

UNIVERSITY OF CALGARY

Building Knowledge about Health Services Utilization by Refugees

by

Valerie Eva Kiss

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES  
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE  
DEGREE OF MASTER OF SCIENCE

DEPARTMENT OF COMMUNITY HEALTH SCIENCES

CALGARY, ALBERTA

SEPTEMBER, 2010

© Valerie Eva Kiss 2010



UNIVERSITY OF  
CALGARY

The author of this thesis has granted the University of Calgary a non-exclusive license to reproduce and distribute copies of this thesis to users of the University of Calgary Archives.

Copyright remains with the author.

Theses and dissertations available in the University of Calgary Institutional Repository are solely for the purpose of private study and research. They may not be copied or reproduced, except as permitted by copyright laws, without written authority of the copyright owner. Any commercial use or re-publication is strictly prohibited.

The original Partial Copyright License attesting to these terms and signed by the author of this thesis may be found in the original print version of the thesis, held by the University of Calgary Archives.

Please contact the University of Calgary Archives for further information:

E-mail: [uarc@ucalgary.ca](mailto:uarc@ucalgary.ca)

Telephone: (403) 220-7271

Website: <http://archives.ucalgary.ca>

## Abstract

**Background:** The objective of this study was to compare the utilization of outpatient physician, emergency department and hospital services between refugees and the general population in Calgary, Alberta.

**Methods:** Data was collected on 2280 refugees from a refugee clinic in Calgary and matched with 9120 non-refugees. Both groups were linked to Alberta Health and Wellness administrative data to assess health services utilization over two years.

**Results:** After adjusting for age, sex and medical conditions, refugees utilized general practitioners, emergency departments and hospitals more than non-refugees. A similar proportion in the two groups had seen a general practitioner within one week prior to their emergency department visit; however, refugees were more likely to have been triaged for urgent conditions and female refugees seen for pregnancy-related conditions than non-refugees. Refugees were more likely to have had infectious and parasitic diseases.

**Interpretation:** Refugees utilized health services more than non-refugees with no evidence of underutilization.

## **Acknowledgements**

First and foremost, I would like to thank my supervisor, Dr. Hude Quan. I am truly grateful for your support, time, patience and encouragement throughout my graduate studies. I have learned a tremendous amount through your mentorship. To my committee members, Dr. Brenda Hemmelgarn and Dr. Carolyn Pim, thank you for your commitment to this project and always providing thoughtful comments and suggestions.

I would like to thank the Calgary Refugee Health Clinic for supporting data collection. I would like to acknowledge Alberta Health and Wellness for providing the data used in this study, and particularly Yan Jin for abstracting the data. I am also very grateful to Vicki Stagg for always willingly offering help with data management.

I would like to thank the Western Regional Training Centre for Health Services Research for providing me with a studentship over the last two years and the Prairie Metropolis Centre for the research scholarship provided to help support this study.

A special thank you to: Sandor and Spencer for reviewing this document and providing great suggestions; Delaine for your ongoing support of my career development; Claudia for listening and encouraging me to take time off to complete my thesis; Alka, Emmanuel and Paul for your support and advice; and to the classmates I met throughout my time in graduate studies for your support along the way.

Lastly, I would to express my heartfelt thanks to my family and friends. Your understanding, love and support have meant the world to me and I am very grateful to have you all in my life.

## **Dedication**

To my parents, for teaching me about the importance of a strong work ethic, believing in me and always encouraging me to pursue higher education. I am extremely grateful for your endless love, support and generosity, and so blessed to have you as my parents.

To Spencer, for providing me with your unconditional love, support and positivity throughout this journey. You are an amazing person and I am so lucky that life brought us together.

## Table of Contents

Abstract.....	ii
Acknowledgements.....	iii
Dedication.....	iv
Table of Contents.....	v
List of Tables.....	ix
List of Figures.....	xi
List of Symbols and Abbreviations.....	xii
CHAPTER ONE: STUDY OBJECTIVE AND SIGNIFICANCE.....	1
1.1 Objective.....	1
1.2 Rationale.....	1
CHAPTER TWO: BACKGROUND.....	4
2.1 The Refugee Population: Terminology and Arrival to Canada.....	4
2.2 Key Statistics and Demographics.....	8
2.3 Resettlement Destination and Country of Origin.....	9
2.4 The Health Status of Refugees.....	10
2.5 Access to Health Services.....	13
2.5.1 Factors Associated with Access to Health Services by Refugees.....	14
2.6 Health Services Utilization by Refugees.....	16
2.6.1 International Research.....	16
2.6.2 Research in Canada.....	19
2.7 Summary and Overview of the Study.....	21

CHAPTER THREE: METHODS .....	23
3.1 Study Design and Time Periods.....	23
3.2 Data Sources .....	24
3.2.1 The Calgary Refugee Health Clinic Patient Charts and Electronic Medical Records .....	25
3.2.2 Alberta Health and Wellness Databases .....	25
3.2.2.1 Alberta Health Care Insurance Plan Registry .....	26
3.2.2.2 Physician Claims Database .....	26
3.2.2.3 Ambulatory Care Classification System Database .....	27
3.2.2.4 Canadian Institute for Health Information Discharge Abstract Database .....	27
3.3 Study Population.....	28
3.3.1 Inclusion Criteria .....	28
3.3.2 Exclusion Criteria.....	29
3.4 Study Variables.....	29
3.4.1 Dependent Variable .....	29
3.4.1.1 Outpatient Physician Visits.....	30
3.4.1.2 Emergency Department Visits .....	30
3.4.1.3 Hospital Inpatient Visits .....	31
3.4.1.4 General Practitioner use before an Emergency Department Visit.....	31
3.4.2 Independent Variables .....	32
3.4.2.1 Refugee Status .....	32
3.4.2.2 Age Group.....	33

3.4.2.3 Sex .....	33
3.4.2.4 Country of Origin.....	33
3.4.2.5 Length of Stay (years).....	35
3.4.2.6 Medical Conditions.....	35
3.4.2.7 Triage Level.....	39
3.4.2.8 Reason for Visit .....	40
3.5 Ethical Approval: .....	40
3.6 Data Analysis:.....	41
3.6.1 Descriptive Statistics .....	41
3.6.2 The Presence of Medical Conditions.....	41
3.6.3 Health Services Utilization: Description and Risk Adjustment .....	41
3.6.3.1 General Practitioner use before an Emergency Department Visit .....	42
 CHAPTER FOUR: RESULTS .....	 44
4.1 Study Population.....	44
4.2 Characteristics of the Refugee Group.....	45
4.3 Medical Conditions.....	47
4.4 General Practitioner Visits.....	49
4.5 Emergency Department Visits .....	51
4.5.1 Triage Level.....	53
4.5.2 General Practitioner use before an Emergency Department Visit.....	54
4.6 Hospital Inpatient Visits .....	55
4.7 Reason for Visiting the Emergency Department and Hospital.....	56
4.8 Health Service Utilization by Country of Origin and Length of Stay in Canada .....	57

4.9 Overall Health Services Utilization .....	58
CHAPTER FIVE: DISCUSSION.....	59
5.1 Summary.....	59
5.2 Overall Health Services Utilization .....	60
5.2.1 Factors Explaining Refugee Patterns of Health Services Utilization.....	61
5.3 Emergency Department Use .....	66
5.4 Health Services Utilization by Country of Origin and Length of Stay in Canada...68	
5.5 Limitations .....	69
CHAPTER SIX: CONCLUSION.....	71
REFERENCES .....	73
APPENDIX A. ICD-9-CM AND ICD-10 CODING SCHEME DERIVED FROM CHARLSON AND ELIXHAUSER CONDITIONS.....	87

## List of Tables

Table 1. Census 2001 counties of birth by world region .....	34
Table 2: ICD-9-CM and ICD-10 codes used to derive conditions for refugees and non-refugees.....	37
Table 3: ICD-9-CM and ICD-10 codes used to derive infectious and parasitic diseases for refugees and non-refugees.....	38
Table 4. Demographic characteristics of refugees (n=2280).....	45
Table 5. Prevalence of medical conditions among refugees and non-refugees as of March 31 <sup>st</sup> , 2007 .....	48
Table 6. Outpatient general practitioner visits over two years (April 1 <sup>st</sup> , 2007 to March 31 <sup>st</sup> , 2009) .....	50
Table 7. Emergency department visits over two years (April 1 <sup>st</sup> , 2007 to March 31 <sup>st</sup> , 2009) .....	52
Table 8. Acuity level of emergency department visits over 2 years (April 1 <sup>st</sup> , 2007 to March 31 <sup>st</sup> , 2009) .....	53
Table 9. General practitioner use before an emergency department visit over two years (April 1 <sup>st</sup> , 2007 to March 31 <sup>st</sup> , 2009) (Refugees: N=669; Non-refugees: N=2454) .....	54

Table 10. Hospitalizations over two years (April 1 <sup>st</sup> , 2007 to March 31 <sup>st</sup> , 2009) .....	55
Table 11. Reason for visits among users over 2 years (April 1 <sup>st</sup> , 2007 to March 31 <sup>st</sup> , 2009) .....	56
Table 12. Refugees with at least one general practitioner, emergency department and hospital inpatient visit over two years (April 1 <sup>st</sup> , 2007 to March 31 <sup>st</sup> , 2009) by country of origin and length of stay in Canada.....	57
Table 13. Adjusted odds ratios for health services utilization by refugees compared to non-refugees over two years (April 1 <sup>st</sup> , 2007 to March 31 <sup>st</sup> , 2009) .....	58

## List of Figures

Figure 1. Refugees coming to Canada from 2000 to 2008 .....	8
Figure 2. Data Sources, Elements and Linkage .....	24
Figure 3. Derivation of Study Groups.....	44
Figure 4. Country of Origin by Length of Stay in Canada .....	46

## List of Symbols and Abbreviations

ACCS	Ambulatory Care Classification System
AHCIP	Alberta Health Care Insurance Plan
AHW	Alberta Health and Wellness
AIDS	Acquired Immune Deficiency Syndrome
CHREB	Conjoint Health Research Ethics Board
CI	Confidence Interval
CIC	Citizenship and Immigration Canada
CIHI	Canadian Institute for Health Information
COPD	Chronic Obstructive Pulmonary Disease
CRHC	Calgary Refugee Health Clinic
CTAS	Canadian Triage and Acuity Scale
DAD	Discharge Abstract Database
GAR	Government-assisted Refugee
HIV	Human Immunodeficiency Virus
ICD	International Classification of Diseases
IFHB	Interim Federal Health Benefit
IQR	Interquartile Range
IRPA	Immigration and Refugee Protection Act
OR	Odds Ratio
PHN	Personal Health Number

PTSD	Post-traumatic Stress Syndrome
PUD	Peptic Ulcer Disease
RR	Rate Ratio
UNHCR	United Nation High Commissioner for Refugees
$\chi^2$	Chi-squared Test

## **Chapter One: Study Objective and Significance**

### **1.1 Objective**

The objective of this study was to evaluate and compare the utilization of outpatient physician (general practitioner), emergency department and hospital inpatient services between refugees and the general population in Calgary, Alberta, over a two year period – from April 1<sup>st</sup>, 2007 to March 31<sup>st</sup>, 2009.

### **1.2 Rationale**

Refugees are a particularly vulnerable population that will continue to grow due to Canada's commitment to resettling refugees each year. Refugees are at risk of a number of physical, mental and social issues. However, they frequently encounter a range of barriers when seeking health care services, which can create disparities in health and unequal access to quality health care services compared to the general population. There are no published studies in Canada determining whether disparities exist in the utilization of health care services by refugees compared to the general population. Generating a deeper understanding of this issue may provide insights for the development and support of interventions aimed at meeting the unique needs of refugees.

Canada plays a significant role in protecting refugees through the in-Canada asylum system and resettlement of refugees selected abroad. In 2008, Canada resettled almost 11,000 refugees from overseas and granted permanent residency to another 7,000 protected persons and 4,000 family-sponsored refugees in Canada. This places Canada among the top five countries resettling refugees and accepting asylum seekers worldwide

(1, 2). In this same year, almost 8% of the refugees arriving in Canada settled in Alberta (1). Approximately 800 of these refugees moved to Calgary (3).

Many studies indicate refugees face different and potentially more serious health and social issues compared to the general Canadian population. The forced nature of their relocation and hostile pre-migration experiences leave many at risk of mental health problems, malnutrition, poor dental health and communicable and infectious diseases infrequently encountered in non-refugees (4-7). Through the process of settling, refugees commonly face unemployment, economic hardship and social isolation. These complex social factors often result in the manifestation of mental and physical health issues (8). Refugees also experience cultural, language, educational and geographic barriers, which may interfere with their ability to access the health care system or result in the inappropriate use of health care services (9). Taken together, these factors result in refugees being recognized as one of the most vulnerable populations in Canada (10).

Health services utilization by refugees has been researched in the United States, Europe and Australia. However, the evidence generated from many of these studies has limitations. First, studies are limited to the refugee population's health service use without a comparison to a non-refugee group. Second, methodological issues exist, specifically in accurately identifying refugee status and the absence of important variables that can impact utilization patterns. Third, healthcare systems in these countries function differently compared to Canada. Lastly, the patterns of immigration worldwide bring refugees to Canada with different backgrounds and experiences than refugees resettling in other countries.

To the best of our knowledge, there are no *published studies* on health services use by the refugee population in Canada.

We included a large group of refugees in Calgary, Alberta, evaluating and comparing their utilization of health services with the general population. Building an evidence base in this area is an important first step in determining whether refugees have equal access to health care. This knowledge will assist in the development of future health services and program planning that support refugee health and wellbeing.

## **Chapter Two: Background**

### **2.1 The Refugee Population: Terminology and Arrival to Canada**

According to the United Nations' 1951 Geneva Convention relating to the Status of Refugees, a refugee is: "a person who is outside his or her country of nationality or habitual residence; has a well-founded fear of persecution because of his or her race, religion, nationality, membership of a particular social group or political opinion; and is unable or unwilling to avail himself or herself of the protection of that country, or to return there, for fear of persecution (11)." In other words, refugees are forced to leave their homes, fleeing war, human rights violations and the threat of persecution. They are often in vulnerable situations. In many cases they are unable or unwilling to return home to avoid continued persecution, therefore establishing themselves in a new country (12).

Refugees differ from economic immigrants, or simply referred to by most people, as "immigrants". Economic immigrants are people who have actively sought to leave their country of origin and settle in Canada to seek a better life. When seeking citizenship, they are generally evaluated against criteria designed to assess their probability of success, and selected for their ability and skills to contribute to Canada's economy (1). This is vastly different from refugees who enter Canada due to forced displacement and in order to save their lives or protect their freedom (12). Although refugees are considered landed immigrants and are often called "immigrants", persons entering Canada through humanitarian and compassionate grounds versus economic objectives have different patterns of migration and face different challenges and opportunities as a result.

It is also important to distinguish between refugees and asylum seekers. The term “refugee” is frequently used to describe both refugees with status and asylum seekers whose status as a refugee has not yet been decided. Asylum seekers request protection as a refugee upon or soon after arrival. They are considered temporary residents while their claim is being evaluated. If they are found to be a refugee as defined by the 1951 Geneva Convention relating to the Status of Refugees and its 1967 protocol, or they need protection based on risk of life or danger of torture, defined by the Convention against Torture, then their claim for refugee status is accepted and they can apply to become a permanent resident (1). If they are not deemed to be a refugee or person in need of protection they can be deported to their country of origin (1, 12).

Our study did not capture information on asylum seekers. For the purposes of this study and throughout this document, the term “refugee” refers to refugees with recognized permanent residency and refugee status in Canada.

Normally a country’s government provides its citizens with rights and protection. When societies break down and people become refugees, the government of the country of refuge bears the responsibility of providing security to refugees. At this point, local non-governmental organizations, together with the United Nations High Commissioner for Refugees (UNHCR), work in a variety of locations (e.g. camps, border areas) to offer protection and solutions for refugees to restart their lives. There are three main solutions for refugees (2, 12):

1. Voluntarily returning to their home country if it is safe and viable (generally the preferred solution).

2. Locally integrating into the country of refuge, although very few countries are prepared to do so.
3. Permanently settling in a third country which only benefits a small number of refugees compared to voluntary repatriation or local integration.

Canada is one of a few nations responding to the challenge of finding permanent solutions for refugees by accepting and permanently resettling them. Under the Immigration and Refugee Protection Act of 2002 (IRPA), refugees can receive protection in Canada through the refugee claim process (i.e. an asylum seeker has their status as a refugee accepted through the Immigration and Refugee Board of Canada) or the resettlement program (13).

To be eligible to come to Canada through the resettlement program, the following criteria under the IRPA must be met (13):

1. A person must require protection and/or be at risk, and be unable or unwilling to return to their country or place of residence.
2. A person must be financially assisted and supported by either a not-for-profit group or organization with a sponsorship agreement with Citizenship and Immigration Canada (CIC) (a privately-sponsored refugee), or by the government through a referral from the UNHCR (a government-assisted refugee (GAR)).
3. A person must have the ability to become established (e.g. the potential to become employed, learn the official language, and/or have relatives in Canada who offer support during resettlement).

