

**ETHNICITY AND PAIN: AN EXPLORATION OF THE EXPRESSION OF PAIN  
AMONG FOUR ETHNIC MINORITY GROUPS IN CANADA**

by

Prinon Rahman

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## **DEDICATION**

I would like to dedicate this thesis to my mother and father, Nazma Rahman and Dr. Aminur Rahman and to my mentors, Dr. Lucie Brosseau, Wilma Jelley and Gisèle Morin-Labatut.

## TABLE OF CONTENTS

LIST OF TABLES.....	v
LIST OF FIGURES .....	vi
ABSTRACT.....	vii
LIST OF ABBREVIATIONS USED .....	viii
GLOSSARY .....	ix
ACKNOWLEDGEMENTS .....	x
CHAPTER 1: INTRODUCTION.....	1
CHAPTER 2: BACKGROUND .....	3
2.1 Definition of Terms.....	3
2.1.1 Nature of Pain.....	3
2.1.2 Prevalence of Pain.....	4
2.1.3 Gender, Ethnic and Cultural Differences in Pain .....	4
2.1.4 Defining Ethnic Minority and Visible Minority Groups .....	5
2.1.5 The Study Populations and Pain Expression.....	5
2.2 Literature Review: Chronic Pain and Ethnicity.....	9
2.2.1 Introduction .....	9
2.2.2 Methods .....	9
2.2.3 Inclusion and Exclusion Criteria .....	9
2.2.4 Results.....	18
2.3 Analytical Framework.....	20
2.4 Objectives and Research Questions .....	26
2.4.1 Objectives .....	26
2.4.2 Research Questions.....	26
CHAPTER 3: METHODOLOGY.....	27
3.1 Study Design, Questionnaire and Data Collection.....	27
3.2 CCHS Sample, Power and Sample Sizes .....	27
3.3 Study Variables.....	28
3.3.1 The Dependent Variables.....	28
3.3.2 The Independent Variables .....	29
3.4 Data Analysis.....	32
CHAPTER 4: RESULTS AND ANALYSIS.....	36

4.1 Descriptive Statistics about the Four EM Groups .....	36
4.2 Clinical Factors .....	38
4.3 Psychological Characteristics.....	38
4.4 Acculturation Characteristics.....	39
4.5 Chronic Pain Prevalence among White Canadians and Four EM Groups (Objective 1) .....	40
4.6 The Differences in Pain Expression, Pain Intensity, and Activity Limitation among the Four EM Groups (Objective 2) .....	41
4.6.1 Data Quality Assurance .....	42
4.6.2 Acculturation and Chronic Pain Experience.....	43
4.7 Bio-Psychosocial Factors and Pain Experience (Objective 3) .....	44
4.7.1 Psychological Factors and Chronic Pain Experience.....	44
4.7.2 Socio-Demographic Factors and Chronic Pain.....	48
CHAPTER 5: DISCUSSION.....	56
5.1 Key Findings and Comparisons with the Extant Literature.....	56
5.1.1 Objective 1. Pain Expression among White Canadians and the Combined four EM Groups .....	56
5.1.2 Objective 2. Pain Expression Among the Four EM Study Groups in Canada .....	57
5.1.3 Objective 3. Psychological and Socio-Demographic Factors Associated with Pain among the our EM Groups.....	59
5.2 Findings in Relation to the Theoretical Framework.....	61
5.3 Strengths and Limitations of this Study .....	62
5.3.1 Strengths .....	62
5.3.2 Limitations.....	62
5.4 Implications, Conclusions and Future Research Directions .....	63
5.4.1 Implications.....	63
5.4.2 Conclusions .....	64
5.4.3 Future Research Directions.....	64
REFERENCES .....	65
APPENDICES.....	83

## LIST OF TABLES

Table 2.1 Inclusion and Exclusion Criteria.....	10
Table 2. 2 Cross-sectional Studies on Ethnic Minorities, Pain Measurement and Prevalence of Pain	11
Table 2. 3 Longitudinal Studies on Ethnic Minorities, Pain Measurements and Prevalence of Pain ...	17
Table 2. 4 The Biological, Psychological and Socio-environmental Factors Included in Previous Pain literature based on the 21 <sup>st</sup> century field framework. ....	24
Table 2. 5 The biological, psychological and socio-environmental factors included in previous pain Literature Based on the Bio-psychosocial framework.....	24
Table 3.1 Grouping of Ethnic Minorities From the Second Variable .....	31
Table 4.1 The Socio-Demographic Environmental Characteristics of the Study Sample by EM Status .....	37
Table 4.2 Clinical Factors of the Study Sample by EM status.....	38
Table 4.3 Psychological Characteristics of the Study Groups by EM Status.....	39
Table 4.4 Acculturation Factors and EM Groups.....	40
Table 4.5 EM Groups by Acculturation Levels.....	40
Table 4.6 Chronic Pain in the Four Em Groups and White Canadians .....	40
Table 4.7 Chronic Pain in the Four Ethnic Minority Groups .....	41
Table 4.8 Odds Ratio of Reporting Being Free of Pain, Pain Intensity and Activity Limitation by EM Groups and Acculturation .....	42
Table 4.9 Chronic Pain in Four EM Groups Limited to those with Chronic Conditions .....	42
Table 4.10 Acculturation and Chronic Pain, Intensity and Activity Limitation by each EM Group.....	43
Table 4.11 Odds Ratio of Chronic Pain in EM Group when Adjusted for Psychological Factors .....	45
Table 4.12 Odds Ratio of Chronic Pain in EM Group when Adjusted for Psychological Factors and Acculturation .....	46
Table 4.13 Odds Ratio of Chronic Pain in EM Group when Adjusted for all Psychological Factors ....	47
Table 4.14 Odds Ratio of Chronic Pain in EM Group when Adjusted for Socio-Demographic Factors.....	50
Table 4.15 Odds Ratio of Chronic Pain in EM Groups when Adjusted for Socio-Demographic Factors and Acculturation .....	52
Table 4.16 Odds Ratio of Chronic Pain in EM Groups when Adjusted for all Socio-Demographic Factors.....	54
Table 4.17 The Odds Ratio of Chronic Pain when adjusting for Psychological and Socio-Demographic Variables.....	55

## LIST OF FIGURES

Figure 2. 1 The Determinants of Health Realm of the 21st Century Field Framework .....	22
Figure 2. 2 The Bio-Psychosocial Approach to Chronic Conditions .....	23
Figure 2. 3 Modified Bio-Psychosocial Framework .....	25
Figure 3.1 The Pain Outcome Variable from the CCHS .....	29
Figure 3.2. The Simple Logistic Regression Models to Test the Association between Chronic Pain Expression and EM Groups .....	33
Figure 3.3. Simple Logistic Regression Models to Test the Association between High vs Low Chronic Pain Intensity and EM groups .....	34
Figure 3.4. Simple Logistic Regression Models to Test the Association between Number of Activities Affected (prevented/curtailed) due to Chronic Pain and EM groups .....	34

## ABSTRACT

**Introduction:** Approximately one in five Canadian adults suffers from chronic pain, a condition which has been associated with reduced quality of life, reduced psychological adjustment, increased disability, potential for reduced income, and high levels of healthcare utilization. A recent review of the literature has shown that the profile of pain reporting appears to be different in ethnic minority (EM) populations. As Canada increasingly becomes a multiethnic society with an influx of immigrants from non-European and non-English speaking countries, it is important for the healthcare system to consider socio-cultural factors related to diagnosis and treatment in order to optimize health outcomes. While much has been done in health and social services to accommodate the diverse needs of the Canadian population as a whole, very little research has sought specifically to investigate pain among different EM populations. Presently, it appears that no research exists investigating the experience of pain in different EM populations. This research gap may contribute to differences in pain assessment, treatment, and outcomes, contributing to perceived differences in quality of healthcare and in health status.

**Objectives:** The three objectives for this study were: 1) to report the differences in chronic pain expression between White Canadians and EM Canadians who self-reported as South Asian, Middle Eastern, East Asian, or Black Canadians; 2) to investigate whether there were differences in the prevalence of chronic pain (the primary dependent variable), pain intensity, and activity limitation (the secondary dependent variables) among Middle Eastern, South Asian, Black, and East Asian EM groups in Canada; 3) to explore the association between the bio-psychosocial risk factors (including acculturation) and chronic pain among the members of the four EM groups who reported chronic pain.

**Methods:** An exploratory secondary data analytical study was conducted using cross-sectional data from Canadian Community Health Survey (years 2007-2013). The study sample included Canadians who self-reported as Black, or with origins in South Asia, the Middle East, Africa and East Asia. Three variables related to being free of pain and discomfort were analysed. Chronic pain prevalence, pain intensity and pain interference with daily activity were described for Canadian EM and majority (non-Hispanic white) populations. Logistic regression models were used to analyse the factors associated with pain expression, intensity and interference with normal activity. To explore the association between psychological and social factors associated with chronic pain expression, the research used a bio-psychosocial framework of pain expression adapted from the Determinants of Health: The 21st Century Field Framework and the Bio-psychosocial Framework presented by Gatchel et al. 2010. These frameworks have been used in previous pain literature.

**Results:** Chronic pain was found to be reported significantly more often by White Canadians (19.3%, 95%CI: 16.9%-21.6%) compared to the combined four EM groups (13.1%, 95%CI: 10.8%-15.4%). Severe pain intensity was also reported statistically significantly more often by White Canadians (17.3%, 95%CI: 16.3%-18.1%) compared to all EM groups (13.0%, 95%CI: 10.6%-15.3%). Logistic regression revealed inter-ethnic differences in pain intensity reporting where the odds of the East Asian group experiencing 'high' pain intensity was 0.47 (95%CI: 0.31-0.69) times the odds of the Black Canadians group. Even after adjusting for the combination of psychological and socio-demographic factors from the framework, this group still had significantly reduced odds of reporting 'severe' pain intensity (OR: 0.38, 95% CI:0.22,0.64) compared to Black Canadians. Multivariable analysis found self-reported mental health, depression, anxiety, alcohol frequency, sex, age and marital status to be associated with pain expression among these four EM groups.

**Conclusion:** Understanding and accurately measuring pain in EM groups requires high levels of 'cultural competence' in healthcare professionals. When assessing chronic pain, specific attention should be given when working with highly acculturated EM groups who have immigrated and lived in Canada for more than 10 years.

## LIST OF ABBREVIATIONS USED

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<b>Abbreviation</b>	<b>Descriptions</b>
CCHS	Canadian Community Health Survey
EM	Ethnic Minority
mHAQ	The Modified Health Assessment Questionnaire
MPI	McGill Pain Intensity
MPQ	McGill Pain Questionnaire
VAS	Visual Analogue Scale
RMDQ	Rolland Morris Disability Questionnaire
StatsCan	Statistics Canada
WOMAC	The Western Ontario and McMaster Universities Arthritis Index

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## GLOSSARY

<b>Term</b>	<b>Definition</b>
<b>Acculturation</b>	The process by which the members of a culture may acquire the norms and values of another (host) culture (Berry, 1989).
<b>Chronic Pain</b>	Chronic pain, for the purposes of this study, is described as pain, or bodily hurt, that has lasted for three months or greater. Chronic pain is felt from week to week. It may be there all the time, come and go from day to day, or get worse or better based on activities. Chronic pain can have a significant negative impact on quality of life.
<b>Ethnicity</b>	An easily identifiable characteristic that implies a common cultural history with others possessing the same characteristic. The most common ethnic 'identifiers' are race, religion, country of origin, language, and/or cultural background.
<b>Pain</b>	The IASP definition of pain is: "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (IASP, 2011).

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# CHAPTER 1: INTRODUCTION

Pain often constitutes the first indication of illness and is a frequent complaint brought to the attention of healthcare professionals. Approximately 20% of Canadians report having experienced chronic pain, a condition which has been associated with reduced quality of life, reduced psychological adjustment, increased disability, potential for reduced income, and high levels of healthcare utilization (Lynch, 2011; Moulin et al., 2002; Reitsma et al., 2011).

Pain is a complex phenomenon in terms of both sensory and emotional experiences and is extremely variable even among homogenous populations. In 1969, anthropologist Mark Zborowski, who studied pain expression in first and second generation Americans of Jewish, Italian and Irish descent, and third and fourth generation White American Protestants, put forward the idea that pain is not only a neurological or physiological experience but it is also a cultural and social one. Zborowski found that each ethnic group had patterns of attitudes and reactions to pain that were particular to that group. A large body of pain literature suggests that diverse biological, psychological and socio-cultural factors are associated with racial and ethnic disparities in pain prevalence and reporting (Campbell et al. 2005, 2008; Edwards et al. 2001; Green et al. 2003; Rahim Williams et al. 2007; Moore & Brodsgard 1999).

This literature is complemented by research, primarily from the USA, that examines the prevalence of pain amongst different ethnic groups. The majority of these studies have considered African-American and Hispanic populations (Carey et al., 2010; Carlisle, 2014; Drwecki, Moore, Ward, & Prkachin, 2011; Meghani & Cho, 2009b; Portenoy, Ugarte, Fuller, & Haas, 2004). My own literature review revealed that both African-Americans and Hispanics reported a greater burden of pain and pain-related suffering compared to non-Hispanic Whites (Green et al., 2003; Green & Hart-Johnson, 2010; Nguyen et al., 2005; Parmelee et al., 2012; Portenoy, et al., 2004). Three population studies in the UK suggested differences in pain prevalence among South Asian immigrant men and women and the general UK population (Ezenwa et al., 2006; Fortier et al., 2009).

There is also clinical evidence suggesting that African Americans have greater pain sensitivity. For example, one systematic review investigating ethnic group differences in pain experience found consistent evidence indicating that African American populations demonstrate lower pain tolerance, higher pain rating and lower pain threshold than non-Hispanic White Americans (Rahim-Williams et al., 2012). The differences in pain reporting have been attributed to the rare *allele* gene OPRM1 A118G SNP which is substantially less frequent in African Americans and has been associated with reduced pain sensitivity (Rahim-Williams et al., 2012). In spite of this evidence of important cultural differences in pain experience from studies in the USA, it appears that no published studies have examined pain prevalence among or between Canadian ethnic groups.

