.0)	2.6 (2.1)	**0.05**
Sch-Rx	3.0 (2.0)	2.8 (1.9)	0.56
Prn-Rx	0.4 (0.7)	0.4 (0.6)	0.89
Sch-OTC	1.0 (1.3)	1.4 (1.3)	0.19
Prn-OTC	0.7 (1.0)	1.2 (1.5)	0.06
Total-meds	5.1 (3.5)	5.7 (3.3)	0.43
Total-sch	4.0 (2.6)	4.1 (2.7)	0.82
Total-prn	1.1 (1.5)	1.6 (1.7)	0.17

Drug type	65-74 years n=24 Mean (SD)	75-84 years n=51 Mean (SD)	85+ years n=31 Mean (SD)	p value (ANOVA)
Total-Rx	4.1 (1.9)	3.0 (2.2)	2.8 (1.7)	**0.03**
Total-OTC	1.9 (1.7)	2.3 (2.1)	2.6 (2.5)	0.51
Sch-Rx	3.8 (2.0)	2.6 (2.0)	2.5 (1.6)	**0.03**
Prn-Rx	0.4 (0.6)	0.4 (0.7)	0.3 (0.7)	0.73
Sch-OTC	1.3 (1.2)	1.3 (1.3)	1.2 (1.5)	0.96
Prn-OTC	0.6 (0.9)	1.1 (1.1)	1.4 (1.9)	0.15
Total-meds	6.0 (3.1)	5.3 (3.4)	5.4 (3.6)	0.67
Total-sch	5.0 (2.7)	3.9 (2.7)	3.7 (2.5)	0.12
Total-prn	1.0 (1.1)	1.5 (1.4)	1.6 (2.2)	0.33

Drug type	Home n=76 Mean (SD)	Institutionalized n=30 Mean (SD)	p value (t-test)
Total-Rx	3.1 (2.0)	3.4 (2.1)	0.58
Total-OTC	2.1 (2.2)	2.8 (1.9)	0.14
Sch-Rx	2.8 (2.0)	3.1 (1.9)	0.44
Prn-Rx	0.4 (0.7)	0.3 (0.5)	0.46
Sch-OTC	1.1 (1.3)	1.7 (1.4)	**0.05**
Prn-OTC	1.0 (1.5)	1.1 (1.2)	0.83
Total-meds	5.3 (3.3)	6.1 (3.4)	0.23
Total-sch	3.9 (2.5)	4.8 (2.9)	0.14
Total-prn	1.4 (1.7)	1.4 (1.4)	0.92

However, in the Scottish population of the Alexander et al. study, men were taking more medications than women; both prescription and OTC drugs were included.

Between age groups, there were significant differences in the categories, total-Rx and sch-Rx (ANOVA $p=0.03$ for both categories). Patients 65-74 years old were taking significantly more total-Rx medications than those older than 85 (Tukey's $p<0.05$), and more sch-Rx medications than those 75-84 years old or those older than 85 ($p<0.05$, Tukey's tests). It is possible that selective survival of healthier older (85 years of age and older) patients resulted in the need for fewer prescription medications. Alexander et al. reported similar results of decreasing drug use with increasing age in American geriatric acute care patients but found the reverse trend in patients of a Scottish geriatric acute care ward.[95] Prescription and OTC medications were not analyzed separately in that study. In the Kruse et al. study, there was also a trend towards decreased prescribing for older patients ($p=0.06$).[98]

On admission in the current study, institutionalized patients were taking slightly more sch-OTC medications than patients living at home (t-test $p=0.05$). In the Kruse et al. study, institutionalized patients were on significantly more prescription drugs than non-institutionalized patients.[98]

5.3.1.4 Comparisons between groups and sites

Control patients were on more medications than intervention patients in the following categories: total-OTC, prn-OTC, total-meds, and total-prn medications [$p<0.05$ (group) for two-way ANOVA tests] (Tables 5.10 & 5.13). Since control patients were taking more total-OTC and prn-OTC medications than intervention patients, this may account for the significant differences in total-meds and total-prn medications, two categories derived by adding the number of OTC and Rx medications.

The numbers of total-OTC, sch-OTC, prn-OTC, and total-meds were different between study sites [$p<0.05$ (site), two-way ANOVA tests] (Tables 5.10 & 5.13). PC patients had the highest average number of total-OTC and total-meds, followed by GAU patients; DH patients had the fewest number of these medications ($p<0.05$, Tukey's tests). PC patients were taking more sch-OTC and prn-OTC medications than DH patients ($p<0.05$, Tukey's test).

Differences in pre-admission living location might account for the study site differences in admission medication numbers. Seventy-five percent of DH patients were admitted from home, whereas 80.6% of PC patients were admitted from hospital units. An approximately equal number of GAU patients were admitted from home and from hospital units. Hospitalized patients are often on more medications than those admitted from home. In support of this, Kruse et

al. reported that patients from institutions were on significantly more medications than patients admitted from home.[98]

Table 5.13
Two-way ANOVA Results on the
Number of Admission Medications
(n = 106 cases)

Drug type	p value for differences between groups	p value for differences between sites	p value for group x site interaction
Total-Rx	0.158	0.503	0.370
Total-OTC	**0.007**	**0.000**	0.289
Sch-Rx	0.115	0.511	0.356
Sch-OTC	0.238	**0.002**	0.335
Prn-Rx	0.672	0.977	0.407
Prn-OTC	**0.003**	**0.029**	0.599
Total-meds	**0.011**	**0.013**	0.425
Total-sch	0.084	0.083	0.560
Total-prn	**0.009**	0.084	0.377

groups : control & intervention
sites : GAU, DH, & PC

5.3.2 Discharge medications

5.3.2.1 Average number of medications

In the current study, two patients (1.9%), both from the DH-C group, were discharged on no medications. This is lower than the 4.1% discharged on no medications in the Asthana and Sood study.[23]

The average number of total discharge medications for all CGS patients was 4.3 (SD=2.3) (Table 5.14). This is slightly higher than the averages of 2.5-4.0 discharge medications per patient reported in other geriatric assessment studies.[30,70,72,73,75,89,95,96,98] In two previous RUH GAU studies, patients were discharged on an average of 3.7 medications.[23,96] As previously discussed, comparisons to these studies are limited by the lack of information regarding which medications (Rx, OTC, scheduled, and/or as-needed) were included.

5.3.2.2 Polypharmacy

Polypharmacy was present in 30.2% of the CGS population on discharge. The presence of polypharmacy on discharge did not differ statistically between control and intervention groups in any of the study sites ($p>0.05$ for all Chi-square tests).

Kruse et al. reported that a lower percentage (16.7%) of their population exhibited polypharmacy on discharge.[98] However, differences in their definition of polypharmacy, as

Table 5.14
Average Number of Discharge Medications

Drug type	Total study cases n=106	Group		Site		
		Control n=53	Inter-vention n=53	GAU n=51	DH n=24	PC n=31
	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)
Total-Rx	2.4 (1.8)	2.4 (1.9)	2.5 (1.7)	2.5 (1.8)	2.0 (1.4)	2.7 (2.1)
Total-OTC	1.9 (1.4)	1.7 (1.4)	2.0 (1.4)	2.2 (1.4)	0.9 (1.0)	2.0 (1.2)
Sch-Rx	2.4 (1.8)	2.4 (1.9)	2.4 (1.7)	2.5 (1.8)	2.0 (1.4)	2.7 (2.1)
Sch-OTC	1.3 (1.2)	1.4 (1.3)	1.3 (1.1)	1.5 (1.2)	0.8 (0.9)	1.6 (1.3)
Prn-Rx	0.04 (0.2)	0.2 (0.1)	0.6 (0.2)	0.02 (0.1)	0.04 (0.2)	0.1 (0.3)
Prn-OTC	0.5 (0.8)	0.3 (0.6)	0.7 (0.8)	0.8 (0.9)	0.1 (0.4)	0.4 (0.6)
Total-meds	4.3 (2.3)	4.1 (2.4)	4.5 (2.3)	4.7 (2.4)	2.8 (2.0)	4.7 (2.1)
Total-sch	3.8 (2.1)	3.8 (2.3)	3.7 (1.9)	4.0 (2.2)	2.7 (1.9)	4.2 (2.0)
Total-prn	0.6 (0.8)	0.3 (0.6)	0.8 (0.9)	0.8 (0.9)	0.2 (0.4)	0.5 (0.6)

discussed in section 5.3.1.2, might have contributed to these results. Polypharmacy on discharge was also slightly lower (27.6%) in the Asthana and Sood study.[23]

5.3.2.3 Comparisons between sexes, age groups, and living locations

In the present study, females were taking more prn-Rx medications than males (t-test $p=0.05$) (Table 5.15). However, this result was only of borderline significance and might have resulted from an increased probability of Type I error because of the numerous statistical tests performed. Four females and no males were on prn-Rx medications on discharge.

Patients 65-74 years old were receiving more prn-Rx medications than those older than 85 (ANOVA $p=0.03$; Tukey's $p<0.05$). Only three patients 65-74 years old, and no patients older than 85, were receiving prn-Rx medications on discharge.

Patients discharged to institutions were receiving more total-OTC and sch-OTC medications than patients discharged home [t-tests $p=0.005$ (total-OTC) & $p=0.04$ (sch-OTC)].

Table 5.15
Number of Discharge Medications by
Sex, Age Group, and Living Location

Drug type	Males n=34 Mean (SD)	Females n=72 Mean (SD)	p value (t-test)
Total-Rx	2.5 (1.9)	2.4 (1.8)	0.71
Total-OTC	1.8 (1.2)	1.9 (1.4)	0.85
Sch-Rx	2.6 (1.8)	2.4 (0.2)	0.53
Prn-Rx	0.0 (0.0)	0.1 (0.2)	**0.05**
Sch-OTC	1.3 (1.0)	1.4 (1.2)	0.92
Prn-OTC	0.5 (0.9)	0.5 (0.7)	0.87
Total-meds	4.4 (2.3)	4.3 (2.3)	0.86
Total-sch	3.9 (2.2)	3.7 (2.1)	0.63
Total-prn	0.5 (0.9)	0.6 (0.8)	0.63

Drug type	65-74 years n=24 Mean (SD)	75-84 years n=51 Mean (SD)	85+ years n=31 Mean (SD)	p value (ANOVA)
Total-Rx	3.1 (1.6)	2.4 (2.1)	2.0 (1.4)	0.09
Total-OTC	1.7 (1.0)	1.8 (1.5)	2.1 (1.4)	0.59
Sch-Rx	3.0 (1.5)	2.4 (2.1)	2.0 (1.4)	0.14
Prn-Rx	0.1 (0.3)	0.0 (0.1)	0.0 (0.0)	**0.03**
Sch-OTC	1.2 (0.8)	1.4 (1.4)	1.4 (1.1)	0.70
Prn-OTC	0.5 (079)	0.4 (0.7)	0.7 (0.9)	0.18
Total-meds	4.8 (2.0)	4.2 (2.7)	4.1 (1.9)	0.49
Total-sch	4.2 (1.6)	3.8 (2.6)	3.9 (1.7)	0.40
Total-prn	0.7 (0.8)	0.4 (0.7)	0.7 (0.9)	0.19

Drug type	Home n=59 Mean (SD)	Institutionalized n=47 Mean (SD)	p value (t-test)
Total-Rx	2.4 (1.8)	2.5 (1.9)	0.95
Total-OTC	1.5 (1.4)	2.3 (1.3)	**0.005**
Sch-Rx	2.4 (1.8)	2.5 (1.8)	0.91
Prn-Rx	0.3 (0.2)	0.4 (0.2)	0.82
Sch-OTC	1.1 (1.0)	1.6 (1.3)	**0.04**
Prn-OTC	0.4 (0.6)	0.7 (0.9)	0.10
Total-meds	3.9 (2.1)	4.7 (2.9)	0.10
Total-sch	3.5 (1.9)	4.1 (2.4)	0.21
Total-prn	0.4 (0.7)	1.3 (0.5)	0.11

5.3.3 Follow-up medications

5.3.3.1 Average number of medications

On follow-up, all patients were taking at least one medication. The average number of total-meds at follow-up was 5.5 (SD=2.9, n=101) (Table 5.16).

5.3.3.2 Polypharmacy

Polypharmacy was present in 40.6% of the study population at follow-up. It occurred more frequently in GAU-C patients (70.0%) than in GAU-I patients (37.0%) (Chi-square p=0.05). For DH and PC patients, polypharmacy occurred with similar frequency in control and intervention groups (p>0.05 for both Chi-square tests).

5.3.3.3 Comparisons between sexes, age groups, and living locations

On follow-up, there were no significant differences in medication usage for all categories between sexes, among age groups, or between those institutionalized versus those living at home (p>0.05, t-tests and ANOVA) (Table 5.17).

5.3.3.4 Results of other follow-up studies

Only three geriatric assessment studies have followed patients post-discharge.[97,98,99] Results from the present study (average of 5.5 total medications on admission versus 5.5 on follow-up) were similar to those of the Kruse et al. study which showed that the number of drugs being taken

Table 5.16
Average Number of Follow-up Medications

Drug type	Total study cases n=101	Group		Site		
		Control n=49	Inter-vention n=52	GAU n=47	DH n=23	PC n=31
	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)
Total-Rx	2.8 (2.0)	2.6 (1.9)	2.9 (2.1)	2.8 (1.8)	2.4 (1.9)	3.0 (2.3)
Total-OTC	2.7 (1.7)	3.0 (1.7)	2.5 (1.8)	3.1 (2.0)	2.1 (1.3)	2.7 (1.4)
Sch-Rx	2.5 (1.9)	2.4 (1.9)	2.7 (1.9)	2.7 (1.8)	2.3 (1.7)	2.5 (2.1)
Sch-OTC	1.6 (1.4)	1.9 (1.5)	1.3 (1.3)	1.8 (1.6)	0.9 (0.9)	1.7 (1.2)
Prn-Rx	0.2 (0.6)	0.2 (0.5)	0.3 (0.7)	0.1 (0.3)	0.1 (0.5)	0.5 (0.9)
Prn-OTC	1.2 (1.3)	1.1 (1.2)	1.3 (1.4)	1.2 (1.3)	1.3 (1.2)	1.0 (1.4)
Total-meds	5.5 (2.9)	5.6 (2.8)	5.4 (3.0)	5.9 (3.0)	4.5 (2.7)	5.7 (2.7)
Total-sch	4.1 (2.4)	4.3 (2.5)	3.9 (2.3)	4.5 (2.5)	3.1 (2.3)	4.3 (2.2)
Total-prn	1.4 (1.5)	1.3 (1.3)	1.5 (1.7)	1.3 (1.3)	1.4 (1.3)	1.5 (1.9)

Table 5.17
Number of Follow-up Medications by
Sex, Age Group, and Living Location

Drug type	Males n=31 Mean (SD)	Females n=70 Mean (SD)	p value (t-test)
Total-Rx	2.8 (1.8)	2.7 (2.1)	0.38
Total-OTC	2.5 (1.7)	2.8 (1.8)	0.80
Sch-Rx	2.7 (1.7)	2.5 (1.9)	0.30
Prn-Rx	0.1 (0.3)	0.3 (0.7)	0.74
Sch-OTC	1.6 (1.5)	1.6 (1.4)	0.53
Prn-OTC	1.0 (1.3)	1.3 (1.3)	0.73
Total-meds	5.4 (2.8)	5.6 (2.9)	0.65
Total-sch	4.3 (2.4)	4.0 (2.4)	0.65
Total-prn	1.1 (1.3)	1.5 (1.6)	0.86

Drug type	65-74 years n=21 Mean (SD)	75-84 years n=51 Mean (SD)	85+ years n=31 Mean (SD)	p value (ANOVA)
Total-Rx	3.2 (2.2)	2.6 (2.0)	2.6 (1.8)	0.47
Total-OTC	2.2 (1.6)	2.8 (1.6)	3.0 (1.9)	0.30
Sch-Rx	2.8 (1.9)	2.4 (1.9)	2.6 (1.7)	0.82
Prn-Rx	0.5 (1.0)	0.2 (0.5)	0.1 (0.3)	0.08
Sch-OTC	1.1 (1.0)	1.5 (1.3)	2.0 (1.8)	0.10
Prn-OTC	1.1 (1.3)	1.3 (1.3)	1.0 (1.3)	0.55
Total-meds	5.5 (3.4)	5.4 (2.6)	5.6 (3.0)	0.97
Total-sch	3.9 (2.1)	4.0 (2.4)	4.5 (2.6)	0.55
Total-prn	1.6 (2.0)	1.5 (1.3)	1.1 (1.4)	0.38

Drug type	Home n=55 Mean (SD)	Institutionalized n=46 Mean (SD)	p value (t-test)
Total-Rx	2.6 (1.8)	3.0 (2.1)	0.38
Total-OTC	2.8 (1.8)	2.7 (1.6)	0.80
Sch-Rx	2.4 (1.8)	2.8 (2.0)	0.30
Prn-Rx	0.2 (0.6)	0.2 (0.7)	0.74
Sch-OTC	1.7 (1.5)	1.5 (1.3)	0.53
Prn-OTC	1.1 (1.3)	1.2 (1.4)	0.73
Total-meds	5.4 (2.6)	5.7 (3.2)	0.65
Total-sch	4.0 (2.3)	4.2 (2.6)	0.65
Total-prn	1.4 (1.3)	1.4 (1.7)	0.86

three months post-discharge was not substantially different from that on admission (average of 4.3 on admission versus 4.6 on follow-up).[98] In their study, the prevalence of polypharmacy was similar on admission (43%) and on follow-up (44%). In our study, polypharmacy was also similar on admission (38.7%) and on follow-up (40.6%).

In the Burns et al. study, patients had their medications assessed at a home visit 5-10 days after their discharge from a geriatric assessment and rehabilitation unit.[99] The unit supplied patients with five days worth of medications. Lack of continuity of medications was identified as a problem. In 27% of patients, the hospital medication supply had run out and no new prescriptions had been issued. In patients who did receive prescriptions after discharge, many had their medications altered by their general practitioners. Eleven percent of prescriptions were for new drugs and 13% of discharge medications were discontinued.

The present study, and the prospective uncontrolled descriptive studies of Kruse et al. and Burns et al., did not have control (patients not receiving geriatric assessment) groups. It was therefore not possible to assess how medications may have changed in patients had they not received geriatric assessment. The prospective randomized control design of the Senior Care study did utilize a control group who received traditional medical or surgical

care in the same hospital.[97] Results presented were based on time from randomization into the control or intervention groups and not from the time post-discharge. Intervention group (received geriatric assessment) patients were on statistically fewer medications than control patients by the third day after randomization; both groups experienced an increase in medication numbers (control = 40% increase, intervention = 18% increase). Compared to admission, medication use at six weeks and three months after study initiation increased by an average of two medications per patient for the entire population. There were no statistically significant differences in medication numbers between the control and intervention groups. However, intervention group patients were judged to be on fewer inappropriate medication choices. The authors attributed the increase in follow-up medications to several factors. These included a disparity in the manner that information was collected on admission and at 6 weeks since home visits were made at 6 weeks. They claimed that home visiting might have resulted in the reporting of more OTC medications but no figures to support this were provided. The other reason given for increased follow-up medication numbers was the type of follow-up care provided. Telephone follow-up was by a nurse only; no direct patient-geriatrician contact occurred. Therefore geriatricians might have missed opportunities for medication alterations.