4. There must be no reasonable prospect for a “durable solution” - no probability of repatriation, local integration or resettlement to another country other than Canada.
5. A person must be “admissible” - not have committed a crime, represent a security risk or be a danger to public health and safety.
6. A person must also complete a medical assessment to determine if they pose a threat to public health. This includes a health history and physical examination, with age-dependent tests (urinalysis ( $\geq 5$  years of age), chest x-ray ( $\geq 11$  years of age), syphilis and HIV testing ( $\geq 15$  years of age)); if approved the assessment is valid for one year (13).

When the application for refugee status and resettlement to Canada is accepted abroad, refugees have permanent residency and are landed immigrants upon arrival. They are officially known as Convention refugees or persons in need of protection (1). As an established and permanent resident in Canada refugees can then sponsor dependants (e.g. a spouse) living abroad. Refugees under these circumstances also have permanent residency and status as a refugee and are referred to as “family-sponsored refugees”.

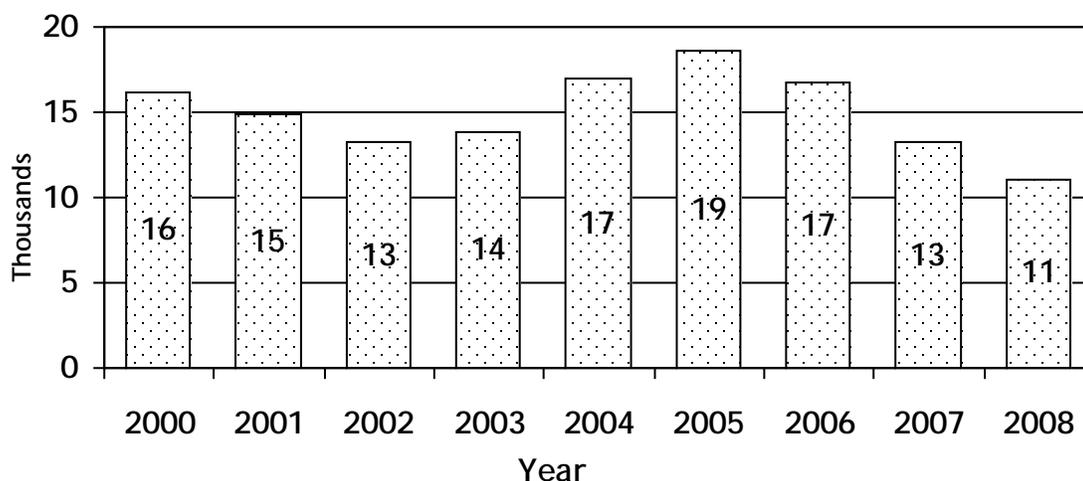
When refugees arrive in Canada, settlement and integration services and supports are available to assist establishing themselves in Canada. These services are typically provided via government; non-government and immigrant-serving organizations; sponsoring agencies or groups; and ethno-cultural community associations. While support varies across the country refugees usually receive: general information and orientation on many aspects of life in Canada; temporary accommodation; financial assistance and support; provisions of basic needs such as shelter, food and clothing; and

directions to access English language training, education, employment or other community support services. In recent years, Canadian cities (e.g. Vancouver, Calgary, Ottawa, Toronto) have established specialized mental and physical health services and programs in response to the growing health needs during settlement.

## 2.2 Key Statistics and Demographics

At the end of 2008, an estimated 11.4 million refugees existed worldwide (12). Canada, together with the United States, Australia, Germany, Sweden and Norway, are global leaders in the number of refugees they admit and resettle each year (2). In 2008, Canada resettled almost 11,000 refugees from overseas (government-assisted and privately-sponsored refugees) (1). Since 2000, resettlement fluctuated between 11,000 to 19,000 refugees annually based on yearly targets and external events worldwide (1) (**Figure 1**). In 2008, permanent residency was granted to an additional 4,000 family-sponsored refugees and 7,000 protected persons in Canada. Refugees accounted for approximately 9% of Canada's total new permanent residents.

**Figure 1. Refugees coming to Canada from 2000 to 2008**



Source: Immigration Overview Permanent and Temporary Residents FACTS AND FIGURES 2008. Citizenship and Immigration Canada, 2009

Of the refugees that arrived in 2008, 50% were 15 years of age or younger. The distribution between males and females was almost equal (55% vs. 45% respectively). About 50% had the ability to speak either official Canadian language (i.e. English or French). Education levels among refugees was low with approximately 35% of those 15 years of age or older having only 0 to 9 years of schooling (1).

### **2.3 Resettlement Destination and Country of Origin**

In Canada, refugees typically settle in a major urban centre. Toronto accepts the most refugees, followed by Montreal, Vancouver and Calgary (1). In 2008, 1,845 (7.6%) refugees arrived in Alberta. Unfortunately, official data on the number of refugees settling in Calgary is unavailable. CIC only provides information on the number of permanent residents by each urban area, but not specific immigration categories. Anecdotally, approximately 800 refugees made Calgary their home in 2008. Of this total, about one-third were government-assisted, one-third privately-sponsored and about one-third transferred to Calgary from other urban centres in Canada (3).

Since 2000, noticeable changes occurred in the leading source countries of refugees arriving to Canada due to shifts in geopolitical conditions worldwide. Colombia now ranks as a top source country according to CIC, which was well down the list of leading source countries in 2000. Countries such as Afghanistan, Sudan and Ethiopia are now considered leading countries, ranking in the top 10, while the former Yugoslavia (ranked number one in 2000) is no longer a top 10 source country (14). A similar trend has occurred in Calgary. The top five source countries of Convention refugees are: Colombia, Iraq, Myanmar (Burma), The Democratic Republic of Congo, and Afghanistan

(3). In general, more refugees are now originating from African, South American, Middle Eastern and Asian countries versus European countries in the past (e.g. the former Yugoslavia, Hungary) (15).

#### **2.4 The Health Status of Refugees**

Before 2000, Canada's refugee selection process under the IRPA focused on a combination of refugees' need for protection coupled with their ability to become "economically established" in Canada. In 2002, new legislation under the IRPA placed more emphasis on the importance of protecting refugees and their ability to become established, making the selection criteria for resettlement less stringent (13). Thus, newly arrived refugees in Canada are recognized by service providers in immigrant-serving organizations as "high needs" – they are in need of much more support, their health issues are far more complex and they are utilizing more resettlement services than a decade ago (3).

Physical and mental health challenges persist among refugees upon arrival and during their process of settlement and integration into Canada. Many incoming refugees are coming from disadvantaged situations putting them at risk of poor health even prior to their departure to Canada. They often leave their homes and countries with minimal or no preparation. Many have been victims of war, torture, rape and extreme prejudice; and have endured dangerous escapes and imprisonment (16). They find themselves in refugee camps with inadequate nourishment, and poor and over-crowded living conditions (17, 18). It is also not uncommon for refugees to lose family members through displacement

and/or death (7). These conditions leave refugees with complex health issues requiring both immediate and long-term attention in Canada (7).

Refugees have many physical health needs when they arrive to Canada that are atypical of Canada's general population. The conditions often identified include: nutritional deficiencies (e.g. anaemia, iron and vitamin deficiencies); failure to thrive in childhood; infectious and parasitic diseases (e.g. HIV, syphilis, tuberculosis); traumatic injuries; sexual and reproductive health issues; dental problems; visual disturbances; and hearing loss (4, 5, 19-21). Pottie et al. did a retrospective cohort study in 2007 on 112 recently arrived adult GARs mainly from sub-Saharan Africa (5). The study revealed refugees had significantly higher rates of infectious and chronic diseases compared to Canadian-born people. The prevalence rate of HIV for refugees was substantially higher than the Canadian population (6.3% vs. 0.18% respectively). Latent tuberculosis rates were 49.5% in the refugee group compared to an estimated prevalence in Canada of less than 10%. The prevalence of chronic hepatitis B (5.4%) and intestinal parasites (13.5%) among refugees was also higher compared to the general population. Notably, most females studied (59.8% of the study population were females) reported never having received a Pap test. Another study by Dillman, Pablo and Wilson involving 1,104 GARs in Calgary highlighted a range of other commonly reported health concerns of refugees including: upper respiratory infections (17.8%), impaired visual capacity (15.4%), dental problems (12.8%), ear infections (many including ear drum perforations) (7.4%), gynaecological problems (including 44 cases of pregnancy reported) (11.7%) and insufficient or lack of immunizations (59%) (4).

Numerous studies indicate refugees experience many stressors before and after migration periods affecting their mental health status. Traumatic events experienced prior to going to a host country result in elevated levels of mental health disorders such as depression, anxiety, post-traumatic stress disorder (PTSD), dissociation and psychosis (6). A study by Schweitzer et al. (7) involving 63 resettled Sudanese refugees found the most common pre-migration trauma exposures included: forced separation from family (85%); the murder of a family member or friend (68%); or personally experiencing torture (28%) or having a family member imprisoned (56%) or tortured (48%). Over half of the sample also experienced a lack of food and water (59%) or shelter (57%). The pre-migration traumas reported were significant predictors of depression, anxiety, PTSD symptomatology and somatization symptoms ( $p < 0.05$ ).

While an initial period of euphoria sets in after reaching a safe country, studies indicate new stressors begin taking shape during the post-migration period of settlement and integration which also impact the mental health and wellbeing of refugees (6). Changes associated with adapting to a new environment and culture with different health care systems, languages, gender roles and norms; dealing with issues of unemployment; and loneliness due to separation from family and friends, may threaten the mental health status of refugees (22). For instance, refugees experiencing economic hardship (worrying about enough money for food and medicine) were between 2.6 to 3.9 times more likely to experience psychological distress such as sleep loss, bad memories and depression, than those not experiencing economic hardship (8). Refugees reporting experiences of racial discrimination had depression levels that were 1.58 times higher ( $p < 0.001$ ) than refugees without these experiences (23). Factors such as unemployment and language proficiency

were also found to be potential risk factors for depression (24). Lack of supportive and meaningful relationships resulted in social isolation, stress and depression as well (25). Refugees may also experience other post-migration social issues during their integration period (e.g. poverty, marital difficulties, family violence, addictions, criminal activities) that may impact the emotional wellbeing of individuals, families and refugee communities at large (26).

Overall, refugees are recognized as one of the most vulnerable populations in Canada. Their pre-migration experiences coupled with various stressors in the post-migration period place the population at greater risk of poor physical, mental and social wellbeing; and experiencing some of the lowest levels of health and wellness compared to other Canadians residents (10, 27, 28).

## **2.5 Access to Health Services**

Canada has a universal health care system promising access to health care for all of its citizens. This principle was designed so every citizen receives reasonable access to medically necessary health care services regardless of their level of need, financial circumstance, geographic location, age or ethnicity. Yet, health disparities still exist for vulnerable populations including refugees (10). This remains a national concern, particularly for health policy makers and planners, despite endorsement of equal access to health care (10, 29, 30). Compared to the general Canadian population, vulnerable populations still have a greater burden of illness and increased likelihood of having unmet health care needs due to issues accessing appropriate health care services (10).

Utilization of health services is an important indicator in determining a person's access to care which can be inhibited or facilitated by a number of factors. Aday and Andersen's model of access to care is the most frequently used framework for the study of access (29, 31). According to the original and subsequently revised model, several determinants interact with one another to determine personal health practices and the use of health care services, which ultimately influence health status and satisfaction with the health care system. These determinants include the characteristics of the population and health care system, and the external environment (i.e. political, economic and physical factors) (31). The characteristics of the population are further divided into predisposing, enabling and need factors. Predisposing factors reflect tendencies for a person to use services such as age, sex and employment status. For refugees, this can include their length of stay in Canada. Enabling factors correspond to capacity to use services (e.g. income, social support, availability of services). Need factors reflect perceived or evaluated levels of health. Our study was able to measure some of these population level determinants. They are highlighted in the next chapter that describes the methods used in this study.

### ***2.5.1 Factors Associated with Access to Health Services by Refugees***

It is widely documented that refugees experience numerous barriers inhibiting their appropriate utilization of health care services (9, 26, 30, 32-37). Thus, many refugees face unequal access to quality care compared to the majority of Canadians. These barriers are a consequence of factors highlighted in Aday and Andersen's model of access to care, specifically, the health care system and population level factors.

Refugees experience several barriers in accessing health care due to the way our health care system is organized. Geographic inaccessibility of health services poses challenges for many refugees lacking adequate transportation or unfamiliar with public transportation that make it difficult to attend health services (9). Many service providers do not recognize the Interim Federal Health Benefit (IFHB) covering refugees for emergency and essential extended health care coverage. Insufficient coverage under IFHB often results in out of pocket costs for medications or low utilization of much needed services as well (e.g. dental services) (34, 37). The barrier most commonly cited is the lack of language interpretation services, bilingual staff and translated health education materials in the health care system, which often leads to communication difficulties and poor satisfaction with services as a result (9, 26, 32-36). Finally, health care providers may lack necessary knowledge and skills to provide culturally competent and sensitive care when dealing with unique needs of refugees. Thus, refugees may underutilize services or fail to use services, which may lead to more acute problems over time (32, 33).

Additionally, factors at an individual level may limit health-seeking behaviour of refugees and influence their satisfaction with services. Settlement issues (e.g. establishing employment, housing, education) may result in delays to seek health care because refugees' first goals are to face the challenge of settling in Canada (9). Cultural differences, including differing perceptions of illness and health-seeking behaviour; a distrust of others; stigmas associated with certain conditions; different gender and family relations; and different concepts of time, may inhibit access to and affect their choice of health services (9, 26, 32-35). Difficulties communicating due to limited language

proficiency are a struggle at every phase of accessing and navigating the health system. This may limit access to care altogether or result in inappropriate use of services such as repeated visits due to fear of not being understood (38). Communication challenges can also impact the relationship between providers and refugees if interpreters are not present, thereby reducing comprehension and compliance by patients and severely compromising the quality of care received (9, 26, 32-36).

## **2.6 Health Services Utilization by Refugees**

### ***2.6.1 International Research***

Health services utilization by refugees has been well researched in the United States, Europe and Australia; however, the evidence generated from many of these studies has limitations.

*Limitation One - No comparison group:* Studies are limited to the refugee population's health service use without comparing the usage levels to a non-refugee group (39-46). Factors related to their utilization of health services can be examined but assessing equality of access to health services compared to the general population is indeterminable. Our study matched refugees with a non-refugee group to evaluate and compare their utilization of and access to health services.

*Limitation Two – Methodology:* Several studies highlighted below have examined health services utilization by refugees compared to non-refugee residents. While they contribute important knowledge to this research area, three issues identified with the methodologies used were observed:

- The level of health was not contemplated

- Length of stay in the country of settlement was not considered
- The study population was not necessarily all refugees

Dyhr, Andersen and Engholm completed a large register-based study with the purpose of comparing visits with general practice and casualty departments at hospitals between select non-Western immigrants and non-immigrants in Copenhagen (47). Immigrants were defined as persons residing in Denmark for more than three months holding foreign citizenship and a residence permit. They focused on nine countries representing two types of immigrants: job-seekers (economic migrants) and mainly refugees and their offspring (persons from Ex-Yugoslavia, Somalia, Palestine, Iran and Iraq). During the one-year study period, they observed that immigrants between 19-59 years of age from most countries used all services more, especially acute care services.

Two other studies examined utilization of health services by refugees using a similar method. A Danish study by Norredam et al. conducted over a one-year period used administrative data to examine visits to the emergency room by nine ethnic groups according to country of birth (48). After controlling for age, gender and income, persons born in Somalia and Ex-Yugoslavia (mainly consisting of refugees), had the highest utilization rates (rate ratio (RR): 1.46; 95% Confidence interval (CI): 1.18, 1.81 and RR: 1.23; 95% CI: 1.11, 1.34 respectively) compared with Danish-born residents. Another study conducted in Australia by Correa-Velez et al. investigated hospital utilization by people born in “refugee-source countries” - “those countries where significant numbers of people have been forcibly displaced due to persecution, violence, and war” (49). They used a hospital discharge dataset to assess several indicators over a six-year period.

Results indicated refugees had higher rates of total hospital admissions and emergency admissions but lower rates of surgical admissions ( $p < 0.05$ ).

Although all three studies indicated distinct differences in the health services utilization rates of persons from countries representing refugees, several issues with the methodologies were observed.

Health Status and Conditions: None of the studies controlled for any measures of health status in the study groups (e.g. perceived health, illnesses) or clinical factors (e.g. the presence of diseases, conditions) to assess the possibility that disparities in health services utilization may have been due to variations in health. It is possible the refugees in these studies had more chronic conditions or were sicker overall, resulting in higher utilization rates compared to the other residents.

Length of Stay: These studies did not control for the length of stay in the host country. Research shows utilization of health services modifies over time based on a persons level of integration into a host country (50).

Study Population: The definition of refugee was not accurately identified in these studies. Country of birth in a refugee-generating country was used as a proxy indicator for refugee status. However, this does not necessarily imply that these people were under the humanitarian resettlement program and had refugee status.

Our study was designed to address these issues. We captured immigration category to confirm refugee status and acquired their length of stay in Canada to assess its impact on the use of health services. We also gathered information on the presence of medical conditions to identify disparities between refugees and non-refugees in their use of services resulting from these conditions.