## Research Rationale

To develop good healthcare policies and guidelines for chronic pain in Canada, studies of pain expression<sup>1</sup> in Canadian ethnic minority groups are sorely needed. There is strong clinical evidence to suggest that race/ethnicity contributes significantly to variability in pain response across most pain stimulus modalities (Campbell et al., 2008; Chan et al., 2013; Edwards & Fillingim, 1999; Hastie et al., 2012; Rahim-Williams et al., 2012). The present study investigated the prevalence of pain among four Canadian ethnic minority groups to determine whether statistically significant differences in pain expression and pain severity exist. There is also a need to identify and understand the relevant factors that are associated with pain expression by Canadian ethnic minority groups. I examined pain expression using a bio-psychosocial framework, that suggests that the experience of pain is shaped by interactions among psychological and social variables, and that all of these factors vary with an individual's ethnic status. Biological variables were considered only for data quality assurance. I also included an acculturation scale using two variables: 1) languages most often spoken at home, and 2) time spent in Canada. While other studies have adjusted for certain variables related to acculturation (e.g. immigrant status), most have not considered acculturation in when investigating differences in pain expression among ethnic minority groups. My thesis research, however, included acculturation in the bio-psychosocial framework and tested whether acculturation was statistically significantly associated with pain expression among ethnic minority groups. To provide optimal treatment to an ethnically diverse population, healthcare practitioners need to understand the bio-psychosocial factors associated with pain expression among ethnic minority groups. Presently there is no published literature that examines the reporting of different levels of pain (pain intensity) and the bio-psychosocial factors associated with it, for Canadian ethnic minority groups. In this study, sample data from the four largest Canadian ethnic minority groups – African Canadians, South Asian Canadians, Middle Eastern Canadians and East Asians Canadians – were analysed in an effort to address the research gap on the relationships between 1) pain expression, pain intensity, daily activity limitation due to pain, and ethnic minority status, and the 2) factors contributing to reporting differences across ethnic minority groups.

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<sup>1</sup> Throughout this document, the term 'pain expression' has been used, as it has a more general connotation than the narrower concept of 'pain reporting'.

## **CHAPTER 2: BACKGROUND**

This chapter will provide working definitions for pain and ethnic minority status, and a description of the study populations. It will also describe the two theoretical frameworks that were combined to create an 'Adjusted Bio-psychosocial Framework of Pain Expression' for the research. This framework was used to determine the variables needed for the analysis of pain expression and prevalence among the four ethnic minority groups. The section will then present a literature-based discussion of the prevalence, economic burden and psychological, cognitive and behavioural aspects of pain, followed by a rationale for the choice of the four ethnic minority groups. It will conclude with a discussion of how gender, ethnicity and culture may influence pain prevalence.

### **2.1 Definition of Terms**

#### **2.1.1 Nature of Pain**

Pain is a complex and multi-dimensional experience (Goulet et al., 2013). The International Association for the Study of Pain (IASP) has defined it as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (Merskey & Bogduk, 1994). Furthermore, pain is considered to be subjective because each individual learns how to express it through personality, cultural variations and previous experiences related to injuries that occurred earlier in life (Merskey & Bogduk, 1994).

According to the literature, a number of mechanisms influence our experience of pain. One of the mechanisms of pain experience is known as ‘nociception’ – the neural process of encoding and processing a noxious stimulus. This afferent activity occurs in the peripheral and central nervous system when a stimulus has the potential to damage tissue (Green & Hart-Johnson, 2010; Greenwald, 1991). When mechanical or chemical change above a certain threshold is detected, nociceptors are initiated, which then trigger a variety of automatic responses and may result in the experience of pain (Green & Hart-Johnson, 2010; Greenwald, 1991). However, McMahon and Koltzenburg (2006) specify that our experience of pain “depends on a host of variables, including the presence of other somatic stimuli and psychological factors such as arousal, attention and expectation. These psychological factors in turn are influenced by contextual cues that establish the significance of the stimulus and help determine appropriate responses to it.” (p.125).

## 2.1.2 Prevalence of Pain

### Prevalence and Burden of Non-specific Chronic Pain

The point prevalence of non-specific chronic pain in the Canadian general population is estimated to range from 11% to 44% (C. L. Edwards et al., 2001; R. R. Edwards & Fillingim, 1999; R. R. Edwards et al., 2001; R. R. Edwards et al., 2005b; Forsythe, et al., 2011). A recent study by Reitsma et al. (2011) examined the data from seven cross-sectional cycles of the household component of the National Population Health Survey (NPHS) (1994/95, 1996/97 and 1998/99) and the Canadian Community Health Survey (CCHS) (2000/01, 2003, 2005 and 2007/08). Reitsma et al. found that chronic pain prevalence in the Canadian population varies between 15% and 19% (Reitsma, Tranmer, Buchanan, & Vandenberg, 2011). Chronic pain was found to be more prevalent among Canadian women (16.5% to 21.5%) than men (13.6% to 16.2%), and among the older (65+ years) population (23.9% to 31.3%) than those 25 to 39 years of age (14.0% to 27.0%) (Reitsma et al., 2011). Furthermore, 11.4% to 13.3% of those reporting chronic pain also reported that the pain prevented them from taking part in at least a few activities (Reitsma et al., 2011).

Pain is very costly to the Canadian healthcare system. According to Lynch (2011), “chronic pain costs more than cancer, heart disease and HIV combined” (p.79). In 2010, the Chronic Pain Association of Canada reported that “the annual cost of chronic pain, including medical expenses, lost income, and lost productivity, but not the social costs, is estimated to exceed \$10 billion” (p.157).

To summarize, the prevalence of chronic pain in Canada is high and is placing a significant burden on Canadian healthcare system.

In the present study, the prevalence of pain was examined based on self-report to a question about pain from the CCHS questionnaire. The prevalence of pain was investigated from a combined sample of the four ethnic minority study groups over the last seven years (2007, 2009/2010, 2011/2012 and 2013) of the CCHS. The prevalence of pain reflects a negative response to the question “are you usually free of pain and discomfort?”

### 2.1.3 Gender, Ethnic and Cultural Differences in Pain

A substantial amount of literature has highlighted gender differences in chronic pain prevalence. Females are more likely to report chronic pain compared to males (Magnusson & Fennell, 2011; Reitsma et al., 2011). Ethnic background and culture play an important role in determining how pain is perceived, if and how a person will communicate pain to others, and how the person acts or responds to pain experience. The first important source of learning is the family, in that pain behaviours are initially learned by observing other family members’ ways of reporting and expressing pain (Sullivan et al., 2004). It is therefore from a person’s ethnic background and culture that they will learn whether

their reaction and responses to pain are appropriate and under what circumstances it is appropriate to report or express pain.

## 2.1.4 Defining Ethnic Minority and Visible Minority Groups

Ethnic minority status is defined by Eaton (1986) as: “An easily identifiable characteristic that implies a common cultural history with others possessing the same characteristic. The most common ethnic ‘identifiers’ are race, religion, country of origin, language, and/or cultural background.” (p.160). The term “ethnic minorities” in this study refers to both immigrants and established racial/ethnic minorities in Canada.

The Canadian *Employment Equity Act* defines visible minorities as individuals (other than Aboriginals) who are non-Caucasian in race or non-White in colour. The visible minority populations in Canada consist mainly of South Asians, Chinese, Blacks (of various geographical origins), Filipinos, Latin Americans, Arabs, Southeast Asians, West Asians, Koreans, and Japanese (Statistics Canada, 2011).

According to Statistics Canada’s *National Household Survey*, Canada is reported to have the highest proportion of foreign-born individuals among the G8 countries. In 2011, 20.6% of the total population was represented by immigrants. South Asian, East Asian, Middle Eastern, and African (or Black) Canadians were the largest ethnic minority groups, accounting for 61.3% of all ethnic minority groups in Canada (Statistics Canada, 2011).

For the purpose of this document, the term “ethnic minority” or “EM” is defined by the race and ethnicity of the target population (South Asian, East Asian, Middle Eastern, and African (Black) Canadians). However, when citing supporting literature, the terminology used in the cited source is preserved.

## 2.1.5 The Study Populations and Pain Expression

Self-ascribed ethnicity from the CCHS was used to classify the participants into four EM categories.

### Black Canadians

People of African origin make up one of the largest non-European ethnic groups in Canada (Statistics Canada, 2011). This category includes people claiming different ethnic origins. In 2001, approximately half (51%)<sup>2</sup> of the population with origins in Africa self-identified as either Black or simply African, while others were more specific: 11% reported their ethnicity as Somali, 6% as South African, 6% as Ghanaian and 5% as Ethiopian (Statistics Canada, 2011). For the purpose of this

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<sup>2</sup> The majority (51%) have self-identified as *Black* or *African* and the remaining 21% identified as having multiple ethnic roots.

study, this population will be referred to as Black Canadians (or simply Black), in keeping with CCHS terminology.

The 2001 Census reported a total of 662,200 Black Canadians, who represented approximately 2% of the population; in the 2011 Census the number was 945,700. Black Canadians currently constitute the third largest visible minority group; they make up 15.1% of the total visible minority population and 3% of the total Canadian population. This group is growing faster than the overall population. For example, between 1996 and 2001, the number of individuals identifying themselves as Black grew by 32%, compared to 10% for the overall population (Milan & Tran, 2004).

Presently, no known studies have been conducted on the prevalence of chronic pain among Black Canadians. However, quite a few studies in the USA have found the disparity in pain prevalence and ethnicity in African Americans and Hispanics receiving care. The literature suggests that African Americans with chronic pain report higher levels of pain severity and disability due to pain than non-Hispanic Whites with chronic pain (Carey et al., 2010; Green et al., 2003; Green & Hart-Johnson, 2010; Tan et al., 2005).

### **South Asian Canadians**

South Asians currently constitute the largest visible minority group in Canada, the province of Ontario being one of the top locations of residence for this community (Statistics Canada, 2011). According to Statistics Canada, Canadians of South Asian origin include a number of different ethnic or cultural origins. In the 2001 Census, 74% of South Asians self-defined as East Indian and the rest identified with various ethnic roots such as Pakistani, Sri Lankan, Punjabi, and Tamil (Statistics Canada, 2011).

Results from several population-based studies conducted in the United Kingdom report higher prevalence of pain in “most joints” amongst South Asians than Europeans (Allison et al., 2002; Palmer et al., 2007). Furthermore, the prevalence of widespread pain was also greater in the South Asian populations compared to Europeans (Ezenwa et al., 2006). This study also noted that differences in pain reporting also existed within the South Asian populations. The authors identified acculturation as a factor which may explain the differences in pain reporting among immigrants (Ezenwa et al., 2006; Fortier et al., 2009).

To date, there have been no studies on pain expression by South Asian Canadians. Investigating the prevalence and contributing factors of pain among South Asians living in Canada would contribute to understanding how bio-psychosocial factors explain the differences in chronic pain experience.



## **East Asian Canadians**

In 2006, there were approximately 1.2 million residents of Chinese ethnicity in Canada and 74.5% of those were first generation, i.e. foreign-born (Statistics Canada, 2011). First generation East Asians come primarily from the Peoples' Republic of China (52.9%) Hong Kong (24.2 %), Taiwan (7.4%) and Viet Nam (5.7%) (Statistics Canada, 2011). The East Asian population in Canada continues to grow at a fast pace when compared to the general population. Between 1996 and 2001 the number of people who identified as Chinese rose by 19%, compared to the general population which rose only by 4% (Statistics Canada, 2011).

Historically, the Chinese culture has been influenced by Buddhism, Confucianism and Taoism, all of which encourage tolerance of pain (Lavernia et al., 2011). According to Chin (2005), Chinese may be more emotionally stoic and therefore more likely to report less pain compared to North Americans of European extraction (Chin, 2005). However, very little is known about pain expression among the East Asian population (Lavernia et al., 2012). Therefore, an important area of study is to investigate whether there is a difference in the prevalence of pain expression among East Asians compared to other minority populations.

## **Middle Eastern Canadians**

Canadians of Middle-Eastern origin come from virtually every country of the region – Bahrain, Cyprus, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Northern Cyprus, Oman, Palestine, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates, and Yemen. For this research, individuals tracing their origins to North Africa have also been included in this category. They may be ethnically Arab, Berber, Israeli, Kurdish, Persian, or other. The 2011 Census reported approximately 381,000 people of Middle Eastern origin living in Canada, representing roughly 1.5% of the total Canadian population. Very few studies have explored pain prevalence or expression within this demographic. One report investigating the provision of healthcare to Middle Eastern patients suggested that pain responses are considered to be private and reserved for immediate family, and not even shared with health professionals; these authors reported that there may often be conflicting perceptions between the family members and nurses regarding the effectiveness of the client's pain relief (Sibberman, 2012).

To conclude, more studies are needed to understand the prevalence of pain and contributing factors in different ethnic populations. This study seeks to help further our knowledge of differences in the prevalence of pain expression among EM groups in Canada as well as the factors associated with these differences. It is my hope that the results will further health professionals' understanding of differences in pain expression, and thus support their efforts to provide optimal healthcare services to these populations.

Blacks, South Asians, Middle Easterners, and East Asians were chosen as the focus of this present research as they constitute the four largest ethnic minorities in Canada and have received very little attention in pain research.

## 2.2 Literature Review: Chronic Pain and Ethnicity

### 2.2.1 Introduction

The main objective of this review was to explore the existing literature about the relationships between EM status and pain expression/perception. The research sought to examine the findings according to: study design, how pain expression was measured, and what biological, psychological and socio-demographic factors had been included in exploring these pain characteristics.

### 2.2.2 Methods

A search strategy was developed to investigate the research evidence available about chronic pain expression among ethnic minorities. The relevant literature was examined; the flow of studies is reported using the PRISMA flow chart (see Appendix A). I conducted the literature search in October 2014 in the PubMed database. The following free text word and terms were used.

**Search 1:** (epidemiology) AND pain[TW] AND ethnicity[TW]

**Search 2:** Search pain experience[tw] OR pain perception[tw] AND (((((((("ethnic groups"[MeSH Terms] OR ("ethnic"[All Fields] AND "groups"[All Fields]) OR "ethnic groups"[All Fields] OR "ethnic"[All Fields])) OR ethnicity[tiab]) OR "Minority Health"[Mesh]) OR racial group\*[tw]) OR minority group\*[tw]) OR minority health[tw]))

**Search 3:** Search (((("Epidemiologic Studies"[Mesh]) OR prevalence)) AND (((((((("ethnic groups"[MeSH Terms] OR ("ethnic"[All Fields] AND "groups"[All Fields]) OR "ethnic groups"[All Fields] OR "ethnic"[All Fields])) OR ethnicity[tiab]) OR "Minority Health"[Mesh]) OR racial group\*[tw]) OR minority group\*[tw]) OR minority health[tw])) AND (((("pain"[MeSH Terms] OR "pain"[All Fields])) OR "Pain Perception"[Mesh]))

In addition, I searched the reference lists of all included studies for additional potentially relevant papers.