5.3.4 Between admission, discharge, and follow-up

5.3.4.1 Average number of medications

Medication numbers were identical on admission and on follow-up but discharge numbers were lower for all grand total medication categories. For all patients, the average number of total-meds was 5.5 (SD=3.3) on admission, 4.3 (SD=2.3) on discharge, and 5.5 (SD=2.9) on follow-up. The average number of total-sch medications was 4.1 (SD=2.7) on admission, 3.8 (SD=2.1) on discharge, and 4.1 (SD=2.4) on follow-up. The average numbers of total-prn medications was 1.4 (SD=1.7) on admission, 0.6 (SD=0.8) on discharge, and 1.4 (SD=1.5) on follow-up.

5.3.4.2 Polypharmacy between admission, discharge, and follow-up

The frequency of polypharmacy on admission, discharge, and follow-up was statistically different only in the GAU-C group (Cochran Q p=0.03) (Table 5.18). In the GAU-C group, 60% presented with polypharmacy on admission. By discharge, this decreased to 35%, but increased to 70% by follow-up. The pharmacy discharge summary (=intervention) may have contributed to decreased polypharmacy occurrence on follow-up. In the DH-I and PC-I groups, there were reductions in polypharmacy occurrence between discharge and follow-up. For the GAU-I group, the increase in polypharmacy occurrence between discharge and follow-up was less than the increase noted in the GAU-C group.

Table 5.18
Cochran Q Results on Polypharmacy Occurrence between Admission, Discharge, and Follow-up

Site-Group	n	%-adm	%-DC	%-FU	p-value for Cochran Q
GAU-C	20	60	35	70	**0.03**
DH-C	14	14	14	36	0.10
PC-C	15	60	47	40	0.37
GAU-I	27	26	26	37	0.37
DH-I	9	22	22	11	0.78
PC-I	16	38	38	31	0.82

%-adm, %-DC, %-FU: percentage of patients experiencing polypharmacy on admission, discharge, & follow-up, respectively

C: control group I: intervention group

5.3.4.3 Reduction between admission and discharge

A change in the average number of total-meds from 5.5 to 4.3 from admission to discharge represents a 22% reduction. This reduction is lower than that reported by some geriatric assessment studies[23,70,72,73,96,98] (Table 5.11). Greater reductions might have occurred in some of the Rubenstein et al. studies[70,72,73] because of the longer assessment durations (ranging from an average of 66.4-87.8 days) and in the Kruse et al. study[98] because of the exclusion of recently assessed patients.

For the CGS population of the present study, the reduction in number of medications was greater than that

reported in studies by Rubenstein et al.[73], Applegate et al.[75], Alexander et al.[95], and Harris et al.[89] (Table 5.11). Differences in patient characteristics and duration of assessment might have resulted in lower medication reductions in these studies. In the Rubenstein et al. study, there was a predominance of outpatients who required fewer medication adjustments. In the Applegate et al. study, only clinically stable hospital patients were included; their assessment period (average = 23 days) was also shorter than the average CGS assessment duration of 49 days. In the Harris et al. study, admission selection was based only on age, nursing home patients were excluded, and their assessment duration (average = 10.9 days) was shorter. Even though medication reduction was lower in the Harris et al. study, patients who underwent geriatric assessment were on significantly fewer medications on discharge than those in a control group that had not received geriatric assessment.

5.3.4.4 Comparisons between groups and sites

In the present study, statistically significant differences in the number of medications between admission, discharge, and follow-up occurred in seven of nine categories: total-OTC, prn-OTC, total-meds, total-prn, sch-Rx, prn-Rx, and total-Rx [$p \leq 0.05$ (time) for two-way repeated measures ANOVA tests] (Table 5.19). For the first four

Table 5.19
Repeated Measures ANOVA Results on the
Number of Medications on Admission, Discharge, and Follow-up

Drug type	p value for site x time interaction	p value for group x time interaction	p value for time
Total Rx	0.649	0.096	**0.000**
Total OTC	**0.043**	**0.008**	**0.000**
Sch-Rx	0.445	0.114	**0.050**
Sch-OTC	0.477	0.161	0.278
Prn-Rx	0.182	0.597	**0.000**
Prn-OTC	0.064	**0.002**	**0.000**
Total-meds	0.581	**0.021**	**0.000**
Total-sch	0.707	0.403	0.105
Total-prn	0.158	**0.008**	**0.000**

sites : GAU, DH, & PC
groups : control & intervention
times : admission, discharge, & follow-up

categories mentioned above, changes were dependent on whether the patient was in the control or in the intervention group [$p<0.05$ (group x time interaction) for two-way repeated measures ANOVA tests]. The number of medications decreased between admission and discharge and increased between discharge and follow-up for the control group ($p<0.05$, Tukey's tests). For the intervention group, the number of medications at admission and discharge were not significantly different, but increased between discharge and follow-up ($p<0.05$, Tukey's test). Control patients might have exhibited a significant decrease between admission and discharge because they were on significantly more admission total-OTC, prn-OTC, total-meds, and total-prn medications. Since post-hoc analyses revealed that the number of medications increased between discharge and follow-up for both control and intervention groups, the pharmacy discharge summary apparently did not have a significant impact in preventing medication increases.

Total-OTC medications also differed among sites [$p<0.05$, site x time interaction, for two-way repeated measures ANOVA]. The largest difference in total-OTC medications between admission and discharge was in PC patients perhaps because PC patients had the highest number of total-OTC medications on admission. Between discharge and follow-up, the largest difference in total-OTC medications occurred in DH patients.

For the remaining three categories, sch-Rx, prn-Rx, and total-Rx, differences were consistent throughout groups and sites [$p>0.05$ (interactions), two-way repeated measures ANOVA tests]. The number of sch-Rx and total-Rx medications decreased between admission and discharge (Tukey's $p<0.05$). The number of prn-Rx medications decreased between admission and discharge and increased between discharge and follow-up ($p<0.05$, Tukey's tests).

5.3.5 Results of prospective controlled studies

Since the present study lacked a control group who had not undergone geriatric assessment, results are not directly comparable to the published controlled studies. However, it is worthwhile to review the results of the four prospective controlled studies published to date.[30,73,89,97] In the Hogan *et al.*[31] and Harris *et al.*[89] studies, geriatric assessment patients on discharge were taking fewer medications than control group patients. In the Owens *et al.* (Senior Care) study[97], geriatric assessment patients were taking fewer medications on the third day after randomization but not by six weeks or three months after randomization. In the Rubenstein *et al.* study[73], although there was no significant difference in the number of discharge medications in the control and intervention (received geriatric assessment) groups, intervention patients had significantly more medications both discontinued and added during their assessment.

5.4 Cost of medications

The daily cost of scheduled medications was determined as described in Section 4.4. Topical creams and ointments, eye drops, eye ointments, and as-needed medications were excluded from the cost calculation since it was difficult to determine the exact quantities used. Similar to the classification for medication numbers, daily costs were calculated for two categories of medications:

-cost of scheduled prescription (sch-Rx) medications

-cost of scheduled OTC (sch-OTC) medications.

A total cost of scheduled medications was calculated by combining the costs for the two categories:

-cost of total scheduled (total-sch) medications
= cost of sch-Rx + cost of sch-OTC medications.

5.4.1. Admission medication costs

For all study patients, the average daily cost of sch-Rx medications on admission was $1.52 (SD=2.14) or $554.80 annually (Table 5.20). In 1989, the average annual cost for prescription drugs used by Saskatchewan seniors was only $208.27.[120] Inflation, the introduction of new higher priced drugs, and the possibility that CGS patients are of poorer health than seniors in the general population might account for the higher medication cost calculated in the present study.

Table 5.20
Average Admission Medication Cost in Dollars

Drug type	Total study cases	Group		Site		
		Control	Inter-vention	GAU	DH	PC
	n=106	n=53	n=53	n=51	n=24	n=31
	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)
Sch-Rx	1.52 (2.14)	1.68 (1.76)	1.35 (2.47)	1.84 (2.71)	1.40 (1.58)	1.07 (1.22)
Sch-OTC	0.24 (0.64)	0.35 (0.87)	0.12 (0.18)	0.30 (0.83)	0.15 (0.33)	0.20 (0.40)
Total-sch	1.75 (2.33)	2.04 (2.04)	1.46 (2.58)	2.14 (2.93)	1.55 (1.67)	1.27 (1.45)

On admission, the cost of sch-OTC medications was greater in the control than in the intervention group [$p<0.05$ two-way ANOVA test] (Table 5.21). However, costs of sch-Rx and total-sch medications were not significantly different between the two groups. No differences in medication costs between study sites were detected.

Table 5.21
Two-way ANOVA Results on the Cost of Admission Medications
(n = 106 cases)

Drug type	p value for differences between groups	p value for differences between sites	p value for group x site interaction
Sch-Rx	0.397	0.275	0.890
Sch-OTC	**0.044**	0.477	0.504
Total-Sch	0.184	0.215	0.871

groups: control & intervention
sites : GAU, DH, & PC

5.4.2 Discharge and follow-up medication costs

Discharge and follow-up medication costs were also calculated (Tables 5.22 and 5.23).

Table 5.22
Average Discharge Medication Cost in Dollars

Drug type	Total study cases	Group		Site		
		Control	Inter-vention	GAU	DH	PC
	n=106	n=53	n=53	n=51	n=24	n=31
	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)
Sch-Rx	1.58 (1.77)	1.63 (1.93)	1.54 (1.61)	1.84 (2.01)	1.39 (1.56)	1.31 (1.47)
Sch-OTC	0.32 (0.39)	0.35 (0.45)	0.28 (0.32)	0.41 (0.47)	0.19 (0.27)	0.26 (0.28)
Total-sch	1.90 (1.81)	1.98 (1.96)	1.82 (1.67)	2.25 (2.03)	1.58 (1.54)	1.57 (1.55)

Table 5.23
Average Follow-up Medication Cost in Dollars

Drug type	Total study cases	Group		Site		
		Control	Inter-vention	GAU	DH	PC
	n=101	n=49	n=52	n=47	n=23	n=31
	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)
Sch-Rx	1.57 (1.72)	1.64 (1.87)	1.51 (1.57)	1.76 (1.87)	1.60 (1.73)	1.27 (1.45)
Sch-OTC	0.26 (0.31)	0.35 (0.36)	0.17 (0.23)	0.34 (0.37)	0.13 (0.16)	0.23 (0.26)
Total-sch	1.83 (1.78)	1.99 (1.96)	1.68 (1.60)	2.09 (1.95)	1.74 (1.80)	1.50 (1.47)

5.4.3 Between admission, discharge, and follow-up

No statistically significant differences were noted between admission, discharge, and follow-up for any scheduled medication cost categories [$p>0.05$ (time), repeated measures ANOVA with between subjects factors, group and site]. This indicates that the changes in scheduled therapeutic agents prescribed to CGS patients did not result in medication cost savings. However, the clinical impact of these changes in altering adverse drug reactions, repeat or continued hospitalizations, quality of life, and the costs associated with these were not studied in this research. The study by Applegate et al. of subsequent health care charges after discharge showed a trend towards lower medication charges in GAU patients than in control patients ($p=0.06$).[88] One of the limitations of their study was that information collected on medication costs may have been estimates made by the patient or the patient's family. One must question the accuracy of these estimates when it was obtained up to one year after expenses occurred. However, this information bias should have been present in both their control and GAU groups.

5.5 Drug classes

The patterns of use for specific drugs and drug classes were studied to determine how therapy changed during and after geriatric assessment. More detailed information about drug classes and subclasses prescribed can be found in Appendix H. Medications were categorized according to the American Hospital Formulary Service (AHFS) classification.[114] Various medications that have not been classified by the AHFS were placed into a miscellaneous category (Appendix I). The Asthana and Sood study also used the AHFS classification system, therefore facilitating direct comparisons.[23] Unfortunately, the Kruse et al., Alexander et al., and Desai et al. studies used other therapeutic drug classifications.[95,96,98] However, where possible, the results of these studies were compared to the CGS results.

Many changes in the prescribing of specific drugs and drug classes were noted. Unless otherwise reported, changes were not statistically significant.

5.5.1 Frequency of drug use by therapeutic class

On admission, patients were taking drugs from several classes (Table 5.24). A greater proportion of patients in the GAU control group than in the GAU intervention group received blood formation and coagulation medications (Chi-square p=0.05). With the borderline p-value and the large number of statistical tests performed, this difference

Table 5.24
Admission Medication Classes

DRUG CLASS	Total study cases* n=106	DRUG CLASS	Total study cases* n=106
Antihistamine	1 (0.9%)	EENT	13(12.3%)
Anti-infective	11(10.4%)	Gastro-intestinal	66(62.3%)
Antineoplastic	1 (0.9%)	Hormones	34(32.1%)
Autonomic	11(10.4%)	Local anesthetics	2 (1.9%)
Blood Formation & Coagulation	19(17.9%)	Skin & Mucous Membrane agents	8 (7.5%)
Cardiovascular	46(43.4%)	Smooth Muscle Relaxants	4 (3.8%)
Central Nervous System	84(79.2%)	Vitamins	16(15.1%)
Electrolytic, Caloric, and Water balance	34(32.1%)	Unclassified	17(16.0%)
Antitussives/ Expectorants/ Mucolytics	3 (2.8%)	Miscellaneous	8 (7.5%)

*: values represent the number of patients (the percentage of the total population) with at least one admission medication from the drug class.

EENT: Eye, ear, nose, and throat

may be evidence of a Type I error. On admission, there were no other significant differences between control and intervention groups in the proportion of patients using specific drug classes.

Central nervous system (CNS), gastrointestinal (GI), cardiovascular (CV), electrolytic, caloric, & water balance, and hormones were consistently the five most frequently used drug classes on admission, discharge, and follow-up (Table 5.25). These five drug classes were also the most frequently used classes reported by Asthana and Sood, although their ranking by frequency of use was slightly different.[23]

During the present study, the frequency of use of various drug classes increased or decreased between admission, discharge, and follow-up and use of drugs from certain classes was eliminated after assessment and by discharge (Table 5.26). No patients were receiving antihistamines, antitussives, or local anesthetics on discharge. At follow-up, no patients were using smooth muscle relaxants or local anesthetics, however some patients were once again taking antihistamines or antitussives.

Table 5.25
Frequency of Drug Class Usage on
Admission, Discharge, and Follow-up

ADMISSION		DISCHARGE		FOLLOW-UP	
DRUG CLASS	%[a]	DRUG CLASS	%[a]	DRUG CLASS	%[a]
CNS	79.2	CNS	78.3	CNS	85.1
GI	62.3	GI	52.8	GI	64.4
CV	43.4	CV	35.8	CV	39.6
Hormones	32.1	Hormones	34.9	Hormones	37.6
Electrolytic, caloric & water balance	32.1	Electrolytic, caloric & water balance	21.7	Electrolytic, caloric & water balance	32.7
Blood Formation & Coagulation	17.9	Unclassified	16.0	Vitamins	25.7
Unclassified	16.0	Autonomic	14.2	Miscellaneous	16.8
Vitamins	15.1	Blood Formation & Coagulation	14.2	Unclassified	15.8
EENT	12.3	Vitamins	12.3	Autonomic	14.9
Antiinfective	10.4	EENT	7.5	EENT	10.9
Autonomic	10.4	Miscellaneous	6.6	Blood Formation & Coagulation	9.9
Skin & Mucous membrane agents	7.5	Skin & Mucous membrane agents	4.7	Antiinfective	8.9
Miscellaneous	7.5	Smooth muscle relaxants	1.9	Antitussives/ expectorants/ mucolytics	7.9
Smooth muscle relaxants	3.8	Antiinfective	1.9	Skin & Mucous membrane agents	3.0
Antitussives/ expectorants/ mucolytics	2.8	Antineoplastic	0.9	Antihistamine	1.0
Local anesthetics	1.9	Antihistamine	0.0	Antineoplastic	1.0
Antihistamine	0.9	Antitussives/ expectorants/ mucolytics	0.0	Smooth muscle relaxants	0.0
Antineoplastic	0.9	Local anesthetics	0.0	Local anesthetics	0.0

a: percentage of total population on at least one medication from the drug class

EENT: Eye, ear, nose, and throat

Table 5.26
Drug Classes with Changes in Frequency of Use between Time Intervals

Between admission and discharge

Increase in frequency of use	Decrease in frequency of use
Autonomic	Antiinfective
Hormones	Blood Formation & Coagulation
	Cardiovascular
	Electrolytic, Caloric, & Water Balance
	Antitussives/Expectorants/ Mucolytics
	Eye, ear, nose, and throat
	Gastrointestinal
	Local Anesthetics
	Skin and Mucous Membrane
	Smooth Muscle Relaxants
	Vitamins
	Miscellaneous

Between discharge and follow-up

Increase in frequency of use	Decrease in frequency of use
Antiinfective	Blood Formation & Coagulation
Cardiovascular	Skin & Mucous Membrane
Central nervous system	Smooth Muscle Relaxants
Electrolytic, Caloric, & water balance	
Antitussives/ Expectorants/ Mucolytics	
Eye, ear, nose, and throat	
Gastrointestinal	
Hormones	
Vitamins	
Miscellaneous	

5.5.2 Central nervous system (CNS) medications

CNS medications were the most frequently used class of medications on admission, discharge, and follow-up (Appendix J). This was also the most frequently prescribed admission drug class in the Asthana and Sood study.[23] The percentage of CGS patients on CNS drugs (including non-prescription agents) was 79% on admission, 78% on discharge, and 85% on follow-up. This is much higher than the 47% of seniors in Saskatchewan receiving CNS prescriptions (1989 data from Saskatchewan's Prescription Drug Plan).[120] However, the Prescription Drug Plan figures do not include non-prescription agents. CNS subclasses include analgesics and antipyretics, psychotherapeutic (antidepressant and antipyschotic), anxiolytic/sedative/hypnotic, and antimanic agents.

The CNS subclass, analgesics and antipyretics, accounted for 82%, 88%, and 91% of CNS drugs utilized on admission, discharge, and follow-up, respectively. The use of narcotics decreased between admission and discharge. During this time period, the use of acetaminophen and pain cocktail (acetaminophen & diphenhydramine) increased. However, use of narcotics increased by follow-up, largely due to increased consumption of OTC acetaminophen/codeine products. Alexander et al. also reported significant reductions in narcotic use in Scottish geriatric patients upon discharge.[95]

The use of antidepressants not only decreased but the choice of agents used also changed markedly between admission and discharge. Nine patients were admitted with prescriptions for amitriptyline, trimipramine, doxepin, fluoxetine, or desipramine. In seven of these patients an antidepressant was not prescribed on discharge. Choice of antidepressant changed for the other two patients (from fluoxetine to fluvoxamine, and from amitriptyline to nortriptyline). Compared to admission, by discharge there were fewer prescriptions for maprotiline and trazodone but more prescriptions for nortriptyline and fluvoxamine. For the treatment of depression in the elderly, nortriptyline, desipramine, trazodone, and fluvoxamine are currently recommended because of their more favorable side effect and pharmacokinetic profiles.[21,121,122,123] In contrast to the Asthana and Sood study where desipramine was the preferred antidepressant after admission, no prescriptions were written for desipramine in the present study.[23] Because CGS physicians have changed since the Asthana and Sood study, differences in prescribing practices are to be expected. Fluvoxamine was also not on the market during the Asthana and Sood study.