*Limitation Three – Differing Health Care Systems:* Major differences in the financing and delivery of each country’s health care system makes it difficult to generalize results and apply them to Canada. For example, the health care system in the United Kingdom, and many other European nations, are primarily publicly funded. Canada and Australia have a more mixed model of public/private funding and delivery comparatively. On the other hand, the United States’ health care system strongly relies on the private sector to provide health care coverage and deliver services (51). Where a country sits on this public/private funding/delivery continuum has implications on access to health services due to financial barriers and other restrictions imposed based on the way a country’s health system is structured.

*Limitation Four – Different Patterns of Immigration Worldwide:* There are likely differences in the cultural features, experiences, sociodemographic characteristics and health status of refugees arriving in Canada compared to refugees from other countries. For example, Canada has more refugees coming from South Asia, the Pacific, and South and Central America; whereas, the United States, United Kingdom, Australia and New Zealand have more refugees settling from Africa, the Middle East and other parts of Asia (52-56). Overall, the pattern of health services use by the refugee population in Canada may have unique characteristics that need to be considered.

### **2.6.2 Research in Canada**

There are no published studies in Canada regarding health services utilization by the refugee population to the best of our knowledge. Canadian literature tends to treat “immigrants” as a homogenous group. Studies often lack information on immigration

category or lack sufficient sample sizes to look at particular sub-groups of immigrants such as refugees (28). Not recognizing differences in immigration categories may mask unique needs or disparities between these sub-groups. Other Canadian studies have compared the general population's health services utilization to that of various ethnic populations (usually defined by country of birth). Yet, whether refugees are included is unknown. We can only generate conclusions common to specific ethnic groups from these studies versus how utilization of health services is shaped by refugee status.

While the evidence generated from Canadian studies on immigrant and ethnic populations provides insights into access to health services, the findings are contradictory and depend on the type of service examined. Some results reveal there are similar patterns in the use of general practitioner (57-62), specialist (57-60, 63), outpatient clinic (57), emergency department (57), hospital inpatient (57, 61, 64, 65), nursing (60), dental health (59) and mental health services (66) between ethnic or immigrant groups and other Canadians. Other findings indicate these populations contact general practitioners more often (63-65) and have higher rates of hospitalizations (67). Other studies highlight immigrant and ethnic populations use some services less, such as general practitioners (for recent immigrants) (68), hospitals (62, 63), emergency departments (58) and preventative screening services (63).

Only one unpublished pilot study was found that stratified the study population by immigration category (e.g. family class, economic immigrant, refugee) (50). Kliewer and Kazanjian examined utilization rates of physician and hospital services by recently landed immigrants living in British Columbia and Manitoba. Refugees utilized physician services more than any immigration category over one year in Manitoba (age-

standardized rate of 6.7 and 8.0 claims per person for males and females respectively, compared to 1.8 and 4.0 claims per person for economic immigrants in the business class) but still less than other Manitobans overall (9.1 and 12.9 claims per person). In British Columbia, male refugees used physician services more than other residents in the province (20.0 vs. 14.8 claims per person). In British Columbia and Manitoba, only male refugees had higher hospitalization rates during their first year in Canada compared to other immigrant categories, but still less than other residents in these provinces.

Kliewer and Kazanjian's study provides some insight into the health services utilization by refugees; however, the primary aim of this study was to determine the feasibility of linking CIC's immigration file to provincial health records and to describe the health status of immigrants to inform the immigration medical screening process. Furthermore, only one year of data was collected on the study population. A longer follow-up period may have provided more stable estimates of health services utilization (50). Our study followed-up and analyzed two years of health services utilization data.

## **2.7 Summary and Overview of the Study**

Canada is committed to resettling many refugees each year. Due to the pre-migration traumas and post-migration stressors associated with the refugee experience, refugees are a vulnerable group with significant physical, mental and social concerns. Despite their health needs, many refugees face barriers to accessing health services. Whether refugees have equal access to health care remains unknown as published research in the area of utilization of health services by refugees is limited internationally and unavailable in Canada.

To begin building a foundation of evidence in this area, our study included a large group of refugees and matched them with the general population in Calgary, Alberta. We evaluated and compared their utilization of outpatient physician (general practitioners), emergency department and hospital inpatient services over two years.

Our hypothesis was that refugees would utilize outpatient physician and hospital inpatient services less than the general population, but that emergency department services would be used more frequently compared to the general population.

## Chapter Three: Methods

### 3.1 Study Design and Time Periods

We conducted a retrospective cohort comparative study evaluating the use of outpatient physician (general practitioner), emergency department and hospital inpatient services by refugees and a matched cohort of non-refugees using patient charts and routinely collected administrative data over two years.

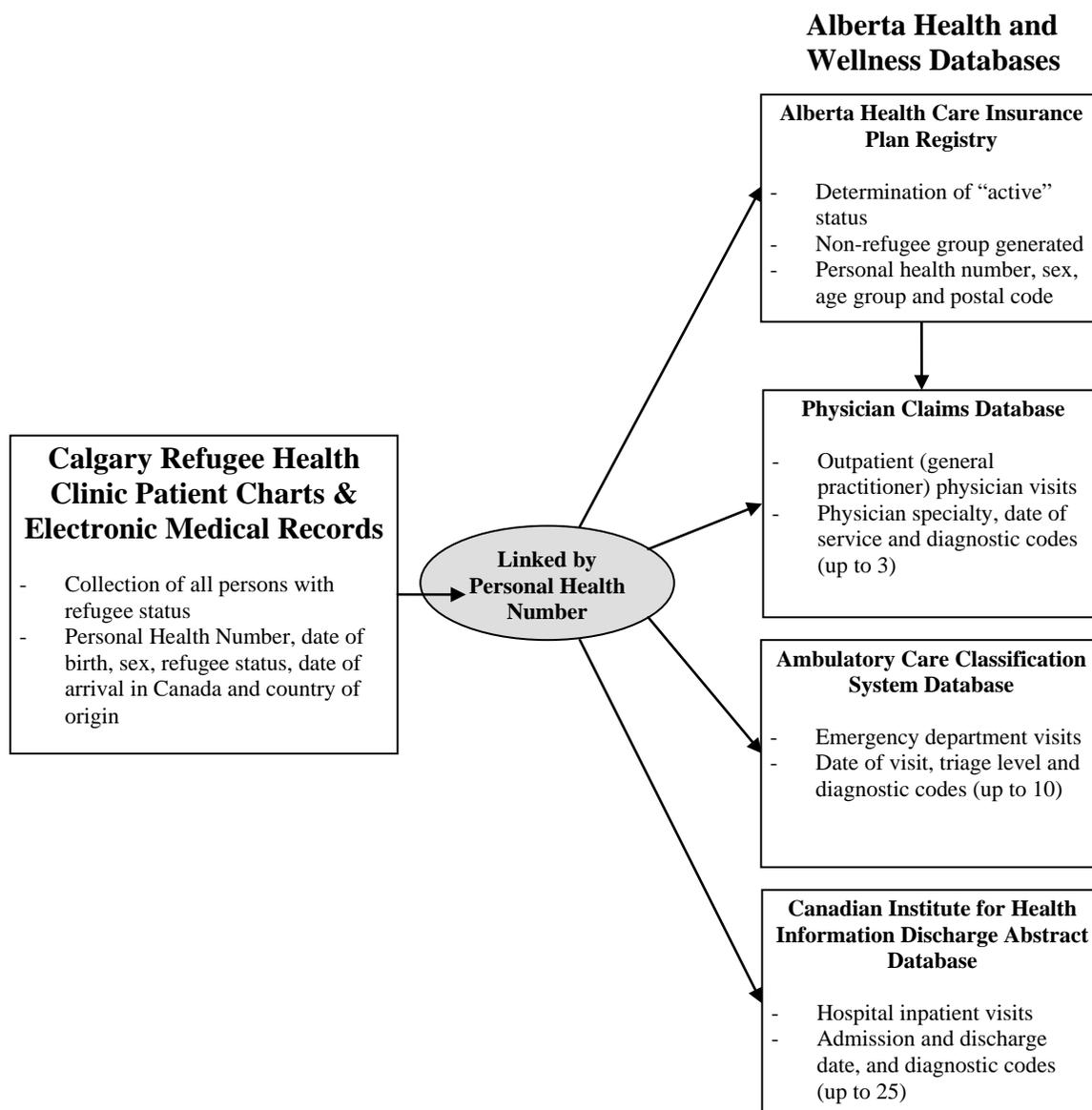
The time periods for data collection, and the assessment of health services utilization and medical conditions included the following (details are provided in sections 3.2 to 3.4):

- a) Refugees attending the Calgary Refugee Health Clinic (CRHC) during the time period from *August 1<sup>st</sup>, 2002 and March 31<sup>st</sup>, 2007* were collected for eligibility into the study.
- b) The presence of any medical conditions by refugees and non-refugees was collected retrospectively through administrative data sources over a three-year period - from *April 1<sup>st</sup>, 2004 to March 31<sup>st</sup>, 2007*.
- c) Our study period for the assessment of health care utilization was determined over two years – from *April 1<sup>st</sup>, 2007 to March 31<sup>st</sup>, 2009*.

### 3.2 Data Sources

Five databases were used that were all linkable using Personal Health Number (PHN) – a unique identifier common in all five databases (**Figure 2**).

**Figure 2. Data Sources, Elements and Linkage**



### ***3.2.1 The Calgary Refugee Health Clinic Patient Charts and Electronic Medical Records***

The CRHC provides transitional primary health care to newly resettled refugees and refugee claimants for approximately their first year after arrival into Canada. It has been in existence since August, 2002, and falls under the auspices of the Calgary Catholic Immigration Society (one of the largest immigrant-serving organizations in Alberta). The Clinic is unique to Calgary and provides a first point of contact with the health care system for newly arrived refugees. They capture the majority of GARs destined to Calgary or who have transferred to Calgary from another province. A relatively small proportion of family and privately-sponsored refugees are seen as well (69).

Data was collected on refugees of all ages attending the CRHC between August 1<sup>st</sup>, 2002 and March 31<sup>st</sup>, 2007. We reviewed paper charts and electronic medical records and extracted information on demographic characteristics. Status as a refugee, length of stay in Canada and country of origin were confirmed through immigration documents available in medical charts.

### ***3.2.2 Alberta Health and Wellness Databases***

The cohort of refugees collected from the CRHC was linked to Alberta Health and Wellness (AHW) administrative data sources. The data sources assessed from AHW included the:

### 3.2.2.1 Alberta Health Care Insurance Plan Registry

Alberta has a provincial registry that contains demographic information on all residents covered by provincial health insurance plan. It contains PHN, date of birth, sex and postal code. The Alberta Health Care Insurance Plan (AHCIP) registry was used to determine if individuals were “active” in the system – had a valid PHN and were a resident of Alberta. The AHCIP registry was also used to derive a randomly selected group of individuals, which composed the non-refugee group.

All “active” persons from the refugee and non-refugee group were linked to the following three AHW databases: the Physician Claims database, the Ambulatory Care Classification System (ACCS) database and the Canadian Institute of Health Information’s (CIHI) Discharge Abstract Database (DAD), over the period of April 1<sup>st</sup>, 2004 to March 31<sup>st</sup>, 2009.

### 3.2.2.2 Physician Claims Database

This database records information on claims submitted by physicians and other health care providers for everyone covered under the provincial health care insurance plan. It contains claims from physicians submitting on a fee-for-service basis and physicians on alternative payment schemes; therefore, physician claims in this database should be complete. The files are updated daily and include provider and service details. The data elements gathered were for outpatient physician claims only and included physician specialty, date of service and diagnostic codes (up to three).

### 3.2.2.3 Ambulatory Care Classification System Database

All Albertans that are recipients of acute care services in the province are recorded in the ACCS database. This includes patients attending outpatient surgery and the emergency department (70). Administrative, demographic and clinical data are recorded such as age, sex, date of service, diagnostic codes (up to 10), procedure codes (up to 10) and disposition. We examined patients attending the emergency department and collected data on date of visit, diagnostic code (up to 10) and triage level. All data are coded by trained health record coders to maintain the quality of data recorded.

### 3.2.2.4 Canadian Institute for Health Information Discharge Abstract Database

Hospital data was obtained from the CIHI DAD. DAD contains data on hospital discharges across Canada. All hospitals in Alberta must submit demographic, administrative and clinical data for hospital discharges (i.e. inpatient acute care, psychiatric, chronic and rehabilitation separations) and day surgeries (71). DAD primarily contains patient characteristics (e.g. age, sex), admission/discharge dates, diagnostic codes (up to 25) and intervention codes (up to 10). All data are entered into the database by trained health record coders. We collected information on hospital inpatient visits, specifically admission and discharge dates and diagnostic codes (up to 25).

### **3.3 Study Population**

#### ***3.3.1 Inclusion Criteria***

This study included two groups: refugees and a matched group of non-refugees. Eligible refugees met three criteria. They:

1. Were patients attending CRHC from August, 2002 to March, 2007
2. Held a valid PHN
3. Were residents of Alberta as of April 1, 2007 (as mentioned in the previous chapter, refugees assisted by the government, privately sponsored or dependents of refugees landed in Canada, are considered landed immigrants, have permanent residency in Canada; therefore, they are eligible to receive a PHN when they first arrive)

The comparison group was a random sample derived from the AHW AHCIP Registry. Eligible subjects in this group included residents of Alberta with a valid PHN as of April 1, 2007. Each refugee was matched one-to-four to randomly selected individuals from the ACHIP Registry; we matched by age (within 1 year), sex and residence area – urban versus rural (based on the first three digits of their postal code). We matched to reduce potential confounding by comparing health services use among refugees to people similar in age, sex and residence location, which are all important predictors in health services utilization (72).

Another approach could have been to choose a random sample from the non-refugee population. However, most refugees reside in urban areas and only a small proportion resides in rural areas. Matching by geographic location allowed us to control

for the availability of health care services and any regional variations between the two groups.

The ideal approach would have been to use all non-refugees residing in urban areas within Alberta. However, it was not feasible to obtain such a large sample from AHW. We chose to match one-to-four on age, sex and residence to obtain an appropriate sample size for this study.

### ***3.3.2 Exclusion Criteria***

There were two exclusion criteria:

1. Asylum seekers. They are not eligible for a PHN because they are temporary residents. They have the IFHB covering them for health services until their rightful status as a refugee and permanent resident of Canada is determined.
2. Out-of-province residents. Persons without a valid Alberta PHN were excluded as the ability to monitor health services utilization for out-of-province patients is not possible.

## **3.4 Study Variables**

### ***3.4.1 Dependent Variable***

Outcome variables were outpatient physician (general practitioner), emergency department or hospital inpatient visits over a two year study period – from April 1<sup>st</sup>, 2007 to March 31<sup>st</sup>, 2009. We also examined general practitioner use before an emergency department visit to evaluate access to primary care services.

Examining three different types of health services gave us a broad representation of the utilization of services by refugees. Health services utilization was assessed over two years to provide more stable estimates as opposed to a single year.

#### 3.4.1.1 Outpatient Physician Visits

Outpatient physician visits were defined using the AHW Physician Claims database for the study period. Our focus was only general practitioner (GP) visits to determine if refugees were accessing primary care services.

To determine the extent of visits by GP users, visits were categorized as: 1 to 2, 3 to 5 and 6 or more. We wanted to distinguish between persons that made only one or two visits (which is likely the case for the majority of the population attending a GP for basic medical needs such as obtaining prescriptions or dealing with a flu, routine physical examinations or preventative screening) versus those using a GP more often which may indicate the possibility other illnesses or minor injuries. We also wanted to assess persons with six or more visits. The overall distribution of the data in our univariate analysis was highly skewed or non-normal. Therefore, we looked at the median number of visits. This defined the cut-off for persons with more than normal GP use. This categorization was also used in a similar study looking at ethnic groups use of health services compared to native Quebecers in Canada (57).

#### 3.4.1.2 Emergency Department Visits

An emergency department (ED) visit was defined using the AHW ACCS database for the study period. Emergency department visits account for a significant portion of

health care delivered, and an increasing share of hospital budgets are allocated to the emergency department (71). Literature suggests immigrants and refugees use the ED more due to barriers in accessing primary care or lack of knowledge in navigating the health system appropriately (73). Among ED users, visits were dichotomized into: 3 or fewer visits versus 4 or more visits. Many studies define frequent users of the ED as having four or more visits annually (74-78).

#### 3.4.1.3 Hospital Inpatient Visits

Hospital inpatient visits were defined using the AHW DAD for the study period. We examined admission to a hospital for an acute event as an inpatient – staying in the hospital and being discharged through release or death (79). This excludes persons treated in care facilities within a hospital such as day surgery or rehabilitation. According to CIHI, inpatient hospitalization is an important measure of illness because the largest proportions of patients (41%) are treated for chronic conditions (80).

#### 3.4.1.4 General Practitioner use before an Emergency Department Visit

Evidence indicates immigrants and refugees have more irrelevant emergency department visits due to barriers accessing primary care (73, 81). To determine if the refugee group had access to primary care we examined GP use before a visit to the ED.

The first visit to the ED was extracted for all ED users in the ACCS database (the ED index date). GP visits from the Claims database were merged with all ED users, and GP visits in the 30 days prior to their ED visit were determined. We examined persons with a GP visit within 7 days (1 week) of their ED index date versus greater than 1 week

to 30 days. If a person had a visit to a GP within 1 week of their ED visit we assumed that it was highly likely that this visit was related to their subsequent ED visit; thus, indicating the possibility of access to primary care and a more appropriate ED visit. If a person had a GP visit greater than 1 week to 30 days, we felt that it was highly unlikely that this visit was related to their ED visit and may indicate potential barriers in access to primary care or an inappropriate ED visit.