### 2.2.3 Inclusion and Exclusion Criteria

The titles and abstracts of identified articles were screened based on the inclusion and exclusion criteria (Table 2.1) and an article was included for further assessment if it met all of the selection criteria. I included recent relevant studies published in English between January 1990 and October 2014. The target population included adults 18 years of age or older who experienced chronic pain (i.e., pain experienced for more than three or six months) as the outcome. The selected articles included direct comparisons between samples from at least two different EM groups. This literature

review excluded narrative reviews, case reports, studies describing surgical, post-surgical and labour pain, as well as studies written in a language other than English.

**Table 2.1 Inclusion and Exclusion Criteria**

<b>Inclusion Criteria</b>	<b>Exclusion Criteria</b>
Articles written in English	Articles written in languages other than English
Articles published between January 1 <sup>st</sup> 1990 and December 31 2014 (in order to obtain substantial manageable amount of up to date relevant literature)	Articles published prior to January 1 <sup>st</sup> 1990
Target population greater than 18 years	Articles assessing pain in pediatrics
Chronic pain measured (cross-sectionally or longitudinally)	Acute pain, surgical pain, post-surgical pain and labour pain
	Articles in which pain was not assessed
Articles featuring a comparison between ethnic/racial populations	
	Articles looking at non-ethnic populations

**Table 2.2 Cross-sectional Studies on Ethnic Minorities, Pain Measurement and Prevalence of Pain**

Authors, Date (country)	Study Purpose	Study Design (N)	Study Population	How are pain and disability measured?	Is there a difference among ethnic groups?	Bio-psychosocial factors associated with pain <sup>3</sup>
Allison et al., 2002 (UK)	To assess the prevalence of musculoskeletal symptoms among the major ethnic populations of Greater Manchester.	Cross-Sectional Study (N=2117)	South Asian (n=477) African Caribbean (n=145) White (n=912)	The presence of pain in most joints; physical function measured by the mHAQ.	The adjusted OR with 95% CI for "pain in most joints" was higher than 1 in all ethnic groups and statistically significant compared to the White populations and ranged from 2.2 (95% CI: 1.8-2.6) for African Caribbean's to 5.1 (95% CI: 4.6-5.6) for Pakistanis.	Age, Gender, Area of residence.
Ang DC et al., 2003 (USA)	To determine if there is a difference in the perception of pain and functional disability between African Americans and Whites at any given radiographic severity of osteoarthritis (OA).	Cross-Sectional Study (N=596)	African Americans (n=262) Whites (n=334)	<b>WOMAC</b> - Index of pain and functional limitations, primary outcome of interest is pain.	African Americans and Whites were not different in mean scores for WOMAC-pain $\pm$ SD (46.75 $\pm$ 18.49 vs 45.87 $\pm$ 18.13) and WOMAC function (49.23 $\pm$ 19.23 vs 47.82 $\pm$ 19.98). After controlling for important covariates, ethnicity was not a significant predictor of WOMAC pain and function.	Age, Income, Education, Employment status, Marital status, Depression.
Carey TS et al., 2010 (USA)	To determine whether prevalence of pain and care use varied by patient race or ethnicity.	Cross-Sectional Study N=837	Latinos (n=34) Blacks (n=183) Whites (n=620)	RMDQ Scale 0 to 10 scale.	Blacks and Latinos reported higher RMDQ pain intensity in the previous 3 months at 7.7 (95% CI: 7.5-8.0) and 7.9 (95% CI: 7.2-8.6) respectively compared to the White population 6.3 (95% CI: 6.1-6.5). The difference was found to be statistically significant.	Education, Income, Employment, Insurance.
Carlisle et al., 2013 (USA)	To examine the ethnic subgroup variation in chronic health by comparing	Cross-sectional study N=5006	Asian-Americans (n=1628)	Pain was measured based on the presence of	Among those reporting chronic pain conditions, Asian Americans and Latino Americans had significant	Gender, Age, Household income, Education,

<sup>3</sup> Biological, psychological and socio-demographic factors associated with chronic pain cited from the literature.

	self-reports of chronic conditions across diverse ethnic subgroups.		Latino-American (n=1940)  African-Americans (n=1438)	pain conditions such as back pain, headache, arthritis, and ulcer.	differences by ethnic subgroups <sup>4</sup> . Among Asian Americans, Filipinos reported the highest level (45.3%), followed by Chinese (37.4%) and Vietnamese (32.2%), $X^2 (2, n = 1627) 5.3, p \leq 0.001$ . Finally, significant differences in reports of chronic pain conditions by ethnic subgroup emerged for Latino American respondents: 48% of Puerto Ricans, 47% of Cubans, and 36.4% of Mexicans, $X^2 (2, n=1937) 7.8, p \leq 0.001$ .	Marital status.
Edwards RR et al., 2005 (USA)	To examine the effects of ethnicity (African American vs. White) on experimental pain tolerance and adjustment to chronic pain.	Cross-sectional Study N= 291	African Americans (n=97) Hispanics (n=97) Whites (n=97)	Pain Measures: MPQ scores, MPI Pain Severity scores and VAS ratings of pain intensity	After matching the three groups to reduce potential confounding variables, there was no difference in mean pain severity $\pm$ SD: African Americans (5.0 $\pm$ 0.9) Hispanics (4.9 $\pm$ 1.1), Whites (4.8 $\pm$ 1.0) or pain intensity; African Americans (5.0 $\pm$ 0.9), Hispanic (4.9 $\pm$ 1.1) and White (4.8 $\pm$ 1.0).	Age, Gender, Education, Work status.
Green et al., 2003 (USA)	To address the potential differential effects of chronic pain cross-culturally in younger Americans. A retrospective analysis of persons younger than 50 years of age presenting for chronic pain management in a multidisciplinary pain centre was done.	Cross-sectional Study N=3669	Black Americans (n=353)  White Americans (n=3316)	MPQ Psychosocial factors such as pain severity, mood and coping were assessed by using items from the MPI via a 7-point Likert scale (pain: 0, no pain; 6, excruciating pain; mood: 0, extremely low; 6, extremely high; coping: 0, not at all successful; 6, extremely successful)	Black Americans reported significantly higher pain $\pm$ SD (3.3 $\pm$ 1.4 vs 2.5 $\pm$ 1.3; $P < .001$ ), level of suffering (5.1 $\pm$ 1.0 vs 4.5 $\pm$ 1.2; $P < .001$ ), and less control of their pain (1.3 $\pm$ 1.7 vs 1.5 $\pm$ 1.5; $P < .001$ ) than White Americans on a 7-point Likert scale. The Black Americans also had higher MPQ scores compared to White Americans (34.0 $\pm$ 13.2 vs 31.2 $\pm$ 3.0; $P < .001$ ) regardless of gender.	Gender, Marital status, Education, Alcohol use.

<sup>4</sup> The differences in weighted prevalence of chronic pain by race and ethnicity.

Green CR et al., 2010 (USA)	To examine Black (6.2%) and White (93.8%) men presenting for initial assessment at a tertiary care pain centre. Racial comparisons utilized analysis of variance.	Cross-sectional Study N = 1650	Black American men (n=103)  White American men (n=1547)	MPQ	Results found Black men with chronic pain to be at risk for more severe pain (Mean $\pm$ SD = 29.3 $\pm$ 13.6) and worse outcomes (including more depressive symptoms, affective distress, PTSD, and disability) when compared to White men with chronic pain (26.4 $\pm$ 12.1).	Race, Age, Median income, Education, Health behaviours.
Hernandez et al., 2006 (USA)	To examine ethnic differences in pain reports between Hispanics and Caucasians with serious health problems.	Cross-Sectional study N=1455	Whites (n=1308)  Hispanics (n=147)	How much pain they experience because of their health problems. 4- Point Likert scale: 1: A lot 4: none at all	Ethnicity found to be related to pain reports. Hispanics reported more pain than Whites ( $F(1, 1450)=5.28$ , $p=0.02$ , ( $\eta^2$ )=0.06).	Age, Gender, Income, Ethnicity, Depression.
Meghani SH et al., 2009 (USA)	To investigate differences in reported pain and pain treatment utilization (use of over-the-counter and prescription pain medications, seeing a pain specialist, and use of complementary and alternative medicine) among minorities and non-minorities in the general population.	Cross-Sectional study N= 902	Whites (n=746)  Blacks (n=71)  Hispanics (n=44)  Others (n=41)	Questionnaires to measure pain presence, pain severity (0: no pain; 10: unbearable pain). Diagnosis of chronic pain.	Minorities reported higher pain severity than non-minorities. Minorities had daily pain that averaged 0.784 points higher than Whites ( $p<.01$ ) <sup>5</sup> .	Age, Gender, Education, Income.

<sup>5</sup> A multivariable analysis was conducted to examine the relationships between race/ethnicity and pain characteristics (pain severity and diagnosis of chronic pain).

Nguyen et al., 2005 (USA)	To evaluate the influence of race and ethnicity on access to treatment for chronic pain among subjects experiencing pain for 3 or more months.	Cross-sectional telephone survey and analysis N=1335	Africans Americans (n=447)  Hispanics (n=434)  Whites (n=454)	Pain was measured on a Likert scale. 0-10 0: no pain 10: the worst pain	African Americans (4.9±3.8) and Hispanics (4.8±3.8) were less likely to report that pain prevented them from living life to the fullest compared to Whites (5.2±3.6) <sup>6</sup> .	Gender, Age, Marital Status, Community, Status, Employment status, Education level, Income, Language, Insurance.
Palmer et al., 2007 (UK)	To investigate the extent to which differences in the prevalence of musculoskeletal pain within the South Asian population could be explained by differences in acculturation.	Cross-sectional analysis N=2998	European (n=933)  Indian (n=1165)  Pakistani (n=401)  Bangladeshi (n=348)	Pain severity was measured on a Likert scale. 0-10 0: no pain 10: the worst pain	Age and gender-adjusted widespread pain prevalence in South Asians is almost 4 times greater (OR 3.7, 95% CI 2.9-4.9) than widespread pain prevalence in Europeans. Within South Asian subgroups, median severity scores ranged from 5 (IQR 4-7) in Gujarati Africans to 8 (IQR 6-9) in Gujarati (P=0.0007)	Gender, Age, Acculturation.
Parmelee PA et al., 2012 (USA)	To conduct a cross-sectional study on how race and sex affect associations among osteoarthritis (OA) pain, disability, and depression in older adults with diagnosed knee OA.	Cross-sectional Study N=363)	Blacks (n=94)  Whites (n=269)	Pain was assessed with the 6-item Philadelphia Geriatric Center (PGC) Pain Scale	African Americans reported greater disability (F(1, 359) = 3.49, p < .062) <sup>7</sup> and marginally greater pain than non-Hispanic Whites.	Age, Gender, Education, Depression.
Plesh O et al., 2011 (USA)	To compare the prevalence of self-reported temporomandibular joint and muscle disorders (TMJMD)-type pain, headaches, and neck and back pains in the 2000 to 2005 USA National Health Interview	Cross-Sectional Study N= 189, 992	Whites (n=138 694)  Hispanic (n=22 799)  Blacks (n=20 899)  Other (n=7 599)	Participants were asked "during the past three months did you have low back pain?" and to respond with "yes" or "no".	White adults (16.0%) were more likely to report neck pain than Hispanic (12.8%, OR 0.77, p<0.001) and Black adults (11.5%; OR 0.68, p<0.001). White adults (29.5%) were more likely to report low back pain than Hispanic (24.4%; OR 0.77, p<0.001) and Black adults (24.6%; OR 0.78, p<0.001).	Age.

<sup>6</sup> Mean pain intensity± SD

<sup>7</sup> Mean pain intensity± SD



	Survey (NHIS) by gender and age for non-Hispanic Whites (Whites), Hispanics, and non-Hispanic Blacks (Blacks).					
Portenoy RK et al., 2004 (USA)	To explore relationships between chronic pain and race or ethnicity.	Cross-sectional survey and studies N= 1335	Whites (n=454)  Blacks (n=447)  Hispanics (n=434)	Pain severity was assessed by using 0- to 10-point scales, where 0 was defined as “no pain” and 10 was defined as “the worst you can imagine”. Respondents were asked to rate pain severity “on average during the past week” and “at its worst during the past week”.	On the 0- to 10-point pain severity scale, White subjects reported significantly lower severity of pain “on average during the past week” than African American (mean± SD: 5.6±2.3 vs 6.1±2.7; $P<.01$ ) or Hispanic (5.6±2.3 vs 6.4±2.5; $P<.001$ ) subjects. Mean±SD severity of worst pain was 7.6±2.6 and did not vary by group.	Gender, Age, Marital Status, Community residence, Employment status, Education level, Income, Language spoken at home.
Riskowski JL et al., 2014 (USA)	To describe and evaluate prevalence and distribution of pain in the United States.	Cross-sectional study N=8270	Blacks (n=1662)  Hispanics (n=1604)  Whites (n=4730)  Other (n=273)	NHANES pain questionnaire “During the past three months did you have low back pain?”	Non-Hispanic White people had higher chronic pain (75.5%, 95% CI: 69.2%-81.8%) experience than Blacks (10.5%, 95% CI: 6.9%-14.0%) and Hispanics (10.0%, 95%: 6.4%-13.5%).	Age, Gender, Marital status, Education, Employment, Health insurance, Government sponsored, Alcohol intake, Smoker.
Stanaway FF et al., 2011 (Australia)	To investigate differences in back pain characteristics, effects and medication use in a population-based sample of Italian-born immigrants and Australian-born	Cross-Sectional study N= 1184	Italian born immigrants (n=335)  Australian born (n=849)	Questions on back pain was taken from the MrOS study. All men were asked if they had experienced any back pain in the last 12 months.	Italian-born men were significantly more likely to report that their back pain was present all or most of the time ( $p = 0.002$ ) and that it was moderate or severe ( $p < 0.001$ ). They were also significantly more likely to have chronic back pain ( $p = 0.020$ ) and to report that they had limited	Age, Marital status, Education level, Occupation history, Income, Housing status, Number of co-morbidities, Years lived in Australia,

	men aged 70 years and over.				their activities because of back pain in the last 12 months ( $p = 0.001$ ).	Language spoken at home.
Tan G et al., 2005., (USA)	To identify similarities and differences among non-Hispanic Black and White patients in pain appraisal, beliefs about pain, and ways of coping with pain. The study also examined the association between these factors (i.e., appraisals, beliefs, coping) and patient perception or subjective experience of their functioning in each ethnic group.	Cross-sectional Analysis N=482	Non-Hispanic Blacks (n=128)  Non-Hispanic Whites (n=354)	Pain prevalence was measured from the pain self-efficacy (PSE) scale and pain prevalence was measured from multi-dimensional pain inventory (MPI).	Pain severity was higher in Black patients ( $5.34 \pm 0.73$ ) compared to White patients ( $5.01 \pm 0.91$ ). Black patients reported lower perceived control over pain, more external pain-coping strategies and a stronger belief that others should be solicitous when they experience pain.	Gender, Education, Marital status, Perceived disability.