Overall antidepressant usage decreased during assessment in our study. However, the Asthana and Sood[23] and Alexander et al.[95] studies reported increases in antidepressant usage after assessment. On follow-up in the

present study, some patients were again receiving prescriptions for trimipramine, doxepin, and fluoxetine.

The frequency of use of all antipsychotics decreased during assessment and continued to decrease after discharge. No patients were on prochlorperazine, perphenazine, flupenthixol, or thioridazine upon discharge. The most frequently used antipsychotic on discharge was haloperidol. Haloperidol causes more extrapyramidal but fewer anticholinergic side effects than thioridazine.[125,126] The desire to avoid anticholinergic side effects, which can further aggravate confusion in cognitively impaired patients, might have been the reason for the more frequent use of haloperidol. Decreased use of antipsychotics has also been reported in other geriatric assessment studies.[95,98]. The Asthana and Sood study showed antipsychotics represented 13% of total CNS drug usage on admission and 14% on discharge.[23]

In the present study, the frequency of anxiolytic/sedative/hypnotic use changed between admission, discharge, and follow-up (Cochran Q p=0.02) (Table 5.27). Changes during geriatric assessment included decreased use of diazepam, chlordiazepoxide, bromazepam, lorazepam, and oxazepam and increased use of alprazolam, temazepam, and buspirone. The favorable pharmacokinetic profiles of alprazolam and temazepam and the lack of addiction potential of buspirone may be the reasons for their increased

Table 5.27
Cochran Q Results on the Presence of Drug Classes on Admission, Discharge, and Follow-up (n=101 cases)

Drug Class	%-adm	%-DC	%-FU	p-value
Antihistamine	1	0	1	0.61
Anti-infective	10	2	9	0.06
Antineoplastic	1	1	1	1.00
Autonomic	10	14	15	0.17
Blood Formation & Coagulation	18	14	10	0.14
-Antianemic	10	9	8	0.84
-Anticoagulant	7	4	2	0.12
Cardiovascular	42	37	40	0.31
-Cardiac	27	23	24	0.49
-Hypotensive	15	13	13	0.72
-Vasodilating	15	12	15	0.44
Electrolytic, Caloric, water balance	35	31	39	0.29
-Replacement preparations	19	11	19	0.08
-Potassium depleting diuretic	20	17	24	**0.03**
-Potassium sparing diuretic	1	3	5	**0.05**
Central Nervous System	80	82	86	0.42
-Analgesics & Antipyretics	67	71	78	0.10
-Anticonvulsants	5	6	6	0.61
-Psychotherapeutic	23	15	16	0.17
-Anxiolytic/Sedative/Hypnotic	24	15	14	**0.02**
-Antimanic	1	0	1	0.37
Antitussive/Expectorant/Mucolytic	3	0	8	**0.01**
Gastro-intestinal	63	52	65	**0.02**
-Antacids	9	5	15	**0.02**
-Antidiarrheals	1	0	0	0.37
-Antiflatuents	0	0	1	0.37
-Cathartics & Laxatives	50	44	55	0.10
-Antiemetics	7	4	4	0.53
-Miscellaneous GI	18	15	16	0.65
Hormone & Synthetic Hormones	34	37	38	0.37
Local Anesthetics	2	0	0	0.14
Skin & Mucous Membrane Agents	7	4	3	0.20
Smooth Muscle Relaxants	3	1	0	0.10
Vitamins	16	13	26	**0.01**
Unclassified	16	16	16	1.00
Miscellaneous	8	7	17	**0.02**

%-adm, %-DC, %-FU: percentage of total population receiving at least one agent from class on admission, discharge, & follow-up, respectively

usage.[127,128,129] In the Asthana and Sood[23], and Alexander et al.[95] studies, decreased sedative and hypnotic use between admission and discharge was also demonstrated. In the CGS population, benzodiazepine use was further decreased between discharge and follow-up.

5.5.3 Gastrointestinal (GI) medications

The use of GI medications (Appendix J) decreased between admission and discharge but increased between discharge and follow-up (63% of patients on admission, 52% of patients on discharge, and 65% of patients by follow-up) (Cochran Q p=0.02) (Table 5.27). This is in contrast to the other studies that showed increased use of GI medications between admission and discharge.[23,98,95,96] In the Asthana and Sood study, GI medications were the most common drug class on discharge.[23]

In the present study laxatives were the most frequently used subclass of GI drugs. Laxative agents changed in a number of patients during their assessment. The three most common laxatives pre-admission were docusate, fibre, and bisacodyl. By discharge, the three most commonly prescribed laxatives were docusate, lactulose, and sorbitol. Agents such as castor oil, mineral oil, cascara, and phenolphthalein, which are not recommended for chronic use in the elderly, were discontinued.[130] Counselling and promotion of non-pharmacologic treatments (e.g. dietary

fibre, increased hydration, exercise, tap water enemas, etc.) to prevent constipation might have resulted in decreased laxative prescribing during assessment. At follow-up laxative use had returned to pre-admission levels. In both the Asthana and Sood and Desai et al. studies, laxative use increased between admission and discharge.[23,96]

By discharge, no patients were receiving cimetidine. Cimetidine has the potential to interact with other drugs and to cause side effects such as confusion, agitation, and delirium in elderly patients with renal or hepatic insufficiency or organic brain syndrome.[23,114,131,132] Therefore, it is not the H_2 antagonist of choice in the elderly. An agent such as ranitidine is a better therapeutic choice.[132] The only H_2 antagonist prescribed on discharge was ranitidine. Prescribing of misoprostol, a cytoprotective agent often used to avoid non-steroidal anti-inflammatory induced gastropathy, also increased.

5.5.4 Cardiovascular (CV) medications

On admission, discharge, and follow-up, 43%, 36%, and 40% of the study population respectively, were on at least one CV medication (Appendix J). In 1989, 43% of Saskatchewan seniors were prescribed drugs from this class.[120] For all three subclassifications (cardiac, hypotensive, and vasodilating drugs), the frequency of use

decreased between admission and discharge. However, the use of cardiac and vasodilating drugs increased by follow-up.

In the Asthana and Sood[23] and Desai et al.[96] studies, the percentage of patients on hypotensives decreased from 24% on admission, to 8.8%[23] and 8.0%[96] by discharge. Similarly, in the present study, the percentage of patients on hypotensives decreased from 16% on admission to 12% by discharge. No patients were on methyldopa, prazosin, clonidine, and labetalol by discharge. Patients on these agents either had their therapy discontinued or replaced with an angiotensin converting enzyme (ACE) inhibitor or calcium channel blocker. ACE inhibitors and calcium channel blockers have a better side-effect profile and can be useful in patients with other concurrent diseases.[133,134,135]

Use of digoxin accounted for 25% of total CV medications on admission, 28% on discharge, and 27% by follow-up. These rates are substantially lower than those reported by Asthana and Sood.[23] Digoxin use accounted for 40% and 61.7% of their total CV drug prescriptions on admission and discharge, respectively. In the Kruse et al. study, 60.6% of patients on admission and 33% of patients on discharge were on cardiac glycosides.[98]

5.5.5 Electrolytic, caloric, and water balance medications

Fewer patients received electrolytic, caloric, and water balance medications after CGS assessment (Appendix J).

However by follow-up, the percentage of patients taking these agents was similar to that reported on admission (32% on admission, 22% on discharge, & 33% on follow-up). These changes were primarily due to changes between admission, discharge, and follow-up in the use of potassium depleting and sparing diuretics [$p \leq 0.05$, Cochran Q test] (Table 5.27).

The decrease in the number of patients on electrolytic, caloric, and water balance drugs is similar to that reported in the Asthana and Sood study.[23] However, in their study as well as in the study by Kruse et al.[98], use of diuretics increased. This was not the case with our study where the percentage of patients on diuretics decreased from 22% on admission to 19% by discharge. Alexander et al. also demonstrated decreased diuretic use between admission and discharge.[95]

5.5.6 Hormonal medications

Frequency of hormone use was 32%, 35%, and 38% on admission, discharge, and follow-up, respectively (Appendix J). The percentage of Saskatchewan seniors using agents from the hormonal class was somewhat lower (24% for females, 16% for males).[120]

During the present study, changes occurred with the prescribing of sulfonylureas. Although three patients were admitted on chlorpropamide or tolbutamide, no patients were taking these agents by discharge or at follow-up. However,

glyburide and metformin use increased, perhaps reflecting the understanding that these are better oral hypoglycemics to use in the elderly.[136,137] These two agents were also the most commonly prescribed oral hypoglycemic agents in Saskatchewan in 1989.[127]

5.5.7 Other drug classes

The percentage of patients on anti-infectives decreased from 10% on admission to 2% by discharge. However upon follow-up, 9% of patients were on anti-infectives. For blood formation and coagulation drugs, frequency of use decreased between admission and discharge and further decreased between discharge and follow-up. The frequency of use of the vitamins, antitussives/expectorants/mucolytics, and miscellaneous agents differed statistically between admission, discharge, and follow-up ($p \leq 0.05$ for Cochran Q tests) (Table 5.27). Between discharge and follow-up, usage of vitamins, antihistamines, antitussives/expectorants/mucolytics, and miscellaneous drugs increased. Potential reasons for this increase include the inability of physicians to directly control OTC medication consumption, as well as the discovery of more OTC medications at a follow-up home visit than were noted on admission or discharge.

5.6 Medication changes

Medication changes between admission and discharge, between discharge and follow-up, and between admission and follow-up were assessed. A medication change was classified as one of the following:

-discontinuation of drug,
-addition of drug,
-change of drug within AHFS therapeutic class (this category includes both the addition of a drug and discontinuation of a drug but is scored as only one change),
-dose increase,
-dose decrease,
-more frequent administration,
-less frequent administration,
-change of route of administration, or
-addition of a medication aid.

The only types of medication changes reported in other geriatric assessment studies have been medication additions and discontinuations.

To limit the number of statistical tests that would be required, only the total numbers of changes (the sum of the these nine categories) were subjected to two-way ANOVA (factors = group and site), as follows:

1. total number of Rx medication changes between admission and discharge;
2. total number of OTC medication changes between admission and discharge;
3. total number of all medication changes (Rx + OTC medication changes) between admission and discharge;
4. total number of Rx medication changes between discharge and follow-up;
5. total number of OTC medication changes between discharge and follow-up;
6. total number of all medication changes (Rx + OTC medication changes) between discharge and follow-up;

7. total number of Rx medication changes between admission and follow-up;
8. total number of OTC medication changes between admission and follow-up; and
9. total number of all medication changes (Rx + OTC medication changes) between admission and follow-up.

5.6.1 Medication changes between admission and discharge

In the CGS population, an average of 1.6 (SD=1.5) Rx and 1.4 (SD=1.7) OTC medications per patient were discontinued and 0.9 (SD=1.1) Rx and 0.9 (SD=1.1) OTC medications per patient were added between admission and discharge (Table 5.28). These figures are lower than the results reported by Rubenstein et al. but higher than those reported by Applegate et al. In the geriatric evaluation group of the Rubenstein et al. study, 4.6 drugs per patient were discontinued while 3.9 drugs per patient were added; more discontinuations and additions occurred in geriatric evaluation patients than in control group patients.[73] Applegate et al. found that 1.9 drugs per patient were discontinued while 1.2 were added.[75] Hogan et al. reported an average of 0.04 changes in prescribed oral medications per geriatric consult patient but provided no information as to the types of changes that occurred.[31] As in the Rubenstein et al. and the Applegate et al. studies, the present study showed that more medications were discontinued than were added.

Table 5.28
Medication Changes

Rx medication changes	Between admission & discharge**		Between discharge & follow-up**		Between admission & follow-up**	
	Mean/pt(SD)	n*	Mean/pt(SD)	n*	Mean/pt(SD)	n*
-stop drug	1.6 (1.5)	74	0.5 (0.8)	34	1.7 (1.5)	74
-add drug	0.9 (1.1)	51	0.8 (1.0)	49	1.3 (1.4)	66
-change AHFS class	0.2 (0.5)	14	0.1 (0.3)	8	0.2 (0.4)	13
-dose ↑	0.1 (0.4)	13	0.2 (0.4)	17	0.2 (0.4)	16
-dose ↓	0.3 (0.6)	26	0.1 (0.3)	11	0.3 (0.6)	22
-interval more frequent	0.1 (0.3)	10	0.1 (0.3)	10	0.1 (0.4)	11
-interval less frequent	0.2 (0.5)	19	0.1 (0.4)	11	0.2 (0.6)	18
-change route of administration	0.02(0.1)	2	0.03(0.2)	2	0.04(0.2)	3
-add medication aid	0.01(0.1)	1	0	0	0	0
OTC medication changes	**Between admission & discharge**		**Between discharge & follow-up**		**Between admission & follow-up**	
	Mean/pt(SD)	n*	Mean/pt(SD)	n*	Mean/pt(SD)	n*
-stop drug	1.4 (1.7)	71	0.5 (0.8)	33	1.3 (1.5)	64
-add drug	0.9 (1.1)	57	1.3 (1.5)	62	1.7 (1.3)	83
-change AHFS class	0.1 (0.4)	12	0.03(0.2)	3	0.1 (0.3)	7
-dose ↑	0.1 (0.2)	5	0.04(0.2)	4	0.02(0.1)	2
-dose ↓	0.1 (0.3)	3	0.1 (0.3)	7	0.03(0.2)	3
-interval more frequent	0.1 (0.4)	13	0.04(0.2)	4	0.1 (0.3)	12
-interval less frequent	0.03(0.2)	3	0.2 (0.5)	17	0.04(0.2)	4
-change route of administration	0.01(0.1)	1	0	0	0	0
-add medication aid	0	0	0	0	0	0

*: number of patients experiencing change
**: number of patients on admission & discharge = 106; number of patients at follow-up = 101.

pt: patient
AHFS: American Hospital Formulary Service

Medication changes within an AHFS therapeutic class were also included in the results. An average of 0.2 (SD=0.5) prescription changes and 0.1 (SD=0.4) OTC changes within an AHFS therapeutic class occurred per patient (Table 5.28). For prescription medications, the average number of dosage reductions was higher than the average number of dosage elevations. Also, more prescription changes resulted in less frequent rather than more frequent drug administration (Table 5.28).

For all patients, an average of 6.1 (SD=4.0) total, 3.4 (SD=2.6) prescription, and 2.7 (SD=2.4) OTC medication changes occurred between admission and discharge (Table 5.29). Control group patients had significantly more OTC medication changes between admission and discharge than intervention group patients [$p=0.03$ (group) two-way ANOVA]. This finding is not unexpected since control patients were taking more OTC medications on admission.

More OTC and total changes occurred for GAU patients than for DH patients [$p=0.003$ (site), two-way ANOVA; Tukey's test $p<0.05$]. These differences between study sites may be due to the higher number of OTC and total medications used by GAU patients on admission.

Table 5.29
Average Number of Medication Changes Between Time Intervals

Types of change	Total study cases	Group		Site		
		Control	Inter-vention	GAU	DH	PC
Between Admission and Discharge						
	n=106 (SD)	**n=53** (SD)	**n=53** (SD)	**n=51** (SD)	**n=24** (SD)	**n=31** (SD)
Total changes	6.1 (4.0)	6.7 (4.2)	5.5 (3.7)	7.2 (4.1)	4.1 (3.2)	5.8 (3.8)
Rx changes	3.4 (2.6)	3.6 (2.5)	3.2 (2.6)	4.0 (2.7)	2.7 (2.3)	2.9 (2.4)
OTC changes	2.7 (2.4)	3.1 (2.9)	2.3 (1.7)	3.2 (2.5)	1.4 (1.3)	2.8 (2.7)
Between Discharge and Follow-up						
	n=101 (SD)	**n=49** (SD)	**n=52** (SD)	**n=47** (SD)	**n=23** (SD)	**n=31** (SD)
Total changes	4.6 (2.9)	4.9 (3.1)	4.4 (2.7)	5.2 (2.5)	3.5 (2.5)	4.6 (3.5)
Rx changes	2.5 (2.1)	2.4 (2.1)	2.5 (2.2)	2.6 (2.0)	1.7 (1.7)	2.8 (2.5)
OTC changes	2.2 (1.8)	2.4 (1.9)	2.0 (1.6)	2.6 (1.9)	1.9 (1.3)	1.8 (1.9)
Between Admission and Follow-up						
	n=101 (SD)	**n=49** (SD)	**n=52** (SD)	**n=47** (SD)	**n=23** (SD)	**n=31** (SD)
Total changes	7.2 (3.8)	7.9 (3.7)	6.6 (3.9)	8.1 (3.9)	5.2 (3.1)	7.3 (3.6)
Rx changes	4.0 (2.5)	4.4 (2.4)	3.6 (2.6)	4.4 (2.5)	3.0 (2.2)	4.1 (2.6)
OTC changes	3.2 (2.0)	3.5 (2.0)	3.0 (2.1)	3.8 (2.2)	2.2 (1.5)	3.2 (1.9)

5.6.2 Medication changes between discharge and follow-up

For both prescription and OTC medications, the average number of drug additions was higher than the average number of drug deletions (Table 5.28). For prescription medications, more dosage increases occurred. However, for OTC medications, there were more dosage decreases and more changes resulting in less frequent drug administration.

For all patients between discharge and follow-up, an average of 4.6 (SD=2.9) total medication changes, 2.5 (SD=2.1) prescription medication changes, and 2.2 (SD=1.8) OTC medication changes took place (Table 5.29). For all three categories of medication changes (Rx, OTC, and total), no statistically significant differences were noted between the control and intervention groups, or between study sites in the time between discharge and follow-up ($p>0.05$ for all two-way ANOVA tests). Because the number of medication changes for control and intervention group patients were not significantly different, the pharmacy discharge summary did not appear to have had an effect in decreasing the number of medication changes after discharge.

5.6.3 Medication changes between admission and follow-up

When compared to admission, follow-up prescription regimens had more drugs stopped than added, reductions in dosages occurred more frequently than elevations, and more changes resulted in less frequent drug administration (Table

5.28). For OTC medications, however, more drugs were added and they were given at more frequent intervals. Overall, even three months after discharge, CGS assessment appears to have had a beneficial impact by decreasing consumption of prescription but not OTC medications.

For all patients between admission and follow-up, an average of 7.2 (SD=3.8) total medication changes, 4.0 (SD=2.5) prescription medication changes, and 3.2 (SD=2.0) OTC medication changes occurred (Table 5.29). For two categories, number of prescription medication changes and number of total medication changes, control group patients had slightly more changes than intervention group patients [p=0.04 and p=0.02 (group), respectively; two-way ANOVA test]. GAU patients also had significantly more OTC and total medication changes than DH patients [p=0.004 and p=0.003 (site), respectively; two-way ANOVA test; Tukey's $p<0.05$].

5.6.4 Variables influencing medication changes

One of the objectives of this study was to determine which variables (Appendix K), if any, influenced the occurrence of medication changes. This type of multiple linear regression analysis has not been reported in other geriatric assessment studies.