### ***3.4.2 Independent Variables***

Collecting and controlling for differences in factors that may account for variations in health services use is essential in making comparisons between refugees and non-refugees. We collected age, sex, refugee status and medical conditions (defined by the primary diagnosis) which are all important risk factors that could alter the outcome variables (82). Country of origin and length of stay in Canada were collected only for refugees. Several Canadian studies have found variations in health services utilization according to these variables (47, 48, 63, 64, 68). Other independent variables included: triage level, medical condition and reason for visit among health services users.

#### **3.4.2.1 Refugee Status**

We confirmed refugee status via the immigration document available in their medical record at the CRHC. As mentioned previously, only refugees with permanent residency were included. All temporary residents (i.e. asylum seekers) were excluded.

#### 3.4.2.2 Age Group

We used the age group variable from the ACHIP Registry. Age was defined at the start of the study period. Actual age was not provided after the linkage process and categorized as: < 10 years, 10-19 years, 20-49 years and  $\geq$  50 years.

#### 3.4.2.3 Sex

We used the variable sex (male or female) from the ACHIP Registry.

#### 3.4.2.4 Country of Origin

Country of origin was defined as the country of birth indicated on refugees' immigration documents and grouped according to the 2001 Census report's geographical world regions (**Table 1**). This grouping is representative of the geographic regions refugees are originating from. Countries which contained 5% or fewer persons were pooled together and categorized as "other".

**Table 1. Census 2001 counties of birth by world region**

<b>World Region</b>	<b>Countries of Birth</b>
East Asia	China, Hong Kong, Taiwan, South Korea, Japan
South-East Asia and Pacific	Philippines, Vietnam, Malaysia, Fiji, Cambodia, Australia, Laos
South and Central Asia	India, Sri Lanka, Pakistan, Iran, Afghanistan, Bangladesh, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan
Western Asia and Middle East	Lebanon, Iraq, Syria, Turkey, Israel, Armenia, Azerbaijan, Georgia
Africa	South Africa, Somalia, Egypt, Algeria, Morocco, Ghana, Ethiopia, Kenya, Tanzania
Eastern Europe	Poland, Romania, Russian Federation, Yugoslavia, Ukraine, Bosnia and Herzegovina, Croatia, Hungary, Czech Republic, Slovakia, countries formerly part of the USSR not separately listed, Belarus, Macedonia, Czechoslovakia, Moldova, Latvia, Lithuania, Estonia, Slovenia
Western Europe	Portugal, France, Germany, Italy, Netherlands, Switzerland, Greece, Ireland, Belgium, Austria, Spain, Sweden, Denmark, Finland, Norway, Malta, Iceland
United Kingdom	
Latin America	El Salvador, Mexico, Peru, Guatemala, Colombia, Chile, Argentina
Caribbean	Jamaica, Guyana, Trinidad and Tobago, Haiti, Barbados
United States	

#### 3.4.2.5 Length of Stay (years)

Date of arrival in Canada was gathered from immigration documents. To maintain confidentiality, we changed date of arrival into year of arrival in Canada. Length of stay was calculated according to the time that elapsed between their year of arrival to the start of the study period (April 1<sup>st</sup>, 2007) and categorized into:  $\leq 1$  year,  $>1$  to 2 years,  $>2$  to 3 years and  $>3$  years.

#### 3.4.2.6 Medical Conditions

The presence of 12 medical conditions were identified using the diagnoses recorded in the Physician Claims database, ACCS database and DAD for a three-year period prior to April 1, 2007. Using administrative data to capture medical conditions is not as accurate as conducting a comprehensive patient chart review, which is seen as the “gold standard” (83). Data quality can be compromised due to gaps in clinical information resulting in under-coding of conditions by health record coders. By including three years of data prior to the start of the study period we tried to mitigate these gaps and enhance the detection of medical conditions (84).

The conditions were derived from the Charlson Co-morbidity Index (85) and Elixhauser Co-morbidity Index (86) using the enhanced International Classification of Disease (ICD-9-CM and ICD-10) coding scheme developed by Quan et al. (87) (see **Appendix A** for Quan et al.’s coding scheme and **Table 2** for the administrative data definitions for the 12 medical conditions used). If at least one diagnostic code recorded in any of the administrative databases fell within the definition of a specific condition it was

considered present. All diagnostic coding fields were used in each database (three for the Physician Claims database, 10 for the ACCS database and 25 for DAD).

Some modifications were made to more appropriately reflect physical and mental health conditions pertaining to the refugee population. Only hypertension, depression, psychosis, and drug and alcohol abuse were included from Elixhauser's list of conditions. Infectious and parasitic diseases were not present in either index. This category was determined from a list developed of the most common infectious and parasitic diseases seen by refugees attending the CRHC. Their respective codes were identified in the ICD-9-CM and ICD-10 manuals (88, 89). Because we developed an infectious and parasitic disease category, hepatitis B was grouped into this category rather than liver disease and AIDS/HIV was added as well (**Table 3**).

Some Charlson conditions were excluded if five individuals or less represented a condition or combined with a similar condition if possible. For example, diabetes with and without complications were grouped as diabetes.

**Table 2: ICD-9-CM and ICD-10 codes used to derive conditions for refugees and non-refugees**

Condition	ICD-9-CM diagnostic codes	ICD-10 diagnostic codes
Congestive heart failure	425.4, 425.5, 425.7, 425.8, 425.9, 428	I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.5-42.9, I43.x, I50.x, P29.0
Chronic obstructive pulmonary disease	416.8, 416.9, 490.x-496.x, 500.x-505.x, 506.4, 508.1, 508.8	J40.x-J47.x, J60.x-J67.x, I27.8, I27.9, J68.4, J70.1, J70.3
Connective tissue-rheumatic disease	446.5, 710.0-710.4, 714.0-714.2, 714.8, 725	M05.x, M06.x, M31.5, M32.x-M34.x, M35.1, M35.3, M36.0
Peptic ulcer disease	531.x-534.x	K25.x-K28.x
Liver disease	070.4-070.6, 070.9, 570.x, 571.x, 573.3, 573.4, 573.8, 573.9, V42.7, 456.0-456.2, 572.2-572.8	K70.0-K70.4, K70.9, K71.3-K71.5, K71.7, K73.x, K74.x, K76.0, K76.2-K76.4, K76.8, K76.9, Z94.4 I85.0, I85.9, I86.4, I98.2, K70.4, K71.1, K72.1, K72.9, K76.5-K76.7
Diabetes	250-250.3, 250.8, 250.9, 250.4-250.7	E10.0, E10.1, E10.6, E10.8, E10.9, E11.0, E11.1, E11.6, E11.8, E11.9, E12.0, E12.1, E12.6, E12.8, E12.9, E13.0, E13.1, E13.6, E13.8, E13.9, E14.0, E14.1, E14.6, E14.8, E14.9, E10.2-E10.5, E10.7, E11.2-E11.5, E11.7, E12.2-E12.5, E12.7, E13.2-E13.5, E13.7, E14.2-E14.5, E14.7
Cancer	140.x-165.x, 170.x-172.x, 174.x-176.x, 179.x-195.x, 200.x-208.x, 238.6, 196.x-199.x	C10.x-C26.x, C30.x-C34.x, C37.x-C41.x, C43.x, C45.x-C58.x, C60.x-C76.x, C81.x-C85.x, C88.x, C90.x-C97.x
Hypertension	401.x, 402.x-405.x	I10.x, I11-I13.x, I15.x
Infectious and parasitic diseases*	006.x, 007.1, 011.9, 042-044, 070.2, 070.3, 084.x, 110.0-110.5, 111.9, 117.8, 117.9, 118, 120.x, 122.9, 123.0-123.3, 123.6, 125.x, 126.x, 127.0, 127.3, 647.4, 771.2 V02.9	A06.x, A07.1, A16.7, B18.0, B18.1, B20.x-B22.x, B24.x, B35.x, B36.x, B49.x, B50.x-B54.x, B65.x, B68.x, B74.x, B76.x, B77.x, B79.x
Depression	296.2, 296.3, 296.5, 300.4, 309.x, 311.x	F20.4, F31.3-F31.5, F32.x, F33.x, F34.1, F41.2, F43.2
Psychoses	293.8, 295.x, 296.04, 296.14, 296.44, 296.54, 297.x, 298.x	F20.x, F22.x-F25.x, F28.x, F29.x, F30.2, F31.2, F31.5
Drug abuse	292.x, 304.x, 305.2-205.9, V65.42	F11.x-F16.x, F18.x, F19.x, Z71.5, Z72.2

\*Infectious and parasitic diseases = bilharzia (schistosomiasis), giardia, amebiasis, hookworm, ascariis, trichuris, taenia species, malaria, post-primary tuberculosis, filarial infections, fungal infections, hepatitis B and AIDS/HIV

**Table 3: ICD-9-CM and ICD-10 codes used to derive infectious and parasitic diseases for refugees and non-refugees**

<b>Condition</b>	<b>ICD-9-CM diagnostic codes</b>	<b>ICD-10 diagnostic codes</b>
Bilharzia (schistosomiasis)	120.x	B65.x
Giardia	007.1	A07.1
Amebiasis	006.x	A06.x
Hookworm	126.x	B76.x
Ascaris	127.0	B77.x
Trichuris	127.3	B79.x
Taenia species	122.9, 123.0-123.3, 123.6	B68.x
Malaria	084.x, 647.4, 771.2 V02.9	B50.x-B54.x
Post-primary tuberculosis	011.9	A16.7
Filarial infections	125.x	B74.x
Fungal infections	110.0-110.5, 111.9, 117.8, 117.9, 118	B35.x, B36.x, B49.x
Hepatitis B	070.2, 070.3	B18.0, B18.1
AIDS/HIV	042-044	B20.x-B22.x, B24.x

### 3.4.2.7 Triage Level

We used the Canadian Triage and Acuity Scale (CTAS) variable in the ACCS database to determine the acuity level of ED visits. This scale was used to identify how urgent the medical needs of the two groups were upon presenting to the ED to provide an indication of the appropriateness of their visit. The CTAS is a valid and reliable tool that assigns a treatment priority to patients (90). The CTAS has five levels (90):

- Level 1 indicates that a patient requires immediate evaluation and management by an emergency physician.
- Level 2 refers to a patient that is in need of an evaluation by a physician within 15 minutes because their condition is a potential threat to life or limb function.
- Level 3 refers to a patient with a condition causing significant discomfort which could potentially become serious and should be evaluated by a physician within 30 minutes.
- Level 4 indicates that a patient does not require a prompt evaluation by a physician but it is advisable to do so within 60 minutes to identify conditions that might deteriorate or benefit from intervention or reassurance.
- Level 5 is assigned if a patient may be seen in a delayed fashion or could be referred for evaluation to other areas of the health care system.

Triage level was categorized into three groupings: acute cases (CTAS levels 1 and 2), evaluation by a physician within 30 minutes (CTAS level 3) and less urgent or non-urgent cases (CTAS levels 4 and 5).

#### 3.4.2.8 Reason for Visit

The reason for an ED and hospital inpatient visit was captured using the ACCS database and DAD respectively and defined using the main condition or primary diagnosis bringing a patient into contact with these services (the “most responsible” diagnosis coding field).

Among ED and hospital users, all codes contained in the “most responsible” coding field were obtained for each visit. The diagnostic codes were categorized according to chapters one through 19 of the ICD-10 manual (89). The five most common chapters for ED and hospital visits among refugees were reported and compared to the non-refugee group.

### **3.5 Ethical Approval:**

This study was approved by the Child Health Research Office and the Conjoint Health Research Ethics Board (CHREB) of the University of Calgary. At the time of the original submission data were only available for a one-year study period. When the analysis of two years of health service use follow-up became available during the data request an amendment to the research protocol was submitted to the CHREB.

### **3.6 Data Analysis:**

For all statistical tests  $p < 0.05$  was considered significant. Data were analyzed using Intercooled STATA 9.2 software (Statacorp, College Station, Texas, USA).

#### ***3.6.1 Descriptive Statistics***

Demographic characteristics (age, sex, country of origin and years in Canada), medical condition, triage level and reason for visit were described using frequencies and percentages. All variables were categorical. Demographic characteristics of the non-refugee group were not reported as they were matched on both age and sex, and years in Canada and country of origin were only reported for the refugee group. Chi-squared ( $\chi^2$ ) tests were used to determine any statistically significant differences when comparing proportions between the refugee and non-refugee groups.

#### ***3.6.2 The Presence of Medical Conditions***

The presence of at least one medical condition from April 1<sup>st</sup>, 2004 to March 31<sup>st</sup>, 2007 was calculated for refugees and non-refugees. The number and proportion of persons with each of the 12 conditions was calculated for each study group as well.  $\chi^2$  tests were used to determine whether or not the proportion of refugees and non-refugees with at least one medical condition and any of the 12 conditions were the same.

#### ***3.6.3 Health Services Utilization: Description and Risk Adjustment***

Initially, a univariate analysis was conducted to examine the distribution of GP, ED and hospital visit variables. We reported the median and the interquartile range (IQR)

for non-normal or highly skewed distributions. Then we compared the total number and proportion of refugees and non-refugees with at least one visit to a GP, ED, and hospital during the study period. To determine if the proportion of refugees who had at least one visit was homogeneous to the non-refugee group we used  $\chi^2$  tests. Among persons with at least one visit, categories of GP and ED use were examined. For refugees, we also determined whether country of origin and years in Canada varied among GP, ED and hospital inpatient users.

Logistic regression models were used to study the relationship between refugee status and health services utilization. We adjusted for age groups, sex (male/female) and the presence of any medical condition (yes/no) – significant variables determined to be important in risk adjustment (82). Refugee status (yes/no) was a binary variable with non-refugees as the reference group. Health services utilization (GP, ED and hospital visits) was modeled as a binary variable - people with at least one visit (yes) versus those with no visits (no). For overall GP, ED and hospital inpatient visits odd ratios (OR) were calculated with 95% CIs. Testing the assumption that continuous variables were linear on the log scale was not necessary as all independent variables in the model were categorical.

#### 3.6.3.1 General Practitioner use before an Emergency Department Visit

We completed analysis of the relationship between refugee status and GP use before an ED visit using logistic regression models similar to the other outcome variables. However, health service use was modelled as two separate binary variables:

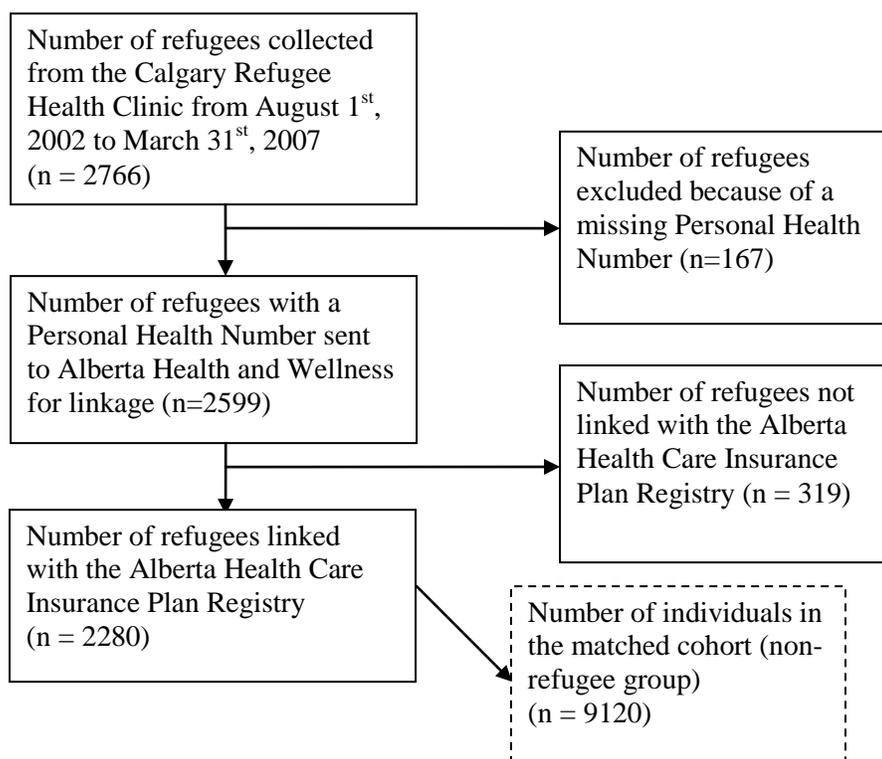
visiting a GP within 7 days prior to their ED index date (yes/no) and visiting a general practitioner between 8 to 30 days prior to their ED index date (yes/no).

## Chapter Four: Results

### 4.1 Study Population

Of the 2766 refugees identified from the CRHC over the period of August 1<sup>st</sup>, 2002 to March 31<sup>st</sup>, 2007, 486 (18%) were excluded due to an invalid PHN (i.e. having a missing a PHN, an out-of-province health care number or a void PHN). The result was a final refugee population of 2280. Through the one-to-four matching process 9120 individuals were identified to represent the non-refugee group (**Figure 3**).

