FACTORS ASSOCIATED WITH PRIMARY HEALTH CARE CONTACTS BY THE ELDERLY POPULATION IN GROUPS OF FAMILY DOCTORS IN QUEBEC, CANADA

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PREFACE

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CONTRIBUTION OF THE AUTHORS

As anM.Sc. candidate, I developedand planned the work that led to this thesis, played an important role in interpreting the results, and wrote the final dissertation. The overall concept of the research was determined by myselfand my supervisors (Drs. Isabelle Vedel and Machelle Wilchesky), Dr. Edeltraut Kröger, and Nadia Sourial. Drs. Vedel and Wilchesky provided their guidance and feedback, while I obtained data collected as part of the Alzheimer's Plan Evaluation Study andran a secondary analysis, synthesis, and interpretation of the findings. The authors donot have any conflicts of interest to report.

ABBREVIATIONS

AD – Alzheimer's Disease

CDS – Chronic Disease Score

ED – Emergency Department

FP – Family Physician

FTE – Full-Time Equivalent

GP – General Practitioner

GEE – Generalized Estimating Equations

GMF – Groupes de Medecins de Famille(family medicine group practice)

MD – Medical Doctor

RN – Registered Nurse

PHC – Primary Health Care

US – United States

WHO – World Health Organization

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ABSTRACT

INTRODUCTION

The aging population in Quebec, combined with the chronic disease rise, has increased the health care service use among elderly population. Therefore, elderly care has largely relied on primary health care (PHC) providers as they are best positioned to care for such population. This influx of PHC physician contacts, both face-to-face and virtual, has become a concern due to the limited PHC physician resources. As such, a clear understanding of the factors contributing to PHC contacts by the elderly population is needed.

OBJECTIVES

To identify the factors contributing to the number of PHC contacts by the elderly population in Quebec family medicine groups, or Groupes de Medecine de Famille (GMF).

METHODS

In a cross-sectional design, two main data sources were used: 1) A chart review from the Alzheimer's Plan Evaluation Study provided patient-level factors and the number of PHC contacts. 2) The Quebec Ministry of Health information pertaining to GMF-level factors. A total of 1,919 patients were randomly selected. Eligibility criteria included patients aged 75+ years with a minimum of one PHC contact in a 9-month period. Descriptive analyses of independent variables and the study outcome were performed. Generalized Estimating Equations; GEE models were used to analyze correlated data with binary, discrete, or continuous outcomes.

RESULTS

Descriptive results:

Males represented 40% (768 patients) of the study population. Patient age ranged from 75.0 to 104.0 (mean=81.7, SD=5.0) years. Patients aged 75.0-79.9, 80.0-84.9, and 85+ represented 44.1%, 30.5%, and 25.4% of the population, respectively. Nearly half (49.7%) lived with family, whereas 20% lived alone. A total of 22,221 medications were retrieved from patient charts to identify chronic diseases. Of those medications, 16,336 were matched to 21 chronic diseases. The number of chronic and non-chronic disease medications ranged from 0 to 33 (mean=8.5, SD=5.3) and 0 to 17 (mean=3.0, SD=2.5) respectively. The number of chronic diseases identified ranged from 0 to 17 (mean=5.7, SD=2.9).

Elderly proportion among total registered patients ranged from 7% to17% (mean=12.1%, SD=3.4%). The number of patients per Full-Time Equivalent (FTE)-physician and FTE-RN ranged from 816 to 2,115 (mean=1,244, SD=439) and from 3,218 to 14,193 (mean 8,048.9, SD=3,909.5), respectively. The number of sites within GMFs ranged from 1 to 8 (mean=3.25, SD=2.5). GMF years of operation ranged from 2.2 to 11 years (mean=7.6, SD=3.0). In terms of the study outcome, total PHC contacts ranged from 1 to 81 (mean=4.4, SD=5.1).

GEE results:

The ‘oldest old’ population group (85+) showed a statistically significant 16.4% increase in PHC contact incidence. Likewise, each additional chronic disease showed an 11% increase in the incidence of PHC contacts. The proportion of elderly population showed a 4.5% decrease in PHC contact incidence for each additional 1% of elderly patients. The number of physicians per FTE physician had a 1.6% decrease in the PHC contact incidence for each additional physician. Moreover, Université Laval-affiliated GMF sites had a 60% higher PHC contact incidence compared to Université de Sherbrooke, our reference (p=0.001). Likewise, public GMFs had an 18.2% lower PHC contact incidence than mixed GMFs.

CONCLUSION

This study provides an evidence-based description of the delivery of PHC contacts among the elderly. Study findings can guide GMF managers and health policy makers, and assist in the development of well-informed staffing, budgetary plans, and decisions in Quebec. Nevertheless, future studies should endeavor to build upon such results for a better understanding of the use of PHC contacts within Quebec GMFs.

RÉSUMÉ

INTRODUCTION

Le vieillissement de la population et l'augmentation du nombre de maladies chroniques a entrainé une utilisation croissante des services de santé par les personnes âgées. En raison de sa position idéal, la première ligne est devenue l'un des plus importants piliers des soins aux personnes âgées. Or, le grand nombre de contacts avec la première ligne, tant virtuels que face-à-face, devient problématique en raison de la pression sur les ressources limitées de première ligne. Ainsi, une meilleure compréhension des facteurs menant à des contacts entre la première ligne et la population âgée est nécessaire.

OBJECTIFS

Identifier les facteurs qui contribuent au nombre de contacts entre la première ligne et la population âgée dans les groupes de médecine de famille (GMF) du Québec.

MÉTHODES

Un devis transversal a été utilisé. Les données provenaient de deux sources : 1) une revue de dossiers effectuée dans le cadre de l'évaluation du Plan Alzheimer fournissant les facteurs individuels et le nombre de contacts avec la première ligne 2) l'information provenant du Ministère de la Santé et des Services Sociaux du Québec sur les facteurs du GMF. Un total de 1 919 patients a été sélectionné au hasard. Les patients devaient être âgés de plus de 75 ans et avoir au moins un contact avec la première ligne dans une période de 9 mois. Des analyses descriptives des variables indépendantes et du résultat d'intérêts ont été effectuée. Des équations d'estimation généralisées (GEE) ont été utilisées pour analyser les données corrélées et des indicateurs binaires, discrets ou continus.

RÉSULTATS

Les résultats descriptifs:

Les hommes représentent 40 % (768 patients) de la population. L'âge des patients varie de 75 à 104 ans (m: 81,7; ÉT: 5,0). Les patients âgés de 75 à 79,9, de 80 à 84,9 et de 85 ans et plus représentent respectivement 44,1 %, 30,5 % et 25,4 % de la population. Une moitié (49,7 %) vit avec la famille tandis que 20 % vivent seuls. Un total de 22 221 médicaments ont été extraits des dossiers. De ces médicaments, 16 336 médicaments ont été reliés à 21 maladies chroniques. Le nombre de médicaments pour maladies chroniques et non-chronique s'étend respectivement de 0 à 33 (m: 8,5; ÉT: 5,3) et de 0 à 17 (m: 3,0; ÉT: 2,5) tandis que le nombre de maladies chroniques s'étend de 0 à 17 (m: 5,7; ÉT: 2,9).

La proportion de patients âgés parmi les patients enregistrés au GMF va de 7 % à 17 % (m: 12,1 %; ÉT : 3,4 %). Le nombre de patients par médecin équivalent temps plein (ETP) et par infirmière ETP est respectivement de 816 à 2 115 (m: 1 244; ÉT : 439) et de 3 218 à 14 193 (m: 8 048; ÉT : 3 909,5). Chaque GMF contient entre 1 et 8 sites (m: 3,25; ÉT : 2,5) et est opérationnel depuis 2,2 à 11 ans (m: 7,6; ÉT : 3,0). Quant au résultat d'intérêt, les contacts avec la première ligne vont de 1 à 81 contacts (m: 4,4; ÉT : 5,1).

Les résultats des GEE:

Le groupe d'âge, les 85 ans et plus, montre une augmentation de 16,4 % des incidences de contacts avec la première ligne. De plus, chaque maladie chronique additionnelle présente une augmentation de 11%. La proportion de patients âgés montre une diminution de 4,5 % pour chaque 1 % additionnel de patients âgés. Le nombre de médecins par médecins ETP montre une diminution de 1,6 % pour chaque médecin additionnel. De plus, les GMF affiliés à l'Université

Laval ont une augmentation de 60 % par rapport aux GMF affiliés à notre référence, l'Université de Sherbrooke (p=0,001). De même, les GMF publics ont une incidence de contacts de 18,2 % plus basse que les GMF mixtes.

CONCLUSION

Cette étude fournit une description ancrée dans les faits de la distribution des contacts en première ligne pour la population âgée. Les résultats de cette étude pourront guider les gestionnaires des GMF et les responsables de l'élaboration des politiques de santé. Ils pourront, en particulier, contribuer à une meilleure planification de la répartition du personnel ainsi qu'à des décisions et des plans budgétaires.

1. AGING, CHRONIC DISEASE, HEALTH SERVICE USE & EXPENDITURE

Multimorbidity, or the presence of multiple chronic diseases, in the elderly population has been increasingly recognized as a major health care system problem (1, 2). Chronic diseases have disproportionately drained various health services (3), and studies have shown that elderly patients with higher morbidity indices (defined as those who have two or more chronic diseases) use more health care services than those with fewer or no morbidities (4).

1.1. AGING & CHRONIC DISEASES

1.1.1. A GROWING ELDERLY POPULATION

In 2015, Canada's elders (aged 65 years and above) increased to represent 16.1% of the total population (5). Not only has the elderly population increased dramatically, but it has also recorded the fastest growth rate among other population groups. Canadian elders demonstrated an annual growth rate of 3.5% in 2015, four times faster than in any other population (5). As a result of such growth rates, the elderly are expected to comprise almost 31% of Canada's population by 2050 (5).

The aging crisis is expected to affect all Canadian provinces, but particularly those that are the most densely populated (Ontario, Quebec, British Columbia and Alberta), as they collectively include 86.3% of Canadians (5). Both the proportion of Canadian elders relative to the rest of the population and the growth of this group vary across Canadian provinces, posing different burdens accordingly. For instance, New Brunswick has the highest proportion of elders (19% of the province's total population) (6), whereas Nunavut has the lowest proportion of elders at 3.7% (5).

Canada has not been the only nation to visit such a shift in age demographics. Many countries worldwide are experiencing similar or, in some cases, more extreme population changes. The World Population Ageing Report, published by the United Nations in 2015, indicated that the elderly (those aged 60 years and above) population in countries such as Japan, Germany, Italy, and Finland represented 33%, 28%, 28% and 27% of their total populations, respectively (7). The same report also projected a 55% growth in the world's elderly population (those aged 60 years or over) by 2030. This percentage will vary across continents, totaling 71%, 66%, 64%, 47%, 41% and 23% in Latin America, Asia, Africa, Oceania, North America, and Europe, respectively. By 2050, these percentages will be even higher, as the elderly population is expected to double worldwide. Finally, the oldest segments of the population (those aged 80 years or older) are demonstrating even faster growth rates (400%) (7).

1.1.2. A RISING TIDE OF CHRONIC DISEASES

The aging population and its related health problems have been a concern for some time. In fact, the number of studies examining the health consequences of aging has been on the rise for the last two decades (8). The literature on chronic disease and multimorbidity has been plentiful, with many studies establishing an association between aging and increased incidence and prevalence of individual chronic diseases, as well as multimorbidity (8).

In Canada, a Canadian Community Health Survey showed that one in three Canadians is currently living with at least one major chronic disease (9, 10). According to Statistics Canada, the prevalence of multimorbidity among people aged 20 years and above is 15% (11), and this proportion steadily increases with age (12). For instance, 11% of adults aged 20-39 years, 26% of adults aged 40-59 years, and 36% of adults aged 60-79 years and above reported having one chronic health condition. Moreover, the percentage of people reporting two or more chronic

diseases increases with age, from 11% of people aged 20-39 years, to 35% of those aged 40-59 years, to 49% of those aged 80 years and above (12, 13).

Provincial figures have reflected those at the national level (13). Studies from Alberta, Ontario, and British Columbia, for example, have reported that age and sex-standardized proportions of the population with multimorbidity range from 19.0% to 26% among representative samples of adults aged 18 years plus (12-18). These proportions also varied by age group, ranging from 24.9% among those younger than 18 years to 92.4% among those aged 90 or more in 2009 (12, 15). In USA, the prevalence of multimorbidity ranges from 14% among those aged 18-45 (19, 20) to 93% among those older than 80 years of age (21). Similarly, the prevalence of three or more chronic conditions ranges from 3.7% to 68% among these two groups (9).

Multimorbidity has also been recognized as a health care system concern worldwide (4, 22). In the United States, a recent study demonstrated that the prevalence of multimorbidity has reached an average of 23% nationwide (19). This percentage varied by age, sex, and socio-economic class (23, 24). Estimates from the 2010 National Health Interview Survey found that only 6.7% of those aged 18-44 years reported two or more chronic diseases (25). This percentage increased to 32.8% and 62.5% among those aged 45-64 and 65 years and older, respectively. In Europe, chronic disease prevalence has spanned between 3% and 98%, depending on the setting, data sources, and population characteristics (i.e. age and gender) (1, 4, 26).

1.2. HEALTH SERVICE USE AMONG THE ELDERLY

Existing health services research has prioritized the exploration of disproportionately high health service user groups (27). A UK-based study, for example, showed that the top 3% of frequent users of primary care services consumed almost 15% of all available resources (28).

Literature on this topic has provided abundance of research demonstrating how both chronic disease and multimorbidity among elders pose enormous burdens on all health care services and resources (4). The same UK-based study showed that 24% percent of elders with multiple chronic diseases consumed 40% of the total health services assigned to the entire elderly population (28). Elderly individuals were also significantly more likely to be frequent attendees and extensive users of PHC services (28-31).

1.2.1. PRIMARY HEALTH CARE PHYSICIAN VISITS

Primary health care (PHC) physicians' time and visits have long been recognized as crucial health care resources for managing chronic disease and multimorbidity (3). PHC physician visits have been extensively examined among elderly groups specifically, as multimorbidity and aging have been shown to have an impact on the number of PHC visits by this population (4). A US-based study showed that elderly patients (aged 65 years plus) had made 6.1 visits per year to their PHC provider, compared to 4.1 visits per year by adults aged 45-64 years (32). A Canadian study demonstrated that the number of PHC physician visits when standardized by age and sex, steadily increased with a patient's number of chronic diseases (12). For instance, a patient with no morbidity or chronic disease had an average of 3.7 visits, as compared to 4.7, 6.3, 7.8, 8.7, 9.3 and 10 visits for patients who had received one, two, three, four, five and six diagnoses of chronic disease, respectively (12).

1.2.2. PRIMARY HEALTH CARE NURSING

The reliance of patients on Registered Nurses (RNs) within PHC settings for chronic disease management, treatment, and prevention has been strongly associated with the number of chronic health conditions affecting patients in USA (20, 33), and Germany (34). One Canadian study showed that an elderly patient with no chronic health conditions required 3.4 visits to the

RN, whereas patients with one, two or three or more chronic diseases required 8.2, 11.1 and 12.9 visits to the PHC nurse, respectively (12). Another Canadian study examining the gradient effect of the number of chronic medical conditions on health service use reported a significantly higher effect among PHC nurses (13). Patients with one or two or more chronic medical conditions used 2.5 and 4 times as many nursing hours, respectively, as compared to those with no chronic medical conditions (13).

1.3. THE COST OF AGING & CHRONIC DISEASES

Higher health expenditures among the elderly in a given community have been associated with: 1) the proportion of elderly people within that community; 2) the prevalence of chronic disease among the elderly population; 3) the amount of health services allocated to chronic disease management; and 4) the cost of chronic disease management (35).

In 2015, the Canadian Institute for Health Information (CIHI) reported a nationwide per capita health spending of $6,105 (12, 36). Such spending has largely varied across age groups, reflecting the impact of aging on health expenditures. A Canadian aged 1-14 years, for example, had a per capita health spending of $1,408, whereas health spending on a senior aged 65+ years was $11,598. The report also sub-grouped the elderly population into 5-year categories, to examine the impact of aging on per capita health spending within each subgroup. Health spending steadily increased with age, with $6,298, $8,384 and $11,557 spent on those aged 65-69, 70-74 and 75-79 years, respectively, and $25,103 and $29,416 spent on those aged 80-84 and 85-89 years, respectively (37). Such increases in health expenditures as a function of age have been attributed to the increase in chronic disease prevalence among the elderly population (12, 37).

In Canada, CIHI reported that the cost of chronic cardiovascular diseases (CVD), including chronic heart disease, was $22.2 billion in 2015. Such costs included $7.6 billion worth of direct costs and $14.6 billion worth of indirect costs. Additionally, the report showed that CVD accounted for 34.6 million visits to PHC providers (including physicians, registered nurse practitioners, and nurses), 17% of hospital admissions, and 65.7 million drug prescriptions (12, 37).

2. PRIMARY HEALTH CARE & CHRONIC DISEASE MANAGEMENT AMONG THE ELDERLY

2.1. THE EVOLUTION OF THE PHC ROLE

The rising elderly population and increased prevalence of chronic disease in this group, coupled with a severe shortage in geriatricians, has necessitated rapid intervention and the collaboration of other health care workers in order to provide effective care to the elderly (38). According to the WHO report, 'Preventing Chronic Diseases: A Vital Investment', one of the defining characteristics of successful chronic diseases management models is a care delivery system that involves several health care disciplines. According to the WHO, multidisciplinary health care services that are inherently rooted in PHC may provide an effective means to combine therapeutic and preventive roles in the management of chronic diseases and multimorbidity in all settings (39).

The Institute of Medicine (IOM) has echoed this WHO recommendation, and has called for new models of care that value physical and mental health, long-term care, and social services within community-based settings. Such models will also be able to demonstrate patient and family-centered care and interdisciplinary team practice (40). In their report, titled: 'Retooling for

an Aging America: Building the Health Care Workforce', the IOM demonstrates more confidence in assigning such services to PHC due to the holistic nature of basic PHC training (40).

In Canada, a severe shortage of geriatricians is threatening the health of seniors. In a nation of 242 geriatricians, of which 35% are over 55 years of age, 0.65 geriatricians are trained to care for 10,000 elderly patients, even though one geriatrician can effectively care for a maximum of 700 patients (41). Such a shortage creates further uncertainty about meeting the need for chronic disease management in the elderly (42).

In addition, PHC professionals (i.e. PHC physicians and registered nurses) are often the first point of contact in the health system (43). PHC physicians have a longitudinal and comprehensive understanding of their patients' needs, and are trained to manage community-based chronic diseases, including the management of older persons with multiple chronic diseases (44).

2.2. IMPACT OF OPTIMAL PRIMARY HEALTH CARE SERVICES

The Canadian National Population Health Survey confirmed that a strong supply of PHC services is associated with better health outcomes (35). An Ontario-based study that examined the impact of optimizing PHC physician supply on diabetes control and quality of care showed that patients in physician networks within the highest tertile of supply of primary care physicians were more likely to receive the optimal number of evidence-based tests for diabetes than patients in networks with a low supply of primary care physicians (45).

The delivery of a strong supply of PHC through timely and effective PHC physician visits has been associated with reduced health care utilization, including: costly hospital admissions, emergency department visits, specialist visits, and surgeries (46, 47). In Quebec, the number of

PHC physician visits has been identified as a strong predictor of emergency department visits among elderly patients (48). This relationship has been explained by the significant role that physicians play in preventing emergency visits through the continuity of care, as defined by the total number of yearly patient visits and the number of physical exams performed by the physician (49, 50). A strong association has also been found between the number of annual visits and physical exams performed by PHC physicians, and their patients' use of the emergency department. As such, patients with higher degrees of continuity of care with their PHC physicians tend to have fewer visits to the emergency room (48). Likewise, patients who received an annual physical exam are less likely to visit an emergency department than those who do not receive it (48).

2.3. PRIMARY HEALTH CARE REFORMS TO ADDRESS POTENTIAL CHALLENGES

PHC systems have held a strong and vital role in the management, treatment, and prevention of chronic diseases and chronic disease complications among the elderly (12).

2.3.1. RECENT PRIMARY HEALTH CARE REFORMS

In the last ten years, PHC systems in many developed countries have initiated multiple reforms in order to address foreseeable challenges and boost the sustainability of the gatekeeping PHC system (51, 52). Such reforms have resulted in various initiatives that mainly focus on strengthening the infrastructure of primary care and introducing and reinforcing the multidisciplinary models of health care delivery to provide a better quality of health services (4). In Canada, provincial PHC reforms have extensively called for an introduction of the new team-based oriented delivery model. For instance, Quebec has introduced three new PHC organizational structures:

1. **Family Medicine Groups**: These groups are privately owned organizations that offer primary care services for registered patients on a non-geographical basis (53-56).
2. **Health and Social Service Centres**: These centres are merged local healthcare institutionsaimed at facilitating collaboration amongst organizations under a single structure(54, 55, 57).
3. **Local Health Networks**: These are private clinics larger than Family Medicine Groups. They consist of an interdisciplinary team(53, 54, 56).

2.3.2. THE CONSEQUENCES OF PHC REFORMS

The team-based oriented models suggested by the above-mentioned PHC reforms recommended making patient care the responsibility of a whole team, rather than assigning all tasks to one primary care physician in a few-minute appointment (53-64). This team consists of PHC nurses, physicians, community health workers, mental health specialists, and pharmacists. In addition, these team members work collaboratively to provide health care services, communicate their findings with each other, and ensure the completeness of the health services that the patient receives (64).

In light of the introduction of this team-based model of PHC service delivery, a significant proportion of face-to face visits to PHC physicians have been replaced by visits to registered nurses (65-69). A US-based randomized controlled trial examining the role of nursing in the PHC has shown that 18% of registered nurse shift time was dedicated to patient visits delegated by the PHC physician (70). Another study showed that 29% of patient visits had been achieved through nursing services, either by registered nurses or nurse practitioners (66). Nevertheless, despite the contribution of the nursing role in PHC service delivery, this study found a 10% increase in the annual number of PHC patient visits

to physicians. In addition, almost all of this new workload was absorbed by physicians, whose annual share of primary care visits increased by 14% (66).

PHC reforms have introduced another novelty as a viable replacement for the unnecessary face-to-face visit: virtual PHC visits. This kind of visit has been defined as doctor- or nurse-patient visits that occur either over the phone, via e-mail or through a web-based portal (65-70). These virtual visits can offer patients higher degrees of flexibility and alternative ways of communicating with their doctors about health issues that do not require a face-to-face visit. The impact of virtual visits on the number of face-to-face visits has been examined in the literature. One UK-based study demonstrated that 50% of phone calls received by a registered nurse were successfully managed without a referral to a PHC physician, which reduced physician-managed calls by 69% and total physician face-to-face visits by 38% (67). This study also reported that both PHC providers' and patients' satisfaction levels were unaffected by the lack of face-to-face contact (67).

In section 7.5.3., we will describe the method by which we have operationalized our novel PHC contact study outcome which will include both visits and virtual contacts.

2.4. CHALLENGES THAT MAY AFFECTPHC

Such a reliance on PHC systems may inevitably be challenged by a scarcity of PHC resources, which would impact chronic disease outcomes(51, 71). PHC resource scarcity has been illustrated by physician shortages and time constraints (72, 73). Over the past few years, the percentage of PHC providers accepting new patients has dropped from 39% to only 9.6% (73). In addition, despite strong efforts, physician-to-patient ratios are only 2.3 per 1,000 (72, 73).

Chronic disease outcomes have remarkably suffered from 'insufficient PHC physician' office hours. PHC physician time constraints have limited the delivery of both curative and

preventive care services for chronic disease, increased unaddressed patient needs, and jeopardized the control of chronic diseases (51, 74, 75).

Poor control due to unaddressed multimorbidity within PHC settings has been associated with lower health-related quality of life (47, 52), higher medication prescriptions and adverse effects (76), higher utilization of health care services, and increased disability and mortality rates. As such, individuals with unaddressed multimorbidity are the highest users of other health care systems (19, 77).

A clear understanding of the factors associated with and contributing to the use of PHC is required in order to develop staffing policies, optimize PHC provider supply, avoid staff burnout, and achieve desired clinical outcomes (78, 79).

2.5. IDENTIFICATION OF THE FACTORS CONTRIBUTING TO PHC VISITS

The importance of identifying the factors that contribute to and predict PHC utilization, particularly PHC visits has been well recognized (4). The identification of such factors has brought about various interventions to effectively manage existing resources for better cost-containment and clinical outcomes (78, 79).

Many theories, models, and frameworks have been created to explain health services use; however, the majority of studies have used the Andersen framework to evaluate and explain health care utilization by the general population (80-82) as well as by the elderly (2, 3, 24, 33, 80, 83).; For more details about these models, please refer to **Appendix I.**

The Andersen framework assumes that health care service use is a function of certain factors that interact with each other (84). These factors have been categorized into individual and

health system factors. Individual, and societal, factors include: predisposing, enabling and needs factors.

Predisposing factors include demographic characteristics (such as age, sex, and marital status), social structures (such as education, occupation, race, and ethnicity), and health beliefs, which incorporate values concerning health and illness, attitudes toward health services and knowledge about the disease. Enabling factors include family-related factors, such as income, health insurance, and employment and community-related factors. Needs factors include professionally evaluated factors (such as disease severity, disease duration, symptom severity, comorbidity, and complications) and subjectively perceived health status (such as overall quality of life (QOL), perceived health status, activities of daily living (ADL), disability, symptom count psychosocial distress, and other psychological variables.

Health care system factors include both the resources available, as well as the organizational structure by which these resources become accessible to the users. Resources include the total volume of resources relative to the population size, and the way that such resources get geographically distributed among the population. The volume may include personnel/population ratios for multiple health care providers, such a physicians, nurses, dentists, etc. Geographical distribution is included as many resources of the health system may not be homogeneously dispersed, meaning that resources might not be available for all users to the same degree.

2.5.1. RAPID LITERATURE REVIEW

A rapid review of the studies examining the factors contributing to PHC visits was completed for this thesis. There exists a high degree of discrepancy in the studies included in this review with respect to population, country, patient sample size, health care utilization measures,

tools, instruments, procedures, research methodologies and statistical tests. However, this review provides a list of potential factors that are associated with the number of visits to PHC settings.For the aggregate results of these studies, please refer to **Table 18 & Table 19 in Appendix II.**

3. STUDY RATIONALE

One in six Canadians were 65 years or older in 2015, and this proportion is estimated to rise to approximately 25% in 2030 and 32% in 2050 (5). In addition to an aging population, Canada is experiencing a rise in the prevalence of individual chronic diseases and multimorbidity (8). As result, there has been a drastic increase in the use of various health care services recorded (14-18), with a particular and systematic reliance on the services of PHC providers (12, 42). In addition, the scarcity of PHC physician resources has also become a concern among health managers and policy makers, who emphasize the importance of attaining a clear understanding of the different contributing factors to use of PHC physician services (42). Such an understanding will enable planning advanced planning for PHC physician resources dedicated to such a demanding population (35).

Many research studies have examined the factors contributing to the use of PHC physicians by elderly patients within the well-known Andersen Model of Health Service Use. However, only three studies have been based on a Canadian population, all of which were from Ontario (38, 85, 86). No study to date has examined the Quebec health care system.

The vast majority of health services research have originated from the US healthcare system (72, 87-95), which differs largely from the universal publically-funded Canadian health care system (72, 87). Indeed, comparative health services research has demonstrated enormous

discrepancies between US and Canadian health care systems outcomes. In addition, most of the studies examining PHC contacts as an outcome have limited their definition of PHC contacts to face-to-face contacts with the physician, thereby overlooking the novel concepts introduced by multiple PHC reforms. This new concept takes all contacts into account, either with PHC physicians or registered nurses, either virtually (through email or over the phone) or physically in a face-to-face contact (2, 24, 34, 88-91, 93-96).

Furthermore, these research studies have extensively and repetitively utilized the first version of the Anderson Model of Health Services Use, overlooking the updated factors that Anderson considered in his re-visit to the old model (84). The updated version of the Andersen model incorporates a new set of health care system factors, such as policy, resource, and organizational factors (81, 95, 97-99). Very few studies (none of which are Canadian) have considered the organization, the health care system, or the health policy factors upon examining PHC visits.

As such, the identification of such factors using the newly revised Anderson team-based model within the Quebec healthcare system will help build future predictive models aimed at developing better staffing policies, cost-containment strategies, and higher quality care indices for elderly patients.

4. RESEARCH HYPOTHESIS

4.1. PRIMARY HYPOTHESIS

The number of PHC contacts is significantly associated with patient-level and GMF-related factors.

5. RESEARCH QUESTION

5.1. PRIMARY QUESTION

What are the associations between the number of PHC contacts by elderly patients and patient-level and GMF-related factors within Quebec GMFs?

6. OBJECTIVES

6.1. MAIN OBJECTIVE

The main objective of this study is to identify the factors associated with the number of PHC contacts among the elderly population in Quebec's family medicine groups (in French: groupes de médecines de famille (GMFs).