5.6.4.1 Between admission and discharge

1. Prescription medication changes

Variables found to be significantly correlated with the number of prescription medication changes were the number of admission prescription medications, the admission class of the patient (first assessment or not), and the patient's CGS geriatrician (multiple linear regression $p<0.0001$ - Appendix K). These three variables accounted for 64.7% of the variance in prescription medication changes between admission and discharge.

The number of admission prescription medications would be expected to have an impact on the number of changes that would occur during geriatric assessment. More medications obviously would allow for a greater likelihood of more changes. Not surprisingly, more changes occurred for first assessment than for follow-up or reassessment visits.

Different prescribing and assessment practices of the geriatricians were also apparent in this analysis; i.e.,

geriatrician #3 made the most changes while geriatrician #2 made the least number of prescription changes.

2. OTC medication changes

The number of admission OTC medications, the CGS study site (GAU, DH, or PC), and the CGS geriatrician were variables significantly correlated with the number of OTC medication changes that occurred (multiple linear regression $p<0.0001$ - Appendix K). These three variables accounted for 69.2% of the variance in OTC medication changes between admission and discharge.

As was the case with prescription medications, more admission OTC medications increased the likelihood for more changes. Of the three study sites, GAU patients had the most OTC changes, followed by DH patients and then PC patients. The different patient load and assessment focus of the study sites probably contributed to this result. Since PC patients are admitted for rehabilitation, not as many medication changes would be expected. On the other hand, GAU patients are acute care patients and would therefore be expected to have the most medication changes.

Geriatrician #4 made the most OTC changes, geriatrician #3 made fewer changes, and geriatrician #2 made the least number of changes.

3. Total medication changes

Variables significantly correlated with the total number of medication changes that occurred between admission

and discharge included the total number of admission medications, study site, and CGS geriatrician (multiple linear regression $p<0.0001$ - Appendix K). These three variables accounted for 70.0% of the variance in total medication changes between admission and discharge.

Again, more admission medications resulted in more medication changes. As was the case with OTC medication changes, GAU patients had the highest number of total medication changes and PC patients the fewest. The number of changes ordered by each geriatrician were in the order of #3> #4> #1> #2.

5.6.4.2 Between discharge and follow-up

1. Prescription medication changes

The only variable with a significant influence on the number of prescription changes between discharge and follow-up was the number of discharge prescription medications (multiple linear regression $p<0.0001$ - Appendix K). More discharge prescription medications increased the likelihood of subsequent changes. This variable accounted for 56.9% of the variance in prescription medication changes between discharge and follow-up.

2. OTC medication changes

OTC medication changes between discharge and follow-up were significantly influenced by the total number of admission OTC medications and geriatrician-primary physician

contact (multiple linear regression p=0.007 - Appendix K). These two variables accounted for 12.8% of the variance for OTC medication changes between discharge and follow-up.

A patient admitted on more OTC medications had more OTC medication changes after discharge. Patients who consumed more OTC medications before CGS assessment were more likely to start on additional OTC medications after discharge. When geriatricians contacted primary care physicians, continuity of care was enhanced. This contact might have included discussions about needed changes in medication regimens. However, it should be noted that the predictive value of the identified variables is quite low, explaining only 12.8% of the variance in OTC medication changes.

3. Total medication changes

Variables significantly correlated with the number of total medication changes that occurred included the number of total discharge medications and the reported development of new medical conditions (multiple linear regression $p<0.0001$ - Appendix K). These variables accounted for 30.7% of the variance in total medication changes between discharge and follow-up.

More discharge medications and the development of new medical conditions were both related to more medication changes.

Regression analysis failed to identify group (control or intervention) as a significant variable. This demonstrates that the pharmacy discharge summary did not have a significant impact in reducing the number of medication changes that occurred after discharge.

Ideally the final regression results should be tested for their accuracy by applying them to a new group of CGS patients. This could be an objective of future CGS studies.

5.7 Questionnaires

An introductory cover letter, a questionnaire, a stamped return envelope, and a patient's discharge summary were sent to family and referring physicians. In this study, referring physicians were doctors who were not patients' family physicians but who were responsible for referring patients to the CGS.

Three styles of questions were utilized in the questionnaire. One type of question asked for a ranking on a 5 point Likert scale. "Yes" or "no" questions were also used and in two cases, a yes answer required completion of a check list. The last type of question required physicians to choose from an ordered time scale.

In the event that two values were circled on a rating scale, the lowest (most conservative) response was used in analysis.

5.7.1 Response rate

In the GAU and DH, only one initial questionnaire per patient was sent to the patient's family physician. For PC patients, up to two initial questionnaires per patient were sent since one discharge summary may have been sent to the patient's family physician and one may have been sent to the referring physician.

A total of 123 initial questionnaires were sent during the study period. Of these, 49 (25 control & 24

intervention) were for GAU patients. Although there were 51 GAU study cases, not every patient's physician received a questionnaire; four GAU-I patients did not have discharge summaries prepared by August 7, 1992, the closing study date. However, one GAU-C patient had two admissions to the GAU, one just prior to the beginning of the study, and one during the study. In error, a questionnaire was sent with the patient's discharge summary for his pre-study assessment. One questionnaire was also sent to the physician of a non-consenting GAU-I patient (for a total of 49 GAU questionnaires).

All 24 DH (14 control and 10 intervention) patients' physicians received a questionnaire. For PC patients, 50 (25 control & 25 intervention) questionnaires were sent; 19 (10 control & 9 intervention) questionnaires were sent to referring physicians.

The response rate was 60.2% for the initial questionnaires. An additional 44 repeat questionnaires were sent to physicians who had not returned their initial questionnaires within three weeks. This increased the overall response rate to 67.5% (68.8% control & 66.1% intervention). Four responses in the PC-C group and six responses in the PC-I group were from referring physicians.

Response rate in this study was higher than the 48% of physicians that responded to a discharge summary questionnaire in the study by South.[62] However, Bado &

Williams, and Sandler et al. obtained higher response rates of 75% and 78%, respectively on their discharge communication questionnaires.[138,139]

The type of physician targeted and the methods utilized in this study might have enhanced the response rate. Unlike studies which surveyed a random sample of physicians, questionnaires were sent only to physicians of CGS patients in this study. According to Woodward et al., methods to enhance response rate include:

1. use of first class mail;
2. short questionnaires (< 12 pages), appealing cover letters, deadline dates, promises of anonymity;
3. personalization;
4. size, reproduction method, & colour of questionnaire;
5. incentives;
6. avoidance of holidays; and
7. follow-up.[140]

In this research project, all but the inclusion of deadline dates, incentives, and promises of anonymity were incorporated.

5.7.2 Multiple responses from individual physicians

Eighty-one different physicians received questionnaires (Table 5.30). Of these physicians, 24 (29.6%) received more than one initial questionnaire because they referred more than one patient to the CGS. Fifteen of these 24 physicians returned more than one questionnaire. Response rates of those sent only one initial questionnaire and those sent more than one initial questionnaire were not significantly different (Chi-square $p>0.05$).

Table 5.30
Number of Initial Questionnaires Sent
and Returned by Physicians

1 questionnaire sent to 57 MDs		= 57 questionnaires
-0/1 returned = 16 MDs		
-1/1 returned = 41 MDs		
2 questionnaires sent to 14 MDs		= 28 questionnaires
-1/2 returned = 3 MDs		
-2/2 returned = 11 MDs		
3 questionnaires sent to 7 MDs		= 21 questionnaires
-0/3 returned = 1 MD		
-1/3 returned = 4 MDs		
-2/3 returned = 1 MD		
-3/3 returned = 1 MD		
4 questionnaires sent to 1 MD		= 4 questionnaires
-4/4 returned = 1 MD		
6 questionnaires sent to 1 MD		= 6 questionnaires
-4/6 returned = 1 MD		
7 questionnaires sent to 1 MD		= 7 questionnaires
-0/7 returned = 1 MD		
	81 MDs	123 questionnaires

Ideally, only one initial questionnaire should have been sent to an individual physician. Because patient admission to the CGS requires a physician's referral, it was not feasible or desirable to limit the number of patients referred by individual physicians. Physicians who received more than one initial questionnaire did not respond differently about non-patient-specific information on questionnaire #1 (first one sent of those returned) and questionnaire #2 (subsequent one sent of those returned) ($p>0.05$, Wilcoxon signed ranks test) (Table 5.31). These results support the validity of these non-patient-specific questions. Therefore, to prevent excessive weighting of responses provided several times by the same physician, only the first questionnaires ($n= 63$) were used in analyses of non-patient-specific variables. Non-patient-specific variables included those pertaining to the importance of providing different types of medication information in the discharge summary, the importance of geriatrician contact, and the importance of receiving interim (between patient discharge and receipt of the discharge summary) medication information.

Table 5.31
Comparisons of Physician Responses on
Questionnaire #1 and Questionnaire #2

Non-patient-specific questions	p value[a]
Question #6 (Questionnaire A) or Question #7 (Questionnaire B):	
Importance of including the following information in discharge summaries:	
-list of pre-admission medications	0.08
-change(s) of dose of pre-admission medications	0.11
-reason(s) for the change	0.18
-change(s) of dosing interval	0.69
-reason(s) for the change	0.72
-change(s) of route of administration	0.50
-reason(s) for the change	0.69
-medications discontinued during the assessment	0.18
-reason(s) for the discontinuation	0.59
-medications instituted during the assessment	1.00
-reason(s) for the addition	0.36
-any side effects noted	0.27
-blood level of medications	0.94
-medication aide supplied	0.53
-list of discharge medications	0.18
-therapeutic rationale for discharge meds	0.13
Question #8 (Questionnaire A) or Question #9 (Questionnaire B):	
-importance of gerontology consultant contact	0.16
Question #13 (Questionnaire A) or Question #14 (Questionnaire B):	
-importance of receiving medication information between patient discharge and receipt of discharge summary	0.61

a: p-value from Wilcoxon signed ranks test, n=15

5.7.3 Questionnaire results

5.7.3.1 Actual and desired discharge summary receipt times

Physicians were asked to report when they received the patient's discharge summary (actual receipt time) and also when they would have liked to receive the discharge summary (desired receipt time).

Only in the GAU-I group were geriatrician and multidisciplinary summaries sent at different times. So in GAU-I questionnaires, an additional question regarding actual and desired times for receiving not only the geriatrician-prepared summary but also the multidisciplinary summary was included. Results will be presented separately for the GAU-I group.

No discharge summaries were received in less than two days and only three were received within three days (Table 5.32). This probably meant that none were prepared immediately and sent by courier or facsimile transfer (FAX) to the primary care physicians. Within one week, 24% of the GAU-C, DH, and PC discharge summaries had been received. This is higher than the 12% of discharge summaries received within one week in the Penney study.[65] The highest percentage of CGS discharge summaries (37.1%) were received within 8-14 days. Twelve summaries (19.4%) were received more than 21 days after patient discharge. An average of 33.6 (SD=16.6) days elapsed before the receipt of these 12 summaries. Geriatrician-prepared discharge summary receipt

times between study sites and between the control and intervention groups did not differ (two-way ANOVA $p>0.05$).

Table 5.32
Actual Time to Receipt of
DH, PC, & GAU-C Discharge Summaries

Discharge summary receipt time:	Number of Discharge Summaries			
	Total	Site		
		GAU-C	DH	PC
< 2 days	0	0	0	0
2-3 days	3	0	1	2
4-7 days	12	4	2	6
8-14 days	23	4	8	11
15-21 days	12	4	4	4
other (> 21 days)	12	5	1	6
Missing	21	16	0	5
	83	33	16	34

For GAU-I questionnaires, the receipt times of the geriatrician-prepared versus the multidisciplinary-prepared discharge summaries did not differ statistically (Wilcoxon signed ranks $p>0.05$) (Table 5.33).

Table 5.33
Actual Time to Receipt of Geriatrician and Multidisciplinary-Prepared GAU-I Discharge Summaries

Discharge summary receipt time:	Number of Discharge Summaries	
	Geriatrician-Prepared	Multidisciplinary-Prepared
< 2 days	0	0
2-3 days	1	1
4-7 days	3	1
8-14 days	3	3
15-21 days	1	0
other (> 21 days)	3	2
Missing	7	11
	18	18

In DH, PC, and GAU-C responses, a discharge summary received within one week was desired by 73.5% of physicians (Table 5.34).

Table 5.34
Desired Time to Receipt of
DH, PC, & GAU-C Discharge Summaries

Discharge summary receipt time:	Number of Discharge Summaries			
	Total	Site		
		GAU-C	DH	PC
< 2 days	2	0	0	2
2-3 days	12	2	2	8
4-7 days	36	12	10	14
8-14 days	14	3	4	7
15-21 days	2	2	0	0
other (> 21 days)	2	0	0	2
Missing	15	14	0	1
	83	33	16	34

For GAU-I responses, 71.4% desired the geriatrician's summary and 66.7% desired the multidisciplinary summary within a week (Table 5.35).

Table 5.35
Desired Time to Receipt of Geriatrician and Multidisciplinary-Prepared GAU-I Discharge Summaries

Discharge summary receipt time:	Number of Discharge Summaries	
	Geriatrician-Prepared	Multidisciplinary-Prepared
<2 days	1	1
2-3 days	3	3
4-7 days	6	4
8-14 days	3	3
15-21 days	0	0
other (> 21 days)	1	1
Missing	4	6
	18	18

For the geriatrician-prepared GAU and DH discharge summaries, the desired and actual discharge summary receipt times differed significantly [Wilcoxon signed ranks p=0.002 (GAU), p=0.003 (DH)]. This was not the case for PC discharge summaries or for GAU-I multidisciplinary discharge summaries (p>0.05, Wilcoxon signed ranks tests).

The significant differences between desired and actual receipt times for GAU and DH summaries are consistent with results from other studies that showed 33%[59] and 36%[141] of discharge summaries were not received within a time period considered satisfactory by the primary care physician. When the general practitioner resumes responsibility for patient care, delays in discharge summaries may be problematic. Both Mageean and Fair found that patients (53% and 16%, respectively) had contacted their general practitioners before discharge summaries were received.[63,142]

The lack of any significant difference between actual and desired receipt times of PC discharge summaries may be due to site-specific patient population differences. Because PC is a rehabilitation facility, patients usually undergo fewer interventions and treatments than those in the GAU and DH. Therefore, family and referring physicians may not need the PC discharge summaries as urgently as those from the other two sites. PC patients' physicians also had the highest percentage of discharge summaries received within one week (27.6% for PC, 23.5% for GAU, and 18.8% for

DH). Because fewer physicians desired the GAU-I multidisciplinary summary within a week and more multidisciplinary summaries were mailed before geriatrician-prepared summaries, the results of the receipt times of multidisciplinary summaries meeting physicians' expectations is not unexpected.

5.7.3.2 Overall quality of discharge summaries

Physicians were asked to rate the overall quality of the discharge summary on a 5 point Likert scale with only the polar ends labelled (1=poor and 5=excellent). Medians for all questionnaires, all study groups, and all sites were 4, a favourable rating (Table 5.36). The rating for the overall quality of the discharge summary was not significantly different between the control and intervention groups [two-way ANOVA $p=0.35$ (group)]. However, the overall quality of GAU summaries was rated higher than DH summaries [two-way ANOVA $p=0.03$ (site); Tukey's $p<0.05$].

Table 5.36
Quality Ratings for the Discharge Summary[a]

	All Responses	Group		Site		
		Control	Intervention	GAU	DH	PC
Median Overall Quality (Range)	4 (2-5)	4 (2-5)	4 (2-5)	4 (3-5)	4 (2-5)	4 (3-5)
Median Quality of Medication Info (Range)	4 (2-5)	4 (2-5)	4 (3-5)	4 (3-5)	4 (3-5)	4 (2-5)

a: measured on a 5 point Likert scale (1 = poor & 5 = excellent)

DH summaries contained summaries from all disciplines, some of which were handwritten and according to some physicians, difficult to read. GAU summaries contained only typed reports. These differences might account for the significant difference in ratings between the GAU and DH summaries.

The Long & Atkins study also assessed the quality of discharge communications.[59] They found that 80% of general practitioners considered the consultants' communications to

be either fairly or very satisfactory.[59] Those results are similar to the favourable rating of overall quality found in the present study.

5.7.3.3 Medication information provided

Using the same 5-point rating scale, physicians were asked to rate the quality of the discharge summary medication information. Medians for all study groups and sites as well as for all questionnaires were 4 (Table 5.36). The rating of the quality of the medication information provided did not differ statistically between groups or between study sites [two-way ANOVA $p>0.05$ (main effect)].

In the questionnaires sent to the physicians of GAU-I patients, the quality of the geriatrician-prepared and the pharmacist-prepared medication information was addressed by two separate questions. Only in the GAU-I group was the pharmacist-prepared summary sent separately from the geriatrician summary. Because the geriatrician had access to the pharmacy summary when dictating his summary and knew that the pharmacy summary would be part of the discharge summary package for DH-I and PC-I groups, the two questions rating geriatrician and pharmacist-prepared medication information were not used for those groups.

In the GAU-I questionnaires, medians of 4 were reported for the quality of the discharge summary medication information provided by both the geriatrician and the

pharmacist. However, a range of 1-5 was documented for the geriatrician-prepared discharge summaries whereas the range was 3-5 for the pharmacy section of the multidisciplinary discharge summaries. The ranking of the quality of the medication information provided by the two professionals did not differ significantly (Wilcoxon signed ranks p=0.18). Of 11 questionnaires that provided responses for both variables, six questionnaires had a tied rating, four questionnaires rated the pharmacist-prepared information higher, and one questionnaire rated the geriatrician-prepared information higher.

Since there was no statistically significant difference between the control and intervention groups for the rating of the quality of medication information provided, the pharmacy discharge summary intervention appears to have had no substantial impact. However in the GAU-I questionnaires where it was possible to compare the quality ratings of the geriatrician-prepared versus the pharmacist-prepared medication information, more questionnaires rated the pharmacist-prepared information as better. Perhaps the low number (11) of responses precluded the possibility of finding any statistically significant difference.

In the current study, only a general rating of medication information quality was obtained and the quality of specific aspects of medication information was not addressed. Other studies have assessed the quality of

specific types of medication information. In a study assessing the quality of medication information contained in discharge summaries, Tulloch et al. reported that drug reactions were under-reported and discharge treatment information was often inadequate.[61] In Harding's questionnaire study, general practitioners expressed concern about the lack of information in discharge communications about drug regimens, especially drug additions and discontinuations.[141] Insufficient details in discharge communications affected the management of 13.8% of their cases. Sandler et al. conducted a questionnaire survey on the utility of a patient information card.[139] The card contained four sections: "personal details", "general practitioner information", "information given to the patient", and "details of discharge medication". The "details of discharge medication" section provided information on medication names, doses, administration times, reasons for the medication, special instructions, duration of supply, and instructions on what to do upon completion of the supply. This card served as a patient information sheet and as the interim discharge summary for general practitioners. Ninety-two percent of general practitioners rated this card as very or quite helpful.