**Figure 3. Derivation of Study Groups**



## 4.2 Characteristics of the Refugee Group

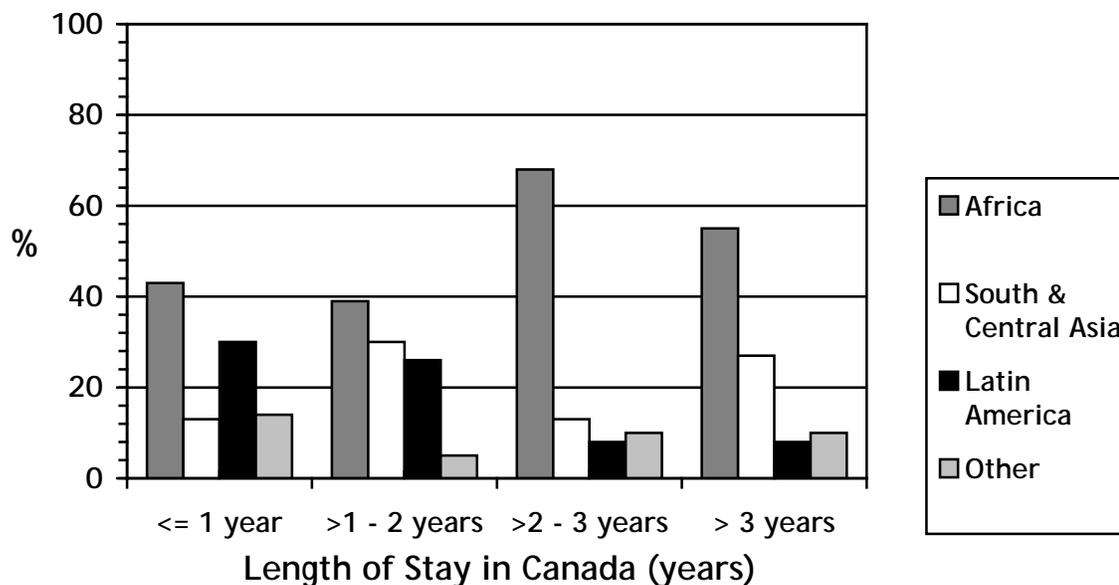
The demographic characteristics of the refugee group are presented in **Table 4**. Refugees were young with 54% between 20 to 49 years of age. The largest proportion of refugees was from Africa (mainly Sudan and Ethiopia) (48%), followed by South and Central Asia (particularly Afghanistan and Iran) (20%) and Latin America (Colombia in particular) (17%). The majority of refugees had resided in Canada for less than three years (63%). Length of stay in Canada and country of origin were unknown for 125 (5%) and 94 (4%) refugees respectively. We could not obtain this information from their immigration documents.

**Table 4. Demographic characteristics of refugees (n=2280)**

Variable	n	%
<i>Age Group</i>		
<10 years	463	20
10-19 years	464	20
20-49 years	1227	54
50+ years	126	6
<i>Sex</i>		
Male	1239	54
Female	1041	46
<i>Length of Stay</i>		
≤1 year	547	24
>1 to 2 years	467	21
>2 to 3 years	402	18
> 3 years	739	32
Unknown	125	5
<i>Country of Origin</i>		
Africa	1101	48
South & Central Asia	460	20
Latin America	376	17
Other	249	11
Unknown	94	4

A further analysis was completed on the refugee group's countries of origin and number of years in Canada (using the length of stay variable) to study any trends in the countries representing refugees over time. Refugees that had been in Canada two years or less represented a larger proportion from Latin American countries compared to refugees in Canada for more than two years. Conversely, refugees from African countries represented a smaller proportion of people that had been in Canada for two years or less (although still the largest group of refugees) compared to refugees that had been in Canada for more than two years (**Figure 4**).

**Figure 4. Country of Origin by Length of Stay in Canada**



### 4.3 Medical Conditions

**Table 5** contains the presence of medical conditions for both refugees and non-refugees at the start of the study period. The proportion of refugees with at least one medical condition (21%) was lower than the proportion for non-refugees (27%,  $p < 0.001$ ). However, when we examined specific conditions refugees had a higher prevalence of peptic ulcer disease (PUD) (1.7% vs. 0.7%,  $p < 0.001$ ) and infectious and parasitic diseases (6.6% vs. 1.8%,  $p < 0.001$ ) and a lower prevalence of chronic obstructive pulmonary disease (COPD) (5.2 vs. 13.0,  $p < 0.001$ ), hypertension (4.2 vs. 5.4,  $p = 0.035$ ) and drug abuse (0.4 vs. 1.3,  $p = 0.001$ ) compared to non-refugees. Of note, refugees were almost four times more likely to have had an infectious and parasitic disease than non-refugees (1.8% vs. 6.6%).

**Table 5. Prevalence of medical conditions among refugees and non-refugees as of March 31<sup>st</sup>, 2007**

Condition	Refugee (n=2280)		Non-refugee (n=9120)		p-value*
	n	%	n	%	
<i>At least one of the following conditions</i>	472	21	2460	27	<0.001
Congestive heart failure	5	0.3	18	0.2	0.648
Chronic obstructive pulmonary disease	96	5.2	1087	13.0	<0.001
Connective tissue/rheumatic disease	5	0.3	31	0.4	0.513
Peptic ulcer disease	31	1.7	55	0.7	<0.001
Liver disease	10	0.5	37	0.4	0.568
Diabetes	33	1.8	203	2.4	0.098
Cancer	21	1.1	80	1.0	0.477
Hypertension	78	4.2	454	5.4	0.035
Infectious and parasitic diseases †	121	6.6	151	1.8	<0.001
Depression	160	8.7	821	9.8	0.129
Psychoses	10	0.5	54	0.7	0.608
Drug abuse	7	0.4	106	1.3	0.001

\* Chi-squared test used to compare proportions

† Infectious and parasitic diseases include: bilharzia (schistosomiasis), giardia, amebiasis, hookworm, ascaris, trichuris, taenia species, malaria, post-primary tuberculosis, filarial and fungal infections, hepatitis B and AIDS/HIV

#### 4.4 General Practitioner Visits

Over the two year study period refugees had a median value of six visits to the GP (interquartile range (IQR): 2, 12) compared to only four visits (IQR: 1, 9) for non-refugees. **Table 6** shows the association between utilization of GPs for refugees and non-refugees across subgroups by age and sex. Compared to non-refugees, refugees utilized GPs more frequently overall (89% vs. 84%, risk adjusted  $p < 0.001$ ). This pattern was consistent across sex and most age groups. Among GP users, 57% of refugees versus 49% of non-refugees visited six or more times, and higher percentages for refugees existed across all age and sex categories, especially in people over 20 years of age.

**Table 6. Outpatient general practitioner visits over two years (April 1<sup>st</sup>, 2007 to March 31<sup>st</sup>, 2009)**

	At least one visit				Adjusted p-value*	Among Users											
	Refugee		Non-refugee			1-2 visits				3-5 visits				≥ 6 visits			
	n	%	n	%		Refugee n	Refugee %	Non-refugee n	Non-refugee %	Refugee n	Refugee %	Non-refugee n	Non-refugee %	Refugee n	Refugee %	Non-refugee n	Non-refugee %
<i>Overall</i>	2028	89	7668	84	<0.001	396	19	1891	25	485	24	2025	26	1147	57	3752	49
<i>Sex</i>																	
Male	1063	86	3916	79	<0.001	266	25	1240	32	294	28	1226	31	503	47	1450	37
Female	965	93	3752	90	0.004	130	13	651	18	191	20	799	21	644	67	2302	61
<i>Age Group</i>																	
<10 years	421	91	1536	83	<0.001	119	28	478	31	141	34	506	33	161	38	552	36
10-19 years	368	79	1534	83	0.185	117	32	506	33	116	31	494	32	135	37	534	35
20-49 years	1123	92	4137	84	<0.001	148	13	860	21	217	19	928	22	758	68	2349	57
50+ years	116	92	461	91	0.720	12	10	47	10	11	10	97	21	93	80	317	69

\*Adjusted for age (categorical), sex and medical condition (any one of the following: congestive heart failure, chronic obstructive pulmonary disease, connective tissue/rheumatic disease, peptic ulcer disease, liver disease, diabetes, cancer, hypertension, infectious and parasitic diseases, depression, psychoses and drug abuse)

#### 4.5 Emergency Department Visits

Refugees and non-refugees had the same median of 0 visits to the ED (IQR: 0, 1). After adjusting for age, sex and medical conditions, refugees were more likely to utilize the ED over two years (29% vs. 27%,  $p=0.003$ ) (**Table 7**). Specifically, female refugees (32% vs. 26%, risk adjusted  $p<0.001$ ) and refugees 20-49 years of age (32% vs. 26%, risk adjusted  $p<0.001$ ) utilized the ED far more than non-refugees in these same categories. Among ED users, there were no important differences in the percentage visiting an ED across categories of use (1 to 3 visits or 4 or more visits) between the two groups.

**Table 7. Emergency department visits over two years (April 1<sup>st</sup>, 2007 to March 31<sup>st</sup>, 2009)**

	At least one visit				Adjusted p-value*	Among Users							
	Refugee		Non-refugee			1-3 visits				≥ 4 visits			
	n	%	n	%		Refugee n	Refugee %	Non-refugee n	Non-refugee %	Refugee n	Refugee %	Non-refugee n	Non-refugee %
<i>Overall</i>	669	29	2454	27	0.003	587	88	2193	89	82	12	261	11
<i>Sex</i>													
Male	339	27	1358	27	0.744	301	89	1227	90	38	11	131	10
Female	330	32	1096	26	<0.001	286	87	966	88	44	13	130	12
<i>Age Group</i>													
<10 years	125	27	578	31	0.139	115	92	532	92	10	8	46	8
10-19 years	105	23	483	26	0.207	89	85	442	92	16	15	41	8
20-49 years	397	32	1281	26	<0.001	349	88	1115	87	48	12	166	13
50+ years	42	33	112	22	0.006	34	81	104	93	8	19	8	7

\*Adjusted for age (categorical), sex and medical condition (any one of the following: congestive heart failure, chronic obstructive pulmonary disease, connective tissue/rheumatic disease, peptic ulcer disease, liver disease, diabetes, cancer, hypertension, infectious and parasitic diseases, depression, psychoses and drug abuse)

#### 4.5.1 Triage Level

Among ED users, the refugee group had a higher proportion of visits triaged in the top three urgent categories of the acuity scale (CTAS levels 1, 2 and 3) (58% vs. 53%) compared to the non-refugee group (**Table 8**).

**Table 8. Acuity level of emergency department visits over 2 years (April 1<sup>st</sup>, 2007 to March 31<sup>st</sup>, 2009)**

Triage Level	Refugee (n=1358 visits)		Non-refugee (n= 4713 visits)	
	n	%	n	%
Most acute overall (Levels 1&2)	203	15	638	13
Observation by a physician within 30 minutes overall (Level 3)	586	43	1859	40
Less urgent overall (Levels 4&5)	552	41	2059	44
Triage Level Missing	17	1	157	3

#### 4.5.2 General Practitioner use before an Emergency Department Visit

In examining GP use before an ED visit, a similar percentage of refugees (27%) had visited a GP within one week of their ED visit compared to non-refugees (25%) (Table 9). After adjusting for age, sex and any medical conditions, there was no significant difference in the proportion contacting a GP within one week of an ED visit between the two groups.

**Table 9. General practitioner use before an emergency department visit over two years (April 1<sup>st</sup>, 2007 to March 31<sup>st</sup>, 2009) (Refugees: N=669; Non-refugees: N=2454)**

	Within 7 Days				Adjusted p-value*	Within 8 to 30 Days				Adjusted p-value*
	Refugee		Non-refugee			Refugee		Non-refugee		
	n	%	n	%		n	%	n	%	
<i>Overall</i>	183	27	616	25	0.292	120	18	344	14	0.020
<i>Sex</i>										
Male	76	22	293	22	0.614	52	15	145	11	0.013
Female	107	32	323	29	0.396	68	21	199	18	0.376
<i>Age Group</i>										
<10 years	30	24	125	22	0.465	12	10	81	14	0.200
10-19 years	23	22	103	21	0.779	12	11	48	10	0.659
20-49 years	117	29	344	27	0.291	84	21	192	15	0.002
50+ years	13	31	44	39	0.330	12	29	23	21	0.280

\*Adjusted for age (categorical), sex and medical conditions (any one of the following: congestive heart failure, chronic obstructive pulmonary disease, connective tissue/rheumatic disease, peptic ulcer disease, liver disease, diabetes, cancer, hypertension, infectious and parasitic diseases, depression, psychoses and drug abuse)

#### 4.6 Hospital Inpatient Visits

Over the two year study period, refugees and non-refugees had the same median hospital visits of zero (IQR: 0, 0). The results for utilization of hospitals across sex and age group are presented in **Table 10**. As with both GP and ED utilization, refugees utilized hospitals more compared to non-refugees (12% vs. 8%, risk adjusted  $p < 0.001$ ). This pattern was consistent across age and sex groups. Specifically, female refugees and refugees in the 10-19 and 20-49 year age categories utilized hospitals more than non-refugees in these categories.

**Table 10. Hospitalizations over two years  
(April 1<sup>st</sup>, 2007 to March 31<sup>st</sup>, 2009)**

	At least one visit				Adjusted p-value*
	Refugee		Non-refugee		
	n	%	n	%	
<i>Overall</i>	282	12	710	8	<0.001
<i>Sex</i>					
Male	66	5	214	4	0.056
Female	216	21	496	12	<0.001
<i>Age Group</i>					
<10 years	8	2	46	2	0.426
10-19 years	37	8	69	4	<0.001
20-49 years	217	18	538	11	<0.001
50+ years	20	16	57	11	0.120

\*Adjusted for age (categorical), sex and medical condition (any one of the following: congestive heart failure, chronic obstructive pulmonary disease, connective tissue/rheumatic disease, peptic ulcer disease, liver disease, diabetes, cancer, hypertension, infectious and parasitic diseases, depression, psychoses and drug abuse)

#### 4.7 Reason for Visiting the Emergency Department and Hospital

The five most common reasons for ED and hospital visits among refugees compared to non-refugees are presented in **Table 11**. The most predominant difference for both visit types was the percentage of refugees attending for pregnancy, childbirth and postpartum related conditions compared to non-refugees (ED visits: 6% for refugees vs. 3% for non-refugees and hospitalizations: 59% for refugees vs. 42% for non-refugees).

**Table 11. Reason for visits among users over 2 years (April 1<sup>st</sup>, 2007 to March 31<sup>st</sup>, 2009)**

Type of Visit	Top 5 Reasons for Refugee Group	Refugee		Non-refugee	
		n=1358 visits	%	n=4713 visits	%
<i>Emergency Department</i>	1. Injury, poisoning and certain other consequences of external causes	362	27	1397	30
	2. Diseases of the digestive system	102	8	348	7
	3. Diseases of the respiratory system	100	7	421	9
	4. Pregnancy, childbirth and postpartum	75	6	141	3
	5. Mental health and behavioural disorders	62	5	224	5
<i>Hospital</i>	<b>Top 5 Reasons for Refugee Group</b>	<b>n=331 visits</b>	<b>%</b>	<b>n=872 visits</b>	<b>%</b>
	1. Pregnancy, childbirth and postpartum	194	59	362	42
	2. Mental health and behavioural disorders	26	8	76	9
	3. Injury, poisoning and certain other consequences of external causes	25	8	76	9
	4. Diseases of the digestive system	20	6	90	10
	5. Neoplasms	10	3	32	4

\*Conditions are classified according to the ICD-10 chapters using the primary diagnosis

#### 4.8 Health Service Utilization by Country of Origin and Length of Stay in Canada

Further analysis was done to examine health services utilization (GP, ED and hospital visits) by refugees according to country of origin and length of stay in Canada. The results are presented in **Table 12**. There were no major variations across country of origin or length of stay in Canada variables. Out of all countries of origin, South and Central Asian countries had a higher percentage of persons with GP visits and refugees from African countries had a higher percentage of persons with ED and hospital visits. Refugees in Canada two years or less had a lower percentage of visits to the ED.

**Table 12. Refugees with at least one general practitioner, emergency department and hospital inpatient visit over two years (April 1<sup>st</sup>, 2007 to March 31<sup>st</sup>, 2009) by country of origin and length of stay in Canada**

	Health Service					
	General Practitioner		Emergency Department		Hospital Inpatient	
	n	%	n	%	n	%
<i>Overall</i>	2028	89	669	29	282	12
<i>Country of Origin</i>						
Africa	974	88	347	32	162	15
South & Central Asia	417	91	120	26	53	12
Latin America	332	88	104	28	44	12
Other	220	88	69	28	14	6
Unknown	85	90	29	31	9	10
<i>Length of Stay</i>						
0-≤1 years	486	89	150	27	70	13
>1-2 years	419	90	127	27	54	12
>2-3 years	351	87	120	30	43	11
>3 years	660	89	227	31	105	14
Unknown	112	90	45	36	10	8

#### 4.9 Overall Health Services Utilization

The adjusted odds ratios (OR) and 95% CIs for utilization of GP, ED and hospitals are presented in **Table 13**. After adjusting for age, sex and medical condition, refugees were more likely than non-refugees to have visited a GP (OR: 1.62, 95% CI: 1.40, 1.87), ED (OR: 1.17, 95% CI: 1.05, 1.29) and hospital (OR: 1.78, 95% CI: 1.53, 2.07) overall.