Notes. OR= odds ratio; CI= confidence interval; SD= standard deviation; WOMAC= The Western Ontario and McMaster Universities Arthritis Index; mHAQ= the Modified Health Assessment Questionnaire; RMDQ= Rolland Morris Disability Questionnaire; MPQ= McGill Pain Questionnaire; MPI= McGill Pain Intensity scale; VAS= visual analogue scale; IQR= inter-quartile range; MrOS= The Osteoporotic Fractures in Men Study;  $X^2$ = chi square test for categorical variables.

**Table 2.3 Longitudinal Studies on Ethnic Minorities, Pain Measurements and Prevalence of Pain**

Authors, Date (country)	Study Purpose	Study Design(N)	Study Population	How is pain measured? (pain measurements)	Is there a difference among ethnic groups?	The bio-psychosocial factors associated with chronic pain
Bates MS, 1993 (USA)	To understand how ethnicity affects the chronic pain experience. This was a quantitative study of 372 chronic pain patients in six ethnic groups under treatment at a multidisciplinary pain management centre in New England.	Longitudinal Analysis N=372	Hispanics (n=44) Italians (n=50) Irish (n=60) French-Canadians (n= 90) Polish (n=20) Old Americans (n=100)	Questionnaires and standardized instruments for assessing pain intensity and whether ethnic background was significantly related to interethnic or intra-ethnic group variation in pain intensity and response.	There was a statistically significant intergroup difference in pain intensity by ethnic identity. Hispanics reported higher pain intensity (40±13.5) compared to all the other groups and Polish and French Canadians reported lower mean pain intensity ± SD compared to all the other groups at 29±11.7 and 29.3 ± 14.1, respectively.	Medical, socio-demographic, psychological variables.
Laguna et al., 2014 (USA)	To investigate racial and ethnic differences in pain after an IPC intervention in 385 seriously ill White, Black, and Latino individuals aged 65 and older.	Longitudinal Analysis N=385	Whites (n=179)  Blacks (n=96)  Latinos (n=110)	Using the 11-point Number Rating Scale, the IPC nurse collected pain data before the consultation (baseline), 2 and 24 hours after consultation, and at hospital discharge.	Latinos were found to be 62% less likely than Whites (RR = 0.38, 95% CI: 0.15–0.97) to report experiencing pain at hospital discharge. In addition, those with higher baseline pain intensity were more likely to report experiencing pain at hospital discharge (RR = 0.64, 95% CI: 0.55–0.74).	Gender, Marital status.

Notes. RR= relative risk; CI= confidence interval; SD= standard deviation; IPC= Inpatient Palliative Care.

## **2.2.4 Results**

### **Types of Studies**

A total of nineteen relevant studies were identified (see Table 2.2 & Table 2.3); all included studies were conducted in the United Kingdom, Australia, and the United States. Seventeen studies were cross-sectional (see Table 2.2) (Allison et al., 2002; Ang et al., 2003; Carey et al., 2010; Carlisle, 2014; Chan et al., 2011; R. R. Edwards et al., 2005a; Green et al., 2003; Green & Hart-Johnson, 2010; Hernandez & Sachs-Ericsson, 2006; Meghani & Cho, 2009c; Nguyen et al., 2005; Palmer et al., 2007; Parmelee et al., 2012; Plesh et al., 2011; Portenoy et al., 2004; Riskowski, 2014; Stanaway et al., 2011) and two were longitudinal follow-up studies (Bates & Edwards, 1992; Laguna et al., 2014) (see Table 2.3).

### **Literature Review Findings**

#### ***Pain Expression/Perception Measurement***

The measurement of pain expression varied across included studies. One study (Allison et al., 2002) used the Multiple Health Assessment Questionnaire (MHAQ), one used the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain scale, and the Roland Disability Score was used in one study (Ang et al., 2003). The McGill Pain Questionnaire (MPQ), the McGill Pain Index and Visual Analogous Scale (VAS) were used in four of the included studies (Edwards et al., 2005; Green et al., 2003; Green & Hart-Johnson, 2010; Tan et al., 2005). The remaining 13 articles included questionnaires with Likert scales to explore pain expression/perception.

#### ***EM Status Considered in the Literature***

Six studies included the differences in pain expression between Non-Hispanic Black and Non-Hispanic White populations. Seven studies compared the three biggest EM populations (Hispanics, Blacks, and Non-Hispanic Whites) in the USA. One study investigated chronic pain prevalence among Indians, Bangladeshi, and White Europeans in the UK.

#### ***Cross-sectional Studies of Pain Expression***

EM differences in pain expression/perception have been documented in a variety of different clinical settings. A total of fourteen cross-sectional studies were conducted in the USA looking at ethnic differences among African Americans, Hispanics, and Whites. A common theme running

through the literature was that Blacks and Hispanics reported having more severe intensity of pain compared to the White population (Carey et al., 2010; Carlisle, 2014; Meghani & Cho, 2009c; Portenoy et al., 2004). Two studies conducted in the UK also found racial/ethnic differences in pain expression. Both studies compared pain expression in South Asian versus White British participants with chronic pain and confirmed that South Asians reported higher severity of pain than the comparison group (Riskowski, 2014). One study (Palmer et al., 2007) further found that excess pain prevalence varies in magnitude between population groups of South Asians (Gujrati versus Gujrati Africans). Another study conducted in Australia (Stanaway et al., 2011) investigating the difference in back pain characteristics in Italian-born men and Australian-born men found the former more likely to report moderate or severe back pain compared to the latter. However, the difference was reduced in magnitude and no longer statistically significant when adjusted for socio-economic factors.

### ***Longitudinal Studies of Intra-ethnic Differences in Pain Expression***

From the two longitudinal studies in the literature review (Bates & Edwards, 1992; Laguna et al., 2014), we can gain insights into intra-ethnic minority differences in pain prognosis and etiology. Given the scarcity of longitudinal studies exploring pain expression among ethnic minorities, the results of these two studies provide valuable information on both between- and within-group variability in pain reporting over time. The results of these longitudinal studies help to identify if there are any factors or mechanisms that may exist that may be able to explain disparities in pain expression between groups.

The first study by Bates et al. (1994) found sub-group differences in emotional response to chronic pain over time as well as pain intensity within a group of individuals classified as Whites. The population that was evaluated for pain included Irish, Italian, French-Canadian, Polish, Hispanics, and elderly Americans (at least third generation USA-born non-Hispanic Caucasians who identify with no other ethnic group). The Hispanic group was found to have significantly higher pain intensity (MPQ pain ratings) recorded over time in comparison to other populations. The Italian group was the second highest, followed by the Polish group. The authors attribute the within-group differences in response to pain as being associated with the patient's heritage (whether they were first or second generation immigrant) and locus-of-control<sup>8</sup>. The second study by Laguna et al. (2014) investigated the difference in pain expression by Latinos, Blacks, and Whites within in-patient palliative care (IPC) interventions. At admission (baseline measurements), Latinos reported higher pain intensity ( $1.5 \pm 2.80$ ) compared to Whites ( $1.2 \pm 2.50$ ) and Blacks ( $1.0 \pm 2.08$ ). The within-group pain differences over time showed that after IPC interventions there was a reduction in pain from severe to mild. The longitudinal analysis showed Latinos were 62% less likely than Caucasians to report pain at discharge. Greater awareness

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<sup>8</sup> Two types of locus of control (LOC) exist. 1) Internal LOC reflects a belief in personal control over behaviour; 2) External LOC is categorized into chance and powerful others.

of the influence of cultural and religious beliefs on pain expression is needed to understand these ethnic differences so that effective strategies to address pain management can be developed.

### ***Conclusion of the Literature Search***

All of the literature reviewed supported the hypothesis that pain expression differs by ethnicity. Although there have been many studies on ethnic minorities and pain in countries such as the USA and the UK, the findings cannot be automatically generalized to Canadian EM populations and there is still a need to study how the reporting of prevalence and intensity of pain differs among the major Canadian ethnic population groups. The aim of this thesis is to increase our understanding of how ethnic origin and cultural, psychological, and social factors are associated with pain expression among four Canadian EM groups.

## **2.3 Analytical Framework**

To explore the association between biological, psychological, and social factors associated with pain expression prevalence, two frameworks within the realm of social determinants of health guided this present research: The 21<sup>st</sup> Century Field Framework ([Figure 2.1](#)) and the Bio-psychosocial Framework ([Figure 2.2](#)) et al., 2011; Leyer, 1990).

Pain research traditionally focused only on sensory modalities and neurological transmissions; these components are captured in the biological framework (Leclair et al., 2011). More recent theories integrating the body, mind, and society have been developed to understand pain. One common framework is the 'Bio-psychosocial framework' (Figure 2.2), in which pain is viewed as a dynamic interaction among and within the biological, psychological, and social factors unique to each individual.

The Determinants of Health: the 21<sup>st</sup> Century Field Framework (Figure 2.1) was adapted from a framework by Evans and Stoddard known as The Health Field Framework (Evans & Stoddart, 1990; Lipton & Marbach, 1984) and is used as a framework to demonstrate how certain socio-demographic factors may influence expression of pain resulting from an injury.

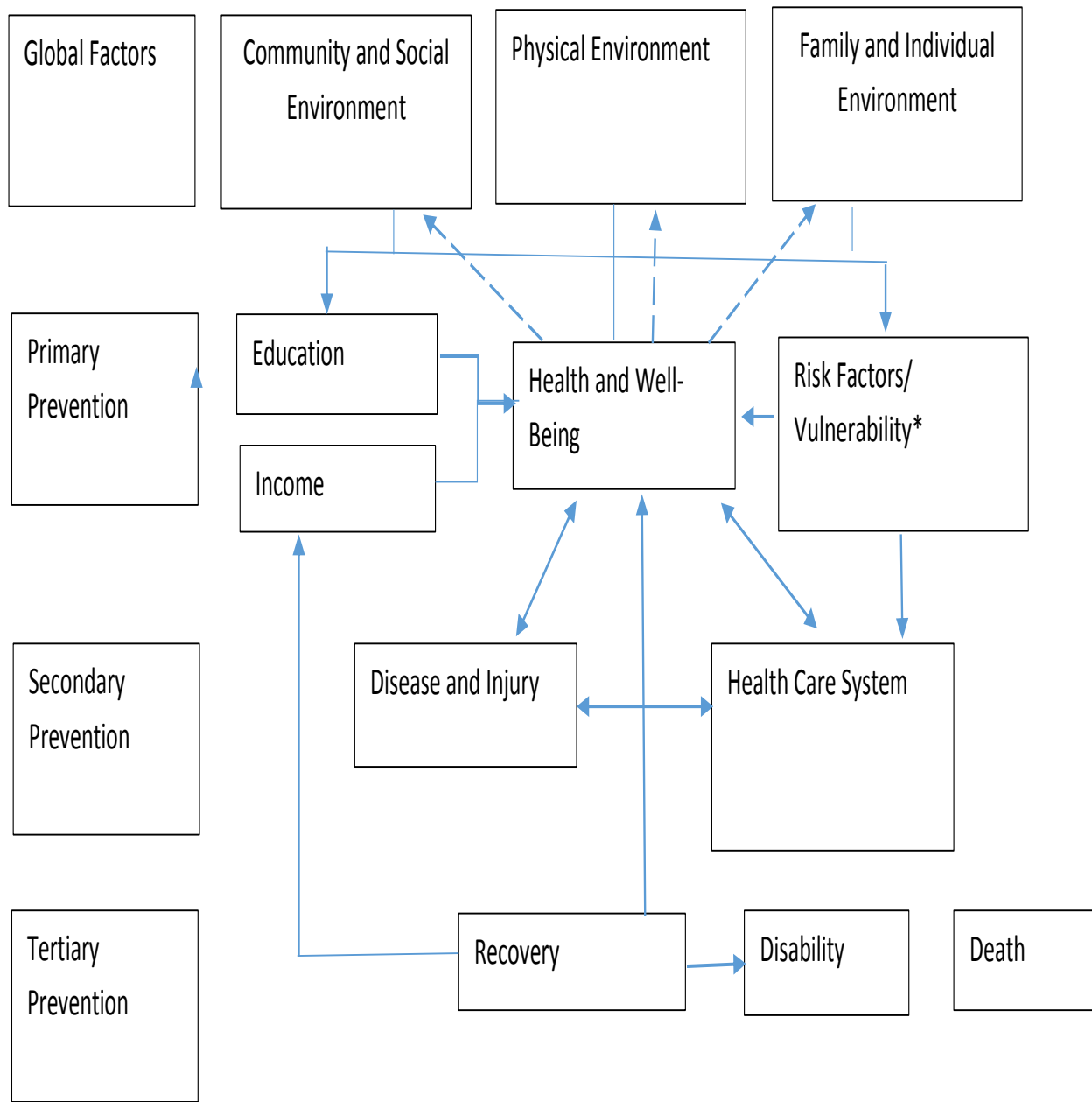
To investigate the association between psychological and social factors associated with pain expression prevalence among EM groups, I have used an modified bio-psychosocial framework that combines the 21<sup>st</sup> Century Field Framework and the Bio-psychosocial Framework ([Figure 2.3](#)) with biological, psychological, and socio-demographic factors included in previous literature in pain characteristics (See Tables 2.4 and 2.5). This framework posits that pain expression is best understood in terms of a combination of biological, psychological and social factors and the association between biological, psychological, and social factors based on the literature.