5.7.3.4 Medication information desired

Physicians were asked to rank on a 5 point Likert scale (1=not important and 5=very important) the importance of including various types of medication information in discharge summaries (Table 5.37). Because this was a non-patient-specific question, only physicians' first questionnaire responses were used in the analyses. For all 63 questionnaires, a median rating of 5 (very important) was assigned to the following medication information categories:

-change of dose of pre-admission medications
    -reason(s) for the change

-medications discontinued during the assessment
    -reason(s) for the discontinuation

-medications instituted during the assessment
    -reason(s) for the addition

-list of discharge medications
    -therapeutic rationale for discharge medications

The lowest median value of 3 was recorded for the importance of reporting blood levels of medications in the discharge summary.

Table 5.37
Importance of Including Different Types of Medication Information in Discharge Summaries[abc]

Type of Medication Information:	Overall	Group		Site		
		Control	Intervention	GAU	DH	PC
List of pre-admission medications	4 (1-5)	4 (1-5)	4 (1-5)	4 (1-5)	4 (3-5)	4 (2-5)
Changes of dose of pre-admission medications	5 (2-5)	5 (2-5)	4 (3-5)	5 (2-5)	4 (3-5)	4 (3-5)
-reasons for change	5 (2-5)	5 (2-5)	4 (3-5)	5 (2-5)	4 (3-5)	4 (3-5)
Changes of dosing interval of pre-admission medications	4 (1-5)	5 (1-5)	4 (3-5)	5 (2-5)	4 (3-5)	4 (1-5)
-reasons for change	4 (1-5)	4.5 (1-5)	4 (2-5)	5 (2-5)	4 (2-5)	4 (1-5)
Changes of route of administration of pre-admission medications	4 (1-5)	4 (1-5)	4 (3-5)	5 (2-5)	4 (4-5)	4 (1-5)
-reasons for change	4 (1-5)	4 (1-5)	4 (2-5)	5 (2-5)	4 (2-5)	4 (1-5)
Medications discontinued[d]	5 (3-5)	5 (3-5)	4 (3-5)	5 (3-5)	4 (4-5)	5 (3-5)
-reasons for the discontinuation	5 (3-5)	5 (3-5)	4 (3-5)	5 (3-5)	4.5 (4-5)	5 (3-5)
Medication instituted[d]	5 (3-5)	5 (4-5)	4 (3-5)	5 (4-5)	5 (4-5)	5 (3-5)
-reasons for the addition[d]	5 (3-5)	5 (4-5)	4 (3-5)	5 (4-5)	5 (4-5)	5 (3-5)
Side effect noted[d]	4 (2-5)	5 (3-5)	4 (2-5)	4 (3-5)	5 (2-5)	4 (3-5)
Blood medication levels	3 (1-5)	3 (1-5)	3 (1-5)	3 (1-5)	3 (1-5)	4 (1-5)
Medication aide supplied	4 (1-5)	4 (1-5)	4 (2-5)	4 (1-5)	3.5 (1-5)	4 (1-5)
List of discharge medications	5 (3-5)	5 (4-5)	5 (3-5)	5 (4-5)	5 (4-5)	5 (3-5)
-therapeutic rationale for discharge[e] medications	5 (2-5)	5 (2-5)	4 (3-5)	5 (3-5)	4 (3-5)	4 (2-5)

a: measured on a 5 point Likert scale (1 = not important & 5 = very important)
b: n = 63 questionnaires
c: median (range)
d: $p<0.05$ between control and intervention groups
e: $p<0.05$ between study sites

Physicians whose patients were in the control group rated the importance of several types of information higher than physicians with intervention group patients [$p<0.05$ (group) for two-way ANOVA tests]. These types of information included: medication(s) discontinued, medication(s) added, reason(s) medication(s) added, and side effects noted. Lack of this information in control group summaries might have prompted the differences in importance ratings because intervention group discharge summaries had this information in the pharmacy summary.

Physicians rated the importance of providing the therapeutic rationale for discharge medications higher for GAU patients than for PC patients [two-way ANOVA $p=0.03$ (site); Tukey's $p<0.05$]. This might be due to site-specific population differences. PC patients are primarily rehabilitation patients whereas GAU patients are acute care patients. To continue care of acute care patients, family physicians might require more medication information.

To determine types of medication information physicians desired in discharge communications, Bado & Williams sent questionnaires to general practitioners who had referred patients to an oncology unit.[138] Information in discharge summaries about drugs used in chemotherapy, doses, and potential side effects were rated as essential by 82%, 68%, and 41% of respondents, respectively. These results are

similar to our study results in that information on drugs used and doses were deemed to be the most important.

Some reports on discharge summary preparation have recommended listing only the discharge medications.[68,143] Penney, however, suggested the reporting of admission as well as discharge medications.[144] Stevenson et al. recommended that discharge drugs should not only be listed but should be referenced to a medical problem with the reason for drug initiation and the duration of administration provided.[111] Our study shows that physicians considered not only the inclusion of discharge medication information as very important but also information on dosage changes, drug additions, and drug discontinuations.

5.7.3.5 Medication changes

There were four items on the questionnaire which dealt with medication changes. Three of these questions used a 5 point Likert scale (1=strongly disagree and 5=strongly agree) to measure a physician's agreement to the following statements:

- -the medication changes implemented for my patient were rational;
- -reasons for changes in medications were provided; and
- -it would be useful if more information was provided explaining the rationale for medication changes.

Medians of 4 were reported for the first two items for all questionnaires and for all groups and sites. These results

indicate consistent agreement that medication changes were rational and reasons for these changes were provided (Table 5.38). With the exception of PC where the median response was 2, median ratings were 3 for all groups and sites for the statement regarding the usefulness of providing more information on the rationale for medication changes.

The responses to these three statements did not differ statistically between groups or sites ($p>0.05$, two-way ANOVA). The lack of differences between the control and intervention groups demonstrate that the pharmacy discharge summary did not affect the responding physicians' answers to these three statements.

Table 5.38
Physicians' Responses to Items about Medication Changes[ab]

Questionnaire Item	All Responses	Group		Site		
		Control	Intervention	GAU	DH	PC
-Medication changes rational	4 (2-5)	4 (2-5)	4 (2-5)	4 (2-5)	4 (3-5)	4 (2-5)
-Reasons for changes provided	4 (1-5)	4 (1-5)	4 (1-5)	4 (1-5)	4 (2-5)	4 (1-5)
-Useful if more information provided	3 (1-5)	3 (1-5)	3 (1-5)	3 (1-5)	3 (1-5)	2 (1-5)

a: measured on a 5 point Likert scale
(1 = strongly disagree & 5 = strongly agree)
b: Median (range)

A fourth question asked whether the primary care physician anticipated any changes to the patient's medication regimen over the next three months, given the patient's current medical status. The question required a yes or no answer. If the physician answered yes, types of anticipated changes were to be identified. Choices included addition of medications, discontinuation of medications, and/or change(s) in medication regimen (dose, interval, and/or route of administration). Anticipated need for medication changes was addressed so that answers could be compared to what actually occurred with patients' medication regimens three months after CGS discharge. In 73.4% of the questionnaires, physicians anticipated no changes to their patients' medication regimens (Table 5.39). Anticipated need for medication change did not differ significantly between the control and intervention groups within each study site ($p>0.05$, Fisher exact test). There was no statistically significant association between the physician's anticipated need for medication changes with actual medication change occurrence (phi coefficient $p=0.86$). Responding physicians therefore appeared unable to accurately anticipate the likelihood of medication changes.

Table 5.39
Anticipated Number of Changes in Patients' Medication Regimens Over a Three Month Period

Types of change anticipated	All Responses	Site					
		GAU[a]		DH[b]		PC[c]	
		C	I	C	I	C	I
Addition of medications	5	2	0	1	0	1	1
Discontinue medications	3	0	0	1	0	1	1
Change medication regimen	6	2	1	0	0	0	3
Add & DC	3	0	2	0	0	1	0
Add & change	2	2	0	0	0	0	0
DC & change	1	1	0	0	0	0	0
Add, DC, & change	1	0	0	0	0	1	0
Total number of anticipated changes	21	7	3	2	0	4	5
Total number with no changes anticipated	58	12	10	7	7	10	12
Missing	4	0	1	0	0	2	1
	83	19	14	9	7	16	18

a: p = 0.47 (Fisher exact)
b: p = 0.48 (Fisher exact)
c: p = 1.00 (Fisher exact)

DC: discontinue

5.7.3.6 Contact by the CGS

CGS physicians are encouraged to contact the primary care physician upon patient discharge. A "yes" or "no" question was asked on the questionnaire to ascertain if the geriatrician had contacted the primary care physician. Contact was defined as the discussion via a telephone call or in person of the patient's medication therapy either during the assessment or upon the patient's discharge. This was followed by a question asking the physician to rate the importance of this type of contact on a 5 point Likert scale (1=not important and 5=very important). Since this was a non-patient-specific question, only a physician's first questionnaire response was used (n=63 questionnaires).

Of those responding, 87.3% were not contacted by the CGS physician about the patient's medication therapy (Table 5.40). Contact did not differ significantly between the control and intervention groups within each study site ($p>0.05$ for all Chi-square tests).

Table 5.40
Number of CGS Geriatrician-Primary Physician Contacts to Discuss Medication Therapy

Contact	All Responses	Site					
		GAU[a]		DH[b]		PC[a]	
		C	I	C	I	C	I
YES	10	5	1	1	0	2	1
NO	69	14	13	7	7	13	15
	79						

a: χ^2, $p>0.05$
b: Fisher exact , $p>0.05$

Goldman et al.[54] and Pupa et al.[57] cited effective communication by personal contact with the referring physician as a means to maximize compliance with consultation recommendations. The 12.7% contact rate obtained in the present study is higher than that reported by Long and Atkins.[59] In their study, only 3% of hospital consultants (not specifically geriatricians) contacted general practitioners about a patient's treatment. However, 67% of consultants and 58% of general practitioners identified a need for communication between consultants and general practitioners when patients are hospitalized.

The median responses for rating the importance of CGS physician contact were 2 for the GAU-I and PC-C groups, and 3 for all other groups. The responses to this question differed between the control and intervention groups based on where the patient was assessed [two-way ANOVA p=0.03

(interaction)]. In the GAU and DH, the importance of contact was rated higher for the control than for the intervention group, but in PC, a higher rating was reported for the intervention group.

Since the control group did not receive the intervention pharmacy discharge summary, primary care physicians of control group patients might have wanted contact to discuss and clarify their concerns regarding medication therapy.

5.7.3.7 Interim medication information provided

The last set of questionnaire items addressed provision of interim medication information between patient discharge and receipt of the discharge summary. A "yes" or "no" question asked if interim information was provided. If the response was yes, the physician was asked to indicate how the information was provided (telephone call, personal communication, interim letter, document sent with the patient, or multidisciplinary discharge summary). The last choice was only available in GAU-I questionnaires. Respondents who answered yes, were also instructed to rate the quality of information provided. All physicians were asked to rate the importance of receiving interim medication information.

Of the 78 respondents, 74.4% did not receive any interim medication information (Table 5.41). The responses provided by the GAU-I respondents were unexpected. Given that in this group, multidisciplinary summaries with a pharmacy section preceded the geriatrician summaries, one would have expected all 13 GAU-I responses, and not only one, to have indicated that the multidisciplinary summary was received. Therefore, the question was not valid, physicians did not notice or remember the pharmacy discharge summary, or physicians did not consider the multidisciplinary summary as interim medication information. No significant differences in the numbers receiving interim information occurred between groups within each study site ($p>0.05$ for all Chi-square tests).

Only 17 of 20 questionnaire respondents who reported receiving interim information rated the quality of the information they received. A median of 4 was obtained for these 17 responses. On this 5 point Likert scale 1 was designated as "poor" and 5 was "excellent". Since no physicians indicated that personal communication was received and many may not have considered the multidisciplinary summary as interim information, the quality of these two types of interim information was probably not represented with this rating. The rating of this variable did not differ significantly between groups or between sites [two-way ANOVA $p>0.05$ (main effect)].

Table 5.41
Numbers Receiving Interim (between patient discharge and receipt of discharge summary) Medication Information

Method of provision	All Responses	Site					
		GAU[a]		DH[b]		PC[c]	
		C	I	C	I	C	I
Phone call	9	5	0	2	0	1	1
Personal communication	0	0	0	0	0	0	0
Interim letter	3	1	0	1	0	0	1
Document sent with patient	5	3	2	0	0	0	0
Call & letter	1	1	0	0	0	0	0
Call & document	1	0	0	0	0	0	1
Letter & multi-disciplinary summary	1	0	1	0	0	0	0
Total number with interim information received	20	10	3	3	0	1	3
Total number with no interim medication information received	58	8	10	6	6	15	13
Missing	5	1	1	0	1	0	2
	83	19	14	9	7	16	18

a: χ^2 p=0.15
b: χ^2 p=0.60
c: χ^2 p=0.60

A 5 point Likert scale with 1 representing "not important" and 5 representing "very important" was utilized to assess a physician's rating of the importance of receiving interim medication information. Since this was a non-patient-specific question, only physicians' first questionnaire responses were utilized in the analysis (n=63 questionnaires). An overall median response of 4 was obtained (Table 5.42). The rating varied between the control and intervention groups depending on the assessment site [two-way ANOVA p=0.03 (interaction)]. The rating of the importance of receiving interim medication information had exactly the same result as the rating of the importance of geriatrician contact. A higher rating occurred in the control than in the intervention group for GAU and DH respondents, but in PC respondents a higher rating was found in the intervention group.

Table 5.42
Primary Care Physicians' Ratings of the Importance of Providing Interim Medication Information[a]

	All Responses	Site					
		GAU		DH		PC	
		C	I	C	I	C	I
Median	4	5	4	4	3	3	4
Range	(1-5)	(1-5)	(1-5)	(2-5)	(1-4)	(1-5)	(2-5)

a: measured on a 5 point Likert scale (1 = not important & 5 = very important)

In the GAU-I patients, a pharmacy medication summary was provided as additional interim medication information. This might have accounted for the difference in ratings between the GAU-C and GAU-I groups. It is unclear why there were significant differences between DH and PC control and intervention groups.

CHAPTER 6

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Altered pharmacokinetic and pharmacodynamic characteristics of drugs, increased susceptibility to side effects and adverse drug reactions, polypharmacy, increased occurrence of drug interactions, and noncompliance are problems associated with drug treatment in the elderly. These problems are especially important in light of the fact that elderly patients consume disproportionately more medications than younger patients. Medication use, therefore, is a focus of geriatric assessment services.

A number of studies have shown that geriatric assessment is effective in decreasing the number of medications, simplifying drug regimens, and improving drug therapy. However, very little information has been provided about how drug therapy was improved or what types of medications were being altered. Only three geriatric assessment studies have determined compliance with medication recommendations by assessing medication regimens post-discharge.

Compliance rates may be enhanced with effective communication between the geriatric assessment team and the patient's primary care physician. The discharge summary is the most commonly used communication medium. However,

studies have demonstrated that discharge summaries may have deficiencies.

Given the above, the objectives of this study were to determine the nature of CGS medication changes, to ascertain patients' medication regimens three months post-discharge, to determine variables significantly correlated with the number of changes occurring post-discharge, and to assess the impact of a pharmacist-prepared medication discharge summary (=intervention). The impact of the summary was determined by comparing compliance with CGS recommendations pre- and post-intervention as well as obtaining physicians' opinions of the discharge summary.

To achieve these objectives, a six month study was conducted. Consenting patients recruited in the first 1.5 months constituted the control group. Consenting patients recruited in the subsequent 1.5 months made up the intervention group. Patients' pre-admission medications and demographic characteristics were determined. Patients underwent geriatric assessment and their discharge medications and study characteristics were noted. Upon discharge, a multidisciplinary summary (including a pharmacy discharge section for intervention patients) and a study questionnaire were sent to the patient's primary and referring physicians. To determine follow-up information three months post-discharge, visits to homes, nursing homes,

and hospitals were made for patients living in Saskatoon, and telephone calls were used for all other patients.

A total of 104 patients (106 study cases) participated in the study. The mean age of the study population was 80.6 years and 68.3% were female. Approximately 75% of patients had never undergone geriatric assessment and 25% were readmission or follow-up patients. There were no statistically significant differences in demographic characteristics between the control and intervention groups.

Patients were admitted on an average of 5.5 total medications. A number of significant differences were noted between groups on admission. Females were admitted on more total-OTC medications. Younger patients (65-74 years) were on more total-Rx medications than older patients ($\geq$ 75 years). Patients admitted from institutions were on more sch-OTC medications than patients admitted from home.

Control group patients were admitted on more total-OTC, prn-OTC, total-meds, and total-prn medications than intervention group patients. More GAU-C than GAU-I patients experienced polypharmacy, the use of five or more total-sch medications.

On admission, differences between sites were also noted. PC patients were taking more total-OTC and total-meds than GAU patients who were taking more than DH patients. The differences noted between sites may be due to differences in patients' pre-admission locations. The

majority of PC patients were admitted from hospitals. Hospitalized patients are often admitted on more medications.

The average length of CGS assessment was 49 days. By discharge, more patients were discharged home or to private care homes than to institutions and fewer were living alone. FIM scores (rehabilitation instrument) improved significantly for PC patients.

The average number of total discharge medications was 4.3. Of borderline significance was the higher number of total-prn medications in females and in younger (65-74 years) as compared to older (>85 years) patients. Institutionalized patients were on more total-OTC and sch-OTC medications.

Between admission and discharge, there was a 22% reduction in medication use. This result indicates that CGS assessments are effective in decreasing medication use.

Information obtained on follow-up lends support to the theory that control group patients may have been sicker than intervention group patients. Significantly more control group patients required hospitalization after discharge. Three deaths occurred between discharge and follow-up; all three were control patients. Significantly more GAU-C than GAU-I patients required institutionalization and experienced polypharmacy after discharge.

Patients were receiving an average of 5.5 total medications on follow-up. This number is identical to that recorded on admission. Despite reductions in medication use during assessment, it appears that these reductions are not maintained by three months post-discharge.

For most medication categories (with the exception of sch-OTC and total-sch medications), the number of medications was significantly different between admission, discharge, and follow-up. For some of the medication categories, the difference in number of medications between admission and discharge was only significant in control patients. This may be due to the statistically higher number of admission medications documented in control patients.

Between admission and discharge, more medications were discontinued than were added in CGS patients. The number of medication changes between admission and discharge were, for some categories, different between groups and sites. These differences probably reflect differences in baseline admission medication numbers between groups and sites.

The number of Rx, OTC, and total medication changes between admission and discharge were significantly correlated with the total number of admission medications and which geriatrician treated the patient. The assessment study site affected the number of total and OTC medication

changes; admission class (first assessment or not) affected the number of prescription medication changes.

Between discharge and follow-up, more prescription and OTC drugs were added than were deleted. For prescription drugs, more doses were increased. However, for OTC medications, more doses were decreased and more drugs were consumed less frequently.

The only variable which significantly affected the number of Rx, OTC, and total medication changes between discharge and follow-up was the total number of discharge medications. The reported development of a new medical condition and geriatrician-physician contact were significantly correlated with the number of total and OTC medication changes, respectively.