6.2. SPECIFIC OBJECTIVES

6.2.1. FIRST SPECIFIC OBJECTIVE

To identify chronic disease as a patient-related factor of health services use among the elderly population at Quebec's GMFs using medications as a proxy for chronic disease. In order to fulfill this objective, we had to map the medications prescribed for the study population and update the medication classes used for the different chronic diseases management among elderly patients at Quebec GMFs.

6.2.2. SECOND SPECIFIC OBJECTIVE

To describe the distribution of the patient-level and the GMF-level factors, as well as the distribution of PHC contacts, among the elderly population at the Quebec GMFs.

6.2.3. THIRD SPECIFIC OBJECTIVE

To study the association between patient-level and GMF-levelfactors of health services use and the number of contacts withPHC providers among the elderly at Quebec GMFs.

7. METHODS

7.1. OVERALL DESIGN

This study was a secondary analysis of the Alzheimer's Plan Evaluation Study, the latter which employed a cross-sectional design. (100).

7.2. STUDY POPULATION

The study population comprised 75 patients at each of the 13 GMFs that participated in both the pre-implementation and post-implementation periods of the Alzheimer Plan evaluation study (100). A total of 1,919 patients were randomly selected according to the two main criteria:

First, participant had to be be 75 years and older. Second, participants had to have experienced a minimum of one contact within a GMF during one of the two 9-month periods of assessment of the Alzheimer Plan Evaluation Study. This study population was used through this current study in order to evaluate our three study objectives.

7.3. METHODS FOR THE FIRST OBJECTIVE

The first objective was to identify the chronic diseasesamong the elderly population at Quebec GMFs. For that purpose, we used medications as a proxy for chronic diseases. First, we updated the medication mapping and matching system proposed by Dubois and colleagues (101). We then mapped the different medications prescribed for the study population, and matched them to the different chronic diseases.

7.3.1. DATA SOURCE

This study used two main sources. First,patient medication listswere obtained through a secondary analysis of the chart review database from theAlzheimer's PlanEvaluation Study(100).

Second, the medication classifications were obtained through the Drug Product Database provided by Health Canada (102).

7.3.1.1. CHART REVIEW

The database of the Alzheimer's Plan Evaluation Studywas developed using chart review in order to objectively "measure the evolution of clinical practices within the GMFs" (100) where the Alzheimer's Plan had been implemented. The Alzheimer's Plan Evaluation Study comprised two nine-month periods: a pre-implementation period (October 2011-July 2012) and a post-implementation period (October 13 - July 2014)(100). Patient charts reviews were conducted retrospectively for each participant GMF (for timelines, please refer to **Appendix III**).

We opted to combine the populations of both the pre- and post-implementation periods of the Alzheimer's Plan Evaluation Study in order to maximize the sample size. In addition, we assumed that the Alzheimer's Plan would not influence the medications prescribed for chronic diseases. Both populations were tested for homogeneity (age, sex, the number of medications and number of contacts). Both pre-and post-Alzheimer's Plan cohorts included an independent sample of 75 patient charts randomly selected from each GMF.

For feasibility purposes, the chart review was limited to patients aged 75 years or older (with the highest prevalence of dementia). The list of patients aged 75 years and older in each GMF was identified using an automated and secure method by the study programmer. This method used for the Alzheimer's Plan Evaluation Study was approved by the Research Ethics Committee at the Lady Davis Institute of Medical Research at the Jewish General Hospital.

The chart review examined patient record summaries, written notes, and reports to determine the medication lists. Specifically, a group of 6 research nurses, 1 auxilliary nurse, 1 registered physiotherapist, and a physician examined the charts to extract these lists of

medications among the many variables of the Alzheimer's Plan Evaluation Study. The prescription medication lists retrieved from the Alzheimer's Plan Evaluation Study came from various sources, including: GMFs physician prescriptions, hospital discharge summaries, specialists' prescriptions, and pharmacy faxes(100).

The team of the Alzheimer's Plan Evaluation Study prepared a database for entering data into a secure web application tailored by the Centre for Clinical Epidemiology at the Jewish General Hospital – Lady Davis Research Institute.

The medication lists included three medication categories. First, medications prescribed by the GMF PHC physician at a GMF during the period of assessment. These medications had to be documented and signed by the PHC physician. Second, medications the patient was taking during the period of assessment, as prescribed by any other physician. These medications had to be recorded in the medication section in the patient's chart or supported by a pharmacy fax dated and received during the period of assessment. Finally, medications reported in the patient's hospitalization discharge summary, provided that the medication was prescribed or administered during the period of assessment.

7.3.1.2. DRUG PRODUCT DATABASE

The Drug Product Database (DPD) offers product specific information on drugs approved for use in Canada (102). The database is managed by Health Canada and includes human pharmaceutical and biological drugs, veterinary drugs, radiopharmaceutical drugs, and disinfectant products. It contains information pertiaining to approximately 47,000 products that are currently approved, marketed or canceled. The DPD provides a search engine that allows for the identification of the American Health Formulary service (AHFS) class and code for each medication entry (103).

7.3.2. SPECIFIC METHODS

In order to identify the list of chronic diseases among our study population, each prescription medication had to be systematically mapped and matched to its corresponding chronic disease. To this end, we used the medication mapping and matching system proposed by Dubois and colleagues in their 2010 paper entitled 'Assessing comorbidity in older adults using prescription claims data' (101).This unique mapping and matching system classified medications using the 2008 American Health Formulary System (AHFS) to categorize classes and codes of medications used for the management of 21 chronic diseases. This mapping and matching system also provided precision rules in order to avoid the mismatching of some medications with an incorrect chronic disease.However, it was necessary to update this matching system given that new medications have been introduced in the management of chronic diseases since its development.

In order to use this mapping and matching system, we developed a 3-phase process (please refer to Figure 1):

Phase I: Identify the Drug Identification Number (DIN), AHFS Class, and AHFS Code for each prescription medication, as recorded in the patient charts according to the 2016 AHFS classification.

Phase II: Update the mapping and matching system used by Dubois and colleagues.

Phase III: Use the final list of medication classes to match the medication entries with their corresponding chronic diseases.

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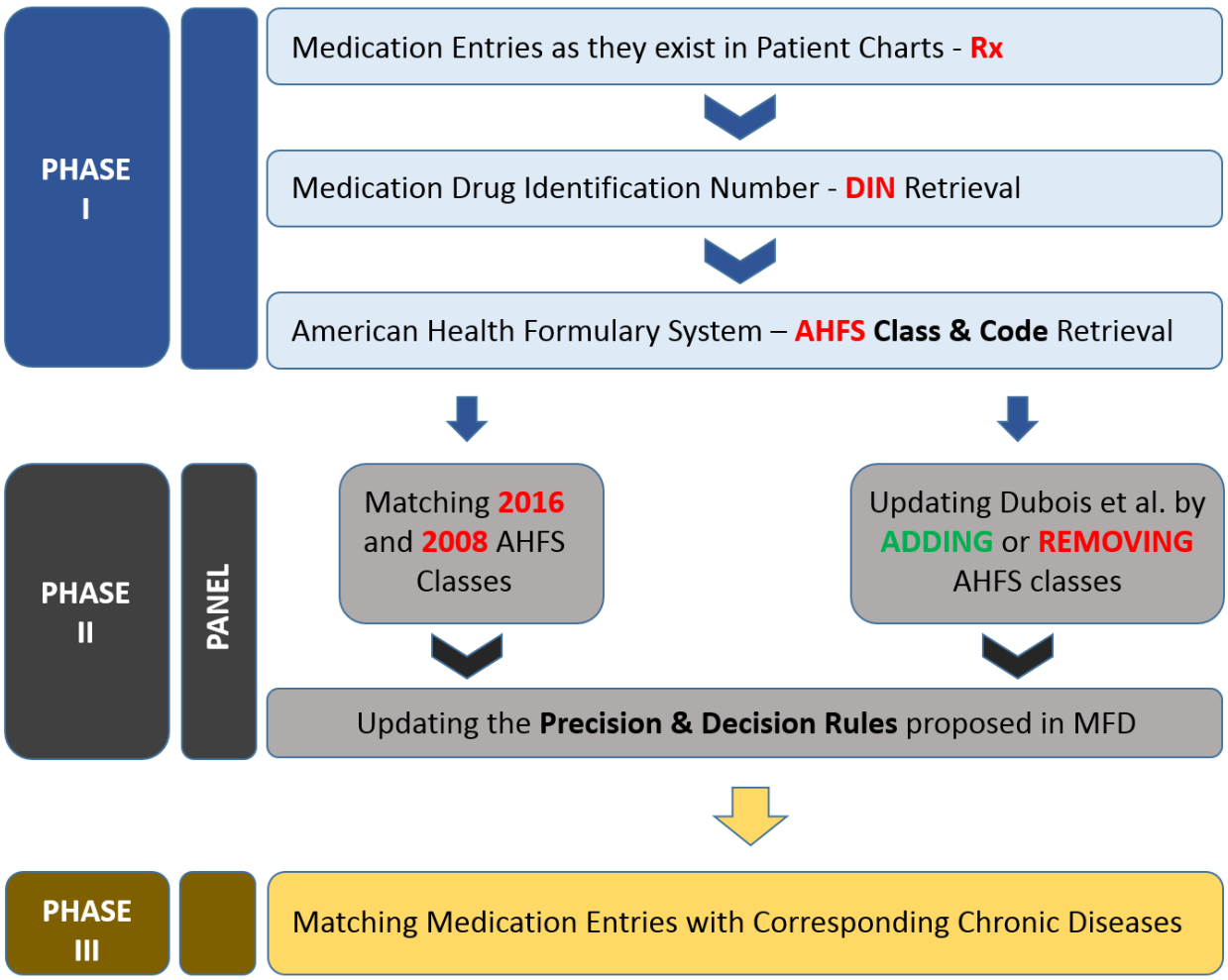

Figure 1. Flow Chart: 3-Phase Process of Matching Medications to Chronic Diseases

7.3.2.1. PHASE I: IDENTIFYING THE CLASS AND CODE OF EACH PRESCRIPTION MEDICATION ACCORDING TO THE 2016 AHFS CLASSIFICATION SYSTEM

Medications had to be mapped in order to identify their AHFS classes and codes. Prior to being mapped, however, all medications entries retrieved from patient charts had to be verified for legibility. Illegible medications were excluded and labeled 'Illegible'. Legible medication entries then had to be verified for the correct spelling. Verification was achieved by consulting the website of Canoé Santé , that publishes information pertaining to medical conditions and medication, and is accredited by an independent body(104).

All medication entries then had to be classified by type (i.e. brand names, generic names, or active ingredients) prior to ascertaining their unique drug identification number (DIN). A DIN is a computer-generated eight digit number assigned by Health Canada to a drug product prior to being marketed in Canada. It uniquely identifies all drug products sold in dosage form in Canada, and can be found on the label of prescription and over-the-counter drug products that have been evaluated and authorized for sale in Canada. A DIN uniquely identifies the following product characteristics: manufacturer, product name, active ingredient(s), strength(s) of active ingredient(s), pharmaceutical form, and route of administration.

For some medications, it was not possible to retrieve a DIN, as these medications are marketed in Canada as over-the-counter (OTC) medications. In these cases, a 'panel' which included a physician, a pharmacist, and a pharmacoepidemiologist met to either match them with chronic diseases or to confirm them as unclassified and unmatched medications. In the end, each generic or brand name medication entry was matched to a unique DIN, and one or multiple DINs were obtained for drugs with multiple active ingredients.

For active ingredients with a single DIN, identification of the AHFS class and code was straightforward. However, for active ingredients with two or more DINs, information pertaining to medication form, strength, and route of administration had to be retrieved ensure appropriate AHFS classification. For example, the active ingredient 'Timolol' matched to two AHFS classes: 'Beta-Adrenergic Blocking Agents' and 'Beta-Adrenergic Agents', depending on the form and mode of administration. The former was assigned to oral tablets, whereas the latter was been assigned to ophthalmic solutions. If a medication had different forms, strengths, and routes of administration, but more than two AHFS classes and codes were found, the 'panel' arbitrated. In situations where a medication contained two active ingredients, two medication classes were identified, and the panel determined the most appropriate chronic disease match..

7.3.2.2. PHASE II: UPDATING THE MAPPING AND MATCHING SYSTEM PROPOSED BY DUBOIS ET AL.

The mapping and matching system proposed by Dubois and colleagues included all medication classes that existed in 2008 (101). Given the introduction of new medications as well changes in medication classifications, it was necessary to update the matching system between medication class and chronic disease. As such, the panel met to update the mapping and matching system. This phase comprised of three main steps:

Step 1: Matching the 2016 and 2008 AHFS classes.

Step 2: Updating the list of medication classes.

The Dubois and colleagues' mapping and matching system included 67 medication classes used in the management of 21 chronic diseases (100). For the list of these diseases, please refer to (**Table 1**).

Table 1 List of 21 Chronic Diseases

Anaemia	Gout	Pain and Inflammation
Anxiety and Sleep Disorder	Hyperlipidaemia	Respiratory Diseases
Behaviour_Problems	Hypertension	Rheumatologic Conditions
Cardiac Diseases	Malignancies	Severe Pain
Diabetes	Mental Disorders	Thyroid Disorders
Gastrointestinal Problems	Neurological Conditions	Urinary and Renal Problems
Glaucoma	Osteoporosis	Vascular Diseases

Step 3: Update the precision and decision rules specified by Dubois and colleagues' mapping and matching system.

Precision and decision rules were introduced by Dubois and colleagues in order to avoid mismatching medications with the incorrect chronic disease (101). For instance, medications classified as 'Adrenals' according to the AHFS can be used for both respiratory problems as well as rheumatologic conditions. In their precision and decision rules, Dubois and colleagues had

decided that inhalation adrenals should be matched to respiratory problems, whereas oral adrenals should be matched to rheumatologic conditions. Such rules were mainly applied to the medications retrieved from the database as active ingredients. The panel met to both review the set of precision and decision rules, and as well to adjudicate situations where medications had two active ingredients.

7.3.2.3. PHASE III: USING THE FINAL LIST OF MEDICATION CLASSES TO MATCH MEDICATIONS TO THEIR CORRESPONDING CHRONIC DISEASES

Upon developing the final list of medication classes (which includes the updated precision and decision rules), medication entries for each study patient were matched using our newly revised classification system, and chronic diseases were attributed to study patients accordingly.

7.4. METHODS FOR THE SECOND OBJECTIVE

7.4.1. DATA SOURCES

7.4.1.1. CHART REVIEW

Chart review data from the Alzheimer's Plan Evaluation Study provided all patient-level independent variables as well as the study primary outcome **(Table 2)**.

7.4.1.2. QUEBEC MINISTRY OF HEALTH DATA

Data pertinent to the GMF-level factors were retrieved from the Ministry of Health of Quebec (La ministère de santé et services socieaux). Please refer to (**Table 2)**.

Table 2. List of Variables according to Data Source

Chart Review	**Patient-Level Factors**	**Predisposing Factors**	Age
			Sex
			Living Status
		Needs Fators	Prescription Medications
	Primary Outcome		Number of Primary Health Care Contacts
Ministry Of Health	**GMF-Level Factors**	**Predisposing Factors**	Total Number of Patients
			Total Number of Elderly Patients
		GMF Resource Factors	Number of Physicians
			Number of FTE Physician
			Number of Registered Nurses
			Number of FTE Registered Nurses
		GMF Organizational Factors	Number of GMF Sites
			Years of Operations
			University Affiliation
			Type (Public /Mixed)

7.4.2. SPECIFIC ANALYTICAL METHODS FOR THE SECOND OBJECTIVE

In order to describe the distribution of the patient-level and the GMF-level factors, as well as the distribution of PHC contacts among the elderly population at the Quebec GMFs, we performed descriptive analyses of all independent study variables, as well as the dependent variable (or study outcome).

7.4.2.1. INDEPENDENT PATIENT-LEVEL VARIABLES

For the continuous patient-level variables (age, number of medications and number of chronic diseases), we calculated the following statistics: minimum, maximum, mean, and standard deviation. These were calculated both by GMF and overall. For categorical patient-level variables (sex, age group, and living status), we calculated the frequency and the percentage (both by GMF and overall). The percentage of missing data was determined for both continuous and categorical variables. In addition, age was stratified into three age groups (75 – 79, 80-84, and 85+), in order to identify whether or not patients within the 'oldest old' (85+) age group had an affect on our outcome across the thirteen participating GMFs(105).

The prevalence of each chronic disease among the whole study population was also calculated, as were the frequency of single and multi-morbidity. The frequency count of each chronic disease among the whole population was also recorded. A table was created to present the frequencies of the different medication classes used for the management of each chronic disease.

7.4.2.2. INDEPENDENT GMF-LEVEL VARIABLES

For continuous patient-level variables (number of physicians per FTE physician, number of patients per FTE physician, number of patients per FTE registered nurse, number of sites within GMF, GMF years of operations, and GMF proportion of elderly patients) we calculated the following statistics: minimum, maximum, mean, and standard deviation (both by GMF and overall). For categorical variables (i.e. GMF university affiliation and type; whether it is public or mixed) we calculated the frequency and the percentage (both by GMF and overall).

7.4.2.3. DEPENDENT VARIABLE

The minimum, maximum, mean and standard deviation were calculated for the number of primary care contacts in the whole study population. These estimates were stratified by all categorical independent patient-level and GMF-level variables.

7.5. METHODS FOR THIRD OBJECTIVE

7.5.1. ANALYTICAL METHODS FOR THE THIRD OBJECTIVE

We first verified the assumption of normality by conducting an analysis of covariance. As our dataset involved a hierarchical structure (patients-nested within GMFs), we needed a model that adjusts for such nesting or clustering. Therefore, we used Generalized Estimating Equations (GEE). (106)which allowed us to account for the violation to the assumption of independence within our data due to the clustering, and produced robust standard errors. Estimates and 95%

confidence intervals for each parameter were also produced. Parameters with a p-value < 0.05 were considered to be statistically significant. All analyses were conducted using SPSS version 24.

GEE models are used to analyze correlated data with binary, discrete, or continuous outcomes (107). In order to use the GEE model, we had to make several decisions. First, we assessed the distribution of the outcome variable, PHC contacts. Based on the distribution of the outcome variable for which overdispersion was observed, a negative binomial model was selected for data analysis. In addition, the exchangeable correlation structure was selected due to the clustering nature of the dataset.

The results for the GEE model are presented as odds ratios rather than regression coefficients, as odds ratios make the interpretation a more intuitive measure of risk. Oddsratios that are greater than 1 are interpreted as increasing the likelihood of an outcome (i.e., are considered harmful) whereas odds ratios that are less than 1 are interpreted as decreasing the likelihood of an outcome (i.e. are considered protective) (106). Odds ratios that are equal to 1 are not associated with an increased or decreased risk.

7.6. STUDY VARIABLES

7.6.1. DEPENDENT VARIABLE

The use of PHC services, asrepresented by the number of PHC contacts,was selected as a primary outcome. This number included:

i. Eachin-personcontact, defined as a face-to-face visit with the PHC physician, the registered nurse at the GMF, and/or any other clinician.

ii. Each virtual contact, defined as a phone call and/or email communication between the patient and either the PHC physician or the registered nurse.

A patient-PHC provider contact may take place for a variety of reasons, including: history-taking, physical examinations, medication prescriptions, medication dose adjustments, prescription renewals, new patient contact, follow-up contact, and patient education.

7.6.2. INDEPENDENT VARIABLES

As per the Andersen Model, two levels of variables were included in the study: patient-level and GMF-level variables (84). Please refer to the adapted Andersen Model used for this study **(Figure 2)**.

Patient-Level Variables

Predisposing Factors

These factors included both the demographic as well as social structure information. Demographic information included patient age, age group, and sex, whereas the social structure considered the living status, referring to whether the patient lives alone or with a family member, spouse, or with children.

Needs Factors

These factors included both the number of medications and the number of chronic diseases. The number of medications includes both number of prescription medications used for the treatment of chronic diseases, as well as that of medications used for other purposes. For the individual chronic diseases, in this study we considered the same list of chronic diseases discussed in the Dubois and colleagues paper. Please refer to (**Table 1**)

GMF-Level Variables

Predisposing Factors

The proportion of elderly patients among the total population of patients registered in each GMF.

GMF Resource Factors

Three factors were considered in this group. First, the number of physicians per FTE physician within the GMFs. This variable was selected to represent the intensity at which physicians work and the continuity of care that they provide. Second, the number of patients per FTE physician within the GMF. Third, the number of patients per FTE registered nurse within the GMF. The last two variables were selected to represent the PHC provider intensity and availability for their rostser of GMF patients.

GMF Organizational Factors

Four different factors were included in this group to represent various GMF organizational variables: the number of sites within each GMF, years of operation, University affiliation (Université de Montréal, McGill University, Université de Laval, and Université de Sherbrooke), as well as the type of GMF (i.e. whether it is comprised of only public sites, or a mixed GMF comprised of both public and private sites).

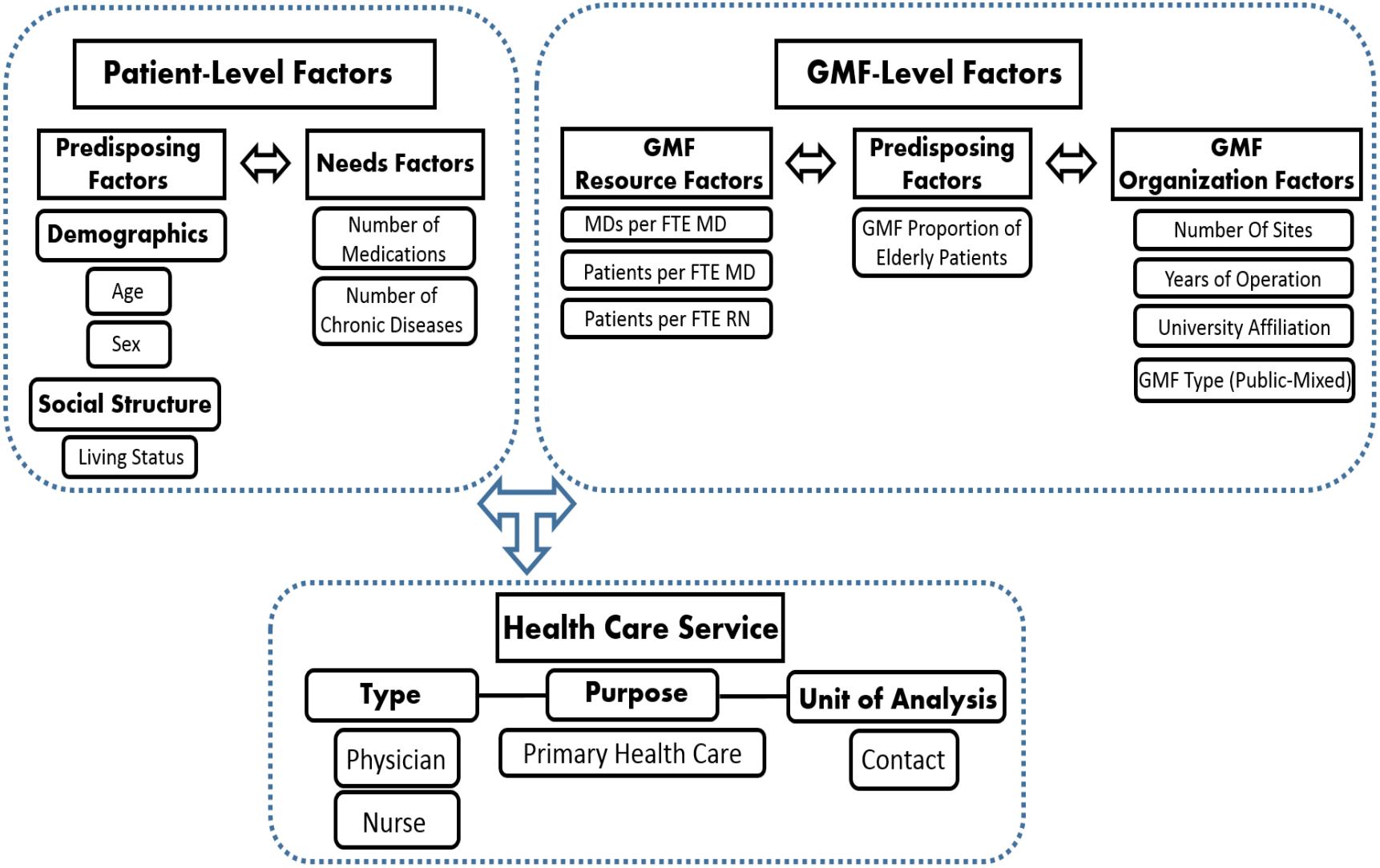

Figure 2. Adapted From the Andersen Model of Health Services Use (84)

8. RESULTS

8.1. CHRONIC DISEASES IDENTIFICATION

8.1.1. IDENTIFYING THE AHFS CLASS AND CODE OF EACH PRESCRIPTION MEDICATION ACCORING TO THE 2016 AHFS CLASSIFICATION

8.1.1.1. MEDICATION VERIFICATION AND DRUG INDENTIFICATION NUMBER RETRIEVAL

A total of 22,221 prescription medications were retrieved from the charts of 1,919 study patients. One hundred and sixty medication entries (0.7% of the total medication number) that were prescribed for 121 patients (6.3% of the total study population) were not legibile. A total of 22,061 medication entries were legible, and were therefore verified for correct spelling and nomenclature. Among these medications, brand name medications were the most commonly prescribed, representing 47.4% (10,449 medication entries) of the total medication entries. This was followed by active ingredients, which represented 38.8% (8,570 medication entries), and then generic medications, which represented 11.6% (2,568 medication entries). The rest included over-the-counter medications (OTC) (specifically, 460 medication entries for 347 patients) and 13 unclear entries (for 12 patients), classified as 'Unclassified Medications'. We were able to identify a DIN for 21,588 prescription medications.

8.1.1.2. AHFS CLASS & CODE IDENTIFICATION

The list of DINs obtained from Phase I were matched using the Drug Product Database in order to identify the medication AHFS code and class. 98.3% of the medications (21,225 medications) had a single active ingredient, while the remaining 1.7% (363 medications) included

two active ingredients. For results pertaining to the medication mapping and matching process, please refer to the flow chart in **(Figure 3).**

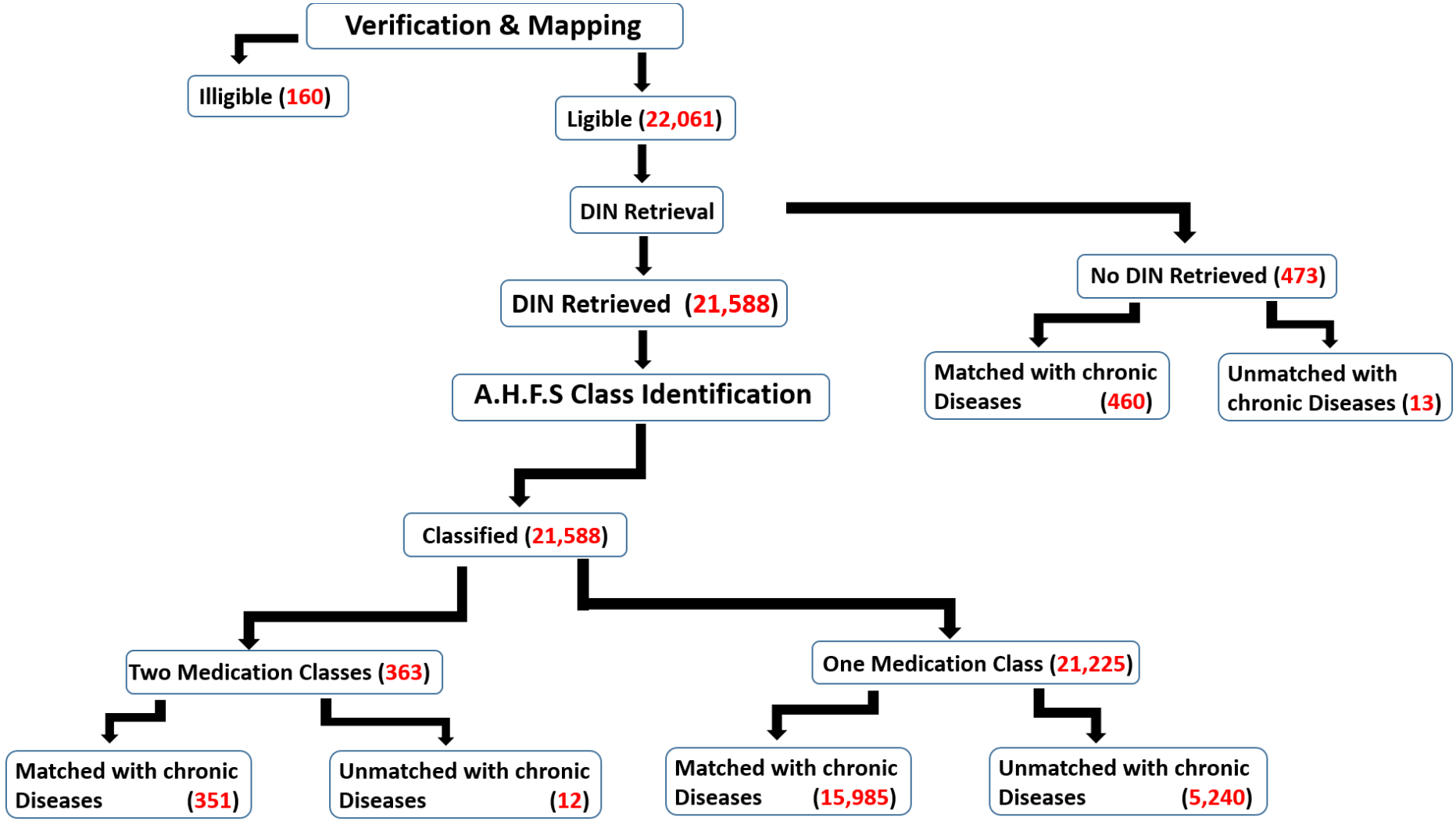

Figure 3.Results of the Medication Mapping & Matching Process

8.1.2. UPDATING THE MAPPING AND MATCHING SYSTEM PROPOSED BY DUBOIS ET AL.

8.1.2.1. MATCHING 2016 AHFS CLASSES WITH 2008 AHFSCLASSIFICATION SYSTEM USED BY DUBOIS ET AL.

A total of 210 AHFS classes and codes were identified from the medications listed in the charts.