In addition, based on previous literature, I have also included a derived acculturation variable by combining two other variables (languages spoken and time spent in Canada). The **biological**

**component** included clinical factors such as whether or not the person has reported suffering any injury during the past 12 months and/or experiencing arthritis and back problems<sup>9</sup>. The **psychological component** included self-reported mental health, depression, and anxiety. Lastly, the socio-demographic component was broken into two parts – demographic factors and social environmental factors: **demographic factors** included age, sex and **social environmental factors** included acculturation, education, employment status, income, marital status, area of residence (urban or rural), and household size.

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<sup>9</sup> Arthritis and low back pain were the only two chronic conditions available in the CCHS associated with chronic pain.

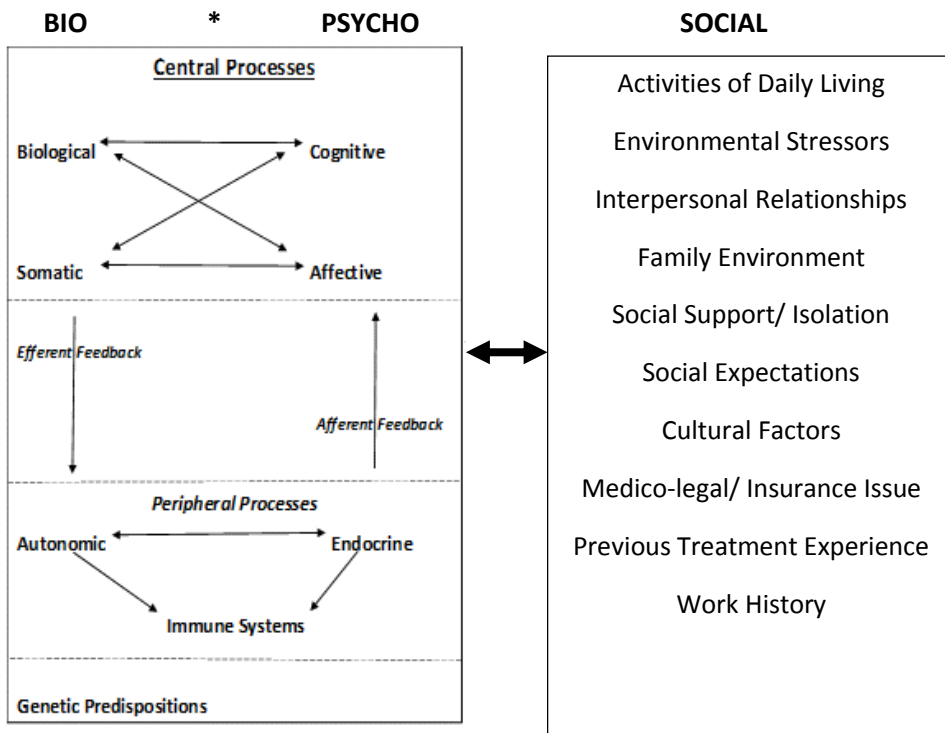


← - - - Potential pathway for individual and community action to influence global factors

\*Risk factors include age, nutritional status, and genetic makeup, among other factors.

**Figure 2.1** The Determinants of Health Realm of the 21st Century Field Mode





**Figure 2. 2** The Bio-psycho-social Approach to Chronic Conditions

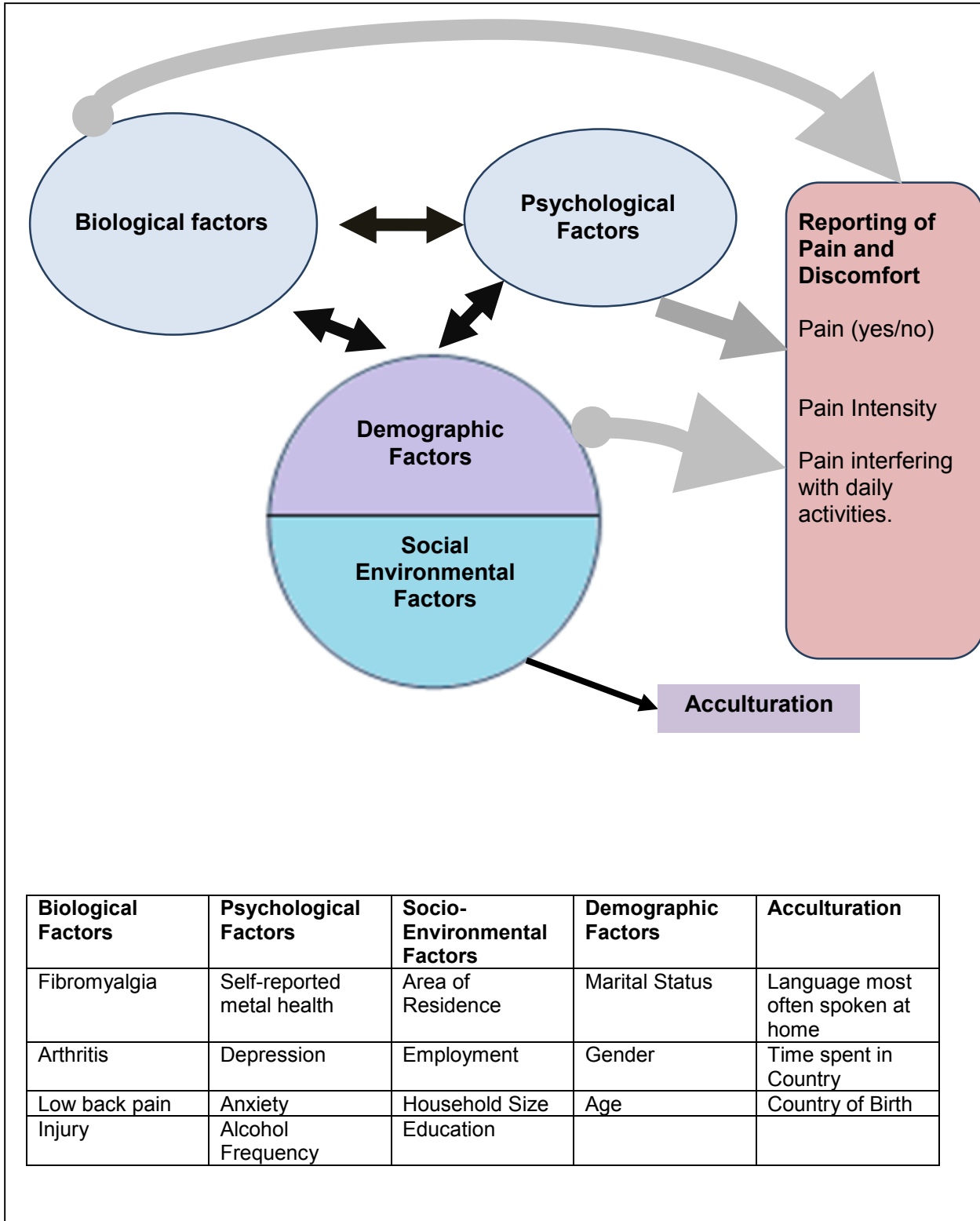
A conceptual model of the biopsychosocial interactive processes involved in health and illness. From "Comorbidity of Chronic Mental and Physical Health Conditions: The Biopsychosocial Perspective," by R. J. Gatchel, *American Psychologist*, 59, 792– 805.

**Table 2. 4 The biological, psychological and socio-environmental factors included in previous pain literature based on the 21<sup>st</sup> century field framework**

The 21 <sup>st</sup> century field framework components	Author(s), Date	Factors included in the literature
Physical Environment	Allison et al., 2002	Area of residence
Family and Individual Environment	Chan A et al., 2011 and Stanaway FF et al., 2011	Housing status
	Ang DC et al., 2003, Carlisle et al., 2013, Green et al., 2003, Laguna et al., 2014, Nguyen et al., 2005, Portenoy RK et al., 2004, Tan G et al., 2005, Riskowski et al., 2014 and Stanaway FF et al., 2011	Marital status
Community and Social Environment	Nguyen et al., 2005	Community status
	Portenoy RK et al., 2004	Community Residence
	Riskowski et al., 2014	Government sponsored
Risk Factors	Green et al., 2003 and Riskowski et al., 2014	Alcohol use
Disease and Injury	Hernandez et al., 2006 and Parmelee PA et al. 2012	Depression
Healthcare system	Laguna et al., 2014	# of chronic conditions
	Stanaway FF et al., 2011	# of co-morbidities
	Carey TS et al., 2010 and Nguyen et al., 2005 and Riskowski et al., 2014	Health insurance status
Education	Ang DC et al., 2003, Carey TS et al., 2010, Carlisle et al., 2013, Chan A et al., 2011, Edwards RR et al., 2005, Green et al., 2003, Green CR et al., 2010, Meghani SH et al., 2009, Nguyen et al., 2005, Parmelee PA et al., 2012, Portenoy RK et al., 2004, Riskowski et al., 2014, Stanaway FF et al., 2011, Bates MS et al., 1993, Carey TS et al., 2010, Carlisle et al., 2013, Green CR et al., 2010	Education
Income	Hernandez et al., 2006, Meghani SH et al., 2009, Nguyen et al., 2005, Portenoy RK et al., 2004 and Stanaway FF et al., 2011	Income

**Table 2. 5 The biological, psychological and socio-environmental factors included in previous pain literature based on the Bio-psychosocial framework**

The Bio-psychosocial framework components	Author(s), Date	Factors considered in the literature.
Activities of daily living	No Published Literature	
Environmental stressors	Allison et al., 2002	Area of residence
	Chan A et al., 2011 and Stanaway FF et al., 2011	Housing status
Interpersonal Relationships	Ang DC et al., 2003, Carlisle et al., 2013, Green et al., 2003, Nguyen et al., 2005, Portenoy RK et al., 2004, Tan G et al., 2005, Riskowski et al., 2014 and Stanaway FF et al., 2011	Marital status
Family environment		
Social support/ isolation	Nguyen et al., 2005 and Portenoy RK et al., 2004	Community status
	Riskowski et al. 2014	Government sponsored
Social expectations		
Cultural factors	Hernandez et al., 2006	Ethnicity
	Palmer et al., 2007	Acculturation
	Portenoy RK et al., 2004, Nguyen et al., 2005 Stanaway FF et al., 2011	Languages spoken at home
Medico-legal/ insurance issue	Carey TS et al., 2010, Nguyen et al., 2005 and Riskowski et al., 2014	Health insurance status
Previous treatment experiences	Green CR et al., 2010	Health Behaviours
Work history	Ang DC et al., 2003, Carey TS et al., 2010, Carlisle et al., 2013, Chan A et al., 2011, Edwards RR et al., 2005, Green et al., 2003, Green CR et al., 2010, Hernandez et al., 2006, Meghani SH et al., 2009, Nguyen et al., 2005, Parmelee PA et al., 2012, Portenoy RK et al., 2004, Riskowski et al., 2014 and Stanaway FF et al., 2011	Education, income and Employment status



**Figure 2.3** Modified Bio-Psychosocial Framework

This modified framework will be used to investigate the associations between bio-psychosocial factors and expression of pain among South Asian, Black, Middle Eastern, and East Asian Canadians with and without chronic pain conditions.

Note: Biological factors were used to assess data quality assurance on pain reporting.

## 2.4 Objectives and Research Questions

### 2.4.1 Objectives

The three objectives for this study were:

1. To report the differences in chronic pain expression between White Canadians and EM Canadians who self-reported as South Asian, Middle Eastern, East Asian, or Black Canadians.
2. To investigate whether there were differences in the prevalence of chronic pain (the primary dependent variable), pain intensity, and activity limitation (the secondary dependent variables) among Middle Eastern, South Asian, Black, and East Asian EM groups in Canada.
3. To explore the association between the bio-psychosocial factors (including acculturation) and chronic pain among the members of the four EM groups who reported chronic pain.

### 2.4.2 Research Questions

The three research questions for this study were:

1. Are there differences in prevalence of pain expression, pain intensity, and activity limitation due to pain between White Canadians and EM Canadians<sup>10</sup> who self-reported as ethnic minorities?
2. Are there differences in prevalence of pain expression, pain intensity and activity limitation due to pain among Canadians who self-report origins in Africa (various Black populations), South Asia, the Middle East, and East Asia?
3. Are the bio-psychosocial factors defined by the selected theoretical framework associated with expression of pain, pain intensity, and pain interference with daily activity among these EM groups?

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<sup>10</sup> The first objective combined all EM Canadians who self-reported origins in Africa (various Black populations), South Asia, the Middle East, and East Asia.

## CHAPTER 3: METHODOLOGY

This study utilized data from the *Canadian Community Health Survey* (CCHS) years 2007-2013 and the following section describes the study design, data source, study measures, and data analysis.

### 3.1 Study Design, Questionnaire and Data Collection

This exploratory secondary data analytic study analysed cross-sectional data from the CCHS. The CCHS survey was administered to a sample of the Canadian population in each year. CCHS is a national cross-sectional survey, which collects data at provincial and health region levels. The survey questionnaires were developed by specialists at Health Canada, Statistics Canada, provincial health ministries, and academic researchers in relevant fields (Statistics Canada, 2011). The CCHS survey was approved by both the Statistics Canada Advisory Committee and expert committees. It collects information about health status, healthcare utilization, and health determinants. The CCHS has a multi-stage, dual frame design to improve coverage. The sample for the CCHS is primarily a selection of dwellings drawn from the *Labour Force Survey* area sampling frame. The samples within the health regions are selected using random digit-dialling (RDD) method. Data are collected through both structured in-person and telephone interviews administered through a Computer-Assisted Personal Interviewing (CAPI) and Computer-Assisted Telephone Interviewing (CATI) systems (Statistics Canada, 2011). The sample survey design of the CCHS provides a probability sample with theoretical basis for drawing statistical inferences about the population with known levels of confidence.

In order to have a large enough sample size, I combined a sample of data related to pain and discomfort and other clinical and psychosocial variables from the last seven years (2007/2008, 2009/2010, 2011/2012, 2013). The data were accessed and analysed through the Atlantic Research Data Centre. The combined sample provided us with 18,195 EM respondents.