Follow-up and admission medication regimens were compared. For prescription medications, more drugs were stopped, more doses decreased, and more drugs were administered less frequently at follow-up. However, for OTC medications more drugs were added and given more frequently. This may reflect physicians' inability to control OTC consumption.

In addition to numbers of drugs used, the costs and the therapeutic agents prescribed were also studied. No significant differences in scheduled medication costs were noted between time periods.

Marked changes were noted in the choice of therapeutic agents prescribed after assessment. The use of narcotics, antidepressants, antipsychotics, and benzodiazepines decreased after assessment. By discharge, nortriptyline and fluvoxamine were the most commonly used antidepressants. Haloperidol was the most frequently prescribed antipsychotic. Temazepam and alprazolam were the most frequently prescribed benzodiazepines. The use of laxatives and cimetidine decreased by discharge. Prescribing of cardiovascular medications decreased during CGS assessment. Use of digoxin accounted for 24.7% of total cardiovascular medications on admission, 28.0% on discharge, and 26.8% by follow-up. Prescribing of diuretics decreased between admission and discharge. During geriatric assessment, changes occurred in the choice of oral hypoglycemic agents prescribed. No patients were discharged on chlorpropamide or tolbutamide. The use of glyburide and metformin increased. For a number of OTC classes (e.g. vitamins, antitussives/expectorants/mucolytics, and antihistamines) use decreased during assessment but many patients began to use these agents again after discharge.

To assess physicians' opinions of the CGS discharge summary, a questionnaire was sent to referring and primary care physicians along with patients' discharge summaries. A response rate of 67.5% was obtained.

Twenty-four percent of summaries were received within one week and 37.5% within 8-14 days. In the GAU and DH, physicians received the discharge summary later than they considered desirable, but at PC, there was no significant difference between desired and actual receipt times. This may be due to the type of patients assessed in the facility (rehabilitation patients undergoing fewer medical interventions).

Median ratings for the overall quality of the discharge summary and the quality of medication information provided were 4 (1=poor and 5=excellent). Ratings for GAU summaries were higher than for DH summaries. This may have been because DH summaries contained some handwritten material that physicians found difficult to read. Although not statistically significant (possibly due to the small sample size of 11), the quality of pharmacist-prepared medication information was more often ranked higher than geriatrician-prepared medication information.

Physicians rated as "very important" the inclusion of information in discharge summaries about discharge medications along with their therapeutic rationale, changes in dose and reasons for this change, medications discontinued and reasons for the discontinuations, and medications added and reasons for the additions. The importance of providing information on the therapeutic rationale for discharge medications was rated higher in GAU

than in PC responses. To continue care of acute care patients, family physicians may require more medication information.

Median responses of 4 (1=strongly disagree and 5=strongly agree) were obtained for statements that "medication changes were rational" and "the reasons for medication changes were provided". A median response of 3 (on the same 5 point Likert scale) was documented for the usefulness of providing more medication information.

Approximately 75% of physicians anticipated no changes in their patients' medication regimens over a three month period. However, more changes occurred than they predicted.

Only 12.7% of primary care physicians indicated that they had been contacted by the geriatrician but the median rating of importance of contact was only 2 or 3 (1=not important and 5=very important). Only 25.6% of physicians indicated they received interim medication information after patient discharge and before arrival of the geriatrician summary. The quality of the information received was ranked a median of 4 (1=poor and 5=excellent).

One of the study objectives was to assess the impact of the pharmacy discharge summary. The lack of impact of this summary was demonstrated by the medication number and cost results between discharge and follow-up (no significant differences between the control and intervention groups). However, differences between the control and intervention

groups in appropriateness of therapy at follow-up, and costs associated with medication changes (e.g. administration costs, costs associated with re-hospitalization due to adverse drugs reactions, quality of life, etc.) were not assessed in this study.

Polypharmacy occurred less frequently in intervention patients. However, because the control group may have been sicker (possible selection bias), it was difficult to determine if this result was actually due to the presence of the pharmacy discharge summary.

More primary care physicians ranked the quality of the medication information prepared by a pharmacist higher than that prepared by the geriatrician. However, possibly due to the small sample size (n=11), this difference was not statistically significant. Control group physicians ranked the need for several items higher than intervention group physicians. These items included information in discharge summaries about medications discontinued, medications added and the reasons for the additions, and side effects experienced. The need for geriatrician-physician contact and the importance of provision of interim information was also ranked higher by control group physicians. This may be indirect evidence for the need for a more complete medication summary which could be prepared by a pharmacist. With a larger sample size, the positive effect of the pharmacy discharge summary may be demonstrated.

6.1 Limitations & bias

Several limitations occurred in the research design of this study. Caution should, therefore, be exercised when drawing conclusions from the results.

Limitations occurred with some of the statistical analyses. First, t-tests and one-way ANOVA instead of three-way ANOVA were used to compare differences in medication numbers between sexes, age groups, and those institutionalized versus those living at home. Three-way ANOVA could not be used because there were too many cells of unequal size. Second, Likert scale questionnaire results were analyzed using two-way ANOVA. Since the Likert scale is not truly a continuous scale, a nonparametric statistical test should have been utilized. However, because no comparable nonparametric test exists and the use of multiple nonparametric tests would increase type I error, two-way ANOVA was used. Lastly, with so many different drug categories used in this study, the use of many statistical tests increases the likelihood of Type I error.

Different methods by which admission and follow-up medication information were obtained may also have affected the results. It is likely that the home visits on follow-up provided more medication information.

Because some of the study patients had memory deficits (average admission MMSE score = 22.8), self-reports of the development of new medical conditions, the number of

physician visits and hospitalizations may not have been accurate. However, in cases where the reliability of the patient's response was questionable, other information sources (e.g. next of kin) were consulted.

More than one initial questionnaire was sent to physicians who referred more than one study patient. This could be problematic in that excessive weight may be given to responses provided by the same physician. In the current research, this was dealt with by utilizing only the first response from each physician for patient non-specific questions. Unfortunately, the date that questionnaires were returned was not recorded. Therefore, an assumption had to be made that the first questionnaire sent of those returned was actually the first questionnaire returned.

The potential for bias, both selection and information bias, should also be considered. Selection bias occurs during the recruitment of study patients. In prospective studies, one way of minimizing selection bias is via randomization. In this study, it was not possible to randomly allocate patients to the intervention group without jeopardizing geriatrician blinding. Unfortunately, there were differences in admission and follow-up characteristics between the control and intervention groups. Controls may have been a sicker group of patients. Control group patients were on significantly more admission medications (in some categories) and incurred higher OTC medication

costs. Significantly more control patients required hospitalization after discharge and all patients who died were control group patients.

Non-response bias is another potential selection bias that may have occurred with the questionnaires. It is possible that questionnaire responders were different from non-responders. The rate of response did not differ between groups since the response rate of 68.8% in the control group was not statistically different from the intervention group response rate of 66.1%.

Two types of information bias (interview and "lost to follow-up") should be considered. One way of minimizing interview bias is via blinding, but investigator blinding was not possible in this study due to the lack of funding for additional personnel. Therefore, to minimize interview bias a set follow-up interview was used in all study cases, and the method of follow-up and source of follow-up information did not differ significantly between the control and intervention groups.

Four GAU-C patients and one DH-I patient were lost to follow-up. However, there appeared to be no major differences in admission and discharge characteristics of patients lost to follow-up when they were compared to the rest of the study population.

6.2 Recommendations for future studies

Because of limitations in the study design, control and intervention groups may not have been comparable. Therefore, to validate the results of this study, some changes in the research design would improve the quality of future studies. Instead of utilizing a number of different methods to obtain medication information, home visits should be made twice, once before admission and once at follow-up. Stratified random sampling of patients on the variables sex, age group, and living location would allow for analysis with three-way ANOVA. Permission to send pharmacist-prepared discharge summaries without a geriatrician's signature would allow for random assignment of the intervention without compromising geriatrician blinding. Random allocation of patients to the control or intervention groups would serve to minimize both selection and confounding bias. Successful randomization would distribute potential confounders equally between the control and intervention groups. Documentation of the number of as-needed doses actually consumed would provide more reliable medication numbers and cost data at all stages. Validation of medication information, the number of physician visits, the number of hospitalizations, and the existence of new medical conditions using health data base information and chart reviews would be desirable.

Further study to establish the validity and reliability of the questionnaire should be performed. If the

questionnaire was modified so that summative analysis of the Likert scale results could be performed, statistical testing with two-way ANOVA would no longer be a limitation. To improve this instrument, deadline dates, incentives, and promises of anonymity should be added to increase the response rate. The primary care physicians' opinions of the utility of the pharmacy discharge summary should be assessed with a "yes" or "no" question. The validity and reliability of the Functional Independence Measure could also be tested. Further study is also required to determine the predictive value of the multiple linear regression results.

Other topics for potential future research include an evaluation of the medication regimens of groups receiving and not receiving geriatric assessment. It may also be desirable to study some of the other services offered by the CGS (e.g. inpatient hospital consultations, outpatient consultations, & service outreach programs) to determine what types of medication changes occur in these sites during assessment and after discharge. Since appropriateness of therapy was not directly assessed in this study, future studies to determine the appropriateness of treatment after geriatric assessment and the outcomes of the medication changes (e.g. re-hospitalizations due to adverse drug reactions) are also warranted.

6.3 Recommendations for the CGS

Based on the questionnaire results, some changes to the discharge summaries prepared by the CGS should be implemented. Because physicians of GAU and DH patients reported that discharge summaries were not received within a desirable time period, quicker discharge summary preparation is needed in these two sites. To prevent criticisms of illegible handwriting, all DH summaries should be typed. Also all future discharge summaries should contain information on dosage changes, drug additions, and discontinuations and the rationale for these changes, and a list of discharge medications along with their therapeutic indications.

In this study, only 10% of patients continued to receive care from the CGS after discharge. Continued follow-up of all patients after discharge should be considered. Follow-up may prevent the increased use of OTC medications that were noted in this study. The pharmacist, as a member of the multidisciplinary team, may have a role in these follow-up evaluations.

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Appendices

Appendix A

Study forms:

-admission study form
-patient consent form
-discharge study form
-nursing discharge study form
-follow-up study form

Admission study form

STUDY FORM #1 (ADMISSION)

Patient Name _____

Patient Study # _____ Hosp # _____ Sask Health # _____

Contact # of Next of Kin: _____

Facility Code ___ Admission Date: ___ ___ ___
1: inpatient GAU
2: Day Hospital
3: Parkridge

Admission Class ___
1: first assessment
2: follow-up (Day Hospital and Parkridge Only)
3: readmission

Birthdate: ___ ___ ___ Sex: ___ 1: Male 2: Female

Race/Ethnicity: ___ English Language: ___
1: White 2: Black 1: yes 2: no 3: partial
3: Asian 4: Native Indian
5: Other

Marital Status: ___ Admission MMSE: _____
1: Single 2: Married
3: Widowed 4: Separated
5: Divorced

Living Arrangement:

a. Setting:

Pre-hospital: ___ ___ Admit from: ___ ___

01: home
02: acute unit - Royal University Hospital
03: acute unit - another hospital
04: level 2 nursing home
05: level 3 nursing home
06: level 4 nursing home
07: levels 2 & 3 nursing home
08: levels 3 & 4 nursing home
09: levels 4 & 5 nursing home
10: levels 1,2, & 3 nursing home
11: levels 2,3, & 4 nursing home
12: respite
13: private care home
14: rehabilitation facility (ie. GRU at Parkridge
15: other

b. Living With:

Pre-hospital: ___

1 : alone
2 : family/relatives
3 : friends
4 : attendant
5 : other

c. Centre: ___

1 : urban
2 : rural

Referring or primary care physician : Name: _____
Specialization: GP _____ or other _____
Telephone # _____

Chief reason(s) for referral or admission:_____

Medication History:

Source(s): ___ ___ ___ ___

1 : meds brought in
2 : patient profile from another institution/unit
3 : Senior's Medication Diary
4 : Admission Data from hospital chart
5 : other

NAME	STRENGTH	ROUTE	INTERVAL

Patient consent form

INFORMED CONSENT FOR:

STUDY OF DRUG USE PATTERNS IN A CLINICAL GERONTOLOGY CONSULTATION SERVICE

I, _____ hereby allow Ms. M. Chan, Dr. W.E. DeCoteau, Dr. S. Bose, Dr. S. Chandrakumar, Dr. Khawar and their associates to include me in the study. _____ has explained the purpose of this study and the contents of this consent to me.

The purpose of this study is to evaluate drug use after discharge from a geriatrics service. Potential benefits of this study will be increased knowledge of patterns of drug use after discharge from hospital and evaluation of methods to improve communication between hospital physicians and general practitioners. This study will include patients of the Clinical Gerontology Service at Royal University Hospital and Parkridge. Should you choose to participate, you will be asked at discharge to provide information regarding your discharge location. Three months after your discharge, a researcher will contact you at your residence, by phone, or upon a return visit to the Clinical Gerontology Service. At that time, information will be obtained regarding your medication use, # of physician visits, and the development of any new diseases or disorders. This should not take longer than 10 minutes.

This study will in no way interfere with the course of your treatment in the geriatrics service. Your geriatric physician will maintain the responsibility of providing the best available medical treatment for you.

Should you decide to participate in the study it will be necessary to obtain your name, address, and phone number for contact purposes. Information collected may be used by Ms. M. Chan, Dr.W.E. DeCoteau, Dr. S. Bose, Dr. S. Chandrakumar, and Dr. Khawar in their study of Drug use patterns in a clinical gerontology consultation service. Confidentiality is assured as no names or personal information will be released. You will be advised of any new information that will have a bearing on your decision to continue in the study.

You are not obligated to continue in the study if you change you mind about participating at a later date. Refusal to participate in this study will in no way adversely affect the quality of care you receive.

If you have any questions or require further information, please feel free to contact Ms. M. Chan at 966-6327.

I agree to participate in the study as outlined above. I understand that I have the right to withdraw that permission at any time. I have received a copy of this consent.

Signature: _____

Researcher: _____

Witness: _____

Date: _____

Individual preference for contact time:

Day: _____

Time: _____

Phone #: _____

Address: _____

_____

_____

Discharge study form

STUDY FORM #2 (DISCHARGE)

Patient Name: _____

Patient Study #: _____ Hosp #: _____

Discharge Date: ___ ___ ___ Discharge MMSE: _____

Discharge Living Arrangements:

a. Setting: ___ ___

01: home
02: acute unit - Royal University Hospital
03: acute unit - another hospital
04: level 2 nursing home
05: level 3 nursing home
06: level 4 nursing home
07: levels 2 & 3 nursing home
08: levels 3 & 4 nursing home
09: levels 4 & 5 nursing home
10: levels 1,2, & 3 nursing home
11: levels 2,3, & 4 nursing home
12: respite
13: private care home
14: rehabilitation facility (ie. GRU at Parkridge)
15: other
16: deceased

b. Living With: ___

1 : alone
2 : family/relatives
3 : friends
4 : attendant
5 : other

c. Centre: ___

1 : urban
2 : rural

Location of Discharge:
Address: _____

_____

_____

_____

Phone #: _____

Current Disease States:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Medications patient on after assessment completed:

NAME STRENGTH ROUTE INTERVAL

Medication changes recommended in consult but not implemented during the assessment:

Nursing discharge study form

INPATIENT CODING SHEET
(to be completed by nursing prior to discharge)

1. Facility Code: ___
   1: inpatient GAU
   2: day hospital
   3: Parkridge

2. Patient Name:_____
   &
   PIN #: _____

3. Admission Date: ___ ___ ___

4. Discharge Date: ___ ___ ___

5. Admission Class: ___
   1: first assessment
   2: follow-up (Day Hospital and Parkridge Only)
   3: readmission

6. Birthdate: ___ ___ ___

7. Race/Ethnicity: ___
   1: White 2: Black
   3: Asian 4: Native Indian
   5: Other

8. Sex: ___
   1: Male 2: Female

9. English Language: ___
   1: yes 2: no 3: partial

10. Marital Status: ___
    1: single 2: married
    3: widowed 4: separated
    5: divorced

11. Living Arrangements:

a. Setting:
Pre-hosp: ___ ___ Admit from: ___ ___ Discharge: __ __

01: home
02: acute unit - Royal University Hospital
03: acute unit - another hospital
04: level 2 nursing home
05: level 3 nursing home
06: level 4 nursing home
07: levels 2 & 3 nursing home
08: levels 3 & 4 nursing home
09: levels 4 & 5 nursing home
10: levels 1,2, & 3 nursing home
11: levels 2,3, & 4 nursing home
12: respite
13: private care home
14: rehabilitation facility (ie. GRU at Parkridge
15: other
16: deceased

b. Living With:

Pre-hospital: ___ Discharge: ___

1 : alone
2 : family/relatives
3 : friends
4 : attendant
5 : other

c. Centre:

Pre-hospital: ___ Discharge: ___
1: urban 2: rural

12. MMSE:
-Admission: _____ -Discharge: _____

13. Functional Independence Measure (FIM

LEVELS		
	7 Complete Independence (Timely, Safely) 6 Modified Independence (Device)	NO HELPER
	Modified Dependence 5 Supervision 4 Minimal Assist (Subject = 75%+) 3 Moderate Assist (Subject = 50%+) Complete Dependence 2 Maximal Assist (Subject = 25%+) 1 Total Assist (Subject = 0%+)	HELPER

	ADMIT	DISCHG
Self Care		
A. Feeding	☐	☐
B. Grooming	☐	☐
C. Bathing	☐	☐
D. Dressing-Upper Body	☐	☐
E. Dressing-Lower Body	☐	☐
F. Toileting	☐	☐
Sphincter Control		
G. Bladder Management	☐	☐
H. Bowel Management	☐	☐
Mobility		
Transfer:		
I. Bed, Chair, W/Chair	☐	☐
J. Toilet	☐	☐
K. Tub, Shower	☐	☐
Locomotion		
L. Walk/wheelChair	w ☐ c ☐	w ☐ c ☐
M. Stairs	☐	☐
Communication		
N. Comprehension	a ☐ v ☐	a ☐ v ☐
O. Expression	v ☐ n ☐	v ☐ n ☐
Social Cognition		
P. Social Interaction	☐	☐
Q. Problem Solving	☐	☐
R. Memory	☐	☐
Total	☐	☐

14. Disease States:

_____

_____

_____

_____

_____

_____

_____

_____

_____

15. Location of Discharge:

Address: _____

_____

_____

_____

Phone #: _____

Follow-up study form

STUDY FORM #3 (FOLLOW-UP)

Patient Name: _____

Patient Study #: _____ Follow-up Date: ___ ___ ___

Living Arrangement:

a.
Setting: ___ ___ _____

_____

_____

01: home
02: acute unit - Royal University Hospital
03: acute unit - another hospital
04: level 2 nursing home
05: level 3 nursing home
06: level 4 nursing home
07: levels 2 & 3 nursing home
08: levels 3 & 4 nursing home
09: levels 4 & 5 nursing home
10: levels 1,2, & 3 nursing home
11: levels 2,3, & 4 nursing home
12: respite
13: private care home
14: rehabilitation facility (ie. GRU at Parkridge)
15: other
16: deceased

b. Living With: ___

1 : alone
2 : family/relatives
3 : friends
4 : attendant
5 : other

c. Centre: ___

1 : urban
2 : rural

Information Source: ___
1: patient 2: family/friend 3: chart 4: doctor

Method: ___
1: residence 2: return visit to Clinical Gerontology
3: telephone 4: mail

Disease States present on _____:

_____
_____
_____
_____
_____
_____
_____

Has any new condition(s) developed? No ____ Yes _____ List:

_____
_____
_____
_____
_____

Dates of subsequent physician visits:

Current Medications:

NAME	STRENGTH	ROUTE	INTERVAL

If noted medication changes :

CHANGE	REASON

Are you currently still under the care of Dr. _____

Yes No

When was your last visit with Dr. _____:

Date: _____

Appendix B

Letters sent prior to follow-up:

-to patient/next of kin
-to director of care/nurse
-to private care home operator

Letter to patient/next of kin

Date

Dear. patient:

As you may recall, during your admission to the Geriatric Assessment Unit at Royal University Hospital in Saskatoon, you consented to being included in a study looking at drug use after discharge from the hospital.