8.1.2.2. UPDATING THE LIST OF MEDICATIONS AND PRECISION & DECISION RULES PROPOSED BY DUBOISET AL.

Updating the chronic disease lists involvedthe addition and removal ofsome medication classes. A total of **18** new medication classes were added to **10** chronic disease classifications, whereas, **3** medication classes were omitted from **2** chronic disease classifications. In updating these 10 chronic disease classifications, a provisional list of chronic disease medication classes was created. Prior to applying this list, however, we had to review and update some of the Dubois's precision and decision rules. Some medication classes were revised in order to update the precision and decision rules created by Dubois and colleagues. As such, a set of rules was developedby the panel, including:

1. The approval of a subset of existing rules applicable to the following **5** medication classes: adrenals, antimuscarinics antispasmodics, antimalarials, opiate agonists,andparasympathomemetic (cholinergic) agents.
2. The modification of a subset of existing rules that applied to **2** medication classes; salicylates and platelet aggregation inhibitors.
3. The development of new rules pertaining to **4** medication classes: anticholinergic agents, alpha adrenergic agents, EENT drugs, and miscellaneous central nervous system agents.

For the list of precision & decision rules, as well as the medication classes added or removed, please refer to **(Table 3).**

Table 3.Results pertaining to our Updated Medication Class Precision & Decision Rules

2016 A.H.F.S. Drug Class	2016 A.H.F.S. Drug Code	Inclusion & Exclusion Criteria according to Dubois et al.	Updated Decisions rules	Chronic Disease
ADRENALS	68:04.00	Inhalation Only Oral or Injections & Not accompanied by Inhalation	Inhalation Oral or Injections & Not accompanied by Inhalation	Respiratory Diseases Rheumatologic Conditions
ANTIMUSCARINICS ANTISPASMODICS	12:08.08	Inhalation Only Rout of adminstration: Oral	Inhalation Only Rout of adminstration: Oral	Respiratory Diseases **Unmatched with Chronic Diseases**
ANTICHOLINERGIC AGENTS	48:12.08 28:36.08	- -	Inhalation Only Rout of adminstration: Oral	Respiratory Diseases Neurologic Conditions
ANTIMALARIALS	08:30:08	Only Plaquinil Other than Plaquinil	Only Plaquinil Other than Plaquinil	Rheumatologic Conditions **Unmatched with Chronic Diseases**
EENT DRUGS, MISCELLANEOUS	52:92.00	- -	Ophthalmic Solution Medication form: other than Ophthalmic Solution	Glaucoma **Unmatched with Chronic Diseases**
MISCELLANEOUS CENTRAL NERVOUS SYSTEM AGENTS	28:92.00	- -	Containing Memantine Active Ingredient: other than Memantine	Neurologic Conditions **Unmatched with Chronic Diseases**
OPIATE AGONISTS	28:08.08	Containing Codiene Only Other than Codiene Medication form: Syrup	Containing Codiene Only Other than Codiene Medication form: Syrup	Pain & Inflammation Severe Pain **Unmatched with Chronic Diseases**
PLATELET AGGREGATION INHIBITORS	20:12:18	Clopidogrel Only: Cardiac Diseases Other than Clopidogrel: Vascular Diseases	All medications included in this class will be considered for Vascular Diseases	**Vascular Diseases** **Vascular Diseases**
PARASYMPATHOMEMETIC (CHOLINERGIC) AGENTS	12:04.00	Only:Rivastagmine - Donepezil - Galantamine Only: Sevelamer - Tamsulon - Alfuzosin Active Ingredient: other than specified above	Only:Rivastagmine - Donepezil - Galantamine Only: Sevelamer - Tamsulon - Alfuzosin Active Ingredient: other than specified above	Neurologic Conditions Urinary and Renal Problems **Unmatched with Chronic Diseases**
SALICYLATES	28:08.04.24	ASA < 600 mg ASA > 600 mg -	ASA 80, 325 or no dosage ASA > 500 mg Medication form: other preparation; Cream	Cardiac Diseases Pain & Inflammation **Unmatched with Chronic Diseases**
ALPHA-ADRENERGIC AGONISTS	52:40.04	-	Ophthalmic Solution or timolol Rout of adminstration: Oral	Glaucoma **Unmatched with Chronic Diseases**
BETA-ADRENERGIC AGENTS	52:40.08	-	New Medication Classes	Glaucoma
PROSTAGLANDIN ANALOGS	52:40.28			
AMMONIA DETOXICANTS	40:10.00	-	New Medication Classes	Gastrointestinal Problems
ANTACIDS AND ADSORBENTS	56:04.00			
CHOLELITHOLYTIC AGENTS	56:14.00			
SELECTIVE SEROTONIN AGONISTS	28:32.28	-	New Medication Classes	Pain & Inflammation
MISCELLANEOUS GENERAL ANESTHETICS	28:04.92			
DISEASE-MODIFYING ANTIRHEUMATIC AGENTS	92:36.00	-	New Medication Classes	Rheumatological Conditions
IMMUNOSUPPRESSIVE AGENTS	92:44.00			
LOCAL ANESTHETICS	72:00.00			
SELECTIVE BETA 3-ADRENERGIC AGONISTS	86:12.08.12	-	New Medication Classes	Urinary and Renal Problems
PHOSPHATE-REMOVING AGENTS	40:18.19			
PLATELET AGGREGATION INHIBITORS - containing CLOPIDOGREL	20:12.18	-	New Medication Class	Vascular Diseases
PHENOTHIAZINE DERIVATIVES	04:04.12	-	New Medication Class	Anxiety and Sleep Disorders
GLYCOGENOLYTIC AGENTS	68:22.12	-	New Medication Class	Diabetes
MINERALOCORTICOID (ALDOSTERONE) RECEPTOR ANTAGONISTS	24:32.20	-	New Medication Class	Hypertension
GONADOTROPINS	68:18.00	-	New Medication Class	Malignancies
ANTI-INFLAMMATORY AGENTS	84:06:00	Gastrointestinal Problem	**Removed** from the list	-
REPLACEMENT PREPARATIONS	40:12:00	Osteoporosis	**Removed** from the list	-
VITAMIN D	88:16:00			-

8.1.3. USING THE FINAL LIST OF MEDICATION CLASSES TO MATCH MEDICATIONS TO THEIR CORRESPONDING CHRONIC DISEASES

The final list, with the updated precision rules was applied to the 21,588 medication entries retrieved from patient charts. As 21,225 out of those medication entries had a single AHFS class, 75.3% (15,985 medication entries) were matched to their corresponding chronic diseases. For a list of the one-active-ingredient medication entries as matched to their corresponding chronic diseases, please refer to **Appendix IV**. The remaining 24.7% (5,240 medication entries) went unmatched to the 21 chronic diseases.

A total of 363 medication entries retrieved from the patient charts had two AHFS classes. Almost 97% of these medications were matched to their corresponding chronic diseases, whereas the remaining 3% (12 medication entries) went unmatched.

Medications with two active ingredients (363 medication entries) fell into four categories:

1. Medications with two active ingredients that matched to the same chronic disease. A total of **338** medication entries were matched to their corresponding chronic diseases according to the final list of chronic disease medication classes.
2. Medications with two active ingredients that did not correspond to any of the 21 chronic diseases. A total of **9** medication entries were considered 'Unmatched'.
3. Medications with two active ingredients that matched to two different chronic diseases. A total of **2** medication entries had to be examined by the panel in order to determine their corresponding chronic disease.

Medications with one active ingredient that matched to a chronic disease and another active ingredient that went unmatched. A total of **12** medication entries were matched to one chronic disease.

Medications with one active ingredient that matched to a chronic disease and another active ingredient that went unmatched, but for which the panel decided to match to neither chronic disease. A total of **2** medication entries fit this category.

For a list of the medication entries with two active ingredients and their corresponding chronic diseases, please refer to **Appendix IV**.

A total of 5,240precriptions for 85 medications were not matched to chronic diseases. Examples of the most common of these include vitamins and minerals, vaccines, anti-inflammatory drugs and corticosteroid creams and ointments. Please refer to Appendix V for a complete listing of these unmatched medication classes.

8.1.4. MATCHING MEDICATIONS WITHOUT DRUG IDENTIFICATION NUMBERS

Out of the 473 medication entries for which we could not obtain the DINs, the panel successfully matched 9 medications associated with 13 prescriptions to three chronic diseases. For the list of the 9 medications and their corresponding chronic diseases, please refer to Table4 (below).

Table 4.Decisions pertaining to Medication Entries matched to 3 Chronic Diseases

	Medication Name as retrieved from charts	No. Of Rx	Chronic Disease
1	Chimio Tx	1	Malignancies
2	Illisible turbuhaler	1	Respiratory
3	Inhalo	1	Diseases
4	Depo + Xylo	1	
5	Illisible infiltration	3	
6	Monovisc	1	Rheumatologic
7	Neovisc	1	Conditions
8	Simvisc-one inj	1	
9	Synvisc	3	
		13	

8.1.5. CHRONIC DISEASE MEDICATION CLASSES AND CHRONIC DISEASE PREVALENCE

In matching the prescription medications with medication classes (125 Classes) and corresponding chronic diseases (21 Diseases), we were able to identify the prevalence of each chronic disease among our study population. Among 125 medication classes, HMG-COA reductase inhibitors has ranked as the most frequently prescribed class (n= 1,097), followed by proton pump inhibitors (n= 917), salicylates (n= 897), cathartics and laxatives (n= 881), and analgesics and antipyretics (n= 851). Among the 21 chronic diseases identified, the proportion of patients identified as having hypertension was highest at 77%, followed by hyperlipidemia (57.2%), gastrointestinal problems (55.9%), cardiac diseases (53.3%) and pain & inflammation (48.2%). For a full list medication class and corresponding chronic disease frequencies, please

refer to **Table 5.** For the remaining 85 Medication Classes that did not match to any of the 21 chronic diseases, please refer to **Appendix V.**

Table 5.Frequency of Medication Class Prescriptions and the Corresponding Chronic Diseases

2016 AHFS Drug Class	Total No. Of Prescribed Active Ingredients	Corresponding Chronic Disease	No. Of Patients Classified as being Diagnosed with This Chronic Disease (%)
IRON PREPARATIONS	218	**Anemia**	**209 (10.9%)**
BENZODIAZEPINES	642	**Anxiety andSleep Disorder**	**639 (33.3%)**
MISCELLANEOUS ANXIOLYTICS SEDATIVES AND HYPNOTICS	98		
PHENOTHIAZINE DERIVATIVES	1		
Respiratory and CNS Stimulants	5		
ANTIMANIC AGENTS	6	**Behaviour Problems**	**168 (8.8%)**
ATYPICAL ANTIPSYCHOTICS	163		
BUTYROPHENONES	18		
MISCELLANEOUS ANTIPSYCHOTICS	1		
PHENOTHIAZINES	8		
THIOXANTHENES	2		
CARDIOTONIC AGENTS	62	**Cardiac Diseases**	**1022 (53.3%)**
CLASS IB ANTIARRYTHMICS	5		
CLASS IC ANTIARRYTHMICS	4		
CLASS III ANTIARRYTHMICS	23		
MISCELLANEOUS VASODILATATING AGENTS	11		
NITRATES AND NITRITES	369		
SALICYLATES	897		
ALPHA-GLUCOSIDASE INHIBITORS	6	**Diabetes**	**423 (22%)**
BIGUANIDES	338		
DIPEPTIDYL PEPTIDASE-4 (DPP-4) INHIBITORS	61		
GLYCOGENOLYTIC AGENTS	1		
INCRETIN MIMETICS	1		
INSULINS	148		
MEGLITINIDES	43		
Sodium-Glucose Cotransporter 2 (SGLT2) Inhibitors	1		
SULFONYLUREAS	128		
THIAZOLIDINEDIONES	18		
PITUITARY	1		
AMMONIA DETOXICANTS	43	**Gastrointestinal Problems**	**1072 (55.9%)**
ANTACIDS AND ADSORBENTS	24		
CATHARTICS AND LAXATIVES	883		
CHOLELITHOLYTIC AGENTS	7		
HISTAMINE H2-ANTAGONISTS	32		
MISCELLANEOUS GI DRUGS	6		
PROKINETIC AGENTS	84		
PROTECTANTS	3		
PROTON-PUMP INHIBITORS	917		
SULFONAMIDES	38		
ALPHA-ADRENERGIC AGONISTS	24	**Glaucoma**	**183 (9.5%)**
BETA-ADRENERGIC AGENTS - **S01ED**	82		
CARBONIC ANHYDRASE INHIBITORS	54		
EENT DRUGS, MISCELLANEOUS	36		
MIOTICS	2		
PROSTAGLANDIN ANALOGS	122		
ANTIGOUT AGENTS	120	**Gout**	**99 (5.2%)**
URICOSURIC AGENTS	0		
BILE ACID SEQUESTRANTS	11	**Hyperlipidaemia**	**1097 (57.2%)**
CHOLESTEROL ABSORPTION INHIBITORS	42		
FRIBIC ACID DERIVATIVES	24		
HMG-COA REDUCTASE INHIBITORS	1097		
MISCELLANEOUS ANTILIPEMIC AGENTS	1		
ALPHA-ADRENERGIC BLOCKING AGENTS	49	**Hypertension**	**1478 (77%)**
ANGIOTENSIN II RECEPTOR ANTAGONISTS	522		
ANGIOTENSIN-CONVERTING ENZYME INHIBITORS	570		
BETA-ADRENERGIC BLOCKING AGENTS	679		
CENTRAL ALPHA-AGONISTS	40		
DIHYDROPYRIDINES	627		
DIRECT VASODILATORS	7		
LOOP DIURETICS	276		
MINERALOCORTICOID (ALDOSTERONE) RECEPTOR ANTAGONISTS	34		
MISCELLANEOUS CALCIUM-CHANNEL BLOCKING AGENTS	163		
POTASSIUM-SPARING DIURETICS	34		
RENIN INHIBITORS	5		
THIAZIDE DIURETICS	497		
THIAZIDE-LIKE DIURETICS	49		

2016 AHFS Drug Class	Total No. Of Prescribed Active Ingredients	Corresponding Chronic Disease	No. Of Patients Classified as being Diagnosed with This Chronic Disease (%)
5-HT3 RECEPTOR ANTAGONISTS	6	Malignancies	102 (5.3%)
ANTINEOPLASTIC AGENTS	93		
GONADOTROPINS	12		
MISCELLANEOUS ANTIEMETICS	2		
Other Unspecified	1		
PROGESTINS	11		
MISCELLANEOUS ANTIDEPRESSANTS	76	Mental Disorders	454 (23.7%)
MONOAMINE OXIDASE INHIBITORS	2		
SELECTIVE SEROTONIN AND NOREPINEPHRINE-REUPTAKE INHIBIT	91		
SELECTIVE-SEROTONIN REUPTAKE INHIBITORS	260		
SEROTONIN MODULATORS	74		
TRICYCLICS AND OTHER NOREPINEPHRINE-REUPTAKE INHIBITORS	59		
ADAMANTANES	4	Neurologic Conditions	399 (20.8%)
ANTICHOLINERGIC AGENTS	6		
BARBITURATES	9		
CATECHOL-O-METHYLTRANSFERASE (COMT) INHIBITORS	4		
DOPAMINE PRECURSORS	32		
HYDANTOINS	14		
MISCELLANEOUS ANTICONVULSANTS	207		
MISCELLANEOUS CENTRAL NERVOUS SYSTEM AGENTS	13		
MONOAMINE OXIDASE B INHIBITORS	2		
NONERGOT-DERIVATIVE DOPAMINE RECEPTOR AGONISTS	27		
PARASYMPATHOMEMETIC (CHOLINERGIC) AGENTS	171		
BONE RESORPTION INHIBITORS	457	Osteoporosis	460 (24%)
ESTROGEN AGONIST-ANTAGONISTS	5		
PARATHYROID	26		
CYCLOOXYGENASE-2 (COX-2) INHIBITORS	97	Pain & Inflammation	925 (48.2%)
MISCELLANEOUS ANALGESICS AND ANTIPYRETICS	851		
MISCELLANEOUS GENERAL ANESTHETICS	2		
OPIATE AGONISTS - CODIENE	51		
OTHER NONSTEROIDAL ANTIIMFLAMMATORY AGENTS	260		
SALICYLATES	8		
SELECTIVE SEROTONIN AGONISTS	4		
ADRENALS	201	Respiratory Diseases	455 (23.7%)
ANTICHOLINERGIC AGENTS	11		
ANTIMUSCARINICS ANTISPASMODICS	230		
LEUKOTRIENE MODIFIERS	10		
RESPIRATORY SMOOTH MUSCLE RELAXANTS	11		
Other Unspecified	2		
SELECTIVE BETA 2-ADRENERGIC AGONISTS	571		
ADRENALS	245	Rheumatologic Conditions	274 (14.3%)
ANTIMALARIALS	23		
DISEASE-MODIFYING ANTIRHEUMATIC AGENTS	4		
IMMUNOSUPPRESSIVE AGENTS	3		
LOCAL ANESTHETICS	56		
Other Unspecified	10		
OPIATE AGONISTS - NON CODIENE	323	Severe Pain	251 (13.1%)
OPIATE PARTIAL AGONISTS	5		
ANTITHYROID AGENTS	6	Thyroid Disorders	512 (26.7%)
THYROID AGENTS	506		
5-ALFA REDUCTASE INHIBITORS	127	Urinary and Renal Problems	362 (18.9%)
Antimuscarinics	106		
HEMATOPOIETIC AGENTS	25		
PARASYMPATHOMEMETIC (CHOLINERGIC) AGENTS	5		
PHOSPHATE-REMOVING AGENTS	7		
POTASSIUM-REMOVING AGENTS	12		
Selective Alfa-1-Adrenergic Blocking Agents	225		
Selective Beta 3-Adrenergic Agonists	2		
COUMARIN DERIVATIVES	200	Vascular Diseases	474 (24.7%)
Direct Factor Xa Inhibitors	24		
DIRECT THROMBIN INHIBITORS	29		
HEMORRHEOLOGIC AGENTS	2		
HEPARINS	78		
MISCELLANEOUS ANTICOAGULANTS	46		
PLATELET AGGREGATION INHIBITORS	164		
PLATELET-REDUCING AGENTS	1		

8.2. BASELINE CHARACTERISTICS OF VARIABLES

A total of 1,919 patients were included in our cross-sectional study. Of these, 944 (49.2%) were from the pre-Alzheimer's Plan implementation period, and 975 (50.8%) were from the post-Alzheimer's Plan implementation period. This section includes a descriptive statistical analysis of all independent variables, as well as the study primary outcome variable. Descriptive analyses follow the same order that the independent variables were retrieved from the study conceptual framework (Andersen's Model of Health Services Use).

8.2.1. INDEPENDENT VARIABLES

In this section, we provide descriptives for both patient-level and GMF-level factors. Please refer to **(Table 6).**

8.2.1.1. PATIENT-LEVEL VARIABLES

Predisposing Factors

Demographic Factors

Age & Age Groups: Patient age ranged from 75.0 to 104.0 years (mean=81.7 years old, SD=5.0) and was divided into three groups. Patients aged 75.0-79.9 years represented 44.1% of the study population. Patients aged 80.0 to 84.9 years represented 30.5% of the study population. Patients within our 'oldest old' age group (85+) represented 25.4% of the population. The distribution of patient age groups stratified by sex are shown in (**Figure 4)**.

Sex: There were 768 (40.0%) male patients and 1151 (60.0%) female patients in this study.

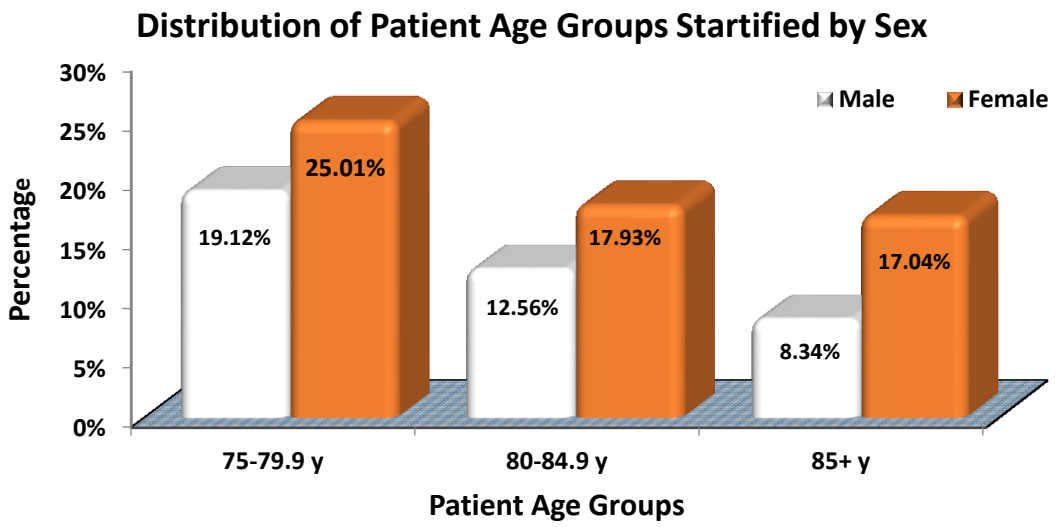

Figure4.Distribution of Patients by Age Group & Sex

Social Structure

Living Status: Twenty percent of the elderly patients included in the study reported that theylived alone and 49.7% reported that they lived with a family member. The remaining 30.3% of the study population did not have a reported living status.

Needs Factors

Three needs factors were identified in our cross-sectional study.

Number of Chronic Disease Medications: This number ranged from 0 to 33 (mean=8.5, SD=5.3). Almost a third of the study population (31.1%) received five or fewer medications, and another third (32%) received 6-9 medications during the study period. **(Figure 5)**presents the cumulative percentage of medication use for chronic diseases among the study population.

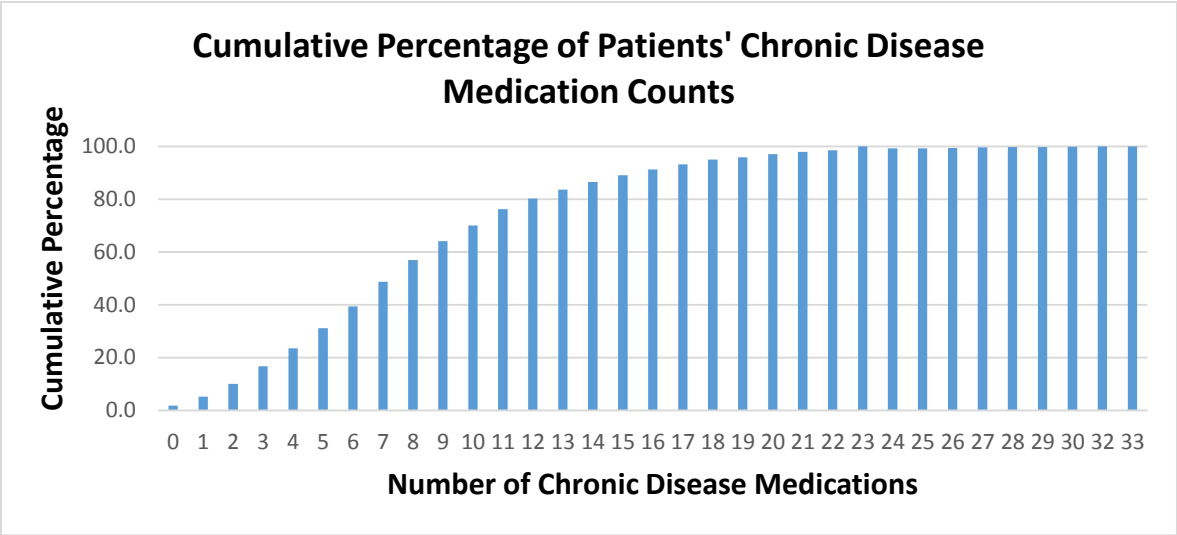

Figure 5.Cumulative Percent of Patients' Chronic Disease Medication Counts

Number of Non-Chronic Disease Medications: This number ranged from 0 to17 medications (mean=3, SD=2.5). Almost a third (31%) of the study population received 0 or 1medication other than those prescribed for chronic illnesses. Additionally, half of the study population (51%) received two to four medications, whereas the remaining fifth (22%) were prescribed more than 5 medications for other conditions rather than the listed chronic diseases**(Figure6).**

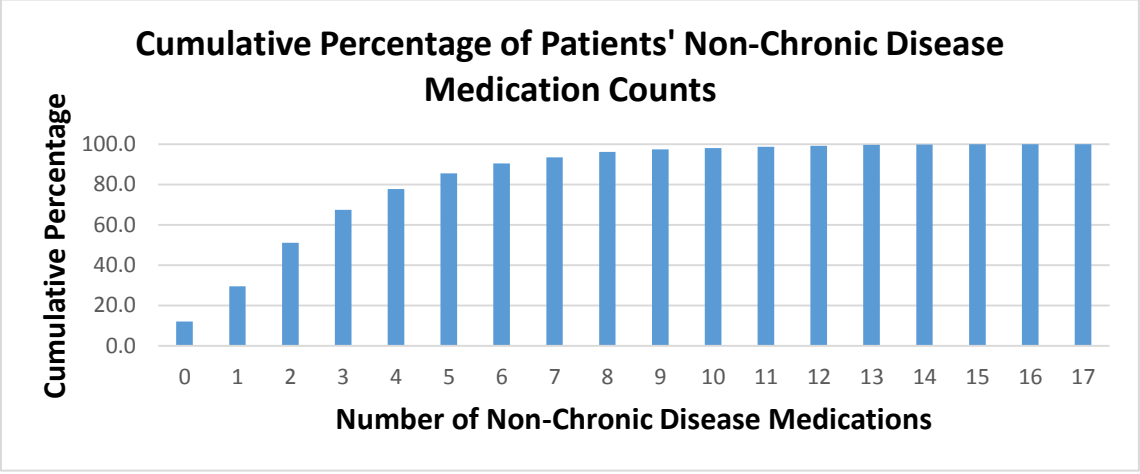

Figure 6.Cumulative Percent of Patients' Non-Chronic Disease Medication Counts

Number of Chronic Diseases: The total number of chronicdiseases ranged from0to 17 (mean=5.7, SD=2.9). The prevalence of the different morbidity levels among the study population is demonstrated in **(Figure7)**.

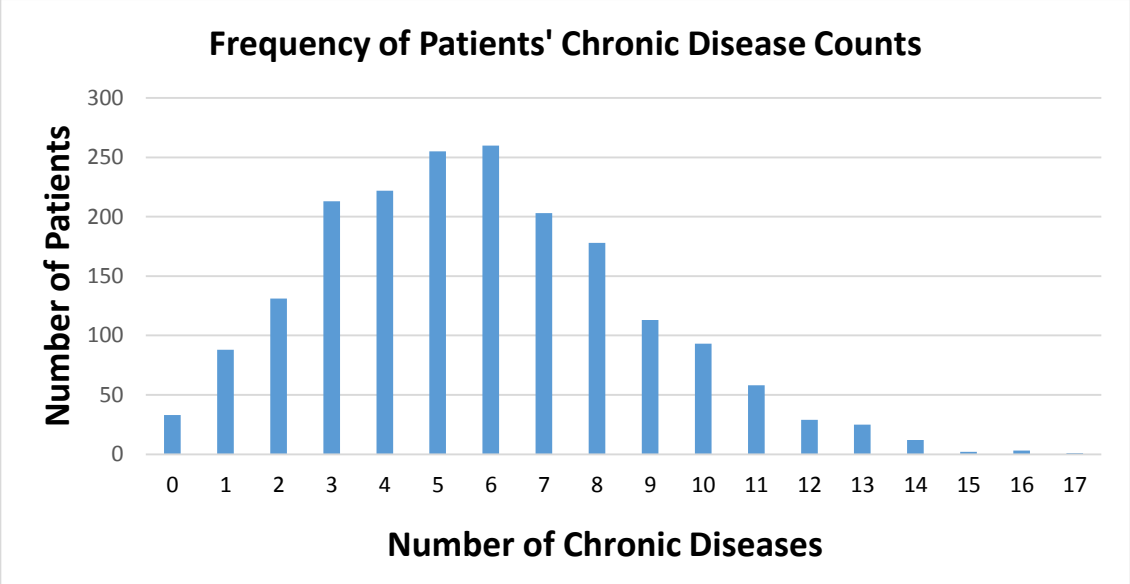

Figure 7.Frequency of Patients' Chronic Disease Count

Individual Chronic Diseases: The overall prevalence of the 21 chronic diseases varied considerably among the study population. For instance, hypertension was the most frequently identified chronic disease based on the medication matching system (77%), followed by hyperlipidemia (57%), gastrointestinal problems (56%), and cardiac diseases (53%). The chronic diseases that were the least commonly identified included Malignancies (5%), gout (5%), and behavioural problems (9%). The prevalence of the rest of the chronic diseases was presented in (**Figure 8)**. The prevalence of the 21 chronic diseases by GMF and by university affiliation isprovided in **Appendices V& VI**.