### 3.2 CCHS Sample, Power and Sample Sizes

In this secondary data analysis, participants 18 years of age or older have been included. The sample sizes were 131,061 participants in 2007/2008, 131,486 in 2009/2010, approximately 130,000 participants in 2011/2012 and 65,000 in 2013 (see Appendix B). The CCHS survey excluded residents of institutions, Indian reserves, members of the Canadian Forces, and some remote areas of the North. Response rates for all cycles used in this study are found to be greater than 77%. [Appendix B](#) shows a list of response rates for each year.

The sample size for this study is calculated as a difference of proportions because the primary dependent variable (experiencing chronic pain) is binary. We are looking for a significance level ( $\alpha$ ) of

0.05 and a power to detect difference (1- $\beta$ ) of 0.8. The percentage of EM groups with chronic pain based on previous literature is estimated to be 5% (Allison et al. 2002). In light of similar studies (Allison et al. 2002; Palmer et al. 2007), the best estimate of the magnitude of association between chronic pain and EM groups is an odds ratio range of 1.8 to 2.6. Using this information, my sample size estimate was calculated using OpenEpi (K. Sullivan, Dean, & Soe, 2009) and came out to range from 274 to 801 participants from each of the four ethnic groups.

### **Missing Data**

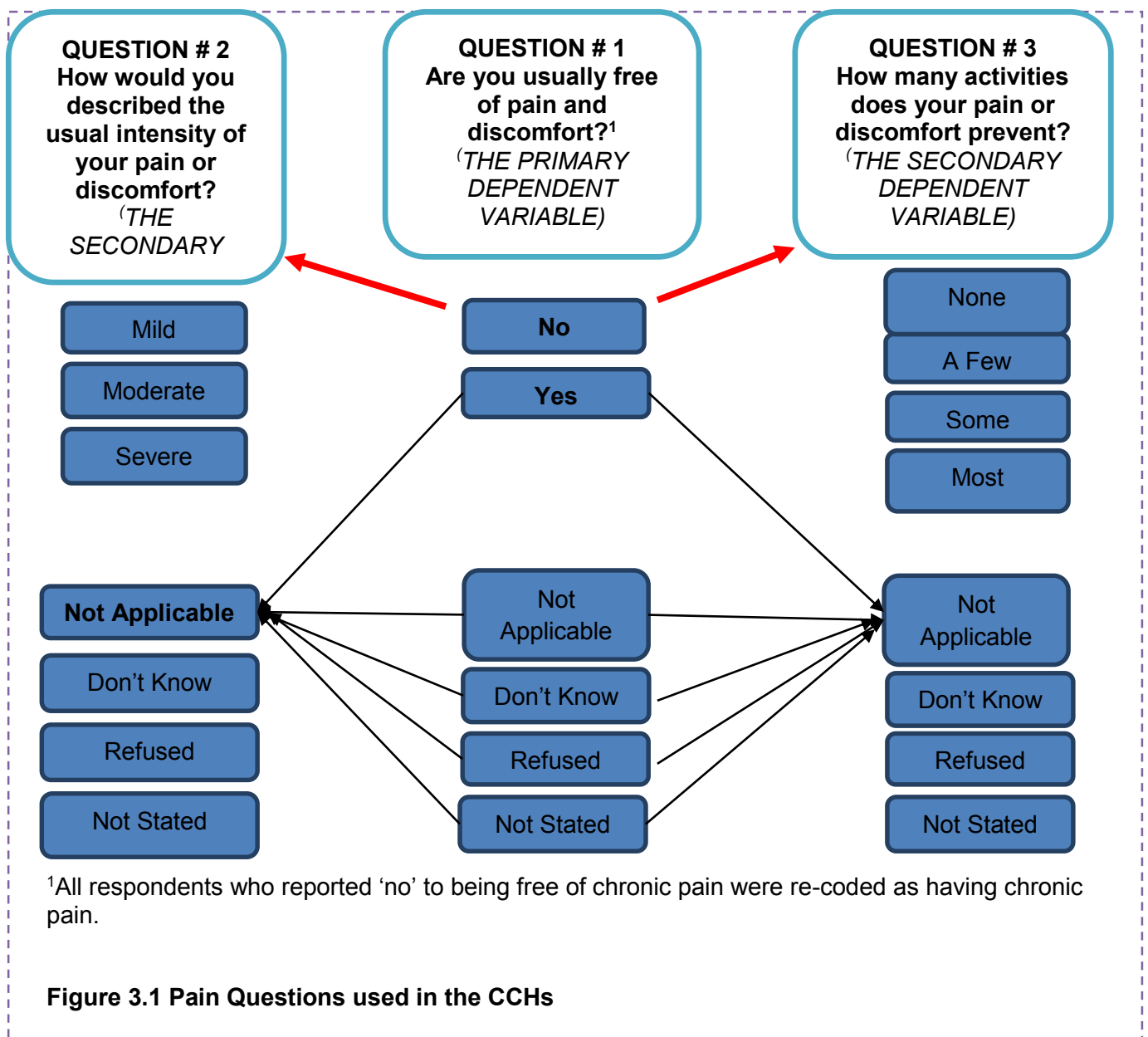
CCHS respondents who declined to answer or were unable to provide information on their EM background were coded as missing and characteristics of EM groups with and without missing data were compared on demographic profile and pain characteristics. Missing data were excluded from the analysis.

## **3.3 Study Variables**

### **3.3.1 The Dependent Variables**

#### **Pain and Discomfort**

In the CCHS questionnaires, there are three questions related to pain and discomfort (see Appendix C). Participants were asked to report on the presence of 'usual pain', to describe the 'usual intensity' of pain and to state the number of activities that the pain interfered with. The first pain related question asks "Are you usually free of pain or discomfort?" (CCHS 2010). This is a binary response with a 'yes' or 'no' answer. Individuals who reported in the negative were considered to have chronic pain and those who reported yes were considered to be free of chronic pain. For the purposes of this study, we recoded all respondents who reported 'no' to being free of chronic pain as 'yes' to having chronic pain and considered this to be the primary dependent variable (see Figure 3.1). Individuals who reported chronic pain were asked to describe the usual "intensity of pain"; the intensity was rated as either 'mild', 'moderate' or 'severe' (CCHS 2010). Participants were also asked "How many activities does your pain and discomfort prevent?" Possible answers included none, a few, some, and most (CCHS 2010). I considered the last two pain related questions to be the secondary dependent variables. See Figure 3.1 below for a flow diagram of the pain questionnaires in the CCHS.



### 3.3.2 The Independent Variables

The primary explanatory variables analysed were EM status, personal factors, clinical factors, psychological factors, and social factors (see Appendix D). These variables were identified in the literature review and the theoretical framework and were restricted to what is available in CCHS database.

#### EM Status

For the purpose of this thesis, the term “ethnic minority” was defined by the race and ethnicity of the target population (South Asian, East Asian, Middle Eastern, and Black Canadians). EM status was determined according to self-identification (see Table 3.1), i.e. by whether participants self-report as Middle Eastern, East Asian, South Asian, or Black Canadian.



**Table 3.1 Grouping of Ethnic Minorities from the Second Variable**

<b>Black Canadians</b>	<b>South Asians</b>
Blacks	South Asians
<b>East Asians</b>	<b>Middle Eastern</b>
Chinese Japanese Korean Filipino	Middle Eastern Arab West Asia North African

### **Acculturation**

Two variables were used to construct a variable to measure levels of acculturation of the EM groups in the study: language most often spoken at home, and year of arrival in Canada. We assigned a score from 1 to 4, where 1 is low and 4 is very high acculturation. An example of how the acculturation scale was used is provided in Appendix E. It is important to note that other scales developed to measure acculturation have included similar variables. Palmer et al. 2007, who investigated widespread chronic pain in EM groups, developed a validated scale which included language as a measurement of acculturation. Another measurement tool developed by Benet-Martinez considered country of birth, language, and length of time spent in country as measures of acculturation (Benet-Martínez & Haritatos, 2005).

### **Demographic Factors**

Personal factors included gender, age, and area of residence. Participants were grouped into the following six age categories: 18-24, 25-39, 40-54, 55-69, 70-84, and 85+. Area of residence included two measures: province in which the participants resided, and whether they lived in a rural or urban setting (see Appendix D).

### **Clinical Factors**

Clinical factors included: 1) whether the participant self-reported having arthritis and/or low back problems; 2) whether the participant had sustained any injuries in the past 12 months; and 3) whether the respondents had taken pain relievers in the past month (see Appendix D).

## **Psychological Factors**

Many clinicians and researchers agree that depression and anxiety are associated with increased prevalence of chronic pain (Louie & Ward 2011; Lu et al., 2013; Luo et al., 2003). On this basis, the psychological factors included participants' self-perceived mental health, and self-reported depression and anxiety. For this study, self-perceived mental health was coded as "excellent", "very good", "good", "fair", or "poor" (see Appendix D). Participants who respond yes to feeling sad, blue, or depressed for two weeks or more in a row were considered to have depression. Participants who respond yes to the presence of a diagnosed anxiety disorder including phobia, obsessive compulsive disorder, or panic disorder were considered to have anxiety (see Appendix D) (Mailis-Gagnon et al. 2007). A study by Katon, Egan, and Miller (1985) found that two most frequent psychiatric disorders for patients with chronic pain were depressive disorder and alcohol use disorder. This is because many suffering from chronic pain often use alcohol for temporary pain relief. Therefore, I included alcohol use frequency as well. This variable was coded based on whether participants consumed alcohol "less than once a month", "once a month", "2 or 3 times a month", "once a week" or "2 or more times a week".

## **Social Factors**

Social factors included education, employment status, income, marital status, living arrangements, and household size. Education was re-coded into four categories: high school, non-university certificate, bachelor's, or graduate degree. Income was categorized into four groups: highest, upper middle, lower middle, and lowest. Marital status was re-coded into six categories (married; living common-law; widowed; separated; divorced; or single). Lastly, household size was re-coded into four categories (1 person, 2 person, 3 person and 4 person or more) (see Appendix D).

## **3.4 Data Analysis**

Statistical analysis was performed using SAS 9.3 and carried out in four parts. In the following sections, I have provided an objective specific data analysis plan that guided this analysis.

### **Data Quality Assurance and Descriptive Analysis**

To test the robustness of the pain question used in the survey, I cross-tabulated pain prevalence, intensity, and interference with daily activity with participants who experienced either arthritis and/or low back pain with the study sample. Descriptive statistics were analysed for clinical, psychological and socio-demographic variables for the four EM groups.

**Objective 1: To investigate whether there are differences in pain expression between White Canadians and the combined four EM groups**

I examined differences in chronic pain prevalence, pain intensity, and pain interference percentages with normal activity among the combined four groups of self-reported Canadian EM and majority (White Canadian) groups to address **Objective 1**. Cross-tabulations were used for descriptive statistics and confidence intervals were used to determine statistical significance between the two groups.

**Objective 2: To investigate whether there are differences in chronic pain expression, intensity, and activity limitation due to pain among the four largest EM groups in Canada**

Detailed statistical estimates were calculated to compare chronic pain expression, pain intensity, and pain interference of daily activity by the four EM groups; cross-tabulations and confidence intervals were used again to determine statistical significance of any differences among these groups. Simple logistic regression models were calculated to analyse inter-ethnic minority differences in pain expression, pain intensity and pain interference of daily activity. To allow for efficient estimates of the regression models, I combined the second (*moderate intensity*) and third (*severe intensity*) categories for the pain intensity outcome variable into one category re-coded as '*high intensity*' to increase the number of observations (see Figure 3.3). For the activity limitation outcome variable, I increased the number of observations by combining the third (*some activity limitation*) and fourth (*most activity limitation*) category. The first model tested the association of the probability of reporting '*many*' activity interferences due to pain versus '*none*', and the second model tested the association of the probability of reporting '*a few*' activity interferences versus '*none*' (see Figure 3.4). Figures 3.2-3.4 show the regression models used.

**The difference in pain expression and ethnic minority groups**

$$\ln\left(\frac{p}{1-p}\right) = b_0 + b_1x_1$$

Where:

p = the probability of reporting yes to chronic pain

x<sub>1</sub> = the categorical explanatory variable ethnic minority status (***Black (ref)***, South Asian, East Asian, Middle Eastern).

**Figure 3.2.** The Simple Logistic Regression Models to Test the Association between Chronic Pain Expression and EM groups

*The difference in chronic pain intensity*

$$\ln\left(\frac{p}{1-p}\right) = b_0 + b_1x_1$$

Where:

p = the probability of reporting *high* intensity versus *low* intensity chronic pain.

x<sub>1</sub>= the categorical explanatory variable ethnic minority status (***Black (ref)***, South Asian, East Asian, Middle Eastern).

**Figure 3.3.** Simple Logistic Regression Models to Test the Association between High vs Low Chronic Pain Intensity and EM groups

*The difference in chronic pain interfering with daily activity*

Model 1:

$$\ln\left(\frac{p}{1-p}\right) = b_0 + b_1x_1$$

Where:

p = the probability of reporting 'many' activity limitations versus none.

x<sub>1</sub>= the categorical explanatory variable ethnic minority status (***Black (ref)***, South Asian, East Asian, Middle Eastern).

Model 2:

$$\ln\left(\frac{p}{1-p}\right) = b_0 + b_1x_1$$

Where:

p = the probability of reporting 'a few' activity limitations versus none.

x<sub>1</sub>= the categorical explanatory variable ethnic minority status (***Black (ref)***, South Asian, East Asian, Middle Eastern).

**Figure 3.4.** Simple Logistic Regression Models to Test the Association between Number of Activities Affected (prevented/curtailed) due to Chronic Pain and EM groups

**Objective 3: To explore the association between the bio-psychosocial risk factors (including acculturation) and chronic pain among the members of the four EM groups who reported chronic pain.**

In order to address this question, multiple logistic regression models were used to analyse the relationship among EM groups and pain expression when adjusting for psychological and social

factors highlighted in the bio-psychosocial theoretical framework. Statistical significance was tested and reported at  $\alpha = 0.05$  with a confidence interval of 95%.