I just thought that I would take this opportunity to inform you that I will be calling you on date to obtain the following information from you:

1. What prescription and non-prescription medications are you taking right now (name, strength, and how often do you take them)?

2. Approximately how may times have you seen a physician (your family doctor or specialist) since discharge from the Geriatric Assessment Unit? When were these visits?

3. Have you developed any new disease(s) or disorder(s) since your discharge from the Geriatric Assessment Unit?

4. Have you had any follow-up appointments with any of the Geriatric Assessment Unit physicians since your discharge from the hospital?

It would be greatly appreciated if you could have this information available when I call.

I want to thank you in advance for your attention on this matter and I look forward to talking to you soon.

Sincerely yours,

Margaret Chan B.Sc. (Pharm), M.Sc. (Pharm) candidate

Letter to director of care/nurse

Date

Dear director of care:

Please be advised that I am writing in regards to patient name who was discharged from the Geriatric Assessment Unit on date. While on the Clinical Gerontology Service, he consented to participate in a study entitled "Study of Drug Use Patterns in a Clinical Gerontology Consultation Service." The purpose of this study is to evaluate drug use after discharge from a geriatrics service. Potential benefits of this study will be increased knowledge of patterns of drug use after discharge from hospital. As part of the study, patients are being followed up three months post-discharge. The following information is to be derived during the follow-up:

1. current medication regimen (drug, dose, route, and duration of administration):

_____

_____

_____

_____

_____

_____

_____

2. approximate number and dates of physician (GP's and specialists) visits since discharge from the GAU: _____

3. development of any new disease(s) or disorder(s) since discharge from the GAU:

   a. Yes (Please list) _____

_____

   b. No

4. Has the patient returned for a follow-up visit with any of the Clinical Gerontology Service geriatricians since discharge from the GAU:

   a. Yes (please state date of last appointment):

   _____

   b. No

I will be calling on date, and would appreciate it if I could obtain this information from you then.

I have included a copy of the consent form of the study.

Thank you in advance for your attention on this matter. If you have any questions about this request, feel free to contact me at (306) 966-6346.

Sincerely yours,

Margaret Chan B.Sc. (Pharm)
M.Sc. (Pharm) candidate

Letter to private care home operator

Date

Dear private care home operator:

Please be advised that I am writing in regards to patient name who was discharged from the Geriatric Assessment Unit on date. While on the Clinical Gerontology Service, he consented to participate in a study entitled "Study of Drug Use Patterns in a Clinical Gerontology Consultation Service." The purpose of this study is to evaluate drug use after discharge from a geriatrics service. Potential benefits of this study will be increased knowledge of patterns of drug use after discharge from hospital. As part of the study, patients are being followed up three months post-discharge. The following information is to be derived during the follow-up:

1. current medication regimen (drug, dose, route, and duration of administration):

_____

_____

_____

_____

_____

_____

_____

2. approximate number and dates of physician (GP's and specialists) visits since discharge from the GAU: _____

3. development of any new disease(s) or disorder(s) since discharge from the GAU:

   a. Yes (Please list) _____

_____

   b. No

4. Has the patient returned for a follow-up visit with any of the Clinical Gerontology Service geriatricians since discharge from the GAU:

   a. Yes (please state date of last appointment):

   _____

   b. No

I will be calling on date, and would appreciate it if I could obtain this information from you then.

I have included a copy of the consent form of the study.

Thank you in advance for your attention on this matter. If you have any questions about this request, feel free to contact me at (306) 966-6346.

Sincerely yours,

Margaret Chan B.Sc. (Pharm)
M.Sc. (Pharm) candidate

Appendix C

Computer form for medication coding

COMPUTER CODING FORM

Patient ID #: _____

Admission	Discharge	Follow-up
# Rx drugs _____	# Rx drugs _____	# Rx drugs _____
# OTC drugs _____	# OTC drugs _____	# OTC drugs _____
# scheduled Rx _____	# scheduled Rx _____	# scheduled Rx ___
# prn Rx _____	# prn Rx _____	# prn Rx _____
# scheduled OTC _____	# scheduled OTC _____	# scheduled OTC ___
# prn OTC ____	# prn OTC ____	# prn OTC _____

Between admission and discharge

	Rx	OTC
Stop drug	_____	_____
Add drug of different therapeutic class	_____	_____
Change drug within therapeutic class	_____	_____
Dose increase	_____	_____
Dose decrease	_____	_____
Interval increase (ie. more frequent)	_____	_____
Interval decrease (ie. less frequent)	_____	_____
Change route of administration	_____	_____
Add compliance device	_____	_____

Between discharge and follow-up

	Rx	OTC
Stop drug	_____	_____
Add drug of different therapeutic class	_____	_____
Change drug within therapeutic class	_____	_____
Dose increase	_____	_____
Dose decrease	_____	_____
Interval increase (ie. more frequent)	_____	_____
Interval decrease (ie. less frequent)	_____	_____
Change route of administration	_____	_____
Add compliance device	_____	_____

Costs

	Rx	OTC
Cost of admission medications	_____	_____
Cost of discharge medications	_____	_____
Cost of follow-up medications	_____	_____

Patient #: _____

Between admission and follow-up

	Rx	OTC
Stop drug	_____	_____
Add drug of different therapeutic class	_____	_____
Change drug within therapeutic class	_____	_____
Dose increase	_____	_____
Dose decrease	_____	_____
Interval increase (ie. more frequent)	_____	_____
Interval decrease (ie. less frequent)	_____	_____
Change route of administration	_____	_____
Add compliance device	_____	_____

Appendix D

Pharmacy discharge section

Pharmacy

MEDICATION DISCHARGE SUMMARY

Patient Name: _____
Date of Birth: _____
Saskatchewan Hospitalization #: _____
Admission Date: _____
Discharge Date: _____

MEDICATIONS ON ADMISSION	ALTERNATION(S) IN REGIMEN (ie. dose, interval, route, or discontinuation)	REASON FOR ALTERATION

NEW MEDICATION INSTITUTED	REASONS FOR THE ADDITION

Patient: _____

MEDICATION, DOSE, ROUTE, INTERVAL	DRUG LEVEL

MEDICATIONS ON DISCHARGE	-INDICATION(S) -NOTABLE SIDE EFFECTS EXPERIENCED -ANTICIPATED DURATION OF USE -+/- COMPLIANCE OR ADMINISTRATION AIDE SUPPLIED

Prepared by Margaret Chan B.Sc. (Pharm), M. Sc. (Pharm) candidate

Date: _____

Approved by: _____
Dr. CGS physician

Appendix E

Cover letters for questionnaires:

-first mailing
-second mailing

Cover letter for first mailing of questionnaire

Date

Dear Dr. _____:

Please find enclosed a discharge summary and an evaluation questionnaire. As part of a study being conducted in the Clinical Gerontology Service at Royal University Hospital and Parkridge Centre, a questionnaire is being mailed with all discharge summaries. Hopefully, information derived from these questionnaires will be utilized to enhance and improve the quality of future discharge summaries.

Your patient, patient name, has consented to participate in this study.

It would be greatly appreciated if you could take a few minutes of your time to fill out this questionnaire. A stamped return envelope is included for your convenience. Alternatively, if you wish to phone in your opinions, I can be reached at 966-6327.

Thank you in advance for your attention to this matter.

Sincerely yours,

Margaret Chan B.Sc. (Pharm)
M.Sc. (Clinical Pharmacy) candidate

Cover letter for second mailing of questionnaire

Date

Dear Dr. _____:

Please find enclosed another discharge summary questionnaire. On date, an identical discharge summary questionnaire was sent to you along with the discharge summary for your patient, **patient name**.

As part of a study being conducted in the Clinical Gerontology Service at Royal University Hospital and Parkridge Centre, a questionnaire is being mailed with all discharge summaries. Hopefully, information derived from these questionnaires will be utilized to enhance and improve the quality of future discharge summaries.

It would be greatly appreciated if you could please complete the enclosed questionnaire and return it in the accompanying stamped envelope.

Please disregard the questionnaire if you have already sent the initial one in.

Sincerely yours,

Margaret Chan B. Sc. (Pharm)
M. Sc. (Clinical Pharmacy) candidate

Appendix F

Questionnaires:

-questionnaire A
-questionnaire B

Questionnaire A

DISCHARGE SUMMARY QUESTIONNAIRE

PLEASE CIRCLE THE NUMBER THAT BEST DESCRIBES YOUR RESPONSE TO EACH OF THE FOLLOWING QUESTIONS.

1. The overall quality of the discharge summary from the Clinical Gerontology Service is :	Poor					Excellent
	1	2	3	4	5	
2. The medication information provided by the discharge summary is :	1	2	3	4	5	
	Strongly Disagree					Strongly Agree
3. The medication changes implemented for my patient were rational.	1	2	3	4	5	
4. Reasons for changes in medications were provided.	1	2	3	4	5	
5. It would be useful if more information was provided explaining the rationale for medication changes.	1	2	3	4	5	

6. The following information on medications may be included in discharge summaries. Please indicate how important you feel each item to be:
   where 1 = not important
   5 = very important

	Not Important				Very Important
-list of pre-admission medications	1	2	3	4	5
-change(s) of dose of pre-admission medications	1	2	3	4	5
-reason(s) for the change	1	2	3	4	5
-change(s) of dosing interval of pre-admission medications	1	2	3	4	5
-reason(s) for the change	1	2	3	4	5
-change(s) of route of administration of pre-admission medications	1	2	3	4	5
-reason(s) for the change	1	2	3	4	5
-medications discontinued during the assessment	1	2	3	4	5
-reason(s) for the discontinuation	1	2	3	4	5
-medications instituted during assessment	1	2	3	4	5
-reason(s) for the addition	1	2	3	4	5
-any side effects of medications noted during the assessment period	1	2	3	4	5
-blood levels of medications	1	2	3	4	5
-medication aide supplied (eg. aerochamber, compliance aids)	1	2	3	4	5
-list of discharge medications	1	2	3	4	5
-therapeutic rationale for discharge medications	1	2	3	4	5

7. Did the gerontology consultant contact you via a telephone call or in person to discuss your patient's medication therapy either during the assessment period or upon discharge from the Clinical Gerontology Service?

   a. Yes
   b. No

8. Please rate how important it is for the gerontology consultant to contact you via a telephone call or in person to discuss your patient's medication therapy.

   Not Important Very Important
   1 2 3 4 5

9. How soon after your patient's discharge from the Clinical Gerontology Service did you receive the discharge summary?

   a. < 2 days
   b. 2-3 days
   c. 4-7 days
   d. 8-14 days
   e. 15-21 days
   f. other, please specify _____

10. How soon after a patient's discharge from the Clinical Gerontology Service would you like to receive the discharge summary?

    a. < 2 days
    b. 2-3 days
    c. 4-7 days
    d. 8-14 days
    e. 15-21 days
    f. other, please specify _____

11. Did you receive any information on your patient's medication therapy between patient discharge and the receipt of the discharge summary?

    a. Yes, please check your response:
       ____ via telephone call
       ____ via personal communication
       ____ via interim letter
       ____ via document sent with the patient

    b. No (if No, please proceed to question #13)

12. The quality of the medication information conveyed between patient discharge and receipt of the discharge summary was:

    Poor Excellent
    1 2 3 4 5 or cannot recall

13. Please rate the importance of receiving medication information between patient discharge and receipt of the discharge summary:

Not Important Very Important
1 2 3 4 5

14. Given the current medical status of your patient, do you anticipate any changes in your patient's medication regimen over the next 3 months?

a. Yes, please check the nature of anticipated change(s):
_____ : addition of new medication(s).
_____ : discontinuation of current medication(s).
_____ : change in medication regimen (ie. dose, interval, route of administration)

b. No

Comments:

Thank you for your input. Please return the questionnaire in the enclosed envelope.

Questionnaire B

DISCHARGE SUMMARY QUESTIONNAIRE

PLEASE CIRCLE THE NUMBER THAT BEST DESCRIBES YOUR RESPONSE TO EACH OF THE FOLLOWING QUESTIONS.

1. The overall quality of the discharge summaries from the Clinical Gerontology Service is :	Poor 1	2	3	4	Excellent 5
2. The medication information provided by the physician's prepared discharge summary is :	1	2	3	4	5
3. The medication information provided by the pharmacy section of the mulit-disciplinary discharge summary is:	1	2	3	4	5
	Strongly Disagree				Strongly Agree
4. The medication changes implemented for my patient were rational.	1	2	3	4	5
5. Reasons for changes in medications were provided.	1	2	3	4	5
6. It would be useful if more information was provided explaining the rationale for medication changes.	1	2	3	4	5

7. The following information on medications may be included in discharge summaries. Please indicate how important you feel each item to be:
   where 1 = not important
   5 = very important

	Not Important				Very Important
-list of pre-admission medications	1	2	3	4	5
-change(s) of dose of pre-admission medications	1	2	3	4	5
-reason(s) for the change	1	2	3	4	5
-change(s) of dosing interval of pre-admission medications	1	2	3	4	5
-reason(s) for the change	1	2	3	4	5
-change(s) of route of administration of pre-admission medications	1	2	3	4	5
-reason(s) for the change	1	2	3	4	5
-medications discontinued during the assessment	1	2	3	4	5
-reason(s) for the discontinuation	1	2	3	4	5
-medications instituted during assessment	1	2	3	4	5
-reason(s) for the addition	1	2	3	4	5
-any side effects of medications noted during the assessment period	1	2	3	4	5
-blood levels of medications	1	2	3	4	5
-medication aide supplied (eg. aerochamber, compliance aids)	1	2	3	4	5
-list of discharge medications	1	2	3	4	5
-therapeutic rationale for discharge medications	1	2	3	4	5

8. Did the gerontology consultant contact you via a telephone call or in person to discuss your patient's medication therapy either during the assessment period or upon discharge from the Clinical Gerontology Service?

   a. Yes
   b. No

9. Please rate how important it is for the gerontology consultant to contact you via a telephone call or in person to discuss your patient's medication therapy.

   Not Important Very Important
   1 2 3 4 5

10. How soon after your patient's discharge from the Clinical Gerontology Service did you receive the: (please reply to both)

-physician prepared discharge summary	-multi-disciplinary prepared discharge summary
a. < 2 days	a. < 2 days
b. 2-3 days	b. 2-3 days
c. 4-7 days	c. 4-7 days
d. 8-14 days	d. 8-14 days
e. 15-21 days	e. 15-21 days
f. other, please specify _____	f. other, please specify _____

11. How soon after a patient's discharge from the Clinical Gerontology Service would you like to receive the: (please reply to both)

-physician prepared discharge summary	-multi-disciplinary prepared discharge summary
a. < 2 days	a. < 2 days
b. 2-3 days	b. 2-3 days
c. 4-7 days	c. 4-7 days
d. 8-14 days	d. 8-14 days
e. 15-21 days	e. 15-21 days
f. other, please specify _____	f. other, please specify _____

12. Did you receive any information on your patient's medication therapy between patient discharge and the receipt of the physician prepared discharge summary?

    a. Yes, please check your response:
       ____ via telephone call
       ____ via personal communication
       ____ via interim letter
       ____ via document sent with the patient
       ____ via multi-disciplinary discharge summary (pharmacy section)
    b. No (if No, please proceed to question #14)

13. The quality of the medication information conveyed between patient discharge and receipt of the physician prepared discharge summary was:

    Poor Excellent
    1 2 3 4 5 or cannot recall

14. Please rate the importance of receiving medication information between patient discharge and receipt of the physician prepared discharge summary:

Not Important Very Important
1 2 3 4 5

15. Given the current medical status of your patient, do you anticipate any changes in your patient's medication regimen over the next 3 months?

a. Yes, please check the nature of anticipated change(s):
_____ : addition of new medication(s).
_____ : discontinuation of current medication(s).
_____ : change in medication regimen (ie. dose, interval, route of administration)

b. No

Comments:

Thank you for your input. Please return the questionnaire in the enclosed envelope.

Appendix G

Sample size calculations

Study sample size calculations

The following equation was used to determine the sample size required to detect one statistically significant medication change between discharge and three months post-discharge:

$$\text{equation: } n = \left[\frac{(z_{alpha} - z_{beta}) \text{ X } SD}{u_1 - u_0} \right]^2$$

where:

n:	required sample size
z_{alpha}:	z value of the upper alpha% point in 2 tails of the normal standard distribution
z_{beta}:	z value of the lower beta% point in 1 tail of the normal standard distribution
u_1-u_0:	# of medication changes between discharge and 3 months post discharge
SD:	standard deviation of the difference (u_1-u_0)

With power=0.80 and alpha set at 0.05, a sample size of 28 patients will be needed.

$$n = \left[\frac{(1.96 - -0.84) \text{ X } 1.9}{1-0} \right]^2$$

If power is increased to 0.90 and alpha remains at 0.05, a sample size of 38 patients will be needed.

$$n = \left[\frac{(1.96 - -1.28) \text{ X } 1.9}{1-0} \right]^2$$

Appendix H

Prescribing of drug classes and subclasses

DRUG CLASSES	ADMISSION n (%[a])	DISCHARGE n (%[a])	FOLLOW-UP n (%[a])
Antihistamine	1 (0.9)	0	1 (0.9)
Anti-infective	11 (10.4)	2 (1.9)	9 (8.9)
Cephalosporin	2 (1.9)	0	2 (2.0)
Penicillin	3 (2.8)	0	1 (1.0)
Erythromycin	0	0	1 (1.0)
Antimalarial	1 (0.9)	0	0
Quinolone	0	2 (1.9)	2 (2.0)
Urinary Anti-infective	2 (1.9)	0	2 (2.0)
Miscellaneous	5 (4.7)	0	1 (1.0)
Antineoplastic	1 (0.9)	1 (0.9)	1 (1.0)
Autonomic	11 (10.4)	15 (14.2)	15 (14.9)
Cholinergic	2 (1.9)	0	0
Antiparkinsons	1 (0.9)	1 (0.9)	1 (1.0)
Anitmuscarinic	0	3 (2.8)	2 (2.0)
Adrenergic	8 (7.5)	11 (10.4)	10 (9.9)
Skeletal Muscle Relaxant	0	1 (0.9)	1 (1.0)
Blood Formation and Coagulation	19 (17.9)	15 (14.2)	10 (9.9)
Iron	10 (9.4)	9 (8.5)	8 (7.9)
Anticoagulants	8 (7.5)	5 (4.7)	2 (2.0)
Hemorrheologic	2 (1.9)	1 (0.9)	0
Cardiovascular	46 (43.4)	38 (35.8)	40 (39.6)
Cardiac	30 (28.3)	24 (22.6)	24 (23.8)
Hypotensive	17 (16.0)	13 (12.3)	13 (12.9)
Vasodilating	15 (14.2)	12 (11.3)	15 (14.9)
Central Nervous System	84 (79.2)	83 (78.3)	86 (85.1)
Analgesics & Antipyretics	69 (65.1)	73 (68.9)	78 (77.2)
Non-steroidal Anti-inflammatory	27 (25.5)	28 (26.4)	36 (35.6)
Opiate Agonist	9 (8.5)	4 (3.8)	10 (9.9)
Miscellaneous	48 (45.3)	57 (53.8)	53 (52.5)
Opiate Antagonist	1 (0.9)	0	0
Anticonvulsants	7 (6.6)	8 (7.5)	6 (5.9)
Barbiturates	3 (2.8)	4 (3.8)	3 (3.0)
Benzodiazepines	0	0	1 (1.0)
Hydantoin	1 (0.9)	1 (0.9)	3 (3.0)
Miscellaneous	3 (2.8)	5 (4.7)	3 (3.0)
Psychotherapeutic	25 (23.6)	18 (17.0)	16 (15.8)
Antidepressants	17 (16.0)	12 (11.3)	14 (13.9)
Tranquilizers	13 (12.3)	7 (6.6)	4 (4.0)
Anxiolytics/ Sedative/Hypnotic	25 (23.6)	16 (15.1)	14 (13.9)
Benzodiazepines	22 (20.8)	13 (12.3)	10 (9.9)
Miscellaneous	5 (4.7)	3 (2.8)	4 (4.0)
Antimanic	1 (0.9)	0	1 (1.0)

a: percentage of total population with at least one medication from the drug class.