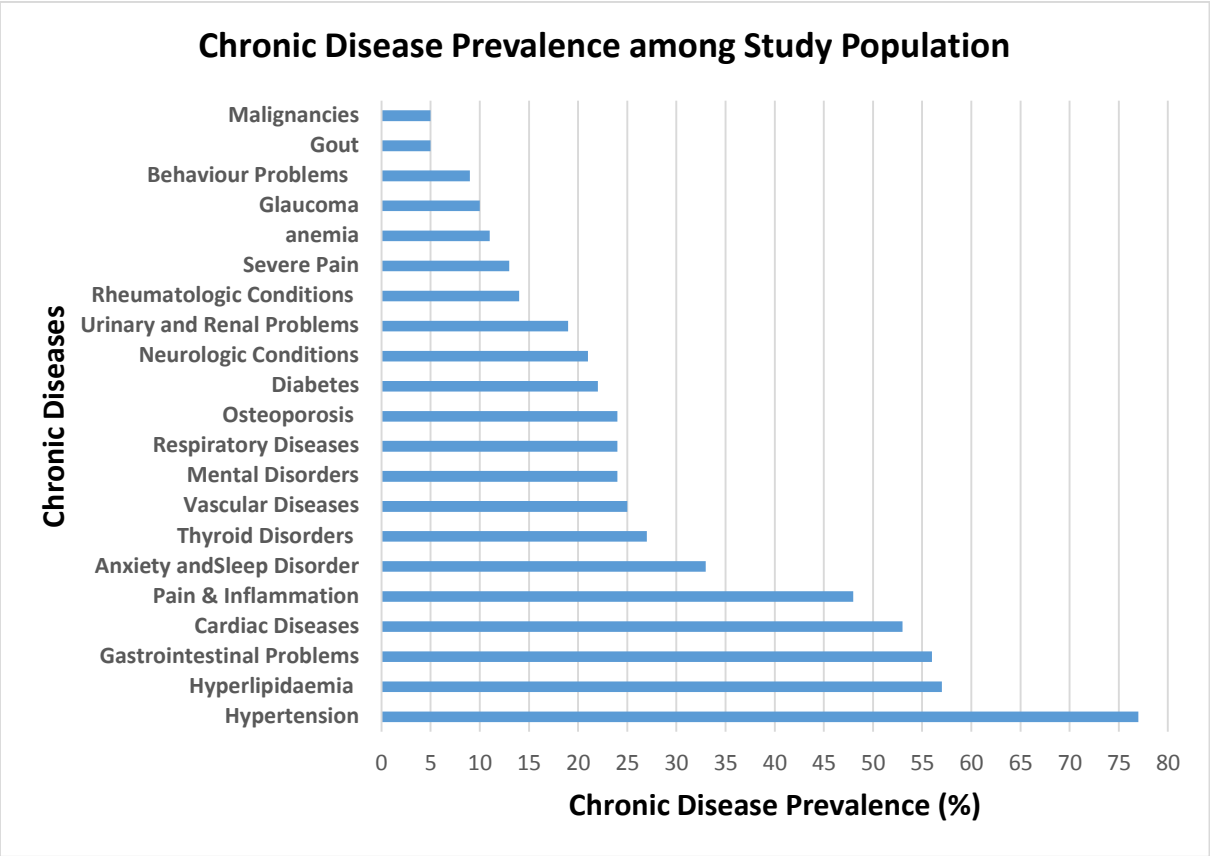

Figure8. Chronic Disease Prevalence Amongthe Study Population

8.2.1.2. GMF-LEVEL FACTORS

Predisposing Factors

The proportion of elderly patients: This proportion varied across GMF, and ranged from 7% to 17% (mean=12.1%, SD=3.4%).

GMF Resource Factors

Number of Physicians per FTE physician Within the GMF: The number of physicians ranged from 16 to 43 physicians (mean=26.9, SD=8.7), while the number of FTE physicians in each GMF ranged from 7 to 36 (mean=13.1, SD=7.6). As a result, the number of physicians per

FTE physician ranged from 1.39 to 3.13 physicians per FTE across the 13 GMFs (mean=2.2, SD=0.6).

Number of Patients per FTE Physician Within the GMF: The number of patients per FTE physician varied across the 13 GMFs, ranging from 816 to 2,115 patients per one FTE physician (mean= 1,244.2, SD=439.6).

Number of Patients per FTE Registered Nursewithin the GMF: This number varied, ranging from 3,218 to 12,695 patients per RN (mean=8,048.9, SD=3,909.5).

GMF Organizational Factors

Number of GMF Sites: The 13 included GMFs were comprised of one or multiple sites, ranging from 1 to 8 (mean=3.25, SD=2.5).

Years of Operation: The GMF years of operations were varied, ranging from 2.2 to11 years (mean=7.6, SD=3.0).

University Affiliation: Almost a third (31.3%) of the study population received their PHC contacts at a Université de Montréal affiliated GMF, whereas nearly a fifth (21.8%) of the study population received their PHC contacts at a Université Laval site. The remainder of the study population was split between McGill University and the Université de Sherbrooke affiliated sites, at 23.4% each.

Type of GMF: While just over half of the study population received PHC at public GMFs (54.7%), 45.3% received PHC at mixed GMFs.

Data pertinent to the independent variables stratified by both GMF and University affiliation are provided in **(Appendices VI& VII).**

Table 6. Patients & GMF Characteristics

Patient-Level Factors	
Predisposing Factors	**N=1919**
Age, mean (SD)	81.7 (5.0)
Age Group	
75.0 - 79.9, (%)	44.1%
80.0 - 84.9, (%)	30.5%
85.0 +, (%)	25.4%
Sex	
Female, (%)	60.0%
Male, (%)	40.0%
Living Status	
Living with a Family Member, (%)	49.7%
Living Alone, (%)	20.0%
Unknown, (%)	30.3%
Needs Factors	
Number of Chronic Disease Medications, mean (SD)	8.5 (5.3)
Number of Non-Chronic Disease Medications, mean (SD)	3.0 (2.5)
Number of Matched Chronic Diseases, mean (SD)	5.7 (2.9)
GMF-Level Factors	**N=13**
Predisposing Factors	
GMF Proportion of Elderly Patients, mean (SD)	12.1% (3.4%)
GMF Resource Factors	
Number of Physicians per FTE Physician, mean (SD)	2.2 (0.6)
Number of Patients per FTE Physician, mean (SD)	1,244.2 (439.6)
Number of Patients per FTE RN, mean (SD)	8,048.9 (3909.5)
GMF Organizational Factors	
Number of GMF Sites , mean (SD)	3.2 (2.5)
Years of Operation, mean (SD)	7.6 (3.0)
University Affiliation	
U. de Sherbrooke, (%)	23.4%
U. Laval, (%)	21.8%
McGill U., (%)	23.4%
U. de Montreal, (%)	31.3%
Type (Public/Mixed)	
Public, (%)	54.7%
Mixed, (%)	45.3%

8.2.2. PRIMARY OUTCOME DISTRIBUTION

8.2.2.1. PRIMARY HEALTH CARE CONTACT DISTRIBUTION AMONG ELDERLY PATIENTS

The number of the PHC contacts by elderly patients within the 13 GMFs ranged from 1 to 81 (mean=4.4, SD=5.1).

Almost a quarter (23.5%) of the study population had only one contact during the study period with the PHC provider, while 20% and 15% of elderly patients had two and three contacts respectively. Less than 60% of the study population had three PHC contacts or fewer. Almost 10% of the study population had four contacts, 7.5% had five contacts, and 5% had 6 contacts. Patients who had 7, 8 or 9 PHC contacts represented 4%, 3%, and 2% of the population, respectively; almost 90% of the study population had 9 or less contacts with their PHC teams. **Figure 9** shows the frequency of the total number of PHC contacts by the study population..

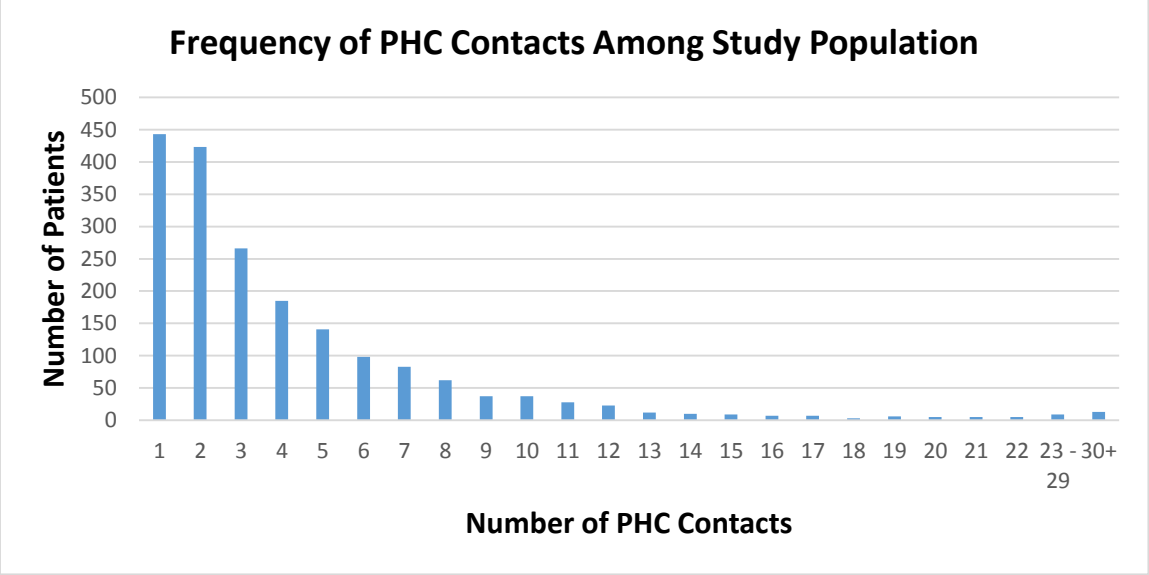

Figure 9.Frequency of Primary Health Care Contact Counts

8.2.2.2. EXAMINING THE BIVARIATE ASSOCIATION BETWEEN THE INDEPENDENT VARIABLES AND THE PRIMARY OUTCOME

8.2.2.2.1. PATIENT-LEVEL FACTORS

Predisposing Factors

Demographic Factors

Patient age group was significantly associated with the number of PHC contacts. Significance existed among the three groups when testedusing ANOVA. Scheffe testing confirmed a significant difference among the three age groups ($P < 0.05$), with the exceptionof two age groups (80.0 – 84.9 and 80+). Patients aged between 75.0 and 80.0 years old had an average of 3.7 PHC contacts (SD=3.7), whereas patients above 80.0 yet below 85.0 had an average of 4.5 contacts (SD=4.9). Patients in the 'oldest old' age group (85+) had an average of 5.3 contacts (SD=6.9).

The correlation between patient age as a continuous variable and the number of PHC contactswas also tested ($R=0.12$, $P<0.001$).

Patient sex was also significantly associated with the number of PHC contacts ($P=0.003$). A male patient required an average of 4.0 contacts (SD=3.9), whereas a female patient required an average of 4.6 contacts (SD=5.7).

The association between patient living status and the number of PHC contacts did not show any significant difference between patients who reporting living with a family member and those who reporting living alone ($p=0.973$). The former group had an average of 4.9 contacts (SD=5.6), whereas the latter group had an average of 5.0 contacts (SD=5.9) .

For a distribution of total PHC contacts by demographic variables, please refer to **(Table 7)**.

Table 7 Primary Health Care Contacts among Patients stratified by Categorical Variable

Patient-Level Factors	**N=1919**
Predisposing Factors	
Age Group	
75.0 - 79.9, mean (SD)	3.7 (3.7)
80.0 - 84.9, mean (SD)	4.5 (4.9)
85.0 +, mean (SD)	5.3 (6.9)
Sex	
Female, mean (SD)	4.6 (5.7)
Male, mean (SD)	4.0 (3.9)
Living Status	
Living with a Family Member, mean (SD)	4.9 (5.6)
Living Alone, mean (SD)	5.0 (5.9)
GMF-Level Factors	**N=13**
GMF Organizational Factors	
University Affiliation	
U. de Sherbrooke, mean (SD)	4.4 (4.2)
U. Laval, mean (SD)	4.3 (4.2)
McGill U., mean (SD)	4.4 (6.2)
U. de Montreal, mean (SD)	4.3 (5.3)
Type (Public/Mixed)	
Public, mean (SD)	4.5 (4.8)
Mixed, mean (SD)	4.2 (5.4)

Needs Factors

The correlations between three needs factors (i.e. the number of chronic disease medications, the number of non-chronic disease medications, and the number of matched chronic diseases)and the number of PHC contacts were also analysed. These three variables showed significant ($P<0.0001$), yet weak correlation with the number of PHC contacts ($r=0.317$, $r=307$, $r=308$) respectively **(Table 8)**.

8.2.2.2.2. GMF-LEVEL FACTORS

GMF Resource Factors

The GMF resource variables included in the study were examined for their linear associations with the number of PHC contacts. The three GMF resource factors; number of physicians per FTE physician, number of patients per FTE physician and per FTE RN have statistically significant, yet weak association with the study primary outcome (r=0.317, r=0.307, r=0.308) respectively.

GMF Organizational Factors

A one-way ANOVA test showed no significant difference betweenuniversity affiliation, and the number of PHC contacts. Université de Montréal, McGill University, Université Laval, and Université de Sherbrooke showed an average of 4.3 (SD=5.3), 4.4 (SD=6.2), 4.3 (SD=4.2) and 4.4 (SD=4.2) contacts respectively. A Scheffe test was also performed to assess any significant differences between any two universities,and no statistical significance was found.

Likewise, there was no statistical significant difference between public and mixed GMFs in terms of PHC contacts. Public GMF patients recorded an average of 4.5 contacts (SD=4.8), whereas patients in mixed GMFs recorded an average of 4.2 contacts (SD=5.4). An Independent T-Test confirmed no statistical significance (P=0.161).

In addition, the number of sites, as well as the GMF years of operation, showed no significant difference on the number of PHC contacts (r=-0.04, r=0.042) respectively. **Table 8** presents the Pearson correlation coefficients for the abovementioned associations.

Table8. Correlation between Number of Primary Health Care Contacts and Continous Variables

	Pearson Correlation	Signifiance (2-tailed)
Patient-Level Factors		
Predisposing Factors		
Age	0.120**	< 0.0001
Needs Factors		
Number of Chronic Disease Medications	0.317**	< 0.0001
Number of Non - Chronic Disease Medications	0.307**	< 0.0001
Number of Matched Chronic Diseases	0.308**	< 0.0001
GMF-Level Factors		
Predisposing Factors		
GMF Proportion of Elderly Patients	-.100**	< 0.0001
GMF Resource Factors		
Number of Physicians per FTE Physician	-0.156	< 0.0001
Number of Patients Per FTE Physician	-.075**	0.004
Number of Patients Per FTE RN	-0.223	< 0.0001
GMF Organizational Factors		
Number of GMF Sites	-0.04	
Years of Operation	0.042	

8.2.3. TESTING FOR COLLINEARITY & MULTICOLLINEARITY

We tested for the association between independent variables before performing regression analyses. In this section, we provide the Pearson correlation coefficient for quantitative variables when the variable is approximating a normal distribution **(Table 9).** The association between nominal (binominal or multi-nominal) variables was tested using a chi-square test (and P-value) **(Table 10)**.

Testing the associations between the independent continuous variables revealed a statistically significant association between the number of patients registered with a FTE physician and the number of patients registered with an FTE RN; (r= 0.62). In addition, a statistically significant association was found between the proportion of elderly patients registered at a GMF and the number of sites within that GMF (r=0.766). Three variables (the

number of medications, the number of sites, and the number of patients registered per FTE RN) were therefore excuded from the adjusted regression analysis.

In addition, multicollinearity was tested by running a linear regression model using the variance inflation factors (VIF) to guide the selection of variables included in the model. Initially, the elderly population to FTE MD ratio showed a significantly high VIF (VIF=176.5, P=0.006). The total population to FTE MD ratio also showed a high VIF (VIF=173.7, P=0.007). Therefore, the latter was removed whereas the former showed a significant decrease in VIF (5.2).

Table9.Pearson Correlation Coefficients: Testing for Colinearity between Independent Variables

		Patient's Age	Number of Matched Chronic Diseases	Number of Chronic Disease Medications	Number of Non-Chronic Disease Medications	Number of GMF Sites	GMF Years of Operation	Number of Patients Per FTE Physician	Number of Patients Per FTE Registered Nurse	Number of Physicians Per FTE Physician	GMF Proportion of Elderly Patients
Patient's Age	Pearson Correlation	1									
	Significance										
Number of Matched Chronic Diseases	Pearson Correlation	0.093**	1								
	Significance	< 0.0001									
Number of Chronic Disease Medications	Pearson Correlation	0.097**	**0.923****	1							
	Significance	< 0.0001	< 0.0001								
Number of Non-Chronic Disease Medications	Pearson Correlation	0.0102**	0.428**	0.452**	1						
	Significance	< 0.0001	< 0.0001	< 0.0001							
Number of GMF Sites	Pearson Correlation	0.026	0.066**	0.053*	0.01	1					
	Significance	0.258	0.004	0.02	0.648						
GMF Years of Operation	Pearson Correlation	0.039	0.095**	0.127**	0.024	0.224**	1				
	Significance	0.099	< 0.0001	< 0.0001	0.317	< 0.0001					
Number of Patients Per FTE Physician	Pearson Correlation	0.043	0.017	0.022	0.014	0.013	0.205**	1			
	Significance	0.102	0.514	0.393	0.593	0.627	< 0.0001				
Number of Patients Per FTE Registered Nurse	Pearson Correlation	0.015	0.067*	0.08**	0.125**	0.453**	0.18**	**0.062****	1		
	Significance	0.622	0.031	,010	< 0.0001	< 0.0001	< 0.0001	< 0.0001			
Number of Physicians Per FTE Physician	Pearson Correlation	0.05	,001	0.031	0.054*	0.406**	0.068**	0.464**	0.431**	1	
	Significance	0.056	0.963	0.232	0.037	< 0.0001	0.009	< 0.0001	< 0.0001		
GMF Proportion of Elderly Patients	Pearson Correlation	0.031	0.083**	0.084**	0.04	**0.766****	0.047	0.067**	0.351**	0.215**	1
	Significance	0.229	0.001	0.001	0.129	< 0.0001	0.069	0.01	< 0.0001	< 0.0001	

Table 10.Pearson Chi-Squares: Testing for Colinearity between Categorical Independent Variables

		Patient's Sex	Patient's Age Group	Patient's Social Status	University Affiliation	GMF Type (Public/Mixed)
Patient's Sex	Pearson Chi-Square	1				
	Asymp. Sig. (2-sided)					
Patient's Age Group	Pearson Chi-Square	14.62[a]	1			
	Asymp. Sig. (2-sided)	0.001				
Patient's Social Status	Pearson Chi-Square	43.998[a]	52.039[a]	1		
	Asymp. Sig. (2-sided)	< 0.0001	< 0.0001			
University Affiliation	Pearson Chi-Square	5.441[a]	14.964[a]	19.668[a]	1	
	Asymp. Sig. (2-sided)	0.142	0.021	0.003		
GMF Type (Public/Mixed)	Pearson Chi-Square	7.771[a]	8.254[a]	8.497[a]	2.69.119[a]	1
	Asymp. Sig. (2-sided)	0.005	0.016	0.014	< 0.0001	

8.3. MISSING DATA

Table 11 presents information pertaining to missing data in our study database. Living status was missing for a third of our study population. In addition, some GMF-level variables were missing : Number of years of operation was missing for one Université Laval affiliated GMF (No. 25), accounting for 7.8% of the total study population. Two sites were missing data pertinent to FTE physicians. The total number of MDs, as well as the proportion of elderly persons within the GMF were missing from one Université de Montréal affiliated GMF (No. 17) and one McGill University affiliated GMF (No. 18). Both GMFs accounted for 15.7% of the study total population.

Table 11.Missing Data

Patient-Level Factors	**N=1919**
Predisposing Factors	**n (%)**
Living Status	582 (30,3%)
GMF-Level Factors	**N=13**
Predisposing Factors	
GMF Proportion of Elderly Patients	300 (15.6%)
GMF Resource Factors	
Number of f Physicians per FTE Physician	300 (15.6%)
Number of f Patients per FTE Physician	300 (15.6%)
GMF Organizational Factors	
Years of Operation	150 (7.8%)

8.4. REGRESSION ANALYSIS

8.4.1. CRUDE MODELS

As a first step, multiple crude (unadjusted) GEE models were performed to provide parameter estimates for each of the study independent variables. The following section presents results from these crude GEE models.(see**Table 12**).

8.4.1.1. PATIENT-LEVEL VARIABLES

Predisposing Factors

All predisposing factors (except for social structure and patient living status) showed a statistically significant association with the number of PHCcontacts.

Age & Age Group: We found a 2.8% increase in the incidence rate of PHC contacts for every year of age (above 75 years). Moreover, falling into the 85 + and 80.0 – 84.9 age groups was associated with a 41% and 21% higher incidence of PHC contacts, respectively as compared with the (75.0-79.9) age group.

Sex: Female study patients had a 16.2 % higher incidence rate of PHC contacts.

Needs Factors

Number of Medications: We found aa 5.7% increase in the incidence rate of PHC contacts for each additional chronic disease medication. However this percent increased to 11.7% for each additional non-chronic disease medication.

Number of Chronic Diseases: The total number of chronic diseases has a statistically significant effect on the incidence rate of PHC contacts. For every additional chronic disease, the percent increase in the PHC contact incidence rate increased by 12%.

Individual Chronic Diseases: Using individual GEE models, we found a statistically significant increase in the incidence rate of PHC contacts for most diseases, with the exception of malignancies, osteoporosis and urinary and renal problems **(Table 12).**

8.4.1.2. GMF-LEVEL FACTORS

Predisposing Factors

A 1% increase in the proportion of elderly patients registered at the GMF was associated with a 3.4% decrease in the incidence rate of PHC contacts.

GMF Resource Factors

The only resource factor that had a statistically significant effect on PHC contact incidence was the number of physicians per FTE physician. An increase in the number of physicians per an FTE physician by one resulted in a statistically significant 1.3% decrease in the incidence rate of PHC contacts.

GMF Organizational Factor

Being registered with a public GMF saw a 7.2% decrease in the incidence of PHC contacts. This finding was statistically significant.

Despite the fact that it was excluded from the full adjusted model, the number of sites within each GMF was statistically significant as each additional was statistically significantly associated with a 2% decrease in the incidence of PHC contacts.

Table 12.Crude Generalized Estimating Equation Models For PHC Contacts

	Odds Ratio	95% Wald Confidence Interval for Exp(B)	
		Lower	Upper
Patient-Level Factors			
Predisposing Factors			
Age	**1.03**	**1.02**	**1.04**
Age Groups			
85.0 +	**1.42**	**1.24**	**1.62**
80.0 - 84.9	**1.22**	**1.09**	**1.36**
75.0 - 79.9	1.00	Reference Category	
Female	**1.16**	**1.05**	**1.28**
Social Status			
Living with a Family Member	0.99	0.86	1.13
Living Alone	1.00	Reference Category	
Need Factors			
Number of Medications			
Number Of Chronic Disease Medications	**1.06**	**1.05**	**1.06**
Number Of Non - Chronic Disease Medications	**1.12**	**1.10**	**1.14**
Chronic Diseases			
Number Of Matched Chronic Diseases	**1.12**	**1.10**	**1.14**
Individual Chronic Diseases			
Anaemia	**1.71**	**1.44**	**2.02**
Anxiety and sleep disorders	**1.16**	**1.04**	**1.28**
Behaviour problems	**1.60**	**1.31**	**1.95**
Cardiac diseases	**1.15**	**1.04**	**1.28**
Diabetes	**1.55**	**1.36**	**1.76**
Gastrointestinal problems	**1.45**	**1.32**	**1.61**
Glaucoma	**1.36**	**1.10**	**1.68**
Gout	**1.40**	**1.03**	**1.89**
Hyperlipidaemia	**1.12**	**1.01**	**1.24**
Hypertension	**1.55**	**1.40**	**1.71**
Malignancies	1.10	0.89	1.36
Mental disorders	**1.38**	**1.22**	**1.56**
Neurologic Conditions	**1.37**	**1.20**	**1.56**
Osteoporosis	1.04	0.93	1.17
Pain & Inflammation	**1.48**	**1.35**	**1.64**
Respiratory Diseases	**1.31**	**1.17**	**1.47**
Rheumatologic Conditions	**1.44**	**1.25**	**1.66**
Severe Pain	**1.57**	**1.38**	**1.79**
Thyroid disorders	**1.17**	**1.04**	**1.31**
Urinary and renal problems	1.12	0.99	1.27
Vascular disease	**1.76**	**1.57**	**1.98**
GMF-Level Factors			
Predisposing Factors			
Proportion of Elderly Patients	**0.97**	**0.95**	**0.98**
GMF Resource Factors			
Number of Physicians per FTE Physician	**0.99**	**0.98**	**0.99**
Number of Patients per FTE Physician	1.0	1.0	1.0
Number of Patients per FTE Registered Nurse	1.0	1.0	1.0
GMF Organizational Factors			
Number of GMF Sites	**0.98**	**0.965**	**0.995**
Years of Operations	1.02	0.99	1.03
University Affiliation			
U. de Sherbrooke	1.02	0.90	1.17
U. Laval	0.98	0.86	1.13
McGill U.	1.02	0.87	1.20
U. de Montreal	1.00	Reference Category	
Type (Public/Mixed)			
Public GMF	0.93	0.83	1.03
Mixed GMF	1.00	Reference Category	

8.4.2. ADJUSTED FULL MODEL

In this model, we excluded the individual chronic diseases, but consider the total number of chronic diseases per patient instead. Please refer to (**Table 13)**.

8.4.2.1. PATIENT-LEVEL VARIABLES

Predisposing Factors

In contrast to the crude GEE models, only one predisposing factor had a statistically significant association with the incidence of PHC contacts.

Age groups: Falling into the 'oldest old' 85 + age group was associated with a 16.4% higher incidence rate of PHC contacts than those aged 75.0-79.9 years.

Needs Factors

Number of Chronic Diseases: Instead of considering the individual chronic diseases (as in the previous model), this model showed that suffering from one additional chronic disease was associated with an 11% increase in the incidence rate of PHC contacts.

8.4.2.2. GMF-LEVEL FACTORS

Predisposing Factors

A 1% increase in the proportion of elderly patients registered at the GMF was associated with a statistically significant 4.5% decrease in the incidence rate of PHC contacts.

GMF Resource Factors

Increasing the number of physicians per FTE physician by one was associated with a statistically significant 1.6% decrease in the incidence rate of PHC contacts.

GMF Organizational Factors

Being registered with a public GMF was associated with a statistically significant 18.2% decrease in the incidence of PHC contacts.

In addition, being registered with a Université Laval-affiliated GMF was associated with a statistically significant 60% increase in the incidence of PHC contacts, as compared to the reference (Université de Montréal).