**Table 13. Adjusted odds ratios for health services utilization by refugees compared to non-refugees over two years (April 1<sup>st</sup>, 2007 to March 31<sup>st</sup>, 2009)**

Health Service	Odds Ratio (95% CI)*† (refugee vs. non-refugee)	p-value
General Practitioner	1.62 (1.40, 1.87)	<0.001
Emergency Department	1.17 (1.05, 1.29)	0.003
Hospital Inpatient	1.78 (1.53, 2.07)	<0.001

\*Adjusted for age (categorical), sex and medical condition (any one of the following: congestive heart failure, chronic obstructive pulmonary disease, connective tissue/rheumatic disease, peptic ulcer disease, liver disease, diabetes, cancer, hypertension, infectious and parasitic diseases, depression, psychoses and drug abuse)

†An OR of <1 means that health service use was less likely, while an OR of >1 means that it was more likely. An OR of 1 means there is no difference.

## Chapter Five: Discussion

### 5.1 Summary

In this study we compared the utilization of health services between refugees and non-refugees in Calgary, Alberta. Some key insights include:

- a) The refugee population was young. They had a lower proportion of at least one medical condition compared to the non-refugee population. However, refugees had a notably higher proportion of infectious and parasitic diseases.
- b) After adjustment for age, sex and the presence of any medical conditions, refugees used general practitioners, the emergency department and hospital inpatient services more than non-refugees.
- c) Refugees were equally likely as non-refugees to have visited a general practitioner within one week prior to an emergency department visit, but were more likely to have been triaged in the emergency department for urgent conditions and seen for pregnancy, childbirth and postpartum related conditions. In particular, female refugees and refugees 20-49 years of age used the emergency department more frequently than non-refugees in these same categories.
- d) No significant variations in health services utilization by refugees according to country of origin and length of stay in Canada existed.

## 5.2 Overall Health Services Utilization

Our study suggests refugees utilized health services more frequently than the non-refugee population with no evidence of underutilization; however, the appropriateness of utilization is unknown and requires more research. This evidence is contrary to our hypothesis that refugees would have lower health care utilization compared to non-refugees due to barriers accessing health care services (9, 58, 63, 68, 91). Nevertheless, our results are consistent with several studies, both nationally and internationally, examining health services utilization by immigrants, refugees or ethnic groups compared to host populations. These studies concluded that inequalities do not exist in the use of services; immigrants, refugees or ethnic groups used services equally or more compared to host populations.

Correa-Velez et al. examined hospital utilization among people born in refugee-source countries and reported that refugees had higher rates of total hospital and emergency admissions (hospital admissions: 495.2 per 1,000 persons vs. 444.8 and emergency admissions: 113.2 per 1,000 persons vs. 100.9,  $p < 0.05$ ) compared to the Australian-born population in 2003 to 2004 (49). A Danish study found similar age and gender patterns of health services utilization between immigrants and non-immigrants, but noted higher rates of contact with general practitioners and acute care services among immigrant groups of refugee origin, namely persons from Ex-Yugoslavia and Palestine (47). Two other studies in Europe also found higher utilization of emergency department services among different immigrant groups compared to resident-born populations (48, 81).

In Canada, Quan et al. analyzed health services utilization across ethnic populations and did not find any evidence of disparities in the utilization of general physicians and specialists between visible minorities and white people (63). Blais and Maiga's study revealed ethnic groups had similar use of most health services and a higher use of specialist services compared to native Quebecers (57). Our results are also consistent with several other studies conducted in Canada comparing health services utilization by immigrants or ethnic groups noting similar or higher use compared to the general population (57, 59-61, 63, 67, 91).

Some Canadian studies examining the use of health care services yielded different results compared to our study. In particular, immigrants and other ethnic groups in these studies were less likely to have utilized the hospital (63, 91) and emergency department (58). However, because these studies did not examine refugees may explain this difference.

### ***5.2.1 Factors Explaining Refugee Patterns of Health Services Utilization***

Using Aday and Andersen's framework as a guide, factors at the policy, health system delivery and individual level may explain the ability of refugees to utilize health services as frequently as the general population (29, 31). Canada has a universal, publicly funded health care system that promises access to health care for all of its citizens. Under this premise, there are no direct costs associated with receiving medically necessary care. Refugees are eligible to receive public health insurance coverage upon arrival in Alberta. Therefore, the financial barriers to using health services do not exist.

The availability of services targeting refugee health in Calgary, Alberta, may also explain refugees' higher utilization of services compared to non-refugees. The CRHC was established in 2002 and facilitates access to specialized, transitional primary care and community supports for refugees. The CRHC medical staff are trained in immigrant/refugee medicine and cultural competency; address medical issues; and assist refugees in accessing health services by linking with interpretation services and being geographically located where settlement services are provided to refugees.

Several characteristics of the refugee population may also explain their higher utilization of health services compared to the non-refugee population. They include:

- Differences in the health status of the two groups
- Other socio-demographic characteristics not controlled for
- The inappropriate use of services

Differences in Health Status: Members of the refugee study group may have had poorer levels of health compared to the non-refugee group resulting in more visits to health services. Our study found refugees were more likely to have infectious and parasitic diseases and PUD. Many studies confirm substantial differences in the prevalence of various infectious and parasitic diseases between refugees and the general population (4, 5, 20, 50) and report PUD is more prevalent in some Asian and African countries where refugees are originating (92).

Our results also indicated that refugees had fewer chronic conditions than non-refugees which is contrary to the explanation above. However, several factors may explain the lower prevalence of chronic conditions and substantiate the claim that refugees may have had poorer health compared to non-refugees resulting in a higher

utilization of health services. First, many studies support the notion that refugees' past exposures and risk of poor health results in a greater burden of chronic conditions and other medical conditions relative to immigrants and other residents in the general population (4-6, 8, 10, 22, 27, 28). In 2009, Newbold completed a study on the short-term health of different immigrant arrival groups to Canada (28). He found that 23.5% of refugees reported a new medical problem/illness within six months of their arrival and this doubled to 55.1% after being in Canada for only two years. During the time between six months to two years post-arrival, the proportion of refugees reporting a new mental or emotional health problem climbed from 8.2% to 34.7%. He also reported that refugees were over two times (OR = 2.316) more likely to report poor health compared to their economic immigrant counterparts.

Second, using administrative data to assess medical conditions could have resulted in the under-reporting of medical conditions for refugees. As previously mentioned, administrative data may not be accurately coded. More importantly, the indices we used to compile our list of medical conditions may not have been culturally-relevant to refugees. Modifications were made to the list used in this study to capture conditions more relevant to refugees; however, the list was not a comprehensive, validated list of conditions. Recently, Swinkels et al. identified 20 high priority conditions through an evidence-based guideline initiative. A list of infectious diseases, chronic conditions and mental health issues were developed for future reference (93).

Third, we were unable to control for health status. Our study captured and controlled for the presence of medical conditions to provide an indication of the need for services by both groups. However, we did not have enhanced indicators of health status

such as self-assessed health or clinical information around the nature of their condition (i.e. the severity of their illness) to more equitably compare health services utilization (28, 57, 82). Altogether, it is possible the refugee group's overall health status was poorer than the non-refugee group resulting in more visits to health services as observed in our study.

Controlling for Socio-demographic Characteristics: While our study controlled for individual level variables (age, sex and medical conditions), other socio-demographic characteristics (e.g. income level, education and occupation) that are important predictors in the utilization of health services were not controlled for. These factors may explain differences in health services use by refugees and non-refugees identified in other studies examining immigrants. Dunn and Dyck suggested socioeconomic factors were important in explaining health status and health care utilization of immigrants (94). A Canadian study highlighted no significant differences in the use of general practitioners and hospitals between foreign and native-born populations after controlling for socioeconomic variables such as income, and marital and employment status (61). The impact of socio-demographic variables on health services use by refugees needs to be explored in the future.

Inappropriate use of Health Services: The higher utilization of health services by refugees also raises the issue of whether they use health services appropriately. Our study identified the level of urgency of the refugee group's needs upon accessing the emergency department compared to non-refugees. We also examined why refugees sought emergency department and hospital services which provided an indication of their

need for services or the nature of the services they received. Yet, whether or not their reason for using a service was relevant to the service accessed was not determined.

For example, our results indicated more female refugees attended an emergency department for pregnancy-related issues compared to non-refugee females. However, it was not determined whether the reason for these visits was best suited for an emergency department visit or a visit to a general practitioner. Also, factors motivating visits by refugees were not determined and may have led to the “overutilization” or inappropriate use of health services. Linguistic or communication barriers could have prevented proper engagement with health services leading to repeat visits to certain services or the use of other services for similar problems. This issue was divulged in a study by Leduc and Proulx when they examined the patterns of utilization by recent immigrants (38).

Despite the fact refugees used general practitioners, the emergency department and hospital services more compared to non-refugees, it is important to note that refugees may still have problems of access. Services and information may not be sensitive to the cultural and language needs of refugees. Refugees can experience racial discrimination by health care providers creating additional barriers after engaging with the health system. These barriers may compromise the quality of the care refugees receive; thus, not meeting their health needs. Access to health care is complex and more than just simply using a service. It is a multifaceted interaction between characteristics of the health care delivery system and the population at risk, along with other external factors. Equal access to health services does not necessarily mean refugees receive equal quality of care or their care requirements are met (28).

### 5.3 Emergency Department Use

We found that compared to non-refugees, refugees were more likely to use the emergency department. These results are consistent with Danish research showing higher rates of contact with acute care services for immigrant groups from countries consisting of mainly refugees (47, 48). We also found that refugees had more visits for urgent conditions and were equally likely to have seen a general practitioner within one week prior to their emergency department visit. This is contrary to evidence suggesting that they inappropriately use the emergency department for non-urgent issues due to uncertainty around navigating the system and barriers to primary care (48, 73, 95).

Our results also indicated that female refugees utilized the emergency department twice as much as non-refugee females for pregnancy, childbirth and postpartum-related issues. Few studies examining the health services utilization of immigrants and refugees have determined their reason for using services. One particular study by Cots et al. analyzed the cost of emergency visits by immigrants compared to the host population in Spain and captured what they referred to as ‘clinical categories’ (e.g. paediatrics or trauma) based on the type of specialist attending to the user (81). Among immigrants from low income countries (Latin America, Asia, Africa and Eastern Europe) they found a greater relative utilization of gynaecology and obstetrics services compared to immigrants from high income countries (Europe, USA, Canada, Japan, Australia and New Zealand) and Spanish-born residents (28% vs. 17.6% and 11.5% respectively).

A possible explanation for our findings is that refugees wait until their medical conditions become more severe before accessing emergency department services. For some refugees, barriers may result in a delay in seeking services and treatment for

medical conditions through a primary care provider; leading to more severe conditions or making it challenging to contact a general practitioner when they have an urgent medical need. On the other hand, as mentioned previously, this may reflect local primary care initiatives to assist refugees in accessing health services. Refugees may be seeing a primary care provider who appropriately refers them to the emergency department for treatment. This is supported by our results indicating that refugees were equally likely as non-refugees to visit a general practitioner prior to their emergency department visit - showing a high probability of access to general practitioners.

Refugees' lack of knowledge about the importance of having regular primary care and taking part in routine preventative care may be another explanation. These concepts may vary from their belief patterns regarding illness and health-seeking behaviour, and how the health system is designed in their country of origin (28, 73). Evidence exists that immigrants and refugees are less likely to participate in prevention screening such as vaccinations and Pap tests (4, 5, 63, 96). The underuse of preventative screening measures through a regular care provider can lead to the under-diagnosis and treatment of conditions (61). This may result in a deterioration of health status over time and increase the likelihood of a visit to the emergency department for more urgent conditions. For example, the unfamiliarity with routine prenatal care follow-up may explain why female refugees utilized the emergency department two times more than non-refugee females for pregnancy, childbirth and postpartum related issues. Female refugees may be attending the emergency department as a substitute for services that can be provided by a general practitioner or for preventable complications.

#### **5.4 Health Services Utilization by Country of Origin and Length of Stay in Canada**

No significant variations existed in health services use by country of origin or length of stay in Canada. Based on empirical evidence we felt that there may be differences in refugees' health services use due to personal experiences with the health care system in their country of origin and at various stages of integration into Canada. Nevertheless, our results are consistent with several studies in Canada and internationally examining health services use by immigrants or refugees reporting no differences across country of origin (59, 60, 73, 81, 94, 97) and length of time in the host country (60, 61, 94). It is possible that health services utilization is influenced more by migration experiences or refugee status than by country of origin or length of stay (38, 73).

Our findings do not coincide with other studies noting variations by either country of origin or length of stay in a host country (38, 39, 47, 50, 63-65, 91, 95, 98, 99). A Canadian study found recent immigrants from Asia had lower rates of emergency department, general practitioner and specialist visits compared to other ethnic groups (58). Norredam et al. found higher utilization rates of the emergency department by persons from Somalia, Turkey and Ex-Yugoslavia (147, 138 and 137 contacts per 1,000 person years respectively), whereas persons from Nordic countries and North America, and the rest of Europe had the lowest rates (95 and 114 contacts per 1,000 person years respectively) (48). The discrepancy of our findings may be due to variable definitions and measurements of the variables used in these studies; thus, limiting the comparability of our results. Country of origin is defined in a variety of ways such as country of birth, racial or cultural background, and nationality. It is also categorized broadly (e.g. European vs. non-European countries) which can mask important differences among

smaller regions or countries. Similarly, length of stay in these studies usually reflects spans over five or ten years versus shorter time frames as captured in our study.

## **5.5 Limitations**

Our study is not without its limitations. First, the refugee group was collected from patients registered with the CRHC, so results are subject to a selection bias. We could not distinguish between refugees that used, or did not use, health services provided by the CRHC and if this would have led to differences in health services utilization. Thus, we may have overestimated overall use of health services by refugees particularly for general practitioners. Regardless of the source of services used by refugees, we documented use of physician services and compared that to a non-refugee population.

Second, although several demographic and clinical variables were gathered, other potentially important confounders were not collected and controlled for which may have influenced the utilization of health services (e.g. education level, language proficiency, marital status, income, pre-migration experiences, more extensive measures of health status). In future research, Aday and Andersen's model of access to medical care would be an effective framework to guide the collection of other important factors that may influence the utilization of health services by refugees (29, 31).

Third, we could not capture preventative care (e.g. screening tests, use of oral health services) or mental health service use despite evidence suggesting immigrants and refugees are less likely to access these services and have high mental health needs (6, 28, 63, 66, 100). Our study did describe the use of general practitioners, the emergency department and hospitals. However, also evaluating service use in these areas would have

provided a more comprehensive picture of the utilization of health care services by refugees.

Fourth, the use of administrative data to capture medical conditions was a limitation. The quality of administrative data can be compromised by gaps in clinical information; therefore leading to the possibility of exclusion and underestimation of medical conditions. Identifying three years of clinic information on the study groups prior to the study period versus one year mitigated this gap.

Finally, this study was restricted to refugees collected from the CRHC and residing in Calgary, Alberta, which limits the generalizability of these results. The leading source countries of the refugee study group were: Sudan, Colombia, Afghanistan, Burma, Ethiopia, Iran and Iraq. Refugee populations across Canada and in other countries may be different from the population examined in Calgary; thus, resulting in different patterns of health services utilization.

Additionally, the majority of the refugees collected through the CRHC for this study were GARs. Approximately 5% of refugees were privately or family sponsored and we excluded asylum seekers altogether. Therefore, we cannot generalize our results to these groups. It would be interesting to examine the health services use of other refugee groups and individuals claiming refugee status as there could be important differences based on their status as a refugee in Canada. For instance, family-sponsored refugees may have more financial resources and social support networks through their family to better navigate and access the health system compared to asylum seekers who have limited eligibility to health services due to their temporary status in Canada.

## **Chapter Six: Conclusion**

We learned that refugees utilize health services more than the non-refugee population, with no evidence of underutilization of general practitioners, emergency departments or hospitals. This may be due to Canada's universal healthcare system or access to primary care clinics targeting refugees, and/or poorer health status among refugees. Despite limitations of this study, our findings can support the development of community-based intervention programs providing knowledge about navigating and appropriately using the health care system. It can support primary care clinics aiming to address the unique needs of refugees, particularly in infectious and parasitic disease screening and treatment.

To the best of our knowledge, this is the only population-based study of its kind evaluating the differences in health service use between refugees and the general population, and in determining whether refugees have equal access to health care. Our study linked a sample of refugees to administrative data sources to effectively evaluate and compare health services utilization with a matched group of non-refugees over two years. We captured reasons why refugees accessed services to provide insight regarding their needs for services compared to non-refugees. Information was also gathered on the presence of medical conditions in both study groups to determine the impact of this risk factor on the utilization of health services.