DRUG CLASSES	ADMISSION n (%[a])	DISCHARGE n (%[a])	FOLLOW-UP n (%[a])
Electrolytic, Caloric, & Water balance	34 (32.1)	23 (21.7)	33 (32.7)
Replacement preps	19 (17.9)	11 (10.4)	19 (8.8)
Diuretic	22 (20.8)	17 (16.0)	24 (23.8)
Diuretic K+ sparing	1 (0.9)	3 (2.8)	5 (5.0)
Antitussives/ Expectorants/ Mucolytics	3 (2.8)	0	8 (7.9)
Antitussive	2 (1.9)	0	4 (4.0)
Expectorant	2 (1.9)	0	4 (4.0)
EENT	13 (12.3)	8 (7.5)	11 (10.9)
Anti-infective	4 (3.8)	3 (2.8)	5 (5.0)
Antibiotic	1 (0.9)	1 (0.9)	3 (3.0)
Miscellaneous	3 (2.8)	2 (1.9)	2 (2.0)
Anti-inflammatory	5 (4.7)	1 (0.9)	3 (3.0)
Miotic	1 (0.9)	1 (0.9)	1 (1.0)
Mydriatic	2 (1.9)	2 (1.9)	2 (2.0)
Miscellaneous	3 (2.8)	4 (3.8)	3 (3.0)
Gastrointestinal	66 (62.3)	55 (52.8)	65 (64.4)
Antacids & Adsorbents	9 (8.5)	5 (4.7)	15 (14.9)
Antidiarrheals	1 (0.9)	0	0
Antiflatuents	0	0	1 (1.0)
Laxatives & Carthartics	53 (50.0)	47 (44.3)	55 (54.5)
Antiemetic	7 (6.6)	4 (3.8)	4 (4.0)
Miscellaneous	18 (17.0)	15 (14.2)	16 (15.8)
Hormones	34 (32.1)	37 (34.9)	38 (37.6)
Adrenals	7 (6.6)	8 (7.5)	9 (8.9)
Estrogens	1 (0.9)	4 (3.8)	4 (4.0)
Antidiabetic Agents	17 (16.0)	15 (14.2)	14 (13.9)
Insulin	7 (6.6)	6 (5.7)	7 (6.9)
Sulphonylurea	11 (10.4)	9 (8.5)	7 (6.9)
Thyroid	13 (12.3)	15 (14.2)	16 (15.8)
Local Anesthetics	2 (1.9)	0	0
Skin & Mucous Membrane	8 (7.5)	5 (4.7)	3 (3.0)
Anti-infective	3 (2.8)	3 (2.8)	2 (2.0)
Antibiotic	2 (1.9)	0	0
Antifungal	1 (0.9)	3 (2.8)	2 (2.0)
Miscellaneous	1 (0.9)	0	0
Anti-inflammatory	5 (4.7)	2 (1.9)	2 (2.0)
Smooth Muscle Relaxants	4 (3.8)	2 (1.9)	0
Vitamins	16 (15.1)	13 (12.3)	26 (25.7)
Unclassified	17 (16.0)	17 (16.0)	16 (15.8)
Miscellaneous	8 (7.5)	7 (6.6)	17 (16.8)

a: percentage of total population with at least one medication from the drug class.

Appendix I

Miscellaneous drug classification

Medications Included in the Miscellaneous Class

1% menthol in hydrous emulsifying ointment

Butt balm

Cod liver oil

Deep heating mentholatum

Garlic oil
Glycoloids

Lacrilube ophthalmic ointment
Lecithin
Liquifilm solution

Murocel 128 ointment
Murocel 128 solution

Oragel

Silicone cream
Sween cream

Tears Naturale

Zinc gluconate
Zincofax

Appendix J

Drug classes:

-central nervous system agents
-gastrointestinal agents
-cardiovascular agents
-electrolytic, caloric, & water balance agents
-hormonal agents

Central nervous system agents

A. Analgesics and Antipyretics - Non steroidal anti-inflammatory

Drug	# of patients on drug on: admission	discharge	follow-up
Acetylsalicylic acid	21	22	29
Diclofenac sodium	0	1	1
Flurbiprofen	0	0	1
Ibuprofen	1	1	2
Indomethacin	2	1	2
Ketoprofen supp.	0	2	1
Ketorolac	0	0	1
Naproxen	4	1	1
Sulindac	1	0	0
Tiaprofenic acid	1	0	1

B. Analgesics and Antipyretics - Opiate agonist

Drug	# of patients on drug on: admission	discharge	follow-up
Acetaminophen-codeine 8 mg	2	1	5
Acetaminophen-codeine 15 mg	2	1	2
Acetaminophen-codeine 30 mg	4	0	0
Propoxyphene	1	1	1
Morphine sustain release	4	3	2

C. Analgesics and Antipyretics - Miscellaneous

Drug	# of patients on drug on: admission	discharge	follow-up
Acetaminophen	49	54	52
Acetaminophen -diphenhydramine	0	5	3

D. Anticonvulsant drugs - Barbiturate

Drug	# of patients on drug on: admission	discharge	follow-up
Phenobarbital	3	4	3

E. Anticonvulsant drugs - Benzodiazepine

Drug	# of patients on drug on: admission	discharge	follow-up
Clonazepam	0	0	1

F. Anticonvulsant drugs - Hydantoin

Drug	# of patients on drug on: admission	discharge	follow-up
Phenytoin	4	1	1

G. Anticonvulsant drugs - Miscellaneous

Drug	# of patients on drug on: admission	discharge	follow-up
Carbamazepine	3	5	3
Valproic acid	1	1	0

H. Psychotherapeutic drugs - Antidepressants

Drug	# of patients on drug on: admission	discharge	follow-up
Amitriptyline	2	0	0
Desipramine	3	0	2
Doxepin	2	0	1
Fluvoxamine	2	6	4
Fluoxetine	1	0	1
Maprotiline	3	1	1
Nortriptyline	1	3	2
Trazodone	3	2	2
Trimipramine	1	0	1

I. Psychotherapeutic drugs - Tranquilizer

Drug	# of patients on drug on: admission	discharge	follow-up
Buspirone	1	3	2
Flupenthixol	1	0	1
Haloperidol	4	3	1
Loxapine	3	1	0
Perphenazine	1	0	0
Prochlorperazine	1	0	0
Thioridazine	4	0	0

J. Anxiolytic/Sedative/Hypnotic - Benzodiazepine

Drug	# of patients on drug on: admission	discharge	follow-up
Alprazolam	2	4	3
Bromazepam	1	0	1
Chlordiazepoxide	1	0	0
Diazepam	5	1	0
Flurazepam	0	0	1
Lorazepam	9	2	0
Oxazepam	2	1	2
Temazepam	3	6	3
Triazolam	2	0	0

K. Anxiolytic/Sedative/Hypnotic - Miscellaneous

Drug	# of patients on drug on: admission	discharge	follow-up
Chloral hydrate	4	3	4
Hydroxyzine	1	0	0

L. Antimanic

Drug	# of patients on drug on: admission	discharge	follow-up
Lithium	1	0	1

Gastrointestinal drugs

A. Antacids and Adsorbent drugs

Drug	# of patients on drug on: admission	discharge	follow-up
Aluminum hydroxide susp.	0	0	1
Magnesium hydroxide susp.	1	1	2
Magnesium/aluminum susp.	9	4	8
Dihydroxyaluminum sodium carbonate chew tabs	0	0	4

B. Antidiarrheal drugs

Drug	# of patients on drug on: admission	discharge	follow-up
Loperamide	1	0	0

C. Antiflatulent drugs

Drug	# of patients on drug on: admission	discharge	follow-up
Simethicone	0	0	1

D. Cathartics and Laxative drugs

Drug	# of patients on drug on: admission	discharge	follow-up
Agar/mineral oil	0	0	4
Bisacodyl	11	1	7
Cascara	1	0	1
Castor oil	1	0	0
Docusate calcium	11	27	16
Docusate sodium caps	22	7	11
Docusate sodium sol'n	0	1	0
Fibre	14	2	12
Glycerin supp.	0	0	4
Lactulose	4	13	9
Magnesium/cascara	1	0	1
Magnesium/mineral oil	4	0	1
Phenolphthalein	2	0	2
Psyllium/senna	1	0	1
Senna	6	3	2
Senna/docusate sodium	1	1	1
Sodium citrate - sodium lauryl sulfoacetate enema	1	3	1
Sodium phosphate enema	6	1	5
Sorbitol	0	4	2

E. Antiemetic drugs

Drug	# of patients on drug on: admission	discharge	follow-up
Dimenhydrinate	7	4	3
Thiethylperazine	0	0	1
Scopolamine patch	1	0	0

F. Miscellaneous gastrointestinal drugs

Drug	# of patient on drug on: admission	discharge	follow-up
Cimetidine	2	0	0
Cisapride	1	0	0
Domperidone	0	0	1
Famotidine	1	0	1
Metoclopramide	0	0	1
Misoprostol	0	5	3
Ranitidine	14	12	12

Cardiovascular agents

A. Cardiac drugs

Drug	# of patients on drug on: admission	discharge	follow-up
Acebutolol	1	0	0
Digoxin	18	14	15
Diltiazem	5	6	7
Nifedipine	6	2	2
Procainamide	0	0	1
Propranolol	3	2	2

B. Hypotensive drugs

Drug	# of patients on drug on: admission	discharge	follow-up
Captopril	6	1	0
Clonidine	1	0	0
Enalapril	5	8	8
Labetalol	1	0	0
Methyldopa	2	0	0
Nifedipine	3	3	3
Prazosin	1	0	0
Triamterene-hydrochlorthiazide	3	2	3

C. Vasodilating drugs

Drug	# of patients on drug on: admission	discharge	follow-up
Isosorbide dinitrate	6	1	1
Nitroglycerin tabs	9	7	11
Nitroglyerin patch	3	4	3

Electrolytic, caloric, and water balance agents

A. Replacement preparations

Drug	# of patients on drug on: admission	discharge	follow-up
Calcium salts	8	6	10
Potassium chloride tabs	10	5	9
Potassium chloride sol'n	2	0	0

B. Diuretics

Drug	# of patients on drug on: admission	discharge	follow-up
Furosemide	22	13	24
Hydrochlorothiazide	1	0	2

C. Diuretics - potassium sparing

Drug	# of patients on drug on: admission	discharge	follow-up
Spironolactone	1	3	5

Hormonal agents

A. Adrenal drugs

Drug	# of patients on drug on: admission	discharge	follow-up
Beclomethasone	5	4	7
Dexamethasone	1	0	0
Prednisone	2	4	3

B. Estrogen drugs

Drug	# of patients on drug on: admission	discharge	follow-up
Conjugated estrogen	0	1	1
Estrogen vaginal cream	1	3	3

C. Antidiabetic agents - insulin

Drug	# of patients on drug on: admission	discharge	follow-up
Humulin N	2	4	4
Humulin R	3	4	4
Novolin 30/70	1	3	3
NPH	3	1	1
Toronto	2	1	1

D. Antidiabetic agents - sulfonylureas

Drug	# of patients on drug on: admission	discharge	follow-up
Chlorpropamide	2	0	0
Glyburide	9	10	9
Metformin	2	1	1
Tolbutamide	1	0	0

E. Thyroid drugs

Drug	# of patients on drug on: admission	discharge	follow-up
L-thyroxine	12	14	16
Thyroid	1	0	0

Appendix K

Multiple linear regression analysis of medication changes:

-variables used in regression analysis

-statistical results for changes between admission and discharge

-statistical results for changes between discharge and follow-up

Variables Used in the Regression Analysis

VARIABLE	VALUES	TIME PERIOD OF MED. CHANGE	
		Admission-Discharge	Discharge-Follow-up
Sex	0=male 1=female	*	*
Age	in years	*	*
Marital status	0=married 1=not married	*	*
Admission class	0=1st assessment 1=not 1st	*	*
Pre-admission residence	0=home 1=elsewhere	*	
Pre-admission cohabitation	0=alone 1=not alone	*	
Pre-admission residence location	0=Saskatoon 1=elsewhere	*	
Discharge residence	0=home 1=elsewhere	*	*
Discharge cohabitation	0=alone 1=not alone	*	*
Dicharge residence location	0=Saskatoon 1=elsewhere	*	*
Admission MMSE	score	*	*
Discharge MMSE	score	*	*
CGS geriatrician	3 indicator values	*	*
Group	0=control 1=intervention	*	*

Variables Used in the Regression Analysis

VARIABLE	VALUES	TIME PERIOD OF MED. CHANGE	
		Admission-Discharge	Discharge-Follow-up
Physician year of graduation	# years since graduation	*	*
CGS assessment duration	in days	*	*
Number of admission medications	number of	*	*
Cost of admission medications	cost in dollars	*	
Study site	2 indicator variables	*	*
Follow-up residence	0=home 1=elsewhere		*
Follow-up cohabitation	0=alone 1=not alone		*
Follow-up residence location	0=Saskatoon 1=elsewhere		*
Duration between discharge & follow-up	in days		*
Number of discharge medications	number of		*
Cost of discharge medications	cost in dollars		*
New medical condition	0=no 1=yes		*
Hospitali-zation	number of		*

Variables Used in the Regression Analysis

VARIABLE	VALUES	TIME PERIOD OF MED. CHANGE	
		Admission-Discharge	Discharge-Follow-up
Continuing CGS care	0=no 1=yes		*
Post-discharge MD visits	number of		*
Rationale for med changes	rating on 5 point Likert scale		*
Geriatrician -Physician Contact	0=no 1=yes		*
Primary MD anticipate med change	0=no 1=yes		*
Primary MD receive med info	0=no 1=yes		*

Multiple Linear Regression Results for Number of Medication Changes Between Admission and Discharge

Variable	Prescription med. changes Beta	OTC med. changes Beta	Total med. changes Beta
-sex	0.01	0.04	0.04
-age	-0.09	0.04	-0.04
-marital status	0.06	0.01	0.03
-admission class	**-0.15[c]**	-0.02	-0.08
-pre-admission residence	-0.01	-0.06	-0.08
-discharge residence	-0.02	-0.05	-0.06
-cohabitation pre-admission	0.03	0.04	0.03
-cohabitation on discharge	-0.03	0.01	-0.03
-location pre-admission	0.03	0.00	0.00
-location on discharge	0.04	0.00	0.00
-admission MMSE	-0.05	0.10	0.03
-discharge MMSE	0.01	-0.07	-0.02
-CGS MD1[a]	**0.09[c]**	**-0.37[c]**	**-0.39[c]**
-CGS MD2[a]	**-0.65[c]**	**-0.88[c]**	**-1.51[c]**
-CGS MD3[a]	**0.86[c]**	**-0.07[c]**	**0.74[c]**
-group	0.05	0.01	0.05
-# years since MD graduated	-0.05	-0.04	-0.05
-CGS assessment duration	0.10	0.05	0.11
-# of adm. meds	**0.95[c]**	**0.98[c]**	**0.98[c]**
-cost of adm. medications	-0.12	0.09	-0.07
-site1[b]	0.08	**1.00[c]**	**1.42[c]**
-site2[b]	-0.06	**0.54[c]**	**0.33[c]**
-constant	0.57	1.84	0.46

a: dummy variables for CGS geriatrician
b: dummy variables for study site

c: variables identified as significant in regression analysis

Multiple Linear Regression Results for Number of Medication Changes Between Discharge and Follow-up

Variable	Prescription med. changes Beta	OTC med. changes Beta	Total med. changes Beta
-sex	-0.05	0.05	0.03
-age	0.02	0.16	0.06
-marital status	0.01	0.02	0.02
-admission class	-0.02	-0.01	-0.15
-discharge residence	-0.04	-0.05	-0.13
-cohabitation on discharge	-0.04	-0.17	-0.20
-location on discharge	0.06	-0.03	0.00
-admission MMSE	-0.02	0.07	0.02
-discharge MMSE	-0.02	-0.10	-0.08
-CGS MD1[a]	0.11	0.02	0.10
-CGS MD2[a]	-0.05	-0.03	-0.02
-CGS MD3[a]	-0.04	-0.03	-0.07
-group	-0.13	-0.00	-0.12
-# years since MD graduated	0.05	-0.03	0.03
-CGS assessment duration	-0.09	0.13	0.06
-# of adm. meds	-0.20	**0.26**[c]	0.01
-site1[b]	0.06	0.16	0.09
-site2[b]	-0.10	0.03	-0.04
-follow-up residence	-0.03	-0.12	-0.11
-cohabitation on follow-up	0.00	-0.12	-0.11
-location on follow-up	0.11	0.03	0.05
-DC - FU duration	0.06	0.09	0.11
-# of discharge medications	**0.90**[c]	0.17	**0.65**[c]
-cost of discharge meds	0.09	0.10	0.12
-new medical condition	0.14	0.11	**0.23**[c]
-hospitalization	0.14	0.14	0.22
-continuing CGS care	-0.01	-0.01	0.05
-# of MD visits	0.13	0.13	0.20
-rationale rating	-0.16	-0.04	-0.13
-MD-geriatrician contact	0.03	**1.34**[c]	0.20
-change anticipated	0.08	-0.07	0.06
-constant	0.27	1.41	1.84

a: dummy variables for CGS geriatrician
b: dummy variables for study site

c: variables identified as significant in regression analysis