Table 13. Adjusted Generalized Estimating Equation Model for PHC Contacts

	Odds Ratio	95% Wald Confidence Interval for Exp(B)	
		Lower	Upper
Intercept	2.5	1.91	3.09
Patient-Level Factors			
Predisposing Factors			
Age Groups			
85.0 +	**1.16**	**1.05**	**1.29**
80.0 - 84.9	1.06	0.96	1.18
75.0 - 79.9	1.00	Reference Category	
Female	1.02	0.94	1.11
Male	1.00	Reference Category	
Social Status			
Living with a Family Member	0.97	0.86	1.09
Living Alone	1.00	Reference Category	
Need Factors			
Chronic Diseases			
Number Of Matched Chronic Diseases	**1.11**	**1.09**	**1.13**
GMF-Level Factors			
Predisposing Factors			
Proportion of Elderly Patients	**0.96**	**0.93**	**0.98**
GMF Resource Factors			
Number of Physicians per FTE Physician	**0.98**	**0.98**	**0.99**
Number of Patients per FTE Physician	1.0	0.99	1.0
GMF Organizational Factors			
Years of Operations	**1.02**	**1.00**	**1.03**
University Affiliation			
U. de Sherbrooke	0.93	0.81	1.06
U. Laval	**1.61**	**1.33**	**1.94**
McGill U.	1.14	0.98	1.34
U. de Montreal	1.00	Reference Category	
Type (Public/Mixed)			
Public GMF	**0.82**	**0.72**	**0.93**
Mixed GMF	1.00	Reference Category	

9. DISCUSSION

9.1. SUMMARY OF THE STUDY FINDINGS

9.1.1. INTRODUCTION

This study sought to explore and identify the factors contributing to the number of PHC contacts by the elderly population at groups of family physicians GMFs.

9.1.1.1. MEETING THE FIRST OBJECTIVE

We identified the different chronic diseases affecting the 1,919 patients in our study using patient medication data as a proxy for chronic disease. We identified 210 AHFS classes from the medications listed in study patient charts. We also updated the Dubois and colleagues mapping and matching system to match 125 medication classes with 21 chronic diseases (anemia, anxiety and sleep disorders, behavior problems, cardiac diseases, diabetes, gastrointestinal problems, glaucoma, gout, hyperlipidemia, hypertension, malignancies, mental disorders, neurological conditions, osteoporosis, pain and inflammation, respiratory diseases, rheumatologic conditions, severe pain, thyroid disorders, urinary and renal problems, and vascular diseases).

9.1.1.2. MEETING THE SECOND OBJECTIVE

This study examined the distribution of patient-level and GMF-level factors, as well as the distribution of PHC contacts among the elderly study population at 13 participating GMFs. In terms of patient-level factors, male patients represented 40.0% of the study population. Patient age ranged from 75.0 to 104.0 years (mean=81.7, SD=5.0). The three age groups included in the study (75.0-79.9, 80.0-84.9, and 85+) comprised 44.1%, 30.5% and 25.4% of the study population, respectively. The total number of medications prescribed for the treatment of chronic disease ranged from 0 to 33 medications (mean=8.5, SD=5.3). The total number of medications

that were not matched to chronic diseases ranged from 0 to 17 (mean=3.0, SD=2.5). The total number of chronic diseases ranged from 0 to 17 (mean=5.7, SD=2.9). Among these, hypertension was the most frequently diagnosed disease (77.2% of the study population), followed by hyperlipidemia (57.2%), gastrointestinal problems (56%), cardiac diseases (53.3%), and pain & inflammation (48.2%).

The proportion of elderly patients within the GMFs ranged from 7.3% to 14% (mean=12.1%, SD=3.4%). Slightly more than half of study population (54.7%) were registered in public GMFs, whereas 45.1% were registered in mixed GMFs. In terms of university affiliation, the universities of Montreal, McGill, Laval, and Sherbrooke represented 31.1%, 23.4%, 21.8%, and 23.4% of the study population, respectively. The number of sites within the GMFs ranged from 1 to 8 sites (mean=3.2, mean=2.5). GMF years of operation ranged from 4 to 11 years (mean=7.6, mean=3).

The number of physicians per FTE MD ranged from1.39 to 3.14 (mean=2.2, SD=0.6). The number of patients registered per FTE MD and FTE RN ranged from 816 to 2,115 patients (mean=1,244.2, SD=439.6) and from 3,218 to 12,695 patients (mean=8,048.9, SD=3,909.5), respectively.

9.1.1.3. MEETING THE THIRD OBJECTIVE

The third objective studied the associations between patient-level and GMF-level factors and the number of contacts with the PHC providers among the elderly population at the Quebec GMFs. Various factors associated with the number of PHC contacts were identified. These factors fell into two main groups, according to the Andersen Model of Health Services Use.

With the exception of the oldest age group (85+), the other patient-level factors did not show any statistically significant contribution to the incidence of PHC contacts. Being a member

of the ‘oldest old’ age group was significantly positively associated with 16.4 % increase in the incidence of PHC contacts.

In terms of patient-level factors, the number of chronic diseases (mean=5.7, SD=2.9) had a statistically significant increase in the incidence of PHC contacts. Each additional chronic disease contributed to an 11% increase in the incidence of PHC contacts.

In terms of GMF resource and organizational factors, a 1% increase in the proportion of elderly registered at GMFs significantly contributed to a 4.5% decrease in the incidence of PHC contacts. In addition, each additional physician in the ratio of total physicians per FTE saw a statistically significant 1.6 % decrease in the incidence rate of PHC contacts. Being registered with a public GMF was associated with a statistically significant 18.2 % decrease in the incidence of PHC contacts. Finally, being registered with a Université Laval-affiliated GMF was associated with a statistically significant 60% increase in the incidence of PHC contacts, as compared to patients at Université de Montreal-affiliated GMFs (the reference category).

9.2. RESEARCH FINDINGS IN LIGHT OF CURRENT LITERATURE

9.2.1. PATIENT-LEVEL FACTORS

Predisposing Factors

Demographic Characteristics

Age: There are many studies with inconsistent results examining age as a continuous or categorical variable. Some studies reported no association between age and the number of PHC physician contacts(85, 97, 98, 108-111), and some studies suggest that older patients requiremore PHC contacts than younger patients(96, 112-116). Despite contrasting outcomes in the current body of literature, our study showed patients aged 85+ years had statistically significant16.4% increase in the incidence of PHC contacts.

Sex: The influence of sex on the number of physician contactsis inconsistent in the literature. While our study was consistent with some studies that reported no association between sexand the number of PHC visits (90, 98, 117), many others found that women visit their doctors more often than men(86, 97, 112).

Social Structure Factors

Living Status: Social structure has also been examined as a factor in evaluating PHC physician contacts. The most commonly evaluated social factor by studies in the literature is marital status, and overwhelming evidence suggests that marital status does not influence the number of PHC visits (85, 108, 113, 118, 119). Only one study foundthat unmarried patients contacted their PHC physician more than their married counterparts. Given the advanced age of our study population, living status (rather than marital status) was recorded in the Alzheimer Plan Evaluation Study, and as such was the variable used in our analysis. Living status refers to whether or not the elderly patient lives alone, and our study found no significant association of this variable with the incidence of PHC contacts. This finding is in keeping with the vast majority of research findings.

Needs Factors

Number of Chronic Diseases: Similar to the results of this study, some studies have confirmed an association between the number of chronic diseases and the number of PHC physician contacts(86, 90, 95, 112, 114).

9.2.2. GMF-LEVEL FACTORS

GMF Resource Factors

Two studies emanating from the United States and one Swiss-based study found that a higher physician supply was positively associated with the number of PHC physician contacts

(82, 98, 119).In contrast to the these studies, our research findings showed that a highersupply of clinicians (as represented by a higher number of FTE clinicians)wasnot statistically associated withthe incidence of PHC contacts. Other health care system factors,such as the proportion of full-time PHC providers, may explain such a departure from the literature. In our study, a higher proportion of FTE clinicians per patient was associated with fewer PHC visits. Although these findings may seem counterintuitive, increasing the number of FTE clinicians per patient can improve continuity of care, which in turn is associated with a lower number of total PHC visits(95).

GMF Organizational Factors

Université Laval- affiliated GMF patients were found to have a statistically significant 60% increase in the incidence of PHC contacts. In addition, patients at public GMFs had a 18.2% reduction in the incidence of PHC contacts. This significant finding require further investigation. For instance, the way in which referral systems and payment mechanism could influence the number PHC contacts should be examined. In a US-based study, the referral system showed a significant impact on the number of PHC contacts in the private practice setting(95).

9.3. STUDY STRENGTHS

This research sought to gain a clearer understanding of PHC use within the context of family physician groups in Quebec. This research can be considered innovative for four main reasons.

First, we used a novel parameter of health care system use. The vast majority of research studies on health services have utilized PHC contacts as a primary outcome, and have restricted their definition of PHC contacts to face-to-face visits with the PHC physician. In this study, we defined PHC ‘contacts’ differently, and included both face-to-face as well as virtual contacts with

both physicians and nurses within the Quebec GMFs. Such a collective and team-based concept better reflects current practice within the context of GMFs in our Quebec healthcare system.

Second, This study has helped explain PHC utilization among the Canadian elderly population.The vast majority of health services research has originated from the US-based health care system. Despite their relatively similar demographics and social characteristcs, variations between the Canadian and American system have limited the usability of US-based research findings.

Third, this study has used the Andersen Model as the conceptual framework. Not only did this model add another level of robustness to the study by directing the selection of independent variables, it also created a hierarchical structure of variables (patient-level and GMF-level). Patient-level factors included patient-level factors such as age and sex, and GMF-level factors such as health care system variables (84).

The fourth strength of this study relies in its methods. The elderly sample of patients included in this study were randomly selected, which contributes to the generalizability of the study findings to other GMFs in Quebec. Moreover, study data were collected through an exhaustive chart review. Chart reviews have been shown to contain more accurate comorbidity information than data from general practitioner surveys and administrative databases (120). Previous studies have indicated that administrative data can contain only 45.5% of the total comorbidity recorded in charts (120). Moreover, comorbidities retrieved from administrative data had a higher occurrence of false negatives when compared to those obtained from chart review(120). In addition, we identified chronic diseases using a well-developed mapping and matching system, which avoided recall bias, as patients were not asked to directly recall the medications that they used (101).

Lastly, we used Generalized Estimating Equations for our analysis of clustered data in order to account for the fact that patients were nested within group practice. In doing so, we obtained robust standard errors despite the fact that our clustering resulted in violations of the assumption of independence among the response(106)..

9.4. STUDY LIMITATIONS

Although this research was carefully prepared and achieved its objectives by answering all of its research questions, there were some unavoidable limitations and shortcomings.

First: Limited Access to Various Factors of Health Services Use.

The Andersen Model of Health Services Use proposes many variables to consider in order to obtain a better understanding of the outcome (in our study, PHC contacts). Despite including a set of variables that were supported by the literature to explain the use of PHC resources, we were limited in terms of access to other variables. In our rapid literature review, we identified potential key variables that should be included in future studies. For instance, needs factors can include patient perceptions about their own diseases, such as the quality of life achieved upon receiving treatment as well as activities of daily living. Moreover, other health system organization factors include physician characteristics, which have shown to significantly contribute to the number PHC contacts.

Second: Missing Data

Living status was missing for a third of our sample. The years of GMF operation was missed for one GMF (No. 25), accounting for 7.8% of the total study population. Additionally, two sites had missing data related to the total number of MDs and elderly population proportion. This missing GMF data accounted for an extra 15.7% of the study total population (No. 17) and GMF (No. 18).

Third: Methodological Limitations

The cross-sectional design of this study imposed a few limitations. First, this design is weak in terms of its ability to infer causality. We can neither assume nor establish causality between the independent variables and the study outcome. Secondly, medication use was recorded as a dichotomous variable (i.e. whether a patient used or didn`t use a given medication during the study period). As such we could not analyze information pertaining to the quantity of medication use (duration of exposure or dose), nor the timing of medication use. To the extent that this information could potentially improve matching of medications to chronic diseases, this could be a limitation.

Reliance on the Dubois et al. Mapping System also had two shortcomings. First, it relied on the use of medications as proxies for chronic diseases (121). Second, it assumed that the medication data recorded in patient charts are complete.

9.5. IMPLICATION OF THE STUDY RESULTS

Comprehensive primary care initiatives, as well as healthcare reforms, have recently emphasized team-based care to create cost-contained budgets, better quality of care, and improved clinical outcomes. Accordingly, studies have followed to provide a clear understanding of the necessary staff composition and staffing infrastructure of primary care practices within such team-based care models. This study provides an evidence-based description of the dynamics of the delivery of one of the basic products of primary health services, the PHC contact. Beyond providing a descriptive analysis, the study broke down the total number of PHC contacts into various elements or attributes associated with the use of PHC contacts among GMFs in Quebec. Study findings, including both the general descriptive findings and the statistical analyses, may

assist GMF managers and health policy makers make informed decisions to improve staffing, budgetary plans, and decisions within the GMFs in Quebec. In particular, the finding that public GMFs have a significantly lower incidence of PHC contatcts may imply that these practices are more efficient thereby improving cost-containment, however this should be validated by future studies. In addition, the findings that the numbers of chronic diseases, as well as the proportion of elderly patient registered in a given GMF, have significantly higher incidence of PHC contacts may imply a need for staffing policies that are based on the workload required to manage such elderly population with such high morbidities. Furthermore, the study has documented a lower incidence of PHC contacts for the GMFs with fewer physicians per FTE physician, such finding may imply a need for further staffing policies that shift towards hiring full-time physicians rather than part-time ones.

9.6. FUTURE STUDIES

This study presents a clearer understanding of PHC contacts within the context of Quebec GMFs. Nevertheless, more studies are required to build upon these results for a better understanding of the use of PHC contacts within Quebec GMFs.

First: In this study, the team-based PHC contact included contacts with physicians and nurses and both face-to-face and virtual contacts. Each of these four options may result in different dynamics, and be associated with different patient outcomes. Further studies will also be required in order to tease out the effects of patient and GMF-level variable on the incidence of each individual type of contact. In addition, it is recommended that these studies examine the association between specific chronic diseases and the use of the various types of contact, as some chronic diseases may require a different balance of contact options for better patient satisfaction and clinical outcomes.

Second: Other potential key factors may need to be considered in future models. It is recommended that these factors be retrieved from the well-known Andersen Model of Health Services Use framework.

Third: The finding that public GMFs have a significantly lower incidence of PHC contacts is worth investigating.

Fouth: Ideally, a future study would also investigate clinical outcomes in relation to the number of contacts in order to find an optimal number of PHC contacts in this population.

Finally, this study examined the factors contributing to the use of PHC contacts specifically within GMFs. Further studies should compare these results within solo practices.

10.CONCLUSION

This study has provided an evidence-based description of use of PHC services using a novel parameter, i.ethe total number of primary health care contacts; which included both face-to-faceas well as virtual contacts. This parameter has now been documented and explained as a function of the various patient and GMF-level factors included in the study. It has examined how various factors may contribute to the number of contacts with PHC providers by the elderly in family medicine group practices in Quebec, Canada. Our study suggests that some factors significantly contribute to the number of PHC contacts, while others do not. It is worth noting, however, that statistical significance was observed pertaining to both patient-level and GMF-level factors, suggesting that both may play a role in explaining utilisation by this population.

Our study has focused on PHC contact as a novel health services use parameter. Given this novel approach, future studies could build upon our study results. For instance, more information may be required pertaining to factors associated with each individual type of contact

(i.e. face-to-face or virtual), in order to optimize the delivery of care. One suggestion for future studies would be to examine the optimal balance between types of contacts, as this may eventually be customizable to patients based chronic disease status and other clinical and social factors.

Given our study strengths and limitations, these findings may provide some guidance to GMF managers and health policy makers, and assist in the future development of well-informed staffing, budgetary plans, and decisions in Quebec.

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12.APPENDICES

12.1. APPENDIX I. OTHER HEALTH SERVICES USE MODELS

12.1.1. SICK ROLE THEORY BY PARSONS (1951)

Parsons suggested that, when an individual falls sick, s/he adopts a role of being sick. This sick role has four main components:

1) The individual is not responsible for his/her illness and is not able to heal without assistance;

2) The individual is exempted from performing normal roles and tasks;

3) There is general agreement that being sick is an undesirable condition; and

4) To enhance recovery, the individual has to seek medical assistance and to accept medical treatment.

This theory attempted to identify frequently occurring behaviors in individuals when they are ill. However, the theory failed to account for variability in illness behaviour (130).

12.1.2. MECHANIC'S GENERAL THEORY OF HELP SEEKING (1978)

This theory attempted to understand health care utilization from a psychological perspective. The theory included 10 decision points that determine illness behavior, such as;

1) The spectrum of signs and symptoms;

2) The patients‟s perception of symptom severity;

3) The impact on the individual‟s daily life, as influenced by the illness;

4) The frequency of symptoms and their persistence;

5) The individual‟s tolerance of symptoms;

6) The individual‟s knowledge about and cultural perception to the illness;

7) Denial of illness;

8) The way response to the illness affects needs;

9) Other interpretations of symptom manifestation; and

10) Availability of treatment and its economic burden and psychological burden (stigma, humility, etc.).

In addition, the theory allowed either the sick individual or the person making decisions on behalf of the individual to influence the illness response (131).

12.1.3. SICHMAN'S STAGES OF ILLNESS AND MEDICAL CARE (1965)

This theory denotes five stages of an individual‟s decision-making process in determining whether or not to use health care (132):

Stage One: The individual's symptom experience: Such as pain, emotion...etc.

Stage Two: The individual's decision to take a sick role: In this stage, an individual may or may not take a sick role. Accordingly, this stage should determine his/her decision to proceed to the following stage.

Stage Three: Medical care visit: During this stage, the individual decides to seek help from a professional health care system. Nevertheless, such decision pertains to social network and determinants. For example, a person within a rural social network may opt to defer medical care seeking decision for longer than a person who enjoys a cosmopolitan network.

Stage Four: Acceptance of professional health care treatment: This highlights the patient provider relationship, which can be either enforced or disrupted depending on the accord between the individual and the professional health care provider opinions of the illness.

Stage Five: The individual‟s recovery from illness: This stage denotes the individual‟s recovery upon giving up their sick role. However, in the case of chronic diseases, a person may assume a chronically ill role.

12.1.4. THE HEALTH BELIEF MODEL (Rosen stock, Strecher, & Becker, 1994)

This theory envisioned the individual‟s decisiona and actions to treat and/or to prevent disease as an outcome of four central variables (133):

Variable 1: The way the individual perceives him or herself prone to certain disease. An individual may seek preventive health care if s/he believes that they are prone to disease.

Variable 2: The way the individual perceives the illness severity. The more serious an individual perceives the illness to be, the more likely s/he will be seeking treatment and/or prevention.

Variable 3: The way the individual weighs benefits versus costs. An individual will not seek treatment or prevention unless s/he weighs benefits to be greater than the costs.

Variable 4: The role of cues to action in the individual's decision. Media, friends, or a family member can encourage for prevention. The absence of such cues would reduce the likelihood of seeking prevention. Accordingly, an individual's decision to seek and use health services is contextually related.

12.1.5. CHOICE MAKING MODEL (1981)

This model incorporated many ethnographic considerations to enlist four components that are most essential to the individual‟s health service choice (134, 135):

First: Cultural perceptions of disease severity or gravity. This category incorporates both the individual‟s as well as the societal perception of illness severity. Gravity is measured based on the the cultural classification of illnesses by level of severity.

Second: Home treatment as a first line. An individual may opt for home remedies as a first line before seeking any professional health care advice.

Third: Faith in treatment. This component underlines the individual's perception of treatment efficacy. **Fourth**: Accessibility of treatment. Accessibility denotes the cost of health services and the availability of those services.

12.2. APPENDIX II. A RAPID LITERATURE REVIEW

A rapid review of the studies examining the factors (or determinants) contributing to PHC visits has been done for this thesis. In spite of the high degree of discrepancy shown in the studies included in this review with respect to the population, country, patient sample size, health care utilization measures, tools, instruments, procedures, research methodologies, and statistical tests, some results are common to all studies. For the aggregate results of these studies, please refer to **Table18& Table19**.

12.2.1. INDIVIDUAL FACTORS

Predisposing Factors

Demographic Characteristics

Age: Studies concerned with physician visits have found inconsistent results.Some studies report no relationship between age and physician visits (81, 95, 97, 98, 108-110, 122), while other studies showed that older patients visit their doctors more often than younger patients (85, 86, 96, 112-116, 123).

Sex: The influence of sex on physician visits is also uncertain. Some studies have found that sexdoes not affect physician visits (88, 98, 117), whereas others have found that women visit their doctors more often than men (86, 97, 112).

Social Structure Factors

Education: This factordoes not seem to affect physician visits in most published studies (86, 88, 95, 97, 108, 110, 118, 124). However, a few studies have concluded thatpatients who were highly educated paid more visits to their physicians than their counterparts(38, 90).

Marital Status: The majority of studies show no effect of marital status on physician visits (85, 108, 110, 113, 118). However, one study showed more physician visits by unmarried patients (81).

Race & Ethnicity: Race has been examined in the literature for its association with the use of physicians in three US-based studies (81, 95, 109). The first study shown no statistical significance between the black and white population (109), whereas the other two studies showed higher services use among white elderly patients (81, 95).

Family size & Family Functioning: Family size and family characteristics (125) have been associated with tphysician visits in both China and Canada.

Socio-economic status (SES): One study concluded that lower SES led to more physician visits (113); however, four more studies found no relationship between these two variables(38, 85, 115, 118).

Social Support: Social support was not a significant factor in most of the physician visits studies (98, 108, 118); however, one study indicated that patients who received less social support were more likely to visit their doctor (116).

Health Beliefs

Health Literacy: One Chinese study found an association between the level of knowledge about the disease and physician visits for an annual physical exam (125). Another US-based study found a negative association between health knowledge and health services use (126).

Health Attitudes: One US-based study found a negative association between attitudes toward health and health style and services use (126).

Enabling Factors

Enabling factors have demonstratedlow predictive value within the context of the chronically ill elderly population.

Family-related Factors

Income: The role of income as a predictor of health care utilization has been examined in a few physician studies (108, 118, 124). Lower income has not been linked with physician visits. Only lower income among emphysema patients has been associated with more doctor visits (88).

Insurance: Having insurance was found to be related to fewer physician visits for some chronic diseases (88, 124), but not others (86, 98, 108). Despite the fact that general population studies have found lower income groups to have higher healthcare utilization rates, most studies investigating income and insurance among the chronically ill population have found no relationship between income and healthcare use (117, 127). Such a discrepancy in the predictive value of enabling factors may be explained by the fact that people with lower incomes are generally less healthy than people higher incomes (124, 128). Additionally, people with lower

incomes may be more likely to be chronically ill,but there are no income-based differences in the rates of healthcare use among chronically ill patients me [115].

Employment: The role of employment has been less represented in US-based studies. While unemployed AIDS patients recorded slightly more visits to their doctor (95), unemployed cancer patients reported less visits in a Korean study (129).

Needs Factors

Professionally evaluated needs factors

Disease Severity: The relationship between physician visits and disease severity has been less evident in the literature. Some studies have found that higher disease severity led to more doctors visits (85, 86, 91, 96, 116), while others ha ve found no such relationship (38, 95, 118).

Disease Duration: While one study found that longer disease duration led to more physician visits (110), some analyses havefound disease duration to have no influence on visit visits (95, 122, 124)

Symptom Severity: In a couple of studies on this topic, symptom severity had a negative effect on physician visits (88, 95).

Comorbidity: Although some studies have confirmed a relationship between comorbidity and physician visits (86, 90, 95, 112, 114), one study did not find this effect (110). Some studies compared the effect of having a chronic disease versus not having a chronic disease on the number of physician visits. For instance, two out of three studies showed that depressed patients visited their physician more often than non-depressed patients (92, 93) but the third project could not detect any differences (118).

Complications: The relationship between complications and physician visits has also been examined. Among these complications, fatigue (95) and weight changes (115) have shown

no effect on physician visits, whereas pain and pain-related complications have been linked to more physician visits (85, 92, 93).

Subjectively perceived needs factors

Quality of Life: Lower quality of life has been linked with more physician visits in a few studies (114, 118), but others could not establish such a link (108).

Perceived health Status: The influence of perceived health status on PHC physician visits has been extensively studied. While some studies have associated negatively perceived health with more physician visits (81, 86, 88, 90, 92, 93, 96, 110, 118), others have reported that perceived health did not affect physician visits (95, 124).

Activity versus Disability: Fewer activities of daily living (ADL) have resulted in more visits to the doctor in some studies (38, 108, 110, 118), whereas other studies have not shown this same result (95, 124).

Psychological & Emotional Distress: Psychological distress and emotional status have led to more doctor visits in a most of the studies that we reviewed(38, 85, 91, 97, 108, 116)

Satisfaction with Living Status: Satisfaction with living status has not been shown to predict physician utilization(91, 118).

12.2.2. HEALTH CARE SYSTEM FACTORS

Health System Resources

Volume: Two US-based studies and one Swiss-based studyfound that higher physician supply was positively associated with the number of physician visits (58).

Geographic Distribution Variables: These variables, including site of residence, distance to hospital, and living in a city center, have been considered as a potential source of unequal service distribution. Thesevariables have been found to have no significant predictive

ability on the number ofphysicians visits. In some studies, living in a metropolitan or city center was not a predictor for physician use (96, 113, 118). Other studies showed inconsistent results; two analyses found living in a city center to be associated with more visits (88, 124),while one analysis found this to be associated with less visits (95).

Health System Organization

Access

Out-of-Pocket Fees: A New Zealand study showed a negative association between the number of physician visits and the extra fees incurred (97).

Wait Time: Wait time has been negatively associated with the number of physician visits among New Zealand community health centre dwellers (97).

Structure

System Characteristics: A US study comparing two system characteristics (Kaiser and MHS) has recognized the impact of system characteristics on the number of physician visits(124). The impact of the system characteristics on the number of visits was significantly higher for physician-initiated visits than for patient-initiated visits.

Referral source as a system characteristic was linked to the total number of physician visits within the private practice setting in another study (53).

Continuity of Care too has been positively associated with the number of physician visits, as shown in a NZ-based study (97)

Physician Characteristics: Physician *gender* has affected number of patient visits, according to two US-based studies. The male gender has been negatively associated with the number of annual visits(97, 98).Physician *readiness* has also been positively associated with number of patient visits (98).Physician *language* has been negatively associated with the number of patient visits among Hispanic patients in a US-based study (81).