Altogether, we believe this study is a positive start in the development of an evidence base regarding the utilization of health services by refugees in Canada. Future

research is required to fully understand the health and health care utilization of refugees, and the focus should be to:

- a) Determine the factors motivating refugees' visits to health services, especially the emergency department.
- b) Examine if refugees are using health care services appropriately. Specifically, to determine if refugees "overutilize" and/or inappropriately use services; or underutilize services based on their needs.
- c) Provide evidence on the refugee population's experiences regarding the quality of care received and their satisfaction with health services.
- d) Evaluate the impact of health services use on refugees' health outcomes.
- e) Explore the use of health services by other refugee groups and asylum seekers; and in other provinces in Canada.
- f) Determine the use of health services by refugees in the area of preventative care and mental health services, and control for socio-demographic and health status variables to understand whether any differences truly exist.

Furthermore, little is known about strategies or interventions that might improve the health of refugees, specifically if the development of targeted health programs and services for refugees developed in recent years effectively meet their unique needs and improve their health outcomes.

Above all, the health of refugees and their utilization of health services is an important area of future investigation. Generating more evidence is necessary to inform health care provision, policies and program planning aimed at improving access to quality health services and ultimately the health and wellbeing of refugees.

## REFERENCES

1. Citizenship and Immigration Canada's Facts and Figures: Immigration Overview Permanent and Temporary Residents, 2008. Ottawa, Ontario; 2009 [updated 2009; cited]; Available from:  
<http://www.cic.gc.ca/english/resources/statistics/menu-fact.asp>.
2. United Nations High Commissioner for Refugees. 2009 Global Trends: Refugees, Asylum-seekers, Returnees, Internally Displaced and Stateless Persons. Geneva, Switzerland: UNHCR; 2010 [updated June 15th, 2010; cited]; Available from:  
<http://www.unhcr.org/4c11f0be9.html>
3. Birjandian F. Executive Director, Calgary Catholic Immigration Society. Statistics on refugees to Calgary; 2009.
4. Dillmann E. PR, and Wilson A. Patterns of health problems observed among newly arrived refugees to Canada. In: Masi R. ML, McLeod K. A., editor. Health and Cultures: Exploring the relationships. 2nd ed. Oakville, Ontario: Mosaic Press; 1993. p. 253.
5. Pottie K, Janakiram P, Topp P, McCarthy A. Prevalence of selected preventable and treatable diseases among government-assisted refugees: Implications for primary care providers. *Can Fam Physician*. 2007 Nov;53(11):1928-34.
6. Keyes EF. Mental health status in refugees: an integrative review of current research. *Issues Ment Health Nurs*. 2000 Jun;21(4):397-410.

7. Schweitzer R, Melville F, Steel Z, Lacherez P. Trauma, post-migration living difficulties, and social support as predictors of psychological adjustment in resettled Sudanese refugees. *Aust N Z J Psychiatry*. 2006 Feb;40(2):179-87.
8. Simich L, Hamilton H, Baya BK. Mental distress, economic hardship and expectations of life in Canada among Sudanese newcomers. *Transcult Psychiatry*. 2006 Sep;43(3):418-44.
9. Lawrence J, Kearns R. Exploring the 'fit' between people and providers: refugee health needs and health care services in Mt Roskill, Auckland, New Zealand. *Health Soc Care Community*. 2005 Sep;13(5):451-61.
10. Beiser M, Steward, M. Reducing health disparities: A priority for Canada. *Canadian Journal of Public Health*. 2005;96(Supplement):S4-5.
11. The United Nations High Commissioner for Refugees. The 1951 Refugee Convention: Questions and Answers. UNHCR Media Relations and Public Information Services; 2007.
12. United Nations High Commissioner for Refugees. Protecting refugees and the role of UNHCR, 2008-2009. [July 16th, 2010; cited]; Available from: <http://www.unhcr.org/cgi-bin/texis/vtx/search?page=search&docid=4034b6a34&query=Protecting%20Refugees>.

13. Building a Nation: The regulations under the Immigration and Refugee Protection Act. Ottawa, Canada: Public Works and Government Services Canada; March, 2002. p. 106.
14. Citizenship and Immigration Canada's 2005 Immigration Overview. The Monitor: Fourth Quarter Data. 2006(2).
15. Gushulak BD, Williams LS. National immigration health policy: existing policy, changing needs, and future directions. *Can J Public Health*. 2004 May-Jun;95(3):I27-9.
16. Dillmann E. PR, and Wilson A. (1993). Resettlement and Integration of Immigrants. In: M. L. Masi R. MKA, editor. *Health and Cultures: Exploring the relationships*. Oakville, Ontario: Mosaic Press; 1993.
17. Al-Khatib I, Ju'ba A, Kamal N, Hamed N, Hmeidan N, Massad S. Impact of housing conditions on the health of the people at al-Ama'ri refugee camp in the West Bank of Palestine. *Int J Environ Health Res*. 2003 Dec;13(4):315-26.
18. Banjong O, Menefee A, Sranacharoenpong K, Chittchang U, Eg-kantrong P, Boonpraderm A, et al. Dietary assessment of refugees living in camps: a case study of Mae La Camp, Thailand. *Food Nutr Bull*. 2003 Dec;24(4):360-7.
19. Denburg A, Rashid M, Brophy J, Curtis T, Malloy P, Audley J, et al. Initial health screening results for Karen refugees: a retrospective review. *Can Commun Dis Rep*. 2007 Dec 1;33(13):16-22.

20. Walker PF, Jaranson J. Refugee and immigrant health care. *Med Clin North Am.* 1999 Jul;83(4):1103-20, viii.
21. MacPherson D. W. GBD. Syphilis in immigrants and the Canadian Immigration Medical Examination. *Journal of Immigrant and Minority Health.* 2008;10:1-6.
22. Baker C. The stress of settlement where there is no ethnocultural receiving community. In: Masi R. ML, McLeod K. A., editor. *Health and Cultures: Exploring the relationships.* 2nd ed. Oakville, Ontario: Mosaic Press; 1993.
23. Noh S, Beiser M, Kaspar V, Hou F, Rummens J. Perceived racial discrimination, depression, and coping: a study of Southeast Asian refugees in Canada. *J Health Soc Behav.* 1999 Sep;40(3):193-207.
24. Beiser M, Hou F. Language acquisition, unemployment and depressive disorder among Southeast Asian refugees: a 10-year study. *Soc Sci Med.* 2001 Nov;53(10):1321-34.
25. Simich L, Beiser M, Mawani FN. Social support and the significance of shared experience in refugee migration and resettlement. *West J Nurs Res.* 2003 Nov;25(7):872-91.
26. Falk A. Immigrant Settlement: Health and Social Supports. In: Masi R. ML, McLeod K. A., editor. *Health and Cultures: Exploring the relationships.* 2nd ed. Oakville, Ontario: Mosaic Press; 1993.

27. Aday LA. Health status of vulnerable populations. *Annu Rev Public Health*. 1994;15:487-509.
28. Newbold B. The short-term health of Canada's new immigrant arrivals: evidence from LSIC. *Ethn Health*. 2009 Jun;14(3):315-36.
29. Aday LA, Andersen R. A framework for the study of access to medical care. *Health Serv Res*. 1974 Fall;9(3):208-20.
30. Sanmartin C, Ross N. Experiencing Difficulties Accessing First-Contact Health Services in Canada: Canadians without regular doctors and recent immigrants have difficulties accessing first-contact healthcare services. Reports of difficulties in accessing care vary by age, sex and region. *Health Policy*. 2006 Jan;1(2):103-19.
31. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav*. 1995 Mar;36(1):1-10.
32. Uba L. Cultural barriers to health care for southeast Asian refugees. *Public Health Rep*. 1992 Sep-Oct;107(5):544-8.
33. Magoon J. *The Health of Refugees in Winnipeg*. 2005. Winnipeg Regional Health Authority. Winnipeg, Manitoba. 78 pages.
34. Gagnon A. *Responsiveness of the Canadian Health Care System Towards Newcomers*. Commission on the Future of Health Care in Canada. Montreal, Quebec; 2002. 38 pages.

35. Davidson N, Skull S, Burgner D, Kelly P, Raman S, Silove D, et al. An issue of access: delivering equitable health care for newly arrived refugee children in Australia. *J Paediatr Child Health*. 2004 Sep-Oct;40(9-10):569-75.
36. Sheikh-Mohammed M, Macintyre CR, Wood NJ, Leask J, Isaacs D. Barriers to access to health care for newly resettled sub-Saharan refugees in Australia. *Med J Aust*. 2006 Dec 4-18;185(11-12):594-7.
37. Miedema B, Hamilton R, Easley J. Climbing the walls: Structural barriers to accessing primary care for refugee newcomers in Canada. *Can Fam Physician*. 2008 Mar;54(3):335-6, 8-9.
38. Leduc N, Proulx M. Patterns of health services utilization by recent immigrants. *J Immigr Health*. 2004 Jan;6(1):15-27.
39. Gerritsen AA, Bramsen I, Deville W, van Willigen LH, Hovens JE, van der Ploeg HM. Health and health care utilisation among asylum seekers and refugees in the Netherlands: design of a study. *BMC Public Health*. 2004 Mar 10;4:7.
40. Gerritsen AA, Bramsen I, Deville W, van Willigen LH, Hovens JE, van der Ploeg HM. Use of health care services by Afghan, Iranian, and Somali refugees and asylum seekers living in The Netherlands. *Eur J Public Health*. 2006 Aug;16(4):394-9.
41. Bhatia R, Wallace P. Experiences of refugees and asylum seekers in general practice: a qualitative study. *BMC Fam Pract*. 2007;8:48.

42. Moreno A, Piwowarczyk L, LaMorte WW, Grodin MA. Characteristics and utilization of primary care services in a torture rehabilitation center. *J Immigr Minor Health*. 2006 Apr;8(2):163-71.
43. Cooke R, Murray S, Carapetis J, Rice J, Mulholland N, Skull S. Demographics and utilisation of health services by paediatric refugees from East Africa: implications for service planning and provision. *Aust Health Rev*. 2004;27(2):40-5.
44. McCrone P, Bhui K, Craig T, Mohamud S, Warfa N, Stansfeld SA, et al. Mental health needs, service use and costs among Somali refugees in the UK. *Acta Psychiatr Scand*. 2005 May;111(5):351-7.
45. Cheung P, Spears G. Illness aetiology constructs, health status and use of health services among Cambodians in New Zealand. *Aust N Z J Psychiatry*. 1995 Jun;29(2):257-65.
46. Silove D, Steel Z, McGorry P, Drobny J. Problems Tamil asylum seekers encounter in accessing health and welfare services in Australia. *Soc Sci Med*. 1999 Oct;49(7):951-6.
47. Dyhr L, Andersen JS, Engholm G. The pattern of contact with general practice and casualty departments of immigrants and non-immigrants in Copenhagen, Denmark. *Dan Med Bull*. 2007 Aug;54(3):226-9.

48. Norredam M, Krasnik A, Moller Sorensen T, Keiding N, Joost Michaelsen J, Sonne Nielsen A. Emergency room utilization in Copenhagen: a comparison of immigrant groups and Danish-born residents. *Scand J Public Health*. 2004;32(1):53-9.
49. Correa-Velez I, Sundararajan V, Brown K, Gifford SM. Hospital utilisation among people born in refugee-source countries: an analysis of hospital admissions, Victoria, 1998-2004. *Med J Aust*. 2007 Jun 4;186(11):577-80.
50. Kliewer EV KA. The health status and medical services utilization of recent immigrants to Manitoba and British Columbia: A pilot study: The University of British Columbia; 2000.
51. Shah C. Federal and Provincial Health Organizations. *Public Health and Preventative Medicine in Canada*. 5th ed. Toronto, Canada: Elsevier; 2003.
52. Citizenship and Immigration Canada's Annual Report to Parliament on Immigration, 2009. [February 15th, 2010; cited]; Available from: <http://www.cic.gc.ca/english/resources/publications/annual-report2009/index.asp>.
53. Australian Government Department of Immigration and Citizenship's Immigration Update 2008-2009.
54. International Migration, Settlement, and Employment Dynamics. *Quota Refugees in New Zealand: Approvals and Movements (1998-2009)*; 2009.
55. Home Office. *Control of Immigration: Statistics United Kingdom*, 2006.

56. United States Department of Homeland Security. Yearbook of Immigration Statistics, 2009.
57. Blais R, Maiga A. Do ethnic groups use health services like the majority of the population? A study from Quebec, Canada. *Soc Sci Med.* 1999 May;48(9):1237-45.
58. Wen SW, Goel V, Williams JI. Utilization of health care services by immigrants and other ethnic/cultural groups in Ontario. *Ethn Health.* 1996 Mar;1(1):99-109.
59. Globerman S. Immigration and Health Care Utilization Patterns in Canada. *Research of Immigration and Integration in the Metropolis.* Vancouver; 1998.
60. Laroche M. Health status and health services utilization of Canada's immigrant and non-immigrant populations. *Can Public Policy.* 2000;26(1):51-73.
61. Newbold KB. Health care use and the Canadian immigrant population. *Int J of Health Services.* 2009;39(3):545-65.
62. Chen J, Wilkins R, Ng E. Health expectancy by immigrant status, 1986 and 1991. *Health Rep.* 1996 Winter;8(3):29-38(Eng); 1-41(Fre).
63. Quan H, Fong A, De Coster C, Wang J, Musto R, Noseworthy TW, et al. Variation in health services utilization among ethnic populations. *CMAJ.* 2006 Mar 14;174(6):787-91.

64. Ng E. WR, Gendron F., Berthelot J. Dynamics of Immigrants' Health in Canada: Evidence form the National Population Health Survey. In: Canada S, editor.; 1996.
65. Newbold B. Health status and health care of immigrants in Canada: a longitudinal analysis. *J Health Serv Res Policy*. 2005 Apr;10(2):77-83.
66. Fenta H, Hyman I, Noh S. Mental health service utilization by Ethiopian immigrants and refugees in Toronto. *J Nerv Ment Dis*. 2006 Dec;194(12):925-34.
67. Glazier RH CM, Cortinois AA, Agha MM, Moineddine R. Utilization of Hospital Services by Recent Immigrants in Toronto, Canada. Research report of 1999 CERIS-funded project. Toronto: St. Michael's Hospital and University of Toronto; 2003.
68. McDonald JT, Kennedy S. Insights into the 'healthy immigrant effect': health status and health service use of immigrants to Canada. *Soc Sci Med*. 2004 Oct;59(8):1613-27.
69. Pim C. Former Program Director, Calgary Refugee Health Clinic. Calgary Refugee Health Program Database. Calgary; March 6th, 2008.
70. Alberta Health and Wellness. Alberta Ambulatory Care Reporting Manual. Edmonton, Alberta, April, 2006.

71. The Canadian Institute for Health Information. Hospital Trends in Canada - Results of a Project to Create a Historical Services of Statistical and Financial Data for Canadian Hospitals Over Twenty-Seven Years. Ottawa, Canada; 2005.
72. Garey KW. The role of matching in epidemiological studies. *American Journal of Pharmacy Education*. 2004;68(3):1-7.
73. Norredam M, Mygind A, Nielsen AS, Bagger J, Krasnik A. Motivation and relevance of emergency room visits among immigrants and patients of Danish origin. *Eur J Public Health*. 2007 Oct;17(5):497-502.
74. Hunt KA, Weber EJ, Showstack JA, Colby DC, Callahan ML. Characteristics of frequent users of emergency departments. *Ann Emerg Med*. 2006 Jul;48(1):1-8.
75. Hansagi H, Olsson M, Sjoberg S, Tomson Y, Goransson S. Frequent use of the hospital emergency department is indicative of high use of other health care services. *Ann Emerg Med*. 2001 Jun;37(6):561-7.
76. LaCalle E, Rabin E. Frequent users of emergency departments: the myths, the data, and the policy implications. *Ann Emerg Med*. 2010 Jul;56(1):42-8.
77. Huang JA, Weng RH, Lai CS, Hu JS. Exploring medical utilization patterns of emergency department users. *J Formos Med Assoc*. 2008 Feb;107(2):119-28.
78. Sun BC, Burstin HR, Brennan TA. Predictors and outcomes of frequent emergency department users. *Acad Emerg Med*. 2003 Apr;10(4):320-8.

79. The Canadian Institute for Health Information. Inpatient hospitalizations in Canada increase slightly after many years of decline. 2005.
80. The Canadian Institute for Health Information. The Cost of Acute Care Hospital Stays by Medical Condition in Canada, 2004-2005. Ottawa, Canada; 2008.
81. Cots F, Castells X, Garcia O, Riu M, Felipe A, Vall O. Impact of immigration on the cost of emergency visits in Barcelona (Spain). *BMC Health Serv Res.* 2007;7:9.
82. Iezzoni LI. Risk Adjustment for Measure Healthcare Outcomes. Chicago: Health Administration Press; 2002.
83. Quan H, Parsons GA, Ghali WA. Validity of information on comorbidity derived from ICD-9-CCM administrative data. *Med Care.* 2002 Aug;40(8):675-85.
84. Lee DS, Donovan L, Austin PC, Gong Y, Liu PP, Rouleau JL, et al. Comparison of coding of heart failure and comorbidities in administrative and clinical data for use in outcomes research. *Med Care.* 2005 Feb;43(2):182-8.
85. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis.* 1987;40(5):373-83.
86. Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. *Med Care.* 1998 Jan;36(1):8-27.

87. Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Med Care*. 2005 Nov;43(11):1130-9.
88. World Health Organization: The International Classification of Disease 9th Revision, Clinical Modification, 4th edition. Geneva, Switzerland; 1996.
89. World Health Organization: The International statistical classification of disease and related health problems, Tenth Revision (ICD-10). Geneva, Switzerland; 1992.
90. Murray MJ. The Canadian Triage and Acuity Scale: A Canadian perspective on emergency department triage. *Emergency Medicine*. 2003;15:6-10.
91. Chen J, Ng E, Wilkins R. The health of Canada's immigrants in 1994-95. *Health Rep*. 1996 Spring;7(4):33-45, 37-50.
92. Lam SK. Aetiological factors of peptic ulcer: perspectives of epidemiological observations this century. *J Gastroenterol Hepatol*. 1994;9 Suppl 1:S93-8.
93. Swinkels H, Pottie K, Tugwell P, Rashid M, Narasiah L. Development of guidelines for recently arrived immigrants and refugees to Canada: Delphi consensus on selecting preventable and treatable conditions. *CMAJ*. 2010 Jun 28.
94. Dunn JR, Dyck I. Social determinants of health in Canada's immigrant population: results from the National Population Health Survey. *Soc Sci Med*. 2000 Dec;51(11):1573-93.

95. Hargreaves S, Friedland JS, Gothard P, Saxena S, Millington H, Eliahoo J, et al. Impact on and use of health services by international migrants: questionnaire survey of inner city London A&E attenders. *BMC Health Serv Res.* 2006;6:153.
96. Greenaway C, Dongier P, Boivin JF, Tapiero B, Miller M, Schwartzman K. Susceptibility to measles, mumps, and rubella in newly arrived adult immigrants and refugees. *Ann Intern Med.* 2007 Jan 2;146(1):20-4.
97. Smaje C, Grand JL. Ethnicity, equity and the use of health services in the British NHS. *Soc Sci Med.* 1997 Aug;45(3):485-96.
98. Hjern A, Haglund B, Persson G, Rosen M. Is there equity in access to health services for ethnic minorities in Sweden? *Eur J Public Health.* 2001 Jun;11(2):147-52.
99. Leclere FB, Jensen L, Biddlecom AE. Health care utilization, family context, and adaptation among immigrants to the United States. *J Health Soc Behav.* 1994 Dec;35(4):370-84.
100. Zimmerman M, Bornstein R, Martinsson T. Utilization of dental services in refugees in Sweden 1975-1985. *Community Dent Oral Epidemiol.* 1995 Apr;23(2):95-9.

## Appendix A. ICD-9-CM and ICD-10 Coding Scheme Derived from Charlson and Elixhauser Conditions

TABLE 1. ICD-9-CM and ICD-10 Coding Algorithms for Charlson Comorbidities

Comorbidities	Deyo's ICD-9-CM	ICD-10	Enhanced ICD-9-CM
Myocardial infarction	410.x, 412.x	I21.x, I22.x, I25.2	410.x, 412.x
Congestive heart failure	428.x	I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.5–I42.9, I43.x, I50.x, P29.0	398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 425.4–425.9, 428.x
Peripheral vascular disease	443.9, 441.x, 785.4, V43.4 Procedure 38.48	I70.x, I71.x, I73.1, I73.8, I73.9, I77.1, I79.0, I79.2, K55.1, K55.8, K55.9, Z95.8, Z95.9	093.0, 437.3, 440.x, 441.x, 443.1–443.9, 47.1, 557.1, 557.9, V43.4
Cerebrovascular disease	430.x–438.x	G45.x, G46.x, H34.0, I60.x–I69.x	362.34, 430.x–438.x
Dementia	290.x	F00.x–F03.x, F05.1, G30.x, G31.1	290.x, 294.1, 331.2
Chronic pulmonary disease	490.x–505.x, 506.4	I27.8, I27.9, J40.x–J47.x, J60.x–J67.x, J68.4, J70.1, J70.3	416.8, 416.9, 490.x–505.x, 506.4, 508.1, 508.8
Rheumatic disease	710.0, 710.1, 710.4, 714.0–714.2, 714.81, 725.x	M05.x, M06.x, M31.5, M32.x–M34.x, M35.1, M35.3, M36.0	446.5, 710.0–710.4, 714.0–714.2, 714.8, 725.x
Peptic ulcer disease	531.x–534.x	K25.x–K28.x	531.x–534.x
Mild liver disease	571.2, 571.4–571.6	B18.x, K70.0–K70.3, K70.9, K71.3–K71.5, K71.7, K73.x, K74.x, K76.0, K76.2–K76.4, K76.8, K76.9, Z94.4	070.22, 070.23, 070.32, 070.33, 070.44, 070.54, 070.6, 070.9, 570.x, 571.x, 573.3, 573.4, 573.8, 573.9, V42.7
Diabetes without chronic complication	250.0–250.3, 250.7	E10.0, E10.1, E10.6, E10.8, E10.9, E11.0, E11.1, E11.6, E11.8, E11.9, E12.0, E12.1, E12.6, E12.8, E12.9, E13.0, E13.1, E13.6, E13.8, E13.9, E14.0, E14.1, E14.6, E14.8, E14.9	250.0–250.3, 250.8, 250.9
Diabetes with chronic complication	250.4–250.6	E10.2–E10.5, E10.7, E11.2–E11.5, E11.7, E12.2–E12.5, E12.7, E13.2–E13.5, E13.7, E14.2–E14.5, E14.7	250.4–250.7
Hemiplegia or paraplegia	344.1, 342.x	G04.1, G11.4, G80.1, G80.2, G81.x, G82.x, G83.0–G83.4, G83.9	334.1, 342.x, 343.x, 344.0–344.6, 344.9
Renal disease	582.x, 583–583.7, 585.x, 586.x, 588.x	I12.0, I13.1, N03.2–N03.7, N05.2–N05.7, N18.x, N19.x, N25.0, Z49.0–Z49.2, Z94.0, Z99.2	403.01, 403.11, 403.91, 404.02, 404.03, 404.12, 404.13, 404.92, 404.93, 582.x, 583.0–583.7, 585.x, 586.x, 588.0, V42.0, V45.1, V56.x
Any malignancy, including lymphoma and leukemia, except malignant neoplasm of skin	140.x–172.x, 174.x–195.8, 200.x–208.x	C00.x–C26.x, C30.x–C34.x, C37.x–C41.x, C43.x, C45.x–C58.x, C60.x–C76.x, C81.x–C85.x, C88.x, C90.x–C97.x	140.x–172.x, 174.x–195.8, 200.x–208.x, 238.6
Moderate or severe liver disease	456.0–456.21, 572.2–572.8	I85.0, I85.9, I86.4, I98.2, K70.4, K71.1, K72.1, K72.9, K76.5, K76.6, K76.7	456.0–456.2, 572.2–572.8
Metastatic solid tumor	196.x–199.1	C77.x–C80.x	196.x–199.x
AIDS/HIV	042.x–044.x	B20.x–B22.x, B24.x	042.x–044.x

TABLE 2. ICD-9-CM and ICD-10 Coding Algorithms for Elixhauser Comorbidities

Comorbidities	Elixhauser's Original ICD-9-CM	Elixhauser AHRQ-Web ICD-9-CM	ICD-10	Enhanced ICD-9-CM
Congestive heart failure	398.91, 402.11, 402.91, 404.11, 404.13, 404.91, 404.93, 428.x	398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.x	I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.5–I42.9, I43.x, I50.x, P29.0	398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 425.4–425.9, 428.x
Cardiac arrhythmias	426.10, 426.11, 426.13, 426.2–426.53, 426.6–426.8, 427.0, 427.2, 427.31, 427.60, 427.9, 785.0, V45.0, V53.3	—	I44.1–I44.3, I45.6, I45.9, I47.x–I49.x, R00.0, R00.1, R00.8, T82.1, Z45.0, Z95.0	426.0, 426.13, 426.7, 426.9, 426.10, 426.12, 427.0–427.4, 427.6–427.9, 785.0, 996.01, 996.04, V45.0, V53.3
Valvular disease	093.2, 394.0–397.1, 424.0–424.91, 746.3–746.6, V42.2, V43.3	093.2, 394.x–397.1, 397.9, 424.x, 746.3–746.6, V42.2, V43.3	A52.0, I05.x–I08.x, I09.1, I09.8, I34.x–I39.x, Q23.0–Q23.3, Z95.2–Z95.4	093.2, 394.x–397.x, 424.x, 746.3–746.6, V42.2, V43.3
Pulmonary circulation disorders	416.x, 417.9	416.x, 417.9	I26.x, I27.x, I28.0, I28.8, I28.9	415.0, 415.1, 416.x, 417.0, 417.8, 417.9
Peripheral vascular disorders	440.x, 441.2, 441.4, 441.7, 441.9, 443.1–443.9, 447.1, 557.1, 557.9, V43.4	440.x, 441.x, 442.x, 443.1–443.9, 447.1, 557.1, 557.9, V43.4	I70.x, I71.x, I73.1, I73.8, I73.9, I77.1, I79.0, I79.2, K55.1, K55.8, K55.9, Z95.8, Z95.9	093.0, 437.3, 440.x, 441.x, 443.1–443.9, 447.1, 557.1, 557.9, V43.4
Hypertension, uncomplicated	401.1, 401.9	401.1, 401.9, 642.0	I10.x	401.x
Hypertension, complicated	402.10, 402.90, 404.10, 404.90, 405.1, 405.9	401.0, 402.x–405.x, 642.1, 642.2, 642.7, 642.9	I11.x–I13.x, I15.x	402.x–405.x
Paralysis	342.0, 342.1, 342.9–344.x	342.x–344.x, 438.2–438.5	G04.1, G11.4, G80.1, G80.2, G81.x, G82.x, G83.0–G83.4, G83.9	334.1, 342.x, 343.x, 344.0–344.6, 344.9
Other neurological disorders	331.9, 332.0, 333.4, 333.5, 334.x, 335.x, 340.x, 341.1–341.9, 345.0, 345.1, 345.4, 345.5, 345.8, 345.9, 348.1, 348.3, 780.3, 784.3	330.x–331.x, 332.0, 333.4, 333.5, 334.x–335.x, 340, 341.1–341.9, 341.9, 345.x, 347.x, 780.3, 784.3	G10.x–G13.x, G20.x–G22.x, G25.4, G25.5, G31.2, G31.8, G31.9, G32.x, G35.x–G37.x, G40.x, G41.x, G93.1, G93.4, R47.0, R56.x	331.9, 332.0, 332.1, 333.4, 333.5, 333.92, 334.x–335.x, 336.2, 340.x, 341.x, 345.x, 348.1, 348.3, 780.3, 784.3
Chronic pulmonary disease	490–492.8, 493.00–493.91, 494.x–505.x, 506.4	490x–492.x, 493.x, 494x–505.x, 506.4	I27.8, I27.9, J40.x–J47.x, J60.x–J67.x, J68.4, J70.1, J70.3	416.8, 416.9, 490.x–505.x, 506.4, 508.1, 508.8
Diabetes, uncomplicated	250.0–250.3	250.0–250.3, 648.0	E10.0, E10.1, E10.9, E11.0, E11.1, E11.9, E12.0, E12.1, E12.9, E13.0, E13.1, E13.9, E14.0, E14.1, E14.9	250.0–250.3
Diabetes, complicated	250.4–250.7, 250.9	250.4–250.9, 775.1	E10.2–E10.8, E11.2–E11.8, E12.2–E12.8, E13.2–E13.8, E14.2–E14.8	250.4–250.9
Hypothyroidism	243–244.2, 244.8, 244.9	243–244.2, 244.8, 244.9	E00.x–E03.x, E89.0	240.9, 243.x, 244.x, 246.1, 246.8
Renal failure	403.11, 403.91, 404.12, 404.92, 585.x, 586.x, V42.0, V45.1, V56.0, V56.8	403.01, 403.11, 403.91, 404.02, 404.03, 404.12, 404.13, 404.92, 404.93, 585.x, 586.x, V42.0, V45.1, V56.x	I12.0, I13.1, N18.x, N19.x, N25.0, Z49.0–Z49.2, Z94.0, Z99.2	403.01, 403.11, 403.91, 404.02, 404.03, 404.12, 404.13, 404.92, 404.93, 585.x, 586.x, 588.0, V42.0, V45.1, V56.x
Liver disease	070.32, 070.33, 070.54, 456.0, 456.1, 456.2, 571.0, 571.2–571.9, 572.3, 572.8, V42.7	070.22, 070.23, 070.32, 070.33, 070.44, 070.54, 456.0, 456.1, 456.20, 571.0, 571.2–571.9, 572.3, 572.8, V42.7	B18.x, I85.x, I86.4, I98.2, K70.x, K71.1, K71.3–K71.5, K71.7, K72.x–K74.x, K76.0, K76.2–K76.9, Z94.4	070.22, 070.23, 070.32, 070.33, 070.44, 070.54, 070.6, 070.9, 456.0–456.2, 570.x, 571.x, 572.2–572.8, 573.3, 573.4, 573.8, 573.9, V42.7

(Continued)

TABLE 2. (Continued)

Comorbidities	Elixhauser's original ICD-9-CM	Elixhauser AHRQ-Web ICD-9-CM	ICD-10	Enhanced IC-9-CM
Peptic ulcer disease excluding bleeding	531.70, 531.90, 532.70, 532.90, 533.70, 533.90, 534.70, 534.90, V12.71	531.41, 531.51, 531.61, 531.7, 531.91, 532.41, 532.51, 532.61, 532.7, 532.91, 533.41, 533.51, 533.61, 533.7, 533.91, 534.41, 534.51, 534.61, 534.7, 534.91	K25.7, K25.9, K26.7, K26.9, K27.7, K27.9, K28.7, K28.9	531.7, 531.9, 532.7, 532.9, 533.7, 533.9, 534.7, 534.9
AIDS/HIV	042.x-044.x	042.x-044.x	B20.x-B22.x, B24.x	042.x-044.x
Lymphoma	200.x-202.3x, 202.5-203.0, 203.8, 238.6, 273.3, V10.71, V10.72, V10.79	200.x-202.3, 202.5-203.0, 203.8, 238.6, 273.3	C81.x-C85.x, C88.x, C96.x, C90.0, C90.2	200.x-202.x, 203.0, 238.6
Metastatic cancer	196.x-199.x	196.x-199.x	C77.x-C80.x	196.x-199.x
Solid tumor without metastasis	140.x-172.x, 174.x, 175.x, 179.x-195.x, V10.x	140.x-172.x, 174.x, 175.x, 179.x-195.x	C00.x-C26.x, C30.x-C34.x, C37.x-C41.x, C43.x, C45.x-C58.x, C60.x-C76.x, C97.x	140.x-172.x, 174.x-195.x
Rheumatoid arthritis/collagen vascular diseases	701.0, 710.x, 714.x, 720.x, 725.x	701.0, 710.x, 714.x, 720.x, 725.x	L94.0, L94.1, L94.3, M05.x, M06.x, M08.x, M12.0, M12.3, M30.x, M31.0-M31.3, M32.x-M35.x, M45.x, M46.1, M46.8, M46.9	446.x, 701.0, 710.0-710.4, 710.8, 710.9, 711.2, 714.x, 719.3, 720.x, 725.x, 728.5, 728.89, 729.30
Coagulopathy	286.x, 287.1, 287.3-287.5	286.x, 287.1, 287.3-287.5	D65-D68.x, D69.1, D69.3-D69.6	286.x, 287.1, 287.3-287.5
Obesity	278.0	278.0	E66.x	278.0
Weight loss	260.x-263.x	260.x-263.x, 783.2	E40.x-E46.x, R63.4, R64	260.x-263.x, 783.2, 799.4
Fluid and electrolyte disorders	276.x	276.x	E22.2, E86.x, E87.x	253.6, 276.x
Blood loss anemia	280.0	280.0, 648.2	D50.0	280.0
Deficiency anemia	280.1-281.9, 285.9	280.1-281.9, 285.2, 285.9	D50.8, D50.9, D51.x-D53.x	280.1-280.9, 281.x
Alcohol abuse	291.1, 291.2, 291.5-291.9, 303.9, 305.0, V113	291.0-291.3, 291.5, 291.8, 291.9, 303.x, 305.0	F10, E52, G62.1, I42.6, K29.2, K70.0, K70.3, K70.9, T51.x, Z50.2, Z71.4, Z72.1	265.2, 291.1-291.3, 291.5-291.9, 303.0, 303.9, 305.0, 357.5, 425.5, 535.3, 571.0-571.3, 980.x, V11.3
Drug abuse	292.0, 292.82-292.89, 292.9, 304.0, 305.2-305.9	292.0, 292.82-292.89, 292.9, 304.x, 305.2-305.9, 648.3	F11.x-F16.x, F18.x, F19.x, Z71.5, Z72.2	292.x, 304.x, 305.2-305.9, V65.42
Psychoses	295.x-298.x, 299.1	295.x-298.x, 299.1	F20.x, F22.x-F25.x, F28.x, F29.x, F30.2, F31.2, F31.5	293.8, 295.x, 296.04, 296.14, 296.44, 296.54, 297.x, 298.x
Depression	300.4, 301.12, 309.0, 309.1, 311	300.4, 301.12, 309.0, 309.1, 311	F20.4, F31.3-F31.5, F32.x, F33.x, F34.1, F41.2, F43.2	296.2, 296.3, 296.5, 300.4, 309.x, 311