### **Weighting and Bootstrapping**

All data were weighted using weights provided by Statistics Canada so that the estimates are representative of the Canadian population. As Statistics Canada surveys use complex stratified cluster designs, variance estimation for these designs cannot be carried out by simple formulas. Therefore, Statistics Canada has suggested that users perform re-sampling variance estimation with the bootstrap weights available in the CCHS master file (StatsCan, 2005). The bootstrap re-sampling weights were incorporated in my analysis. In addition, both the sample weights and the bootstrap weights were normalized to represent the Canadian population. Normalizing the weights means that “the survey weight for each member of the sample in the subpopulation being analysed is divided by the mean of the survey weights for all members of the sample in the subpopulation” (StatsCan, 2013).

## CHAPTER 4: RESULTS AND ANALYSIS

In this chapter, the results of the analysis are presented in five parts that: i) explore descriptive statistics about the four EM groups (East Asian, South Asian, Middle Eastern, and Black Canadian); ii) investigate prevalence of chronic pain experience among White Canadians vs. all EM groups combined using cross-tabulations; iii) infer statistical significance of the difference between pain experience, pain intensity, and activity limitation among the four EM groups using cross-tabulations and simple logistic regression models; and, iv) identify bio-psychosocial factors (see Figure 2.3 theoretical framework) that are statistically significantly associated with chronic pain experience in the four EM study groups of interest.

All of the estimates are adjusted with bootstrap and survey weights<sup>11</sup> (see section 3.4), and a significance level of  $p < 0.05$  was used for all analyses. Tables 4.1, 4.2, 4.3, and 4.4 provide weighted descriptive statistics for clinical, psychological, and socio-demographic variables for each of the four EM groups. These statistics are expressed as percentages and the statistical significance of differences among South Asian, East Asian, Middle Eastern, and Black Canadian are judged using sample estimates and 95% confidence intervals.

### Missing Data

I compared the CCHS respondents who declined to answer or were unable to provide information on their EM background with the included study sample with respect to: (1) socio-demographic characteristics; and (2) pain characteristics. The results showed no differences between the respondents who declined to answer and the included sample for any of the socio-demographic factors and chronic pain. Twenty-four thousand six hundred and seventy seven subjects with missing data about EM status were excluded from my analysis.

## 4.1 Descriptive Statistics about the Four EM Groups

My analysis included 18,195 adults, aged 18 years and above. The percentages vary by EM groups, 44.1% (95%CI: 41.2%-46.9%) to 51.1% (95%CI: 49.0%-56.0%) of the sample were males and 49.0% (95%CI: 44.0%-54.0%) to 55.9% (95%CI: 53.1%-58.8%) females; 42% were East Asian, 10% Middle Eastern, 32% South Asian, and 16% Black Canadians (see Table 4.1).

East Asians (1.6%, 95%CI: 1.1%-2.1%) had a statistically significantly higher percentage of respondents aged 85 years or older. The majority of the four EM groups reported either being married or single compared to living in common-law, being widowed, separated, or divorced; and lived in a household with an average size of four or more people. There was no statistically significant

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<sup>11</sup> The end of section 3.5 in Chapter 3 provides details on how we applied sample weights and bootstraps to data.

differences among the four groups for marital status. For household size, a higher percentage of South Asians (50%, 95%CI: 47.5%-52.5%), compared to other EM groups, reported living in a large household (4+ members) and this was found to be statistically significant ( $p < 0.05$ ) (see Table 4.1). The percentage of respondents with a post-secondary degree ranged from 36.4% (95% CI: 33.6%-39.2%) to 43.4% (95% CI: 40.7%-46.1%) for bachelor's degree and 7.3% (95% CI: 4.9%-9.6%) to 11.9% (8.1%-15.7%) for graduate degree. The differences in education among the four groups were not found to be statistically significant. 63% (95% CI: 58.3%-68.3%) to 67.3% (95% CI: 63.4%-71.2%) of the EM groups also reported being employed and again, the difference among the four groups was not found to be statistically significant. 26.1% (95%CI: 23.6%-28.7%) to 42.4% (95%CI: 38.4%-46.5%) of the four EM groups reporting having an *income of less than \$40 000* (lower middle income) and 34.7% (35%CI: 31.0%-38.4%) to 40.1% (95%CI: 37.4%-42.8%) reported having an *income between \$40 000-\$80 000* (middle income). The differences in household income among the four EM groups was also not found to be statistically significant (see Table 4.1)

**Table 4.1 The Socio-demographic and Environmental Characteristics of the Study Sample by EM Status<sup>1</sup>**

Variables	EM Groups			
	East Asians (N=7687)	Middle Eastern (N=1718)	South Asians (N=5793)	Black Canadians (N=2997)
<b>Sex, % (95%CI)</b>				
<i>Male</i>	44.1(41.2-46.9)	51.0(46.0-56.0)	50.3(43.5-57.1)	44.9(40.4-49.4)
<i>Female</i>	55.9(53.1-58.8)	49.0(44.0-54.0)	49.7(42.9-56.5)	55.1(50.6-59.6)
<b>Age, % (95%CI)</b>				
18-24	17.6(9.4-25.8)	22.4(12.2-32.5)	20.8(11.9-29.6)	17.8(12.3-23.4)
25-39	30.1(28.3-31.9)	38.8(33.0-45.0)	37.4(33.5-41.4)	36.6(33.6-39.7)
40-54	25.6(21.2-29.9)	23.1(18.7-27.6)	20.7(18.1-23.4)	24.0(20.4-27.6)
55-69	16.0(12.0-20.1)	10.9(6.3-15.4)	14.7(11.7-17.7)	14.9(12.6-17.2)
70-84	9.1(8.1-10.0)	4.3(2.45-6.1)	5.7(4.1-7.2)	5.9(3.6-8.2)
85+	1.6(1.1-2.1)	0.48(0-1.0)	0.7(0.3-1.1)	0.7(0.3-1.0)
<b>Marital Status, % (95%CI)</b>				
<i>Married</i>	50.0(34.5-65.2)	50.7(36.5-65.0)	55.5(40.8-70.2)	32.5(24.1-40.8)
<i>Living common-law</i>	2.3(1.3-3.4)	1.5(0-3.3)	1.3(0.1-2.5)	5.1(3.1-7.0)
<i>Widowed</i>	5.4(4.2-6.7)	2.4(1.4-3.5)	4.2(3.1-5.2)	3.7(2.6-4.8)
<i>Separated</i>	2.1(1.3-2.9)	2.9(1.4-4.4)	1.7(0.8-2.6)	5.6(4.2-7.0)
<i>Divorced</i>	3.2(2.6-3.9)	4.5(2.7-6.4)	2.9(1.9-3.8)	7.5(5.1-9.8)
<i>Single, never married</i>	37.0(22.5-51.5)	37.9(23.6-52.2)	34.5(20.0-48.9)	45.7(37.9-53.5)
<b>Household size, % (95%CI)</b>				
1 person	20.3(17.2-23.4)	18.5(15.2-21.6)	11.8(9.6-14.0)	26.3(23.1-29.5)
2 person	21.6(11.4-31.8)	17.2(11.2-23.2)	16.6(11.5-21.6)	22.5(16.8-28.3)
3 person	25.5(15.9-35.2)	22.6(15.2-29.9)	21.6(16.9-26.3)	21.3(14.6-28.0)
4 or more person	32.6(29.7-35.5)	41.9(38.0-45.7)	50.0(47.5-52.5)	29.8(25.6-34.1)
<b>Community Residence, % (95%CI)</b>				
<i>Urban</i>	96.4(95.8-97.0)	97.1(93.0-100.0)	96.9(95.4-98.4)	95.3(94.0-96.6)
<i>Rural</i>	3.6(3.0-4.2)	2.9(0.0-7.0)	3.1(1.6-4.6)	4.7(3.4-6.0)
<b>Education level, % (95%CI)</b>				
<i>High School</i>	37.8(35.5-40.1)	40.4(33.3-47.5)	40.9(37.7-44.1)	38.8(2.1-45.5)
<i>Non-University certificate</i>	10.8(9.5-12.1)	9.1(3.6-14.6)	11.0(7.3-4.6)	14.5(9.6-19.4)
<i>Bachelor's degree</i>	43.4(40.7-46.1)	38.6 (33.5-43.8)	36.4(33.6-39.2)	39.5(35.1-43.8)
<i>Graduate</i>	8.0(6.6-9.4)	11.9(8.1-15.7)	11.7(8.3-15.1)	7.3(4.9-9.6)

<b>Income, % (95%CI)</b>				
<i>No Income</i>	1.1(0.6-1.6)	1.0(0.0-2.1)	0.3(0-0.6)	0.3(0.0-0.9)
<i>Lower middle income</i>	28.8(26.9-30.6)	40.4(36.1-44.7)	26.1(23.6-28.7)	42.4(38.4-46.5)
<i>Middle income</i>	38.7(36.7-40.7)	34.7(31.0-38.4)	40.1(37.4-42.8)	35.7(28.8-42.5)
<i>Upper middle income</i>	27.9(25.9-29.9)	20.7(16.7-24.8)	28.7(26.0-31.5)	19.4(15.6-23.2)
<i>Highest income</i>	3.6(2.8-4.3)	3.1(0.3-6.0)	4.7(2.6-6.8)	2.1(0.6-3.7)
<b>Has Employment, % (95%CI)</b>				
Yes	66.3(61.9-70.7)	63.3(58.3-68.3)	65.8(61.9-69.7)	67.3(63.4-71.2)
No	33.7(29.3-38.1)	36.7(31.7-41.7)	34.2(30.3-38.1)	32.7(28.8-36.6)
<b>Has a regular doctor, % (95%CI)</b>				
Yes	85.6(84.4-86.8)	84.8(81.6-88.0)	85.0(83.2-86.8)	84.2(81.9-86.4)
No	14.4(13.2-15.6)	15.2(12.0-18.4)	15.0(13.2-16.8)	15.8(13.6-18.1)

Note. **Lower Middle:** less than \$40 000; **Middle income:** \$40 000 or more but less than \$80 000; **Upper middle income:** \$80 000 or more but less than \$150 000; **Highest income:** \$150 000 and over.

<sup>1</sup>Results are weighted to the Canadian population and are representative of most of the population.

## 4.2 Clinical Factors

Seven and a half percent (95%CI: 6.2%-8.8%) to 10.8% (95% CI: 7.3%-14.2%) of all EM groups reported sustaining an injury. The difference among EM groups was not found to be statistically significant. Eight point seven percent (95% CI: 6.9%-10.6%) to 10.4% (95%CI: 8.0%-12.4%) of EM groups reported 'yes' to experiencing arthritis and 13.3% (95% CI: 11.8%-14.8%) to 17.2% (95% CI: 13.9%-20.5%) reported 'yes' to low back pain. Pain medication use ranged from 37.9% (95% CI: 23.5%-52.3%) to 53.7% (95%CI: 19.7%-87.7%) in all EM groups. Again these differences among EM groups were not found to be statistically significant (see Table 4.2).

**Table 4.2 Clinical Factors of the Study Sample by EM Status<sup>1</sup>**

% (95%CI)	East Asians (N=7687)	Middle Eastern (N=1718)	South Asians (N=5793)	Black Canadians (N=2997)
<b>Sustaining Injuries</b>	7.5(6.2,8.8)	10.1(5.4,14.9)	8.6(6.6,10.7)	10.8(7.3,14.2)
<b>Has Arthritis</b>	9.1(7.9,10.2)	8.7(6.9,10.6)	9.7(7.0,12.4)	10.4(8.0,12.7)
<b>Experiences Low Back Pain</b>	13.3(11.8,14.8)	17.2(13.9,20.5)	13.9(12.3,15.5)	15.1 (13.2,17.1)
<b>Uses Pain Medication</b>	37.9(23.5,52.3)	53.7(19.7,87.7)	43.9(32.8,55)	46.2(18.1,74.3)

<sup>1</sup>Results are weighted to the Canadian population and are representative of most of the population.

## 4.3 Psychological Characteristics

Compared to Black Canadians (43.2%, 95%CI: 39.9%-46.5%), South Asians (37.2%, 95%CI: 35.2%-39.2%) and Middle Eastern (39.7%, 95%CI: 33.1%-46.2%), 29.8% (95%CI: 28.0%-31.5%) of East Asians reported 'excellent' self-perceived mental health. This difference was found to be statistically significant. Among the four EM groups, 2.6% (95%CI: 2.0%-3.2%) of those in the East Asian Group compared to Black Canadians (4.4%, 95%CI: 3.2%-5.6%), Middle Eastern (6.6%, 95%CI: 4.6%-8.6%) and South Asian (4.6%, 95%CI: 3.5%-5.7%) reported 'yes' to experiencing depression and this difference was statistically significantly different ( $p < 0.05$ ). A statistically



significantly higher percentage of South Asians (22.9%, 95%CI: 20.6%-25.3%) compared to East Asian (15.6%, 95%CI: 13.9%-17.2%) Canadians reported drinking alcohol two or more times a week (see Table 4.3).

**Table 4.3 Psychological Characteristics of the Study Groups by EM Status<sup>1</sup>**

% (95%CI)	EM Groups			
	East Asians (N=7687)	Middle Eastern (N=1718)	South Asian (N=5793)	Black Canadians (N=2997)
<b>Self-Perceived mental health</b>				
<i>Excellent</i>	29.8(28.0,31.5)	39.7(33.1,46.2)	37.2(35.2,39.2)	43.2(39.9,46.5)
<i>Very Good</i>	38.8 (37.0,40.6)	32(28.2,35.8)	33.7(30.2,37.2)	32.1(29.2,35)
<i>Good</i>	26.1(24.4,27.7)	23(14.7,31.4)	24.1(21.1,27)	19.8(17.1,22.4)
<i>Fair</i>	4.7(3.9,5.4)	4.2(2.3,6.1)	3.8(2.9,4.7)	4.2(2.3,6.2)
<i>Poor</i>	0.7(0.4,1.1)	1.2(0.2,2.1)	1.2(0.8,1.7)	0.7(0.3,1.1)
<b>Experiences Depression</b>	2.6(2.0,3.2)	6.6(4.6,8.6)	4.6(3.5,5.7)	4.4(3.2,5.6)
<b>Experiences Anxiety</b>	2.1(1.6,2.7)	3.7(2.1,5.4)	3.3(2.4,4.3)	3.4(2, 4.7)
<b>Frequency of Alcohol Use</b>				
<i>Less than once a month</i>	38.8(34.6,43.0)	24.2(17.3,31.0)	26.9(23,30.8)	31(27.1,35.0)
<i>Once a month</i>	16.1(13.3,18.8)	12.7(5.2,20.3)	15.2(12.7,17.7)	15.4(12.5,18.4)
<i>2 to 3 times a month</i>	13.7(12.0,15.4)	19.1(4.7,33.6)	15.9(13.6,18.3)	15(11.7,18.4)
<i>Once a week</i>	15.9(14.3,17.5)	22.5(16.5,28.6)	19(15.7,22.3)	17.3(11.3,23.3)
<i>2 or more times a week</i>	15.6(13.9,17.2)	21.4(16.3,26.5)	22.9(20.6,25.3)	21.2(16.7,25.8)

<sup>1</sup>Results are weighted to the Canadians populations and are representative of most of the population.