Table 14Aggregate Result of Studies Examining Factors Contributing to PHC Visits (Patient-Level Factors)

FACTOR CATEGORY		FACTOR	TOTAL	SIGNIFICANT		NON SIGNIFICANT
				POSITIVE	NEGATIVE	
PREDISPOSING FACTORS	DEMOGRAPHIC	AGE	**17**	11	0	6
		SEX	**17**	10	0	7
		MARITAL STATUS	**6**	1	1	4
	SOCIAL STRUCTURE	EDUCATION	**11**	2	0	9
		RACE	**1**	1	0	0
		ETHNICITY	**3**	3	0	0
		SES	**5**	0	1	4
		SOCIAL SUPPORT	**4**	0	1	3
		FAMILY SIZE & FUNCTIONING	**2**	2	0	0
	BELIEFS	VALUES CONCERNING HEALTH & ILLNESS	**1**	0	1	0
		ATTITUDES TOWARD HEALTH	**1**	1	0	0
		KNOWLEDGE ABOUT DISEASE	**1**	0	1	0
ENABLING FACTORS	FAMILY RELATED	INCOME	**4**	0	1	3
		INSURANCE	**4**	0	2	2
		EMPLOYMENT	**3**	1	1	1
		DRIVING	**2**	1	0	1
NEED FACTORS	PROFESSIONALLY EVALUATED	DISEASE SEVERITY	**8**	5	0	3
		DISEASE DURATION	**4**	1	0	3
		SYMPTOM SEVERITY	**2**	2	2	0
		COMORBIDITY	**6**	5	0	1
		COMPLICATIONS	**5**	3	0	2
		MEDICATION COUNT	**5**	3	0	2
	SUBJECTIVELY PERCEIVED	SYMPTOM COUNT	**2**	1	0	1
		PHYSICAL ACTIVITY	**3**	3	0	0
		QOL	**3**	2	0	1
		PERCEIVED HEALTH	**11**	9	0	2
		ADL	**6**	0	4	2
		FUNCTIONAL DISABILITY	**1**	0	1	0
		PSYCHOLOGICAL/EMOTIONAL DISTRESS	**6**	1	1	4
		SATISFACTION WITH LIVING STANDARDS	**1**	1	0	0

Table 15 Aggregate Result of Studies Examining Factors Contributing to PHC Visits (Health Care System Factors)

FACTOR CATEGORY			FACTOR	TOTAL	SIGNIFICANT		NON SIGNIFICANT
					POSITIVE	NEGATIVE	
HEALTH SYSTEM FACTORS	RESOURCES	VOLUME	PERSONNEL POPULATION RATIO	**1**	0	0	1
		DISTRIBUTION	GEOGRAPHIC VARIABLES	**5**	1	1	3
	ORGANIZATION	STRUCTURE	CONTINUITY OF CARE	**2**	2	0	0
			PHYSICIAN GENDER	**2**	1	1	0
			REFERRAL SOURCE	**1**	1	0	0
			DELIVERY SYSTEM	**1**	1	0	0
			PHYSICIAN READINESS	**1**	1	0	0
			PHYSICIAN FEES	**1**	0	1	0
		ACCESS	WAITING TIME	**1**	0	1	0
			COMMUNITY SIZE	**1**	0	1	0

Table 16 Individual Studies that Examined Factors Contributing to PHC Visits

No.	AUTHOR	COUNTRY	YEAR	FACTOR EXAMINED	Significance
1	**Yelin et al.** [88]	USA	1983	EDUCATION	✓
				INCOME	✓
				INCOME	✗
				INSURANCE	✓
				PERCEIVED HEALTH	✓
				SOCIAL SUPPORT	✗
2	**Lubeck et al.** [118]	USA	1985	ADL	✗
				AGE	✗
				COMPLICATION	✗
				DISEASE DURATION	✗
				EDUCATION	✗
				INCOME	✗
				INSURANCE	✓
3	**Cox et al.** [81]	USA	1986	AGE	✗
				MARITAL STATUS	✓
				PERCEIVED HEALTH	✓
				SEX	✓
4	**Meyers et al.** [113]	USA	1988	ADL	✓
				AGE	✓
				DISEASE SEVERITY	✗
				EDUCATION	✗
				MARITAL STATUS	✗
				PERCEIVED HEALTH	✓
				QOL	✓
				SES	✗
				SEX	✗
				SOCIAL SUPPORT	✗
				SOCIAL SUPPORT	✗
5	**Maeland et al.** [120]	NORWAY	1989	COMPLICATION	✓
				PERCEIVED HEALTH	✓
				SEX	✓
6	**Browne et al. 38**	CANADA	1990	DISEASE SEVERITY	✗
				ADL	✓
7	**Drossman et al.** [103]	USA	1991	AGE	✗
				EDUCATION	✗
				INCOME	✗
				MARITAL STATUS	✗
				QOL	✗
				SES	✗
				SEX	✓
				ADL	✓
8	**Lundeen et al.** [91]	USA	1991	COMPLICATION	✓
				DISEASE SEVERITY	✓
9	**Hurwicz et al.** [105]	USA	1991	AGE	✗
				DISEASE DURATION	✓
				EDUCATION	✗
				MARITAL STATUS	✗
				PERCEIVED HEALTH	✓
				SEX	✗
				ADL	✓
10	**Von Korff et al.** [96]	USA	1991	AGE	✓
				DISEASE SEVERITY	✓
				PERCEIVED HEALTH	✓
				SEX	✓
11	**Von Korff et al.** [92]	USA	1992	AGE	✓
				COMPLICATION	✓
				PERCEIVED HEALTH	✓
				SEX	✓

No.	AUTHOR	COUNTRY	YEAR	FACTOR EXAMINED	Significance
12	**Weir et al.** [85]	CANADA	1992	AGE	✓
				COMPLICATION	✓
				MARITAL STATUS	✗
				SES	✗
				SEX	✗
13	**Mor et al.** [95]	USA	1993	AGE	✗
				DISEASE DURATION	✗
14	**Szpalski et al.** [110]	BELGIUM	1995	AGE	✓
				DISEASE SEVERITY	✓
				SES	✗
				SEX	✗
15	**Cronan et al.** [109]	USA	1995	AGE	✓
				QOL	✓
16	**Johnston et al.** [110]	UK	1996	AGE	✓
				DISEASE SEVERITY	✓
				SOCIAL SUPPORT	✓
17	**Houle et al.** [86]	Ontario, Canada	2001	AGE	✓
				SEX	✓
				EDUCATION	✓
				LIVING STATUS	✓
				PERCEIVED HEALTH	✓
				PHYSICAL ACTIVITY	✓
				FAMILY FUNCTIONING	✓
				INCOME	✓
				INSURANCE	✓
				DRIVING ABILITY	✓
				COMMUNITY SIZE	✓
				FUNCTIONAL DISABILITY	✓
				DISEASE COUNT	✓
				EMOTIONAL STATUS	✓
18	**Flett et al.** [97]	NEW ZEALAND	2004	AGE	✗
				SEX	✓
				LIVING STATUS	✗
				PERCEIVED HEALTH	✓
				PHYSICAL ACTIVITY	✓
				FAMILY FUNCTIONING	✓
				INCOME	✗
				INSURANCE	✓
				DRIVING ABILITY	✗
				PHYSICIAN GENDER	✓
				TIME WITH SAME PHYSICIAN	✓
				PHYSICIAN FEES	✓
				WAITING TIME	✓
				SATISFACTION WITH LIVING STANDARDS	✓
				PSYCHOLOGICAL DISTRESS	✓
				PHYSICAL SYMPTOMS	✓
19	**Van der Zee, J. et al.** [117]	NETHERLANS	2005	AGE	✓
				MARITAL STATUS	✗
				SES	✓
				SEX	✓
				SOCIAL SUPPORT	✗
20	**Kurtz et al.** [107]	USA	2006	AGE GROUP	✓
				SEX	✓
				COMORBIDITY	✓
				SYMPTOM COUNT	✗
				PHYSICAL ACTIVITY	✓
21	**Suominen-Taiple et al.**	Finland & Norway	2006	AGE	✓

No.	AUTHOR	COUNTRY	YEAR	FACTOR EXAMINED	Significance
22	**Preisser et al.** [98]	USA	2009	AGE	✗
				SEX	✓
				INSURANCE	✓
				MD SEX	✓
				MD READINESS	✓
23	**Hoogeboom et al.** [90]	NETHERLANS	2012	EDUCATION	✗
				COMORBIDITY	✓
				PAIN	✓

12.3. APPENDIX III.ALZHEIMER PLAN EVALUATION STUDY TIMELINE

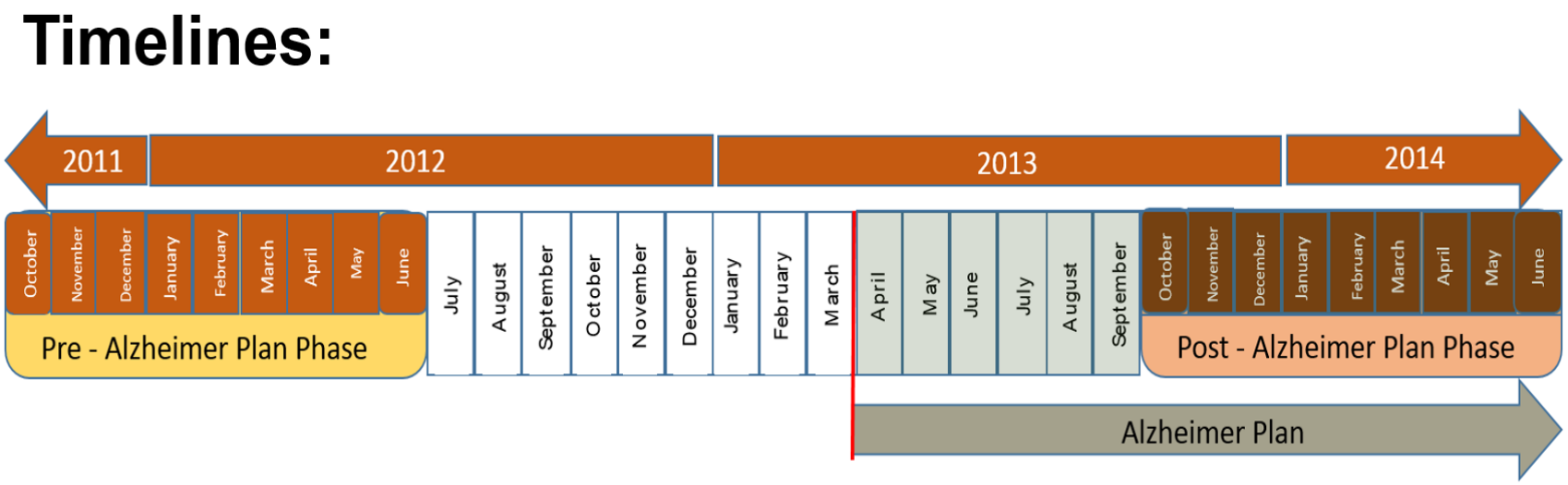

Figure - 10 Alzheimer's Plan Evaluation Study Timeline

12.4. APPENDIX IV: MATCHING MEDICATIONS WITH CORRESPONDING CHRONIC DISEASES

12.4.1. MEDICATIONS WITH ONE ACTIVE INGREDIENT

Table 17 Matching 1- Active Ingredient Medications to Corresponding Chronic Diseases

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Apo ferrous sulfate,Euro ferreux sulfate,Euro Ferrous sulfate, Jamp-Ferrous Polysaccharide, Euro fer, Euro Ferrous, Jamp sulfate ferreux, PMS Ferrous Sulfate	Genereic Names	20:04.04	IRON PREPARATIONS	Anemia
Fe SO4,Fer liquide,Ferreux sulfate,Ferrous Gluconate,Fer, Fer Sulphate, Ferrous fumarate, Ferrous sulfate, FeSO4,Fumarate ferreux, Gluconate ferreux,Sulfate ferreux	Active Ingredient			
Proferrin,Feramax,Ferodan,Infufer,Dexiron,Fer-In-Sol,Ferrlicit,Palafer,Venofer,Venofer i.v.	Brand names			
Apo alpraz,Apo clonazepam,Apo flurazepam,Apo oxazepam,Apo Bromazepam,Apo Diazepam,Apo lorazepam,Apo temazepam,Apo-Clonazepam,Apo-Oxazepam,Apo-Temazépam,Bio Flurazepam,Apo-Lorazepam,Apo-Temazepam,Apozolam,Novo bromazépam,Novo Lorazem,PMS-Clonazepam,Teva Alprazolam,Teva-Temazepam,PMS clonazepam,Pro lorazepam,Teva Lorazepam,Riva Oxazepam,Riva-oxaline,Riva-Oxazepam	Genereic Names	28:24.08	BENZODIAZEPINES	Anxiety and Sleep Disorders
Alpraz,Chlorozepam,Diazepam,Oxazepam,Alprazolam ,Clobazam,Flurazepam,Oxazépam,Alprozolam,Clonapam,Lorazepam,Temazepam,Bromazepam,Clonazepam,Midazolam,Temazépam,Bromazépam,Clonazépam,Nitrazepam	Active Ingredient			
Atalopram,Dalmane,Restoril,Triazolone,Ativan,Frisium,Rivotril,Valium ,Ativan s/l,Lectopam,Serax,Versed,Ativan<,Mogadon,Sérax,Xanax	Brand names			
Apo hydroxyzine,Pms zopiclone,Sivem zopiclone,Teva-Hydroxyzine,Co zopiclone,Pro Zopiclone	Genereic Names	28:24.92	MISCELLANEOUS ANXIOLYTICS SEDATIVES AND HYPNOTICS	Anxiety and Sleep Disorders
Buspirone,Hydroxyzine,Zopicion,Zopiclone	Active Ingredient			
Atarax,Buspar,Dom zopiclone,Imovan,Imovane,Rhovane,Sublinox,Histantil	Brand names			
Apo Methylphenidate	Genereic Names	28:20.32	Respiratory and CNS Stimulants	Anxiety and Sleep Disorders
Methylphenidate	Active Ingredient			
Ritalin	Brand names			
Lithium	Active Ingredient	28:28.00	ANTIMANIC AGENTS	Anxiety and Sleep Disorders
Carbolith	Brand names			
Apo risperidone,Jamp-rispéridone,PMS Quétiapine,PMS-Quetiapine,Pro quetiapine,Pro-Quétiapine,Ran ris,Riva-Rispéridone,Teva-Quetiapine,Sandoz risperidone	Genereic Names	28:16.08.04	ATYPICAL ANTIPSYCHOTICS	Anxiety and Sleep Disorders
Olanzapine,Quetiapine,Quétiapine,Risperidone,Rispéridone	Active Ingredient			
Abilify,Risperdal,Seroquel,Séroquel,Seroquel XR,Zyprexa	Brand names			
Teva Halopéridol,Teva-Haloperidol	Genereic Names	28:16.08.08	BUTYROPHENONES	Anxiety and Sleep Disorders
Haloperidol	Active Ingredient			
Haldol,Isoperidol	Brand names			
Xylac	Brand names	28:16.08.92	MISCELLANEOUS ANTIPSYCHOTICS	Anxiety and Sleep Disorders
Prochlorperasine,Prochlorperazine	Active Ingredient	28:16.08.24	PHENOTHIAZINES	Anxiety and Sleep Disorders
Largatil,Modecate,Stemetil	Brand names			
Fluanxol	Brand names	28:16.08.32	THIOXANTHENES	Anxiety and Sleep Disorders

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Digoxin,Digoxine,Digoxine i.v.	Active Ingredient	24:04.08	CARDIOTONIC AGENTS	Cardiac Diseases
Lanox,Lanoxin,Taloxin,Toloxin,Toloxin tabs	Brand names			
Lidocaine,Lidocaïne	Active Ingredient	24:04.04.08	CLASS IB ANTIARRYTHMICS	Cardiac Diseases
Flecaïnide,Profafenone,Propafenone	Active Ingredient	24:04.04.12	CLASS IC ANTIARRYTHMICS	Cardiac Diseases
Tambocor	Brand names			
APO-Amiodarone,Riva amiodarone	Genereic Names	24:04.04.20	CLASS III ANTIARRYTHMICS	Cardiac Diseases
Amiodarone	Active Ingredient			
Cordarone	Brand names			
Dipyridamole	Active Ingredient	24:12.92	MISCELLANEOUS VASODILATATING AGENTS	Cardiac Diseases
Aggrenox,Persantin	Brand names			
Apo ISMN,Apo-ISMN,Apo-ISMN L.A,Gen nitro s/l spray,Gen nitro sl spray,Milan nitro,Milan Nitro S/L spray,Mylan Nitro,Mylan nitro pompe,Mylan Nitro SL Spray,Mylan nitro spray,Mylan-Nitro Spray,Mylan-Nitro-SL,Mylan-Nitro-SL spray,PMS ISMN,PMS ISMU,PMS-ISMN,Pro ISMN,Pro-ISMN,RHO Nitro,RHO nitro pompe,RHO Nitro pulv,Rho-Nitro,Rho-nitro sub lingual	Genereic Names	24:12.08	NITRATES AND NITRITES	Cardiac Diseases
Isosorbide,Isosorbide-5-mononitrate,Nitro,Nitro I C,Nitro lingual,Nitro lingual pompe,Nitro lingual spray,Nitro lingual vap orale,Nitro patch,Nitro pompe,Nitro PRN,Nitro puff,Nitro S/L,Nitro s/l spray,Nitro SL spray,Nitro spray,Nitro timbre,Nitro vap,Nitroglycerine,Nitroglycerine pommade,Nitroglycerine S/L,Nitrolingual,Nitrolingual pompe,Nitrolingual sol spray,Nitrospray,Nitrostat	Active Ingredient			
Imdur,Indur,Ismn,ISMN LA,Isordil,Nitro dur,Nitro dur patch,Nitro dur timbre,Nitrodur,Nitro-Dur,Nitro-Dur timbre,Nitro-dur timbre cutané,Nitro-dur timbre cutané /,TNT,TNT Spray,Tridil,Trinipatch	Brand names			
ASA Jamp,Jamp A.A.S.,Jamp A.S.A. EC,Jamp aas,Jamp AAS croq.,Jamp AAS EC,Jamp ASA,Jamp ASA croq,Jamp ASA croq.,Jamp ASA EC,Jamp ASA EC 80,Jamp-A.S.A EC,Jamp-ASA,PMS ASA,PMS ASA EC,Pro AAS,Pro AAS EC,Pro AAS EC 80,Pro asa ec,Pro ASA EC 80,Risava,Rivasa,Rivasa fc,Rivesa ?	Genereic Names	28:08.04.24	SALICYLATES	Cardiac Diseases
Aas,AAS 80,AAS Antiplaquettair,AAS e.c.,AAS EC,AAS-antiplaquettaire,Acide acétylsalicylique,Asa,ASA 80,ASA Chew Tab,ASA croq.,Asa E.C.,Asa ec	Active Ingredient			
Asacol,Asaphen,Asaphen CHEW tab,Asaphen croquable,Asaphen E.C.,Asaphen ec,Aspirin,Aspirin EC,Aspirine,Aspirine pour bébé,ECASA,Entrophen,Entrophen EC,Novasen	Brand names			
Acarbose	Active Ingredient	68:20.02	ALPHA-GLUCOSIDASE INHIBITORS	Diabetes
Glucobay,Prandase/glycobay	Brand names			
Apo Metformin,Apo-Metformin,Jamp Metformin Mures,Novo Metformin,Pro Metformin,Pro-Metformin,Ratio Metformin,Ratio Metformine,Ratio-Metformin,Riva Metformin,Riva metformine,Riva-Metformin,Sivem Metformin FC,Teva-metformin	Genereic Names	68:20.04	BIGUANIDES	Diabetes
Metfomin,Metformin,Metformin FC,Metformin HCT,Metformin HCT 850 mg,Metformine	Active Ingredient			
Canaglifloxine,Glucophage,Avandamet,Janumet	Brand names			
Jentadueto,Komboglyze,Glumetza				

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Saxagliptin	Active Ingredient	68:20.05	DIPEPTIDYL PEPTIDASE-4 (DPP-4) INHIBITORS	Diabetes
Januvia,Nesina,Onglyza,Trajenta	Brand names			
Glucagon	Brand names	68:22.12	GLYCOGENOLYTIC AGENTS	Diabetes
Victoza	Brand names	68:20.06	INCRETIN MIMETICS	Diabetes
Insulin humalog,Insulin humulin,Insuline,Insuline Apidra,Insuline aspart,Insuline Humalog,Insuline humulin,Insuline Humulin N,Insuline Humulin R,Insuline Lantus,Insuline Lispro,Insuline Mix 30/70,Insuline Novo rapide,Insuline novolin,Insuline Novolin NPH,Insuline NPH,Insuline toronto,Insuline-Lantus	Active Ingredient	68:20.08	INSULINS	Diabetes
Apidra,Humalog,Humalog R,Humulin,Humulin N,Humulin R,Ins.reg.novGE tor.hum R,Lantus,Lantus Cart,Lantus insulin,Lantus SoloSTAR,Levemir,Novo rapid,Novo rapid flex,Novolin,Novolin ge,Novolin GE 30/70,Novolin GE NPH Pen,Novolin GE Toronto,Novolin-GE-NPH,Novolin-GE-Toronto,Novolinn NPH,Novomix s/c,NovoRapid	Brand names			
Repaglinide	Active Ingredient	68:20.16	MEGLITINIDES	Diabetes
Gluconorm	Brand names			
DDAVP	Active Ingredient	68:28.00	PITUITARY	Diabetes
Apo Gliclazide,Apo gliclazide mr,Apo glyburide,Novo-glyburide,Pro glyburide,Pro-glyburide,Teva glyburide	Genereic Names	68:20.20	SULFONYLUREAS	Diabetes
Glicazide,Glicazyde mr,Gliclazide,Gliclazide MR,Glyburide,Glycazide,Glyclazide,Tolbutamide	Active Ingredient			
Diabeta,Diamicron,Diamicron MR,Diamicron MR 30,Euglucon	Brand names			
Pms Pioglitazone,Pro Pioglitazone	Genereic Names	68:20.28	THIAZOLIDINEDIONES	Diabetes
Pio glitazone,Pioglitazone,Proglitazone	Active Ingredient			
Actos,Avandia,Avandamet	Brand names			
Pms lactulose	Genereic Names	40:10.00	AMMONIA DETOXICANTS	Gastrointestinal Problems
Lactulose	Active Ingredient			
Calcium antiacide X fort	Active Ingredient	56:04.00	ANTACIDS AND ADSORBENTS	Gastrointestinal Problems
Almagel,Gaviscon,Maalox,Maalox/Tums,Pepto-Bismol	Brand names			
Apo docusate,Apo docusate sodium,Apo-docusate,Euro Docusate,Euro Docusate C,Euro Lac,Euro lac sol.orale,Euro Senna,Euro-docusate,Euro-Senna,Jamp docusate,Jamp lactase X fort,Jamp Senna,Jamp senna nat,Jamp Sennosides,Pms docusate,PMS docusate sodium,PMS Ducosate Calcium,PMS Ducosate Sodium,PMS Sennosides,PMS senoside,PMS Sonnosides,PMS-Bisacodyl,PMS-Docusate Sodium,PMS-Sennosides,Ratio Docusate Sodium,Riva-Senna,Taro docusate,Taro Ducosate Sodium,Taro-docusate	Genereic Names	56:12.00	CATHARTICS AND LAXATIVES	Gastrointestinal Problems
Docusate,Docusate Calcium,Docusate de sodium,Docusate sodique,Docusate Sodium,Ducosate,Ducosate de Sodium,Ducosate sodium,Glycerine,Glycerine rectale supp,Glycerine Supp,Glycérine suppositoire,Peg 3350,Peg3350,Polyethylene glycole,Phosphate sodium (lavement),Senna,Senna Tab,Sennatabs,Sennodides,Sennosides,Supp. glycerine	Active Ingredient			

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Ursodiol,Ursodiol-c	Active Ingredient	56:14.00	CHOLELITHOLYTIC AGENTS	Gastrointestinal Problems
URSO DS	Brand names			
Pms ranitidine	Genereic Names	56:28.12	HISTAMINE H2-ANTAGONISTS	Gastrointestinal Problems
Famotidine,Ranitidine,Ranitidine HCl	Active Ingredient			
Pepcid,Zantac ,	Brand names			
Dicetel,Resotran,Xenical	Brand names	56:92.00	MISCELLANEOUS GI DRUGS	Gastrointestinal Problems
Apo domperidone,Apo- Dompéridone,Apo-Domperidone,Pms domperidone,PMS-Domperidone,Ran domperidone,Ratio Domperidone,Ratio Dompéridone,Ratio-Domperidone	Genereic Names	56:32.00	PROKINETIC AGENTS	Gastrointestinal Problems
Domperidone,Dompéridone	Active Ingredient			
Maxeran,Metonia,Motilium	Brand names			
Sucralfate	Active Ingredient	56:28.32	PROTECTANTS	Gastrointestinal Problems
Sulcrate,Sulcrate plus	Brand names			
Apo Esomeprazole,Apo ésomeprazole,Apo esomeprazole plaq,Apo lansoprazole,Apo omeprazole,Apo pantoprazole,Apo-Esomeprazole,Apo-ésomeprazole,Apo-Omeprazole,Dom-Pantoprazole,Gen pantoprazole,Novo lansoprazole,Novo Pantoprazole,PMS Omeprazole,PMS pantoprazole,PMS-Pantoprazole,Ran pantoprazole,Ran rabeprazole,Ran-Pantoprazol,Ratio omeprazo,Ratio pantoprazole,Riva Pantoprazole,Riva- Pantoprazole,Riva-Pantoprazole,Sandoz omeprazole,Sandoz Pantoprazole,Sivem pantoprazole,Teva Pantopraz,Teva Pantoprazole,Teva-Pantoprazole,Teva-Rabeprazole-EC ,	Genereic Names	56:28.36	PROTON-PUMP INHIBITORS	Gastrointestinal Problems
Dexlansoprazole,Esomeprazole,Lansoprazole,Omeprazole,Pantoprazole,Pantoprazole EC,Pantoprozole,Rabeprazole	Active Ingredient			
Dexilan,Dexilant,Dexilant L.A.,Losec,Nexium,Nexium ec,Nexium L.A.,Pantaloc,Pantoloc,Pantoloc EC,Pantoloc EC tabs,Pariet,Prevacid,Prévacid,Prévacid Fast Tab,Prevacid Fastab,Prevacide L.A.	Brand names			
Apo Sulfatrim,Apo Sulfatrim D,Apo Sulfatrim DS,Teva sulfame-tri DS ,	Genereic Names	08:12.20	SULFONAMIDES	Gastrointestinal Problems
TMP SMX,Trimethoprim,Trimoxazole,Sulfasalasine	Active Ingredient			
Bactrim,Bactrim DS,Bactrin,Bactrin DS,Proloprim,Sulfatrim	Brand names			
Apo brimondine,Ratio brimonidine	Genereic Names	52:40.04	ALPHA-ADRENERGIC AGONISTS	Glaucoma
Brimo,Brimonidine,Brimonidine gttes opht	Active Ingredient			
Alphagan,Alphagan P	Brand names			

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Sandoz latanoprost/timolol,Teva Dorzotimol sol opht	Genereic Names	52:40.08	BETA-ADRENERGIC AGENTS	Glaucoma
Levobunolol solution ophtalmique,Timolol,Timop Opht,Timolol gte opht,Timolol gttes,Dorzotimol,Dorzotimol ,Timolol sol opht,Timolol sol opht gel,Timolol Maleate-Ex gte opth.,Timolol Maleate-Ex sol opth.	Active Ingredient			
Betagan,Betoptic,Timoptic,Timoptic XE,Timoptic XE gel opht,Tinoptic XE sol opht,Azarga,Azarga gouttes opht,Casopt 2% gtts,Cosept sol opht,Cosopt,Cosopt gte,Cosopt gte opht,Cosopt oph,Cosopt sol opht,Duo trav gttes,Duo trav sol opht,Duotrav,Duotrav PQ sol opht,Duotrav solution,Xalacom,Xalacom gttes opht	Brand names			
Sandoz-Dorzolamide	Genereic Names	52:40.12	CARBONIC ANHYDRASE INHIBITORS	Glaucoma
Dorzolamide,Acetazolamide	Active Ingredient			
Trusopt,Asopt,Azept 1%,Azopt,Azopt gtte opht,Azopt Ophtalmic,Trusopt,Trusopt gttes opht,Trusopt sol opht	Brand names			
Ranibizumab	Active Ingredient	52:92.00	EENT DRUGS, MISCELLANEOUS	Glaucoma
Lucentis,Systane gttes	Brand names			
Isopto Atropine,Isopto Carpine	Brand names	52:40.20	MIOTICS	Glaucoma
Apo latanoprost,Apo- Latanoprost gte opht APX,Apo travoprost gtte opht,Co Latanoprost sol opht,Sandoz Latanoprost GTE OPHT,Sandoz-latanoprost	Genereic Names	52:40.28	PROSTAGLANDIN ANALOGS	Glaucoma
Bimatoprost,Latanoprost,Latanoprost gttes,Latanoprost sol opht,Travoprost	Active Ingredient			
Lumig,Lumigan,Lumigan gttes,Lumigan RC,Travatan,Travatan Z,Travatan Z gtte opht,Xalatan,Xalatan gouttes opht,Xalatan sol opht,Xalatan sol. opht.	Brand names			
Apo Allopurinol,Jamp allopurinol,Jamp colchicine	Genereic Names	92:16.00	ANTIGOUT AGENTS	Gout
Allopurinol,Colchécine,Colchicine	Active Ingredient			
Uloric,Ziloprim,Ziyloprim,Zyloprim	Brand names			
Cholestyramine	Active Ingredient	24:06.04	BILE ACID SEQUESTRANTS	Hyperlipidemia
Cholestid,Olestyr leger,Olestyr legere sachet,Questran	Brand names			
Ezetimibe	Active Ingredient	24:06.05	CHOLESTEROL ABSORPTION INHIBITORS	Hyperlipidemia
Ezetrol	Brand names			
Apo feno,Apo Feno Super	Genereic Names	24:06.06	FRIBIC ACID DERIVATIVES	Hyperlipidemia
Fenofibrate,Gemfibrozil	Active Ingredient			
Feno-micro,Lipidil,Lipidil EZ,Lipidil supra	Brand names			
Act-Simvastatin,Apo Atorvastatin,Apo lavastatin,Apo lovastatin,Apo pravastatin,Apo Rosuvastatin,Apo simvastatin,Apo-Lovastatin,Apo-Rosuvastatin,Co simvastatin,Dom Atorvastatin,Dom-Atorvastatin,Jamp-atorvastatin,Mint Simvastatin,PMS Atorvastatine,PMS Rosuvastatin,PMS-Atorvastatin,PMS-Simvastatin,Ran Atorvastatin,Ran simvastatin,Ran-Atorvastatin,Ratio Atorvastatin,Ratio-Atorvast,Ratio-Atorvastatin,Ratio-Atorvastatine,Riva Pravastatin,Teva Lovastatin,Teva Pravastatin,Teva Rosuvastatin,Teva- Simvastatin,Teva-Atorvastatin,Teva-Pravastatine,Teva-Rosuvastatin,Teva-Simvastatin	Genereic Names	24:06.08	HMG-COA REDUCTASE INHIBITORS	Hyperlipidemia

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Atorvas,Atorvastatin,Atorvastatin calcium,Atorvastatin calcium tabs,Atorvastatine,Atorvastin,Atovastatin,Lovastatin,Novastatin,Pravastatin,Provastatin,Rosurvastatin,Rosuvastatin,Rosuvastatin calcium,Rosuvastatine,Simvast,Simvastatin,Simvastatin	**Active Ingredient**	24:06.**08**	**HMG-COA REDUCTASE INHIBITORS**	**Hyperlipidemia**
Avastin,Crestor,Lescol,Lipidil micro,Lipitor,Mevacor,Pravachol,Provachol,Vastatin,Zocar,Zocor Niaspan	**Brand names**			
Apo Doxazosin,PMS Terazosin,Teva doxazolin,Teva-Terazosin	**Genereic Names**	24:20.00	**ALPHA-ADRENERGIC BLOCKING AGENTS**	**Hypertension**
Doxazosin,Doxazosine,Prazosin,Terazosin	**Active Ingredient**			
Cardura,Hytrin	**Brand names**			
Apo Irbesartan,Apo-candesartan,PMS Irbesartan,PMS Losartan,Sandoz Candesartan,Sandoz Valsartan,Sandoz-Losartan,Sandoz-Valsartan,Teva Losartan,Teva telmisartan,Teva Valsartan,Teva-Telmisartan,Co Losartan,Co valsartan,Apo Losartan HCTZ,Co Irbesartan HCT,Milan losartan HCTZ Plaq,Sandoz Valsartan HCT,Sivem Irbesartan HCT,Telva telmisartan/hctz,Teva Valsartan/HCTZ,Teva-Telmisartan/HCTZ,PMS Ramipril hctz,PMS-Ramipril-HCTZ,Sandoz Lisinopril/HCT	**Genereic Names**	24:32.**08**	**ANGIOTENSIN II RECEPTOR ANTAGONISTS**	**Hypertension**
Candes,Candesartan,Ibesartan,Irbesartan,Irbésartan,Losartan,Losartan plaq,Telmisartan,Valsartan,Valsartan plaq,Candesartan HCT,Candestartan HCTZ,Irbesartan HCT,Irbesartan HCTZ,Irbesartan-HCT,Irbesartan-HCTZ,Losartan HCT,Losartan HCTZ,Telmisartan, HCTZ,Telmisartan+hydrochlorothiazide,Valsartan HCT,Valsartan HCTZ,valsartan/hct,Valsartan+Hydrochlorothiazide	**Active Ingredient**			
Atacand,Avalide,Avapro,Cozaar,Diovan,Miacardins,Miacardis,Micadis,Micardis,Olmetec,Teveten,Avalid,Diovan HCT,Diovan HCTZ,Hizaar,Hyzaar DS,Micardis Plus,Mircadis / hct,Olmetec-Plus,Teveten Plus,Atacand Plus,Prinzide,Accuretic,Altace + HCTZ,Altace HCT,Altace HCT tabs,Altace plus,Coversyl Plus,Coversyl Plus-HD,Zestoretic,Vaseretic	**Brand names**			
Apo cilazapril,Apo enalapril,Apo lisinopril,Apo quinapryle,Apo Ramipril,Apo- Ramipril,Apo-Ramipril,Co ramipril,Co-ramipril,Dom-Ramipril,Novo fosinopril,Novo Lisinopril,Novo-captoril,PMS Ramipril,PMS ramipril plaq,PMS-Ramipril,Pro enalapril,Pro Lisinopril,Pro ramipril,Ran linsiopril,Ran ramipril,Ran-Lisinopril,Sandoz Enalapril,Sivem ramipril,Teva Enalapril,Teva Fosinopril,Teva ramipril,Teva-Lisinopril	**Genereic Names**	24:32.**04**	**ANGIOTENSIN-CONVERTING ENZYME INHIBITORS**	**Hypertension**
Captopril,Cilazapril,Enalapril,Enalapril maleate,Enalopril,Fosinopril,Lisinopril,Lisinopril Z,Lisinopril HCT,Lisinopril/HCTZ,Quinapril HCTZ,Ramipril/HCTZ,Quinalapril,Quinapril,Ramipril	**Active Ingredient**			
Accupril,Altace,Capoten,Conversyl,Coversyl,Inhibace,Monopril,Perindopril,Prinivil,Vasotec,Vasotec pre-pak,Zestril	**Brand names**			

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Apo Acebutolol,Apo atenol,Apo bisoprolol,Apo Metoprolol,Apo atenol,Apo propranolol,Apo-Acebutolol,Apo-Atenol,Apo bisoprolol,Apo-Nadol,Jamp Metoprolol,Milaan Acébutolol,Mylan atenolol,Mylan-Acebutolol,Novo acebutolol,Novo Metroprolol,Novo Pranol,Novocor,PMS Atenolol,PMS Aténolol,PMS Bisoprolol,PMS metoprolol,PMS-Atenolol,PMS-Bisoprolol,PMS-Metoprolol,Pro bisoprolol,Pro-Bisoprolol,Ran atenolol,Ratio-Atenolol,Rhotral,Riva aténolol,Riva-Atenolol,Riva-Metoprolol,Sandoz Bisoprolol,Sandoz Metoprolol,Sandoz Metoprolol SR,Sandoz-Bisoprolol,Sandoz-Metoprolol,Sivem bisoprolol,Teva bisoprolo,Teva Bisoprolol,Teva Métoprolol,Teva Pranol,Teva propranolol,Co atenolol,Apo-metoprolol,Mylan atenolol,	**Genereic Names**	24:24.00	**BETA-ADRENERGIC BLOCKING AGENTS**	**Hypertension**
Acebutol,Acebutolol,Acebutolol S,Acetab,Atenolol,Aténolol,Bisoprolol,Carvedilol,Labetalol,Metoprol, Metoprolol,Métoprolol,Metoprolol L,Metoprolol sr,Metropolol,Metroprolol SR,Nadolol,Propanol,Propanolol,Propanolol HCl,Propranolol,Solalol,Sotalol,Sotalol HCL,Timolol,Pindolol, Labetalol,Metoprol,Metoprolol,Métoprolol, Metoprolol L,Metoprolol sr,Metropolol,Metroprolol SR, Nadolol,Propanol,Propanolol,Propanolol HCl, Propranolol,Solalol,Sotalol,Sotalol HCL, Timolol,Pindolol	**Active Ingredient**			
Atenol,Aténol,Biso,Inderal,Inderal LA,Indéral LA,Lopresor,Lopressor,Lopressor SR,Monocor,Nadol,Pindol,Sectral,Sotacor,Tenormin,Trandate,Visken,Viskazide	**Brand names**			
Novo Clonidine,Teva Clonidine,Teva-clonidine	**Genereic Names**	24:08.**16**	**CENTRAL ALPHA-AGONISTS**	**Hypertension**
Clonidine	**Active Ingredient**			
Catapres,Catapress,Methyldopa	**Brand names**			
Apo Amlodipine,Co amlodipine,Jamp Amlodipine,MAR Amlodipine,Milan-nifedipine,Mylan nifedipine EX,Mylan Nifedipine XL,Mylan-Nifedipine,Mylan-Nifedipine EX,PMS Amlodipine,PMS-amlodipine,PMS-Amlodipine,Ram amlodipine,Ran amlodipine,Ratio Amlodipine,Riva Amlodipine,Riva-Amlodipine,Sandoz amlodipine,Septa-Amlodipine,Sivem amlodipine,Teva amlodipine,Teva-Amlodipine,Norvasc-HCTZ	**Genereic Names**	24:28.**08**	**DIHYDROPYRIDINES**	**Hypertension**
Amlodipine,Amlodipine besylate,Amlopidine,Felodipine,Félodipine,Nifedipine,Nifédipine,Nifedipine EX LA,Nifedipine XL,Nifedipine XR	**Active Ingredient**			
Adalat,Adalat PA,Adalat xc,Adalat XL,Norvac,Norvasc,Plendil,Renedil,Twinsta,Twynstor	**Brand names**			
Hydralazine	**Active Ingredient**	24:08.**20**	**DIRECT VASODILATORS**	**Hypertension**

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Apo furosemide,Apo Furosémide,Apo-Furosémide,Novo Semide,Novosemide,PMS-Furosemide,Teva Furosemid,Teva Furosemide,Teva semide,Teva-Furosemide	Genereic Names	40:28.08	LOOP DIURETICS	Hypertension
Furosemide,Furosémide	Active Ingredient			
Edecrin,Lasix,Lasix i.v.,Lasix spécial,Semide	Brand names			
Teva Spironolactone,Teva-Spironolactone	Genereic Names	24:32.20	MINERALOCORTICOID (ALDOSTERONE) RECEPTOR ANTAGONISTS	Hypertension
Spironolactone	Active Ingredient			
Aldactone,Aldactazide	Brand names			
Apo diltiaz,Apo Diltiazem,Apo Diltiazem CD,Apo verap sr,Apo-Diltiaz CD,Co Diltiazem,Co Diltiazem CD,Milan-Verapamil,Mylan Verapamil,Mylan Verapanil,Mylan Verapanil LA,Novo diltiazem,Novo diltiazem HCL ER,Sandoz Diltiazem,Sandoz Diltiazem CD,Sandoz Diltiazem T,Teva Diltiazem,Teva Diltiazem CD,Teva Diltiazem HCL,Teva-Diltiazem,Teva-Diltiazem CD,Gen Verapamil SR	Genereic Names	24:28.92	MISCELLANEOUS CALCIUM-CHANNEL BLOCKING AGENTS	Hypertension
Diltazem,Diltiaz,Diltiazem,Diltiazem CD,Diltiazem ER,Diltiazem HCL,Diltiazem T,Verapamil,Verapamil HCC,Verapanyl sr	Active Ingredient			
Cardizem,Cardizem CD,Isoptin,Isoptin SR,Tiazac,Tiazac XC,Tiazacyl,Triazac XC	Brand names			
Teva triamterene/HCTZ	Genereic Names	40:28.16	POTASSIUM-SPARING DIURETICS	Hypertension
Triamterene HCT,Triamterene/hydrochlorothiazide	Active Ingredient			
Amiloride,Amilzide,Moduret,Triazide,Dyazide,Pro triazide,Apo Triazide,Novamilor,Amilzide Rasilez	Brand names			
Apo hydro,Apo Hydrochlorothiazide,Apo hydrodiuril,Apo-Hydro,Novo hydrazide,PMS Hydrochlor,PMS Hydrochlorothiazide,PMS-Hydrochloro,PMS-Hydrochlorothiazide,Teva Hydrazide,Teva-Hydrochlorothiazide	Genereic Names	40:28.20	THIAZIDE DIURETICS	Hypertension
Chlorothiazide,Chlorthalidone,HCCTZ D,HCT,HCTZ,HLTZ,HTCZ,Hydrochlor,Hydrochlorothiazide,Hydrochlorothiazide,Hydrochlorthiazide,Hydrodiuril	Active Ingredient			
Hydrazide,MCTZ,Triamzide,Triazide	Brand names			
PMS Indapamide	Genereic Names	40:28.24	THIAZIDE-LIKE DIURETICS	Hypertension
Chlorthalidone,Indapamide,Indépamide	Active Ingredient			
Fludex,Lozide,Zaroxolyn	Brand names			
Ondansetron	Active Ingredient	56:22.20	5-HT3 RECEPTOR ANTAGONISTS	Malignancies
Zofran,Zofran iv	Brand names			
Apo Methotrexate,Apo-Tamox,Teva Bicalutamide	Genereic Names	10:00.00	ANTINEOPLASTIC AGENTS	Malignancies
Anastrozole,Bicalutamide,Bortezomib,CDZ,Cyclophosphamide,Hydroxyurea,Hydroxyurée,Letrozole,Methotrexate,MTX,Nilotinib,Tamoxifen,Tamoxifene,Tamoxifène	Active Ingredient			
Anandron,Arimidex,Aromasin,Avastin opht.,Casode,Casodex,Cazodex,Ceptin,Eligard,Euflex,Femara,Femora,Gemzar,Gleevec,Hydrea,Lupron depot i/m,Revlimid,tarceva,Xeloda,Zytiga,Firmagon,Firmagor s/c	Brand names			
Zoladex,Zoladex injection,Zoladex LA,Zoladex LA s/c	Brand names	68:18.00	GONADOTROPINS	Malignancies
Cesamet	Brand names	56:22.92	MISCELLANEOUS ANTIEMETICS	Malignancies
Medroxy,Mepro,Prometrium,Provera	Brand names	68:32.00	PROGESTINS	Malignancies
Chimio Tx	N/A	N/A	Other Unspecified	Malignancies

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
PMS mirtazapine,Pro-Mirtazapine,Sandoz Mirtazapine,Teva mirtazapine ,	Genereic Names	28:16.04.92	MISCELLANEOUS ANTIDEPRESSANTS	Behavioral Problems
Bupropion,Bupropion FR,Bupropion XL,Mertazapine,Mirtazapine,Mirtazapine tabs	Active Ingredient			
Rameron,Remeron,Réméron,Remeron RD,Remeron tabs,Wellbutrin,Wellbutrin XL	Brand names			
Moclobenide	Active Ingredient	28:16.04.12	MONOAMINE OXIDASE INHIBITORS	Behavioral Problems
Parnate	Brand names			
Apo venlafaxine xr,Pms venlafaxine,Pms venlafaxine xr,Ratio venlafaxine XR,Teva venlafaxine,Teva venlafaxine EXR LA,Teva Venlafaxine XR,Teva-Venlafaxine	Genereic Names	28:16.04.16	SELECTIVE SEROTONIN AND NOREPINEPHRINE-REUPTAKE INHIBITORS	Behavioral Problems
Duloxétine,Venlafaxine,Venlafaxine XR	Active Ingredient			
Cymbalta,Effexor,Effexor XR	Brand names			
Apo sertraline,APo-Sertraline,Co citalopram,Dom-citalopram,Jamp-Citalopram,PMS Citalopram,Ran citalo,Riva- Citalopram,Riva Paroxétine,Sivem citalopram,Sivem paroxetine,Teva citalopram,Teva-Citalopram,Teva-Paroxetine,Teva-Sertraline	Genereic Names	28:16.04.20	SELECTIVE-SEROTONIN REUPTAKE INHIBITORS	Behavioral Problems
Citalopram,Citalopram tabs,Escitalopram,Fluoxetine,Fluvoxamine,Paroxetine,Sertraline	Active Ingredient			
Celexa,Cipralex,Luvox,Paxil,Prozac,Zoloft	Brand names			
Novo trazodone,Pms trazodone,Teva trazodone,Apo trazodone	Genereic Names	28:16.04.24	SEROTONIN MODULATORS	Behavioral Problems
Tradozone,Trazadone,Trazodone	Active Ingredient			
Desyrel,Désyrel	Brand names			
Teva-Nortriptiline	Genereic Names	28:16.04.28	TRICYCLICS AND OTHER NOREPINEPHRINE-REUPTAKE INHIBITORS	Behavioral Problems
Amitriptyline,Amitriptyline 25,Doxepine,Nortriptiline,Nortriptyline,Trimipramine	Active Ingredient			
Aventyl,Elavil,Élavil	Brand names			
Amantadine	Brand names	40:12.00	ADAMANTANES	Neurological Conditions
Apo trihex,PMS Procyclidine	Genereic Names	28:36.08	ANTICHOLINERGIC AGENTS	Neurological Conditions
Procyclidine,Trihexyphenidyl	Active Ingredient			
Cogentin,Kemadrin	Brand names			
Phenobarbital,Phénobarbital,Primidone	Active Ingredient	28:12.04	BARBITURATES	Neurological Conditions
Mysoline	Brand names			
stalevo,Comtan	Brand names	28:36.12	CATECHOL-O-METHYLTRANSFERASE (COMT) INHIBITORS	Neurological Conditions
Apo levocarb,Dom Levo Carbidopa	Genereic Names	28:36.16	DOPAMINE PRECURSORS	Neurological Conditions
Levocarb,Levodopa,Levovarb	Active Ingredient			
Prolopa,Sinement,Sinemet,Sinemet 100/25,Sinemet CR	Brand names			
Phenytoine	Active Ingredient	28:12.12	HYDANTOINS	Neurological Conditions
Dilantin	Brand names			
Apo Gabapentin,Apo-Valproic,Pms pregabalin,PMS Prégabalin,Pro Levetiracetam,Riva prégabalin,Teva-Carbamaz,Teva-Pregabaline	Genereic Names	28:12.92	MISCELLANEOUS ANTICONVULSANTS	Neurological Conditions
Gabapentin,Lamotrigine,Levetiracetam,Pregabalin,Prégabalin,Pregabaline	Active Ingredient			
Divalproex,Epival,Keppra,Lamictal,Lyrica,Lyrica Exelon T C,Neurontin,Tegretol cr,Valproate	Brand names			

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Memantine,Mémantine	Active Ingredient	28:92.00	MISCELLANEOUS CENTRAL NERVOUS SYSTEM AGENTS	Neurological Conditions
Ebixa	Brand names			
Selegiline	Active Ingredient	28:36.32	MONOAMINE OXIDASE B INHIBITORS	Neurological Conditions
Azilect	Brand names			
Co Pramipexole,PMS Pramipexole	Genereic Names	28:36.20.08	NONERGOT-DERIVATIVE DOPAMINE RECEPTOR AGONISTS	Neurological Conditions
Pramipexole	Active Ingredient			
Mirapex,Neupro,Requip	Brand names			
Apo donépézil,Mylan Galantamine ER,PMS Rivastigmine	Genereic Names	12:04.00	PARASYMPATHOMEMETIC (CHOLINERGIC) AGENTS	Neurological Conditions
Chlorhydrate de donépézil,Donepezil,Donépézil,Galantamine,Galantamine ER,Rivastigmine,Rivastigmine Timbre	Active Ingredient			
Aricept,Aricept tabs,Exelon,Exelon patch,Exelon timbre,Exelon timbre cutané,Mestinon,Reminyl,Reminyl ER	Brand names			
Apo alendronate,Co alendronate,Co-Etidrocal,Novo risedronate,Pms alendronate,Riva Alendronate,Riva risédronate,Riva-Alendronate,Sandoz alendronate,Sandoz risedronate,Sivem alendronate,Sivem alendronate FC,Teva Alendronate,Teva Risedronate,Teva-Alendronate	Genereic Names	92:24.00	BONE RESORPTION INHIBITORS	Osteoporosis
Alen,Alendronate,Alendronate sodium,Alendronate/cholecal,Alendronate-FC,Denosumab,Denosumab (inj),Risedronate,Risédronate,Risedronate sodium,Risidronate	Active Ingredient			
Etidrocal,Aclasta,Aclista IV,Actonel,Aredia,Ca + biphosphate,CA/fosamax/D,Forza,Forza10,Fosamax,Fosavance,Prolia, Prolia inj,Xgeva,Xgeva injection	Brand names			
Apo Raloxifene,Pms raloxifene	Genereic Names	68:16.12	ESTROGEN AGONIST-ANTAGONISTS	Osteoporosis
Raloxifène	Active Ingredient			
Evista	Brand names			
Sandoz Calcitonin ns,Sandoz calcitonine HS	Genereic Names	68:24.00	PARATHYROID	Osteoporosis
Apo-calcitonine aéro nas,Calcitonin,Calcitonine,Calcitonine vap nasale,Calcitriol IV,Calcitrol	Active Ingredient			
Forteo,Miacalcin	Brand names			
Celebrex,Célébrex,Celecoxib,Celocoxib	Brand names	28:08.04.08	CYCLOOXYGENASE-2 (COX-2) INHIBITORS	Pain and Inflamation
Apo acetaminophene,Apo-Acetaminophen,Jamp Acetaminophen,Jamp Acetaminophene,Jamp acétaminophène,Novagesic,Novo Gesic,Novo Gesic forte,Novogesic,PMS Acet,Teva gesic	Genereic Names	28:08.92	MISCELLANEOUS ANALGESICS AND ANTIPYRETICS	Pain and Inflamation
Acetami,Acetaminophen,Acétaminophen,Acetaminophen 325,Acetaminophen arthrite,Acetaminophen arthritique,Acetaminophen arthritis,Acetaminophen arthritis pain pain,Acetaminophen regulier,Acétaminophen tab,Acetaminophene,Acétaminophene,Acetaminophène,Acétaminophène,Acetaminophene 325,Acetaminophene 500,Acetaminophène 500,Acetaminophène Arthritique,Acétaminophène arthritique L.A,Acetaminophène caplet,Acetaminophene supp	Active Ingredient			

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Acet,Tylenol 500,Tylenol arthritis pain,Tylenol regulier,Atasol forte,Tylénol 500 mg,Tylenol arthritis pain tabs,Tylenol rhume,Pédiaphen,Tylenol 650,Tylenol Extra Fort,Tylenol sinus,Tylenol,Tylenol arthrite,Tylenol extra-strength,Tylenol X fort,Tylénol,Tylenol arthritique,Tylenol forte,Tylenol X-Fort,Tylenol 325,Tylenol arthritis,Tylenol L.A.	**Brand names**	28:08.92	**MISCELLANEOUS ANALGESICS AND ANTIPYRETICS**	**Pain and Inflamation**
Ketamine	**Brand names**	**28:04.92**	**MISCELLANEOUS GENERAL ANESTHETICS**	**Pain and Inflamation**
Ratio Codéine,Ratio Emtec,Ratio Emtec-30,Ratio-Codeine	**Genereic Names**	28:08.08	**OPIATE AGONISTS**	**Pain and Inflamation**
Codeine,Codéine,Codéine Contin,Codeine phosphate	**Active Ingredient**			
Empracet,Triatec,Triatec-30,Emtec,Fiorinal C	**Brand names**			
Apo diclo SR,Pms diclofenac	**Genereic Names**	28:08.04.**92**	**OTHER NONSTEROIDAL ANTIIMFLAMMATORY AGENTS**	**Pain and Inflamation**
Diclofenac,Diclofenac émulgel,Naproxen,Naproxen E,Naproxène	**Active Ingredient**			
Advil,Indomethacin,Teva Naproxen,Voltaren Emulgel gel top,Advil (vente libre),Kétorolac,Volt gel,Voltaren gel,AINS,Meloxicam,Voltare-Gel,Voltaren onguent,Arthritis pain extended,Motrin,Voltaren,Voltaren top,Arthrotec,Naprosyn,Voltaren (vente libre),Voltaren topique,Ibuprofen,Naprosyn E,Voltaren cr,Voltaren-Gel,Ibuprofene,Pennsaid,Voltaren Emugel,Voltaren-Imulgel,Ibuprofène,Pennsaid sol. topique,Voltaren Emulgel,Voltaren-Imulgel top,Indocid,Pensaid,Voltaren émulgel,Voltarin,Vimovo ,	**Brand names**			
ASA 500	**Active Ingredient**	28:08.04.**24**	**SALICYLATES**	**Pain and Inflamation**
Anacin,Fiorinal,Tecnal	**Brand names**			
Teva Sumatriptan	**Genereic Names**	**28:32.28**	**SELECTIVE SEROTONIN AGONISTS**	**Pain and Inflamation**
Axert,Triptan	**Brand names**			
Alvasco,Asmanex,Flovent Diskus,Pulmicort Turbuhaler,Alvesco,Flovent,Flovent HFA Alvesco inh,Flovent avec aerochambre,Pulmicort	**Brand names**	68:04.00	**ADRENALS**	**Respiratory Problems**
Glycopyrronium	**Active Ingredient**	**48:12.08**	**ANTICHOLINERGIC AGENTS**	**Respiratory Problems**
Seebri Breezhaler	**Brand names**			
PMS Ipratropium sol. aérosol	**Genereic Names**	12:08.08	**ANTIMUSCARINICS ANTISPASMODICS**	**Respiratory Problems**
Ipratropium,Tiotropium,Tiotropium inh	**Active Ingredient**			
Atrovent,Combivent UDV,Spiriva avec aerochambre,Tudorza,Atrovent HFA,Spiriva,Spiriva avec handhaler,Tudorza genuair,Atrovent nasal,Spiriva (inh. poudre),Spiriva inh,Ultibro,Combivent,Spiriva aérochambre,Spiriva inha	**Brand names**			
Montelukast	**Active Ingredient**	48:10.24	**LEUKOTRIENE MODIFIERS**	**Respiratory Problems**
Singulair	**Brand names**			
Apo Theo L.A.,Teva-theophylline	**Genereic Names**	86:16.00	**RESPIRATORY SMOOTH MUSCLE RELAXANTS**	**Respiratory Problems**
Aminophylline,Theophylline	**Active Ingredient**			
Uniphyl	**Brand names**			

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Novo Salbutamol,PMS Salbutamol,Teva salbutamol,Teva-Salbutamol,Novo Salbutamol HFA,Ratio Salbutamol HFA inh,Teva salbutamol HFA,Teva-Salbutamol-HFA	**Genereic Names**	12:12.**08.12**	**SELECTIVE BETA 2-ADRENERGIC AGONISTS**	**Respiratory Problems**
Fluticosone vap.nasale,Salbutam,Salbutamol HFA,Salmétérol,Salbuta,Salbutamol,Salbutamol inh.,Terbutaline sulfate,Formoterol	**Active Ingredient**			
Advair,Apo salvent,Oxeze turbuhaler,Symbicort Turbuhaler,Advair aérochambre,Apo salvent sans cfc,Oxeze turbuhaler (inh. poudre),Vento,Advair Diskus,Apo-Salvent,Salvent,Vento disk,Advair inh.,Bricanyl,Salvent sans CFC,Ventolin,Advair MDI,Bricanyl-Turbuhaler,Serevent,Ventolin avec aérochambre,Advaire,Onbrez Breezhaler,Serevent Diskus,Ventolin diskus,Airomir,Oxeze,Symbicort,Ventolin HFA,Airomir sol aero orale,Oxeze turbuhale,Symbicort Pd Inh.,Ventolin sol aérosol	**Brand names**			
Inhalo ,Turbohaler	**N/A**	N/A	**Other Unspecified**	**Respiratory Problems**
Novo Prednisone,Novo-Prednisone,Sandoz prednisolone,Teva-Prednisone,Novo-medrone,Ratio Prednisone,Teva Prednisone	**Genereic Names**	68:04.00	**ADRENALS**	**Rheumatologic Diseases**
Cortisone,Infiltration Methylpred.acetate,Prednisolone orlo,Triamcinolone infiltration,Cortisone infiltration,Methylpred.acetate infiltration,Prednisone,Triamicinolone Acetonide,Cortisone infiltrée,Methylprednisolone,Triamcinolone Dexamethasone,Prednisolone	**Active Ingredient**			
Cortef,Dépomédrol,Kenalog inj.,Pred forte,Decadron,Depomedrol + Xylo,Kenalog/ marcaine,Pred Mild,Depomedrol,Dépomedrol-Xylo,Kenalog/lidocaine,Solucortef,Depo-Medrol,Winpred,Kenalog-40,Solumedrol,Depomédrol,Infiltation xylo/kenolog,Kenalolog+Xylocaine en infiltration Kenalog	**Brand names**			
Apo Hydroxyquine,Apo-hydroxyquine,Hydroxychloroquin Mylan	**Genereic Names**	08:30.08	**ANTIMALARIALS**	**Rheumatologic Diseases**
Chloroquine,Hydroxyquine,Hydroxychloroquine,Hydroxyquinine	**Active Ingredient**			
Plaquenil	**Brand names**			
Enbrel s/c,Humira,Humira s/c,Remicade pd inj	**Brand names**	**92:36.00**	**DISEASE-MODIFYING ANTIRHEUMATIC AGENTS**	**Rheumatologic Diseases**
Azathioprine	**Active Ingredient**	**92:44.00**	**IMMUNOSUPPRESSIVE AGENTS**	**Rheumatologic Diseases**
Imuran	**Brand names**			
Infiltration,Marcaine 0.5%,Xylo avec épinéphrine,Xylocaïne 2%	**Brand names**	**72:00.00**	**LOCAL ANESTHETICS**	**Rheumatologic Diseases**
infiltration xylo+?,Novocaiine,Xylo sans epinephrine,Xylocaïne infiltration				
Marcaine,Xylo + Soluspan,Xylocaine,Xylocaine visqueuse				
Marcaïne,Xylo 1% (infiltration),Xylocaïne				
Marcaine 0.25%,Xylo 2%,Xylocaine 2%				
Depo + Xylo,Illisible infiltration,Monovisc,Neovisc,Simvisc-one inj,Synvisc	**N/A**	N/A	**N/A**	**Rheumatologic Diseases**