## 4.4 Acculturation Characteristics

The percentage of EM groups that reported having lived more than 10 years in Canada ranged from 45.4% (95%CI: 41.5%-49.3%) to 50.6% (95% CI: 48.9%-52.4%). For time spent in Canada, the difference among groups was not found to be statistically significant. A higher percentage of Black Canadians (70.7%, 95%CI: 63.4%-78.0%) reported speaking English most often at home compared to the other three EM groups and this difference was found to be statistically significant ( $p < 0.05$ ) (See Table 4.4).

When looking at acculturation levels, a higher percentage of Middle Eastern Canadians (39.0%, 95%CI: 33.0%-45.1%) had low levels of acculturation compared to Black Canadians (17.1%, 95%CI: 11.0%-23.1%), East Asians (26.9%, 95%CI: 22.7%-31.0%), and South Asians (27.3%, 95%CI: 24.4%-30.3%). This difference was found to be statistically significant ( $p < 0.05$ ). A higher percentage of East Asians (52.9%, 95%CI:48.6%-57.1% ) compared to Black Canadians had moderate acculturation and this difference was also found to be statistically significant. Lastly, a higher percentage of Black Canadians (48.6%, 95%CI: 41.4%-55.8%) compared to East Asians (20.3%, 18.8%-21.8%), South Asians (27.3%, 95%CI: 24.4%-30.3%) and Middle Eastern (20.9%, 95%CI: 16.9%-24.9%) Canadians had high acculturation and again this difference was statistically significant ( $p < 0.05$ ) (See Table 4.5).

**Table 4.4 Acculturation factors and EM Groups<sup>1</sup>**

% (95%CI)	East Asians (N=7687)	Middle Eastern (N=1718)	South Asians (N=5793)	Black Canadians (N=2997)
<b>Time Spent in Canada</b>				
>10 years	50.6(48.9,52.4)	45.4(41.5,49.3)	49.7(45.6,53.7)	47.8(43.8,51.8)
<10 years	49.4(47.6,51.1)	54.6(50.7,58.5)	50.3(46.3,54.4)	52.2(48.2,56.2)
<b>Languages Most Often Spoken at Home</b>				
English	39.3(36.7,41.8)	34.4(27.7,41.0)	45.8(39.6,52.1)	70.7(63.4,78.0)
Other	60.7(58.2,63.3)	65.6(59.0,72.3)	54.2(47.9,60.4)	29.3(22.0,36.6)

<sup>1</sup>Results are weighted to the Canadian population and are representative of most of the population.

**Table 4.5 EM Groups by Acculturation Levels<sup>1</sup>**

% (95%CI)	East Asians (N=7687)	Middle Eastern (N=1718)	South Asians (N=5793)	Black Canadians (N=2997)
<b>Acculturation Levels</b>				
Low Acculturation	26.9(22.7,31.0)	39.0(33.0,45.1)	27.3(24.4,30.3)	17.1(11.0,23.1)
Moderate Acculturation	52.9(48.6,57.1)	40.1(35.4,44.7)	43.9(41.3,46.5)	34.3(30.5,38.2)
High Acculturation	20.3(18.8,21.8)	20.9(16.9,24.9)	28.7(25.2,32.2)	48.6(41.4,55.8)

<sup>1</sup>Results are weighted to the Canadian population and are representative of most of the population.

## 4.5 Chronic Pain Prevalence among White Canadians and Four EM Groups (Objective 1)

Table 4.6 shows chronic pain prevalence, pain intensity, and activity limitation due to chronic pain among the combined four EM groups and White Canadian respondents. Chronic pain (see Table 4.6) was found to be reported significantly more often in White Canadians (19.3%, 95%CI: 16.9%-21.6%) compared to the four EM groups combined (13.1%, 95%CI: 10.8%-15.4%). Severe pain intensity was also reported significantly more often in White Canadians (17.3%, 95%CI: 16.3%-18.1%) compared to all EM groups combined (13.0%, 95%CI: 10.6%-15.3%). There were no significant differences between the two groups for the number of activity limitations due to chronic pain.

**Table 4.6 Chronic Pain in the Four EM Groups and White Canadians<sup>1</sup>**

% (95%CI)	EM Groups ( <i>East Asians, Middle Eastern, South Asians and Black Canadians</i> ) (N=18 195)	White Canadians (N=320 859)
<b>With Chronic Pain</b>		
	13.1(10.8,15.4)	19.3(16.9,21.6) <sup>#</sup>
<b>Pain Intensity</b>		
<b>Mild</b>	44.3(41.3,47.3)	29.0(28.4,35.8) <sup>#</sup>
<b>Moderate</b>	42.7(40.0,45.4)	53.7(52.7,54.6) <sup>#</sup>
<b>Severe</b>	13.0(10.6,15.3)	17.3(16.3,18.1) <sup>#</sup>
<b>Activity Limitation</b>		
<b>None</b>	31.0(26.3,35.6)	27.6(27.2,35.8)
<b>A Few</b>	32.7(29.2,36.3)	29.3(29.2,35.8)
<b>Some</b>	23.5(20.6,25.37)	23.4(20.6,25.7)
<b>Most</b>	12.8(10.7,14.8)	19.7(10.7,14.7)

<sup>1</sup>Results are weighted to the Canadians populations and are representative of most of the population.

## 4.6 The Differences in Pain Expression, Pain Intensity, and Activity Limitation among the Four EM Groups (Objective 2)

This section summarizes Objective 2 results. Chronic pain experience across the four EM groups was very similar, and no statistically significant difference was found in pain experience. The Middle Eastern and Black Canadian groups had the highest experience of chronic pain at 17%, followed by South Asian groups at 16% (see Table 4.7).

Nine point one percent (95% CI: 3.7%-14.5%) to 19.6% (95%CI: 12.6%-26.6%) of all EM groups experienced having 'severe' chronic pain intensity and 9.2% (95% CI: 6.2%-12.4%) to 18.5% (95% CI: 11.2%-25.9%) of EM groups having 'most' daily activities limited due to chronic pain (see Table 4.7). The group differences for pain intensity and activity limitation were not found to be statistically significant, however.

Three simple logistic regression models were run to analyse the odds of: reporting 'yes' to experiencing chronic pain, experiencing 'high intensity' chronic pain and 'a few' or 'many' activity limitations due to chronic pain in East Asian, Middle Eastern, and South Asian compared to Black Canadians (reference group) (see Table 4.8). The results show that the odds of the East Asian group experiencing 'high'<sup>12</sup> pain intensity is 0.47 (95%CI:0.31-0.69) times the odds of Black Canadians group; this association was found to be statistically significant.

**Table 4.7 Chronic Pain in the Four Ethnic Minority Groups<sup>1</sup>**

% (95%CI)	EM Groups			
	East Asians (N=7687)	Middle Eastern (N=1718)	South Asians (N=5793)	Black Canadians (N=2997)
<b>With Chronic Pain</b>	14.9(13.7,16.0)	16.7(11.5,21.9)	15.5(13.3,17.7)	16.8(14.8,18.8)
<b>Pain Intensity</b>				
<b>Mild</b>	52.9(45.9,59.9)	40.1(29.5,50.7)	38.8(30.2,47.3)	35.9(29.2,42.5)
<b>Moderate</b>	38.0(33.6,42.3)	40.3(29.1,51.5)	46.1(39.9,52.4)	47.7(40.9,54.5)
<b>Severe</b>	9.1(3.7,14.5)	19.6(12.6,26.6)	15.1(10.3,19.8)	16.4(11.2,21.6)
<b>Activity Limitation</b>				
<b>None</b>	33.9(28.0,39.8)	23.9(16.7,31.2)	25.7(21.0,30.4)	31.9(25.6,38.2)
<b>A Few</b>	34.2(28.6,39.7)	31.2(22.4,40.1)	30.5(24.9,36.1)	33.6(26.0,41.1)
<b>Some</b>	22.7(19.1,26.3)	26.3(16.5,36.1)	27.6(22.8,32.3)	19.9(11.6,28.1)
<b>Most</b>	9.2(6.0,12.4)	18.5(11.2,25.9)	16.3(12.4,20.1)	14.6(10.6,18.7)

<sup>1</sup>Results are weighted to the Canadians populations and are representative of most of the population.

<sup>12</sup> High intensity includes moderate and severe intensity

**Table 4.8. Odds Ratio of Experiencing Chronic Pain, Pain Intensity and Activity Limitation by EM Groups**

EM Groups (OR, 95% CI) <sup>1</sup>	Chronic Pain Ref=No Chronic Pain	Pain Intensity Ref=Low Intensity	Activity Limitations <sup>c</sup> Many vs. None	Activity Limitations <sup>d</sup> Some vs. None
Model 1: $\ln(p/(1-p))=b_0 + b_1x_1$				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.87(0.70,1.10)	0.47(0.31,0.69)**	0.88(0.55,1.41)	1.02(0.55,1.87)
Middle Eastern	1.02(0.63,1.64)	0.85(0.48,1.48)	1.78(0.98,3.25)	1.41(0.73,2.70)
South Asians	0.93(0.68,1.27)	0.90(0.57,1.42)	1.60(0.99,2.59)	1.09(0.56,2.11)

<sup>1</sup>the odds of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' or 'some' to activity limitation due to chronic pain.

$x_1$ = the categorical explanatory variable ethnic minority status (Black (ref), South Asian, East Asian, Middle Eastern)

$p$ = the probability of reporting 'yes' to chronic pain, 'high=moderate + severe' to pain intensity and 'many=most some' to activity limitation due to chronic pain

<sup>c</sup>= The probability of reporting 'many' activity limitations compared to 'none'

<sup>d</sup>= The probability of reporting 'some' activity limitations compared to 'none'

\*\* Significant at  $p < 0.05$

### 4.6.1 Data Quality Assurance

Although the pain question used in the CCHS is considered to measure chronic pain, the question did not include a specified duration (e.g. pain must be persistent for three months) as is normally done in pain literature. I therefore conducted a data quality assurance to test whether the questions used accurately assessed chronic pain. Table 4.9 shows the results of chronic pain prevalence in only EM groups who report experiencing arthritis and/or low back pain. When comparing the results from table 4.9 to pain expression in all of the four EM groups (Table 4.7), the results consistently show there is no statistically significant difference in reported pain expression, pain intensity or activity limitation among the four groups. As the trends between the two samples used for calculations in table 4.7 and table 4.9 are similar, we considered that the pain question used in the CCHS appears to be capturing data on respondents with chronic pain.

**Table 4.9 Chronic Pain in Four EM Groups Limited to those with Chronic Conditions<sup>1</sup>**

	EM Groups			
	East Asians (N=1420)	Middle Eastern (N=375)	South Asians (N=1125)	Black Canadians (N=632)
<b>With Chronic Pain, %(95%CI)</b>	41.1(36.7,45.4)	44.7(35.7,53.8)	47.4(42.7,52.1)	44.2(38.0,50.5)
<b>Pain Intensity, % (95%CI)</b>				
<b>Mild</b>	41.2(34.8,47.5)	32.9(19.2,46.7)	27.3((14.9,39.7)	26.6(18.7,34.6)
<b>Moderate</b>	46.4(40.3,52.5)	45.1(33.7,56.5)	54.3(42.2,66.4)	52.1(39.8,64.4)
<b>Severe</b>	12.5(7.0,17.9)	22.0(6.9,37.0)	18.5(13.1,23.9)	21.3(12.2,30.4)
<b>Activity Limitation, % (95% CI)</b>				
<b>None</b>	25.3(18.9,31.6)	17.1(7.2,26.9)	19.0(12.7,25.3)	24.2(15.4,33.0)
<b>A Few</b>	34.9(26.8,43.1)	29.9(13.0,46.9)	27.1(20.8,33.3)	36.0(26.7,45.2)
<b>Some</b>	27.6(21.6,33.6)	31.0(16.7,45.3)	32.9(26.0,39.7)	20.0(11.4,28.6)
<b>Most</b>	12.2(8.3,16.1)	22.0(10.2,33.8)	21.1(15.7,26.5)	19.9(14.1,25.6)

<sup>1</sup>Results are weighted to the Canadians populations and are representative of most of the population.

## 4.6.2 Acculturation and Chronic Pain Experience

Acculturation has been identified in the literature as an important factor to consider when looking at inter-ethnic minority pain experience. Table 4.10 illustrates the role of acculturation in chronic pain experience in the four EM groups. Table 4.10 also shows that a significantly ( $p < 0.05$ ) higher percentage of EM respondents with high acculturation report 'yes' to experiencing chronic pain compared to those with low acculturation. This same statistically significant pattern can be observed for pain intensity and activity limitation. A larger percentage of respondents with high acculturation experienced having severe chronic pain intensity and most of their daily activities were limited by chronic pain. However, in both these situations, the difference was not found to be statistically significant. In Table 4.10, I also looked at acculturation levels and pain experience within each individual EM group and found the same pattern to be apparent in the Black Canadian group. A higher percentage of Black Canadians with high acculturation reported 'yes' to experiencing chronic pain and this difference was found to be statistically significant. For the East Asian group, chronic pain experience was highest in the moderate acculturation group (see Table 4.10) and again this difference was found to be statistically significant ( $p < 0.05$ ) when compared to East Asians with low acculturation. Among the South Asian group, moderate and high acculturation groups had a higher percentage of chronic pain compared to those with low acculturation (see Table 4.10) and these differences were found to be marginally significant.

**Table 4.10 Acculturation and Chronic Pain, Intensity and Activity Limitation by each EM Group**

Acculturation Levels		All Four EM Groups	East Asians (N=7687)	Middle