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
PMS Hydromorphone,PMS-Hydromorphone,Teva Hydromorphone PMS Oxycodone,Ratio Fentanyl timbre,Apotramadol/acet	Genereic Names	28:08.08	OPIATE AGONISTS	Severe Pain
Tramadol+acetaminopĥène,Fentanyl timbre,Morphine ir,Sufentanil,Fentanyl,Hydromorphone,Oxycodone,Tramadol,Fentanyl patch,Morphine,Oxycodone-L.A. Fentanyl TC,Morphine GEL	Active Ingredient			
Demerol,M-elson,MS-IR,Statex,Dilaudid,M-Eslon,Oxy IR,Supeudol,Dilaudidd,Met,Oxycocet,Tridural,Duragesic,Metadol,Oxycontin,Ultram,Hydromorph Contin,MS Contin,Oxyneo,Zytram,Hydromorphone Contin,MS IR,Percocet,Zytram xl,Kadian,MSIR,Sandoz Tramadol,Tramacet,Atasol	Brand names			
Butrans,Narcan	Brand names	28:08.12	OPIATE PARTIAL AGONISTS	Severe Pain
Methimazole	Active Ingredient	68:36.08	ANTITHYROID AGENTS	Thyroid Diseases
Propylex,Tapazole	Brand names			
Levothyroxine	Active Ingredient	68:36.04	THYROID AGENTS	Thyroid Diseases
Desiccated thyroid,Synthoid,Synthroid,Synthroid tabs,Eltroxin,Synthro,Synthroïd	Brand names			
Apo dutasteride,Pms dutasteride,Sandoz Finasteride,Teva-Dutastéride,	Genereic Names	92:08.00	5-ALFA REDUCTASE INHIBITORS	Urinary and Renal Problems
Dutasteride,Finasteride,Finastéride	Active Ingredient			
Avoda,Avodart,Proscar	Brand names			
Apo oxybutynine,Teva Oxybutiynine	Genereic Names	86:12.04	Antimuscarinics	Urinary and Renal Problems
Oxybutinine,Oxybutynin,Oxybutynin chloride,Oxybutynine,Tolterodine	Active Ingredient			
Detrol,Ditropan,Toviaz,Versicare,Detrol L.A,Ditropan XL,Trosec,Vesicare,Detrol-LA,Enablex,Uromax,Vesicare LA	Brand names			
Aranesp,Eprex,Eprex s/c,Neupogen s/c,Aranesp s/c,Eprex (inj),Neupogen	Brand names	20:16.00	HEMATOPOIETIC AGENTS	Urinary and Renal Problems
ACETYLCHOLINESTASE,Bethanechol	Active Ingredient	12:04.00	PARASYMPATHOMEMETIC (CHOLINERGIC) AGENTS	Urinary and Renal Problems
Duvoid	Brand names			
Fosrenol,Renagel,Renvela	Brand names	40:18.19	PHOSPHATE-REMOVING AGENTS	Urinary and Renal Problems
Kayexalate,Solystat	Brand names	40:18.18	POTASSIUM-REMOVING AGENTS	Urinary and Renal Problems
Apo-Alfuzosin,Ratio Tamsulosin,Sandoz tamsulosin,Sandoz-Tamsulosin,Apo-Tamsulosin,Ratio-Tamsulosin,Sandoz tamsulosin CR,Teva Tamsulosin CR,Apo-Tamsulosin CR,Sandoz alfuzosin	Genereic Names	12:16.04.12	Selective Alfa-1-Adrenergic Blocking Agents	Urinary and Renal Problems
Alfuzosin,Tamsulosin CR,Tamsulosin CR plaq,Tamsulosine,Tamsulosin	Active Ingredient			
Flamax,Flomax cr,Rapaflo,Xatrol,Flomax,Flomax-CR,Xatral,Myrbetriq	Brand names			
Taro warfarin,Taro-Warfarin,Teva-Warfarin	Genereic Names	20:12.04.08	COUMARIN DERIVATIVES	Vascular Diseases
Warfarin,Warfarine	Active Ingredient			
Coumadin,Sintram,Sintrom	Brand names			

Medication Name or active ingredient (as found in patient's charts)	G/B/A	2016 A.H.F.S. Code	A.H.F.S. Class 2016	Chronic Disease
Apixaban,Eliquis,Éliquis,Fondaparinux	Brand names	20:12.04.14	Direct Factor Xa Inhibitors	Vascular Diseases
Pradax,Pradaxa	Brand names	20:12.04.12	DIRECT THROMBIN INHIBITORS	Vascular Diseases
Pentoxifilline	Active Ingredient	20:24.00	HEMORRHEOLOGIC AGENTS	Vascular Diseases
Trental	Brand names			
Daltéparine,Héparine,Heparine inj,Tinzaparine,Heparine,Heparine i/v,Héparine sodique	Active Ingredient	20:12.04.16	HEPARINS	Vascular Diseases
Enoxaparine,Hepalean,Innohep sous-cutanée,Lovenox s/c,Fragmin,Innohep,Lovenox,Lowprin,Lowprin EC	Brand names			
Xarelto	Brand names	20:12.04.92	MISCELLANEOUS ANTICOAGULANTS	Vascular Diseases
Ran-Clopidogrel	Genereic Names	20:12.18	PLATELET AGGREGATION INHIBITORS	Vascular Diseases
Clopidogrel	Active Ingredient			
Apo Clopidogrel,Apo-Clopidrogrel,Plavix	Brand names			
Dom-Anagrelide	Genereic Names	20:12.14	PLATELET-REDUCING AGENTS	Vascular Diseases

12.4.2. MEDICATIONS WITH TWO ACTIVE INGREDIENT

Table 18 Matching 2-Active Ingredient Medications with Corresponding Chronic Diseases

Medication Name or active ingredient (as found in patient's charts)	First Active Ingredient A.H.F.S. Class 2016	First Active Ingredient A.H.F.S. Code 2016	Second Active Ingredient A.H.F.S. Class 2016	Second Active Ingredient A.H.F.S. Code 2016	Final Chronic Disease
Librax	ANTIMUSCARINICS ANTISPASMODICS	12:08.08	BENZODIAZEPINES	28:24.08	Gastrointestinal problems
Stemetil	PHENOTHIAZINES	28:16.08.24	ANTIHISTAMINES	N/A	Behavioral Problems
Avandamet	BIGUANIDES	68:20.04	THIAZOLIDINEDIONES	68:20.28	Diabetes
Janumet, Jentadueto, Komboglyze	BIGUANIDES	68:20.04	DIPEPTIDYL PEPTIDASE-4 (DPP-4) INHIBITORS	68:20.05	Diabetes
Apo trimebutine, Modulon, Polibutin	ANTIMUSCARINICS ANTISPASMODICS	12:08.08	PROKINETIC AGENTS	56:32.00	Gastrointestinal problems
Sandoz latanoprost/timolol, Timolol + travoprost, Duo trav gttes,Duotrav PQ sol opht,Xalacom gttes opht, Duo trav sol opht, Duotrav solution, Duotrav,Xalacom	BETA-ADRENERGIC AGENTS	52:40.08	PROSTAGLANDIN ANALOGS	52:40.28	Glaucoma
Dorzolamide+timolol gtte opht,Cosopt,Cosopt sol opht, Azarga gouttes opht,Cosopt gte,Azarga, Casopt 2% gtts,Cosopt gte opht,Dorzotimol, Cosept sol opht,Cosopt oph,Teva Dorzotimol	BETA-ADRENERGIC AGENTS	52:40.08	CARBONIC ANHYDRASE INHIBITORS	52:40.12	Glaucoma
Combigan gtte opht ALL, Combigan ,	BETA-ADRENERGIC AGENTS	52:40.08	ALPHA-ADRENERGIC AGONISTS	52:40.04	Glaucome
Caduet	HMG-COA REDUCTASE INHIBITORS	24:06.08	DIHYDROPYRIDINES	24:28.08	Hypertension
Norvasc-HCTZ	DIHYDROPYRIDINES	24:28.08	THIAZIDE DIURETICS	40:28.20	Hypertension
Apo Losartan HCTZ, Irbesartan-HCT, Avalide,Telmisartan+hydrochlorothiazide, Irbesartan-HCTZ, telmisartan/hctz, Candesartan HCT, Losartan HCT, Valsartan/HCTZ, Candestartan HCTZ, Losartan HCTZ, Diovan HCTZ, Co Irbesartan HCT, Micardis Plus,Teveten Plus, Milan losartan HCTZ Plaq, Diovan HTC, Valsartan HCT, Teva-Telmisartan/HCTZ, Mircadis / hct, Valsartan HCTZ, Valsartan+Hydrochlorothiazide, Olmetec-Plus, valsartan/hct, Sandoz Valsartan HCT, Hisaar DS, Hizaar, Sivem Irbesartan HCT, Ibesartan HCT,Atacand Plus,Irbesartan HCTZ,Telmisartan HCTZ,	ANGIOTENSIN II RECEPTOR ANTAGONISTS	24:32.08	THIAZIDE DIURETICS	40:28.20	Hypertension
Prinzide, Altace plus, PMS Ramipril hctz, PMS-Ramipril-HCTZ, Coversyl Plus, Accuretic, Altace + HCTZ, Coversyl Plus-HD, Quinapril HCTZ, Altace HCT, Lisinopril HCT, Ramipril/HCTZ, Altace HCT tabs,Lisinopril/HCTZ,Vasertic, Zestoretic, Lisinopril/HCT	ANGIOTENSIN-CONVERTING ENZYME INHIBITORS	24:32.04	THIAZIDE DIURETICS	40:28.20	Hypertension
Viskazide	BETA-ADRENERGIC BLOCKING AGENTS	24:24.00	THIAZIDE DIURETICS	40:28.20	Hypertension
Twinsta,Twynstor	DIHYDROPYRIDINES	24:28.08	ANGIOTENSIN II RECEPTOR ANTAGONISTS	24:32.08	Hypertension
Triamterene/hydrochlorothiazide, Apo Triazide,Aldactazide	MINERALOCORTICOID (ALDOSTERONE) RECEPTOR ANTAGONISTS	24:32.20	THIAZIDE DIURETICS	40:28.20	Hypertension
Amiloride, Novamilor,Amilzide, Teva triamterene/HCTZ, Moduret,Triamzide, Dyazide, Triamterene HCT, Triazide, Pro triazide	POTASSIUM-SPARING DIURETICS	40:28.16	THIAZIDE DIURETICS	40:28.20	Hypertension
Firmagon, Firmagor s/c,	ANTINEOPLASTIC AGENTS	10:00.00	GONADOTROPIN-RELEASING HORMONE ANTAGONISTS	92:40.00	Malignancies
Amantadine	ADAMANTANES	08:18.04	ADAMANTANES	28:36.04	Neurologic Conditions
stalevo	CATECHOL-O-METHYLTRANSFERASE (COMT) INHIBITORS	28:36.12	DOPAMINE PRECURSORS	28:36.16	Neurologic Conditions
Etidrocal	BONE RESORPTION INHIBITORS	92:24.00	VITAMINS & MINERALS	88:28.00	Osteoporosis
Robaxacet	CENTRALLY ACTING SKELETAL MUSCLE RELAXANTS	12:20.04	MISCELLANEOUS ANALGESICS AND ANTIPYRETICS	28:08.92	Pain & Inflammation
Anacin	SALICYLATES	28:08.04.24	Respiratory and CNS Stimulants	28:20.32	Pain & Inflammation
Emtec	OPIATE AGONISTS	28:08.08	MISCELLANEOUS ANALGESICS AND ANTIPYRETICS	28:08.92	Pain & Inflammation
Fiorinal C	OPIATE AGONISTS	28:08.08	BARBITURATES	28:24.04	Pain & Inflammation
Vimovo	OTHER NONSTEROIDAL ANTIIMFLAMMATORY AGENTS	28:08.04.92	PROTON-PUMP INHIBITORS	56:28.36	Pain & Inflammation
Dristan	PROPYLAMINE DERIVATIVES	04:04.20	MISCELLANEOUS ANALGESICS AND ANTIPYRETICS	28:08.92	Pain & Inflammation
Combivent,Ultibro,	ANTIMUSCARINICS ANTISPASMODICS	12:08.08	SELECTIVE BETA 2-ADRENERGIC AGONISTS	12:12.08.12	Respiratory Diseases
fluticasone/salmetrol	CORTICOSTEROIDS	52:08.08	SELECTIVE BETA 2-ADRENERGIC AGONISTS	12:12.08.12	Respiratory Diseases
Symbicort	SELECTIVE BETA 2-ADRENERGIC AGONISTS	12:12.08.12	ADRENALS	68:04.00	Respiratory Diseases
Tramadol+acetaminophène,Tramacet,Atasol, Apotramadol/acet, Percocet, Ocycocet	OPIATE AGONISTS	28:08.08	MISCELLANEOUS ANALGESICS AND ANTIPYRETICS	28:08.92	Severe Pain

12.5. APPENDIX V.UNMATCHED MEDICATION CLASSES

Table -19 Frequencies of Unmatched Medication Classes

Medication Classes Unmatched to Chronic Diseases	Frequency of Prescription
ADRENALS	1
ADRENOCORTICAL INSUFFICIENCY	2
ALLYLAMINES	37
ALPHA-ADRENERGIC AGONISTS (oral)	1
ALPHA-AND BETA-ADRENERGIC AGONISTS	10
AMEBICIDES	1
AMINOGLYCOSIDES	2
AMINOPENICILLINS	93
ANDROGENS	3
ANTIALLERGIC AGENTS	3
ANTIBACTERIALS	31
ANTIBIOTICS	84
ANTIDIARRHEA AGENTS	43
ANTIDOTES	2
ANTIFLATULENTS	1
ANTIHISTAMINE DRUGS	2
ANTIHISTAMINES	51
ANTI-INFLAMMATORY AGENTS (topic)	331
ANTI-INFLAMMATORY AGENTS, MISCELLANEOUS (topic)	3
ANTIMALARIALS	25
ANTIMUSCARINICS ANTISPASMODICS (other than inhalation)	22
ANTIPRURITICS AND LOCAL ANESTHETICS	8
ANTITUBERCULOSIS AGENTS	1
ANTITUSSIVES	24
ANTIVIRALS	3
ARTIFICIAL TEARS	78
AZOLES	120
BASIC LOTIONS AND LINIMENTS	1
BASIC OINTMENTS AND PROTECTANTS	28
CALORIC AGENTS	1
CARBAPENEMS	6
CELL STIMULANTS AND PROLIFERANTS	2
CENTRALLY ACTING SKELETAL MUSCLE RELAXANTS	18
CONTRACEPTIVES	1
CORTICOSTEROIDS	250
DENTAL AGENTS	1
DIGESTANTS	4
EENT DRUGS, MISCELLANEOUS (other than ophtalmic)	64
ERYTHROMYCINS	12
ESTROGENS	87
ETHANOLAMINE DERIVATIVES	42
EXTENDED-SPECTRUM PENICILLINS	9
FIRST GENERATION CEPHALOSPORINS	47
GABA-DERIVATIVE SKELETAL MUSCLE RELAXANTS	1
GLYCOPEPTIDES	6
HCV Antivirals	1
HERBS AND NATURAL PRODUCTS	27
HOMEOPATHIC PRODUCTS	2
HYDROXYPYRIDONES	15
IRRIGATING SOLUTIONS	2

Medication Classes Unmatched to Chronic Diseases	Frequency of Prescription
IRRIGATING SOLUTIONS	**2**
KERATOLYTIC AGENTS	**23**
LINCOMYCINS	**7**
LOCAL ANESTHETICS (other route than inflitration)	**5**
MISC. SKIN AND MUCOUS MEMBRANE AGENTS	**14**
MISCELLANEOUS ANTI-INFECTIVES	**6**
MISCELLANEOUS ANTIPROTOZOALS	**26**
MISCELLANEOUS ANTIVIRALS	**1**
MISCELLANEOUS AUTONOMIC DRUGS	**13**
MISCELLANEOUS CENTRAL NERVOUS SYSTEM AGENTS (other than Memantine)	**30**
MISCELLANEOUS DERIVATIVES	**2**
MISCELLANEOUS GENERAL ANESTHETICS	**2**
MISCELLANEOUS LOCAL ANTI-INFECTIVES	**30**
MISCELLANEOUS SKELETAL MUSCLE RELAXANTS	**2**
MISCELLANEOUS THERAPEUTIC AGENTS	**4**
MYDRIATICS	**3**
N/A (illisible, no AHFS class)	**619**
NATURAL PENICILLINS	**5**
NEURAMINIDASE INHIBITORS	**8**
NONSTEROIDAL ANTI-INFLAMMATORY AGENTS	**3**
NUCLEOSIDES AND NUCLEOTIDES	**21**
OPIATE AGONISTS (sirup)	**1**
OTHER MACROLIDES	**81**
OTHER NUTRITIONAL AGENTS	**27**
PARASYMPATHOMEMETIC (CHOLINERGIC) AGENTS (other than for urinary or neurologic)	**2**
PENICILLINASE-RESISTANT PENICILLINS	**8**
Phosphodiesterase Type 4 Inhibitors	**1**
PHOSPHODIESTERASE TYPE 5 INHIBITORS	**46**
POLYENES	**18**
PROPYLAMINE DERIVATIVES	**1**
QUINOLONES	**246**
REPLACEMENT PREPARATIONS	**2**
ROENTGENOGRAPHY	**1**
SALICYLATES (topic)	**10**
SCABICIDES AND PEDICULICIDES	**1**
SECOND GENERATION ANTIHISTAMINES	**44**
SECOND GENERATION CEPHALOSPORINS	**27**
SUNSCREEN AGENTS	**7**
TETRACYCLINES	**10**
THIOCARBAMATES	**2**
THIRD GENERATION CEPHALOSPORINS	**15**
URINARY ANTI-INFECTIVES	**25**
VACCINES	**590**
VASOCONSTRICTORS	**2**
VITAMIN B COMPLEX	**365**
VITAMIN C	**3**
VITAMIN D	**608**
VITAMIN K ACTIVITY	**25**
VITAMINS & MINERALS	**1267**

12.6. APPENDIX VI.INDEPENDENT VARIABLES& PRIMARY OUTCOME STRATIFIED BY GMF

Table 20 Independent Variables Stratified by GMF

	University of Montreal				McGill University			University of Sherbrooke			University of Laval		
	15	17	24	26	18	21	28	19	20	23	22	25	27
	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=119
Patient-Level Factors													
Predisposing Factors													
Age, mean (SD)	81.9 (4.8)	80.5 (4.6)	81.9 (4.9)	82.5 (5.1)	82.4 (5.8)	81.6 (5.1)	82.2 (5.0)	83.2 (4.8)	81.0 (4.7)	81.9 (4.9)	81.6 (4.8)	80.4 (4.2)	81.9 (5.5)
Age Groups													
85.0 +, (%)	25.3%	14.0%	24.7%	30..0%	29.3%	27.3%	29.3%	37.3%	21.3%	27.3%	22.7%	13.3%	28.6%
80.0 - 84.9, (%)	36.0%	30.7%	35.3%	30.7%	32.0%	26.7%	27.7%	32.7%	29.3%	28.0%	30.,%	30.7%	24.4%
75.0 - 79.9, (%)	38.7%	55.3%	40.0%	39.3%	38.7%	46.0%	42.0%	30.0%	49.3%	44.7%	47.3%	56.0%	47.1%
Male, (%)	46.7%	46.0%	40.0%	38.0%	32.0%	42.0%	34.0%	36.7%	44.0%	44.0%	38.7%	47.3%	28.6%
Living Status													
Living with a Family Member, (%)	35.3%	44.7%	48.0%	42.7%	49.3%	71.3%	32.7%	50.5%	51.3%	62.0%	42.7%	60.0%	57.1%
Living Alone, (%)	42.0%	21.3%	18.0%	13.3%	27.7%	22.0%	13.3%	19.3%	14.7%	15.3%	15.3%	20.7%	19.3%
Missing, (%)	22.7%	34.0%	34.0%	44.0%	26.0%	6.7%	54.0%	30.7%	34.0%	22.7%	42.0%	19.3%	23.5%
Need Factors													
Number of Medications													
Number of Chronic Disease Medications, mean (SD)	7.8 (5.1)	8.7 (6.3)	9.6 (5.7)	8.0 (5.3)	6.9 (4.3)	8.9 (4.9)	5.6 (3.7)	9.3 (4.5)	7.6 (4.4)	9.5 (6.3)	7.9 (4.1)	10.6 (5.4)	11.0 (6.0)
Number of Non-Chronic Disease Medications, mean (SD)	2.8 (2.3)	3.4 (2.7)	3.1 (2.6)	3.0 (2.8)	3.0 (2.6)	2.5 (2.4)	2.1 (2.2)	4.2 (2.6)	2.7 (2.3)	3.6 (2.4)	2.9 (2.2)	2.9 (2.6)	3.4 (3.1)
Chronic Diseases													
Number Of Chronic Diseases, mean (SD)	5.2 (2.7)	5.8 (3.2)	6.4 (3.2)	5.4 (2.9)	4.9 (2.7)	5.9 (2.7)	4.1 (2.3)	6.3 (2.7)	5.5 (2.8)	6.0 (3.1)	5.7 (2.5)	7.0 (3.1)	7.1 (3.3)
Individual Chronic Diseases, (%)													
Anaemia	7.3%	12.7%	13.3%	17.3%	12.0%	6.7%	6.7%	10.0%	8.0%	13.3%	10.0%	10.7%	14.3%
Anxiety and Sleep Disorder	29.3%	34.7%	46.7%	28.7%	26.7%	43.3%	18.7%	36.0%	30.0%	23.3%	35.3%	36.0%	47.1%
Behaviour_Problems	10.7%	12.7%	5.3%	8.0%	7.3%	5.3%	8.7%	10.7%	4.0%	9.3%	7.3%	12.7%	12.6%
Cardiac Diseases	45.3%	53.3%	64.0%	50.7%	46.7%	60.0%	35.3%	60.7%	50.7%	49.3%	52.7%	66.0%	58.8%
Diabetes	30.7%	24.0%	24.0%	22.7%	19.3%	16.0%	12.7%	21.3%	20.0%	27.3%	22.0%	26.0%	20.2%
Gastrointestinal Problems	50.7%	64.0%	56.7%	60.7%	44.0%	56.0%	38.7%	64.0%	50.0%	55.3%	46.0%	70.7%	73.1%
Glaucoma	8.0%	7.3%	8.0%	8.7%	12.0%	6.7%	4.0%	14.0%	9.3%	10.0%	10.7%	13.3%	12.6%
Gout	4.7%	8.7%	2.0%	8.0%	6.0%	2.0%	2.7%	6.0%	4.7%	6.7%	5.3%	6.0%	4.2%
Hyperlipidaemia	46.7%	58.7%	64.7%	55.3%	50.7%	56.7%	40.0%	50.7%	52.7%	66.0%	68.7%	70.7%	63.0%
Hypertension	72.7%	70.7%	80.7%	78.0%	76.0%	80.0%	64.7%	77.3%	78.0%	84.0%	77.3%	81.3%	81.5%
Malignancies	4.7%	6.0%	6.0%	4.0%	6.7%	6.7%	2.0%	10.7%	1.3%	4.7%	3.3%	6.7%	6.7%
Mental Disorders	30.7%	24.0%	26.7%	16.0%	13.3%	20.0%	19.3%	25.3%	26.0%	22.7%	17.3%	32.0%	37.0%
Neurological Conditions	10.7%	16.7%	18.7%	18.0%	16.0%	20.7%	37.3%	21.3%	27.3%	22.0%	18.7%	22.7%	20.2%
Osteoporosis	16.0%	24.0%	16.7%	23.3%	22.7%	17.3%	16.7%	33.3%	32.7%	23.3%	27.3%	30.0%	29.4%
Pain and Inflammation	42.0%	43.3%	58.0%	43.3%	43.3%	52.7%	32.7%	56.0%	44.7%	46.0%	48.7%	55.3%	63.9%
Respiratory Diseases	28.7%	22.0%	31.3%	17.3%	16.0%	30.0%	8.7%	21.3%	19.3%	28.0%	18.7%	35.3%	33.6%
Rheumatologic Conditions	10.7%	12.7%	23.3%	14.7%	8.7%	20.0%	8.0%	20.7%	17.3%	17.3%	10.0%	19.3%	16.8%
Severe Pain	9.3%	16.0%	21.3%	11.3%	6.0%	12.7%	5.3%	8.7%	11.3%	16.7%	9.3%	17.3%	22.7%
Thyroid Disorders	22.7%	21.3%	29.3%	17.3%	26.7%	30.0%	16.7%	36.7%	19.3%	29.3%	32.7%	28.7%	38.7%
Urinary and Renal Problems	16.0%	20.0%	18.7%	17.3%	8.0%	20.7%	15.3%	20.7%	21.3%	20.7%	20.7%	28.0%	17.6%
Vascular Diseases	22.0%	24.0%	28.0%	20.7%	25.3%	28.0%	16.0%	26.7%	18.7%	26.0%	23.3%	33.3%	30.3%

	University of Montreal				McGill University			University of Sherbrooke			University of Laval		
	15	17	24	26	18	21	28	19	20	23	22	25	27
	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=150	n=119
GMF-Level Factors													
Predisposing Factors													
GMF Proportion of Elderly Patients	10.7	N/A	16.7	15.7	N/A	14	12.1	7.4	7.3	12	16.9	10	11.5
GMF Resource Factors													
Number of Physicians per FTE Physician	3.14	N/A	2.0	2.03	N/A	1.54	2.5	2.2	1.67	2.35	1.39	N/A	3.13
Number of Patients per FTE Physician	919	N/A	1,270.6	2,038.1	N/A	1025	1,244.2	1,501.6	967.8	816.7	916.3	1,034.6	2,115.8
Number of Patient per FTE Registered Nurse	3218	N/A	7941	8,152.5	N/A	13325	8,048.9	7,508	5226	4,165	14,193.5	4,086.5	12,695
GMF Organizational Factors													
Number of Sites within GMF	3	1	5	1	4	7	1	3	1	1	8	1	7
Years of Operations	10.8	5.5	8.6	4.1	10.1	6.4	10.5	11	6.8	2.2	10.4	N/A	4
Primary Health Care Contacts mean (SD)	7.0 (8.5)	3.3 (2.6)	2.8 (3.0)	4.3 (3.9)	7.2 (9.7)	3.1 (3.1)	3.1 (2.5)	4.2 (4.8)	4.2 (3.7)	5.0 (3.9)	3.4 (3.9)	4.9 (4.7)	4.6 (3.8)

12.7. APPENDIX VII.INDEPENDENT VARIABLES& PRIMARY OUTCOME STRATIFIED BY UNIVERSITY

Table 21Independent Variables Stratified by University Affiliation

	University of Montreal n=600	McGill University n=450	University of Sherbrooke n=450	University of Laval n=419
Patient-Level Factors				
Predisposing Factors				
Age, mean (SD)	81.7 (4.9)	82.1 (5.4)	82.0 (4.9)	81.2 (4.9)
Age Groups				
85.0 +, (%)	23.5%	28.7%	28.7%	21,0%
80.0 - 84.9, (%)	33.2%	29.1%	30,0%	28.6%
75.0 - 79.9, (%)	43.3%	42.2%	41.3%	50.4%
Male, (%)	42,7%	36,0%	41,6%	38,9%
Living Status				
Living with a Family member, (%)	23.7%	20,0%	16.4%	18.4%
Living Alone, (%)	42.7%	51.1%	54.4%	53,0%
Missing, (%)	33.7%	28.9%	29.1%	28.6%
Need Factors				
Number of Medications				
Number of Chronic Disease Medications, mean (SD)	8.5 (5.7)	7.1 (4.5)	8.8 (5.2)	9.8 (5.3)
Number of Non-Chronic Disease Medications, mean (SD)	3.1 (2.6)	2.5 (2.4)	3.5 (2.5)	3.0 (2.6)
Chronic Diseases				
Number Of Chronic Diseases, mean (SD)	5.7 (3.0)	5.0 (2.7)	5.9 (2.9)	6.6 (3.0)
Individual Chronic Diseases, (%)				
Anaemia	12.7%	8.4%	11.5%	10,4%
Anxiety and Sleep Disorder	34.8%	29.6%	38.9%	29.8%
Behaviour_Problems	9.2%	7.1%	10.7%	8.0%
Cardiac Diseases	53.3%	47.3%	59.2%	53.6%
Diabetes	25.3%	16.0%	22.9%	22.9%
Gastrointestinal Problems	58.0%	46.2%	62.5%	56.4%
Glaucoma	8.0%	7.5%	12.2%	11.1%
Gout	5.8%	3.5%	5.3%	5.8%
Hyperlipidaemia	56.3%	49.1%	67.8%	56.4%
Hypertension	75.5%	73.5%	79.9%	79.8%
Malignancies	5.2%	5.1%	5.5%	5.6%
Mental Disorders	24.3%	17.5%	28.2%	24.7%
Neurological Conditions	16.0%	24.7%	20.5%	23.6%
Osteoporosis	20.0%	18.8%	28.9%	29.8%
Pain and Inflammation	46.7%	42.8%	55.4%	48.9%
Respiratory Diseases	24.8%	18.2%	28.9%	22.9%
Rheumatologic Conditions	15.3%	12.2%	15.3%	18.4%
Severe Pain	14.5%	8.0%	17.4%	12.2%
Thyroid Disorders	22.7%	24.4%	32.9%	28.4%
Urinary and Renal Problems	18.0%	14.7%	22.4%	20.9%
Vascular Diseases	23.7%	23.1%	28.9%	23.8%
GMF-Level Factors				
Predisposing Factors				
GMF Proportion of Elderly Patients	12.4 (3.0)	12.7 (1.2)	8.9 (2.2)	16.3 (0.6)
GMF Resources Factors				
Number of Physicians per an FTE Physician	2.29 (0.64)	1.9 (0.67)	1.84 (0.35)	2.0 (1.23)
Number of Patients per an FTE Physician	1,074.8 (146.3)	1,570.4 (546.3)	1,095.3 (294.1)	1,412.6 (558.2)
Number of Patients per an FTE Registered Nurse	5,081.8 (2,055.0)	13,010.0 (3,15.5)	5,633 (1,396.3)	11,521.1 (3,006.0)
GMF Organizational Factors				
Number of Sites within GMF	2.5 (1.7)	4.0 (2.5)	1.7 (0.9)	5.2 (3.2)
GMF Years of Operations	7.2 (2.7)	9.0 (1.9)	6..7 (3.6)	7.6 (3.2)
Primary Health Care Contacts mean (SD)	4.35 (5.3)	4.45 (6.2)	4.4 (4.2)	4.27 (4.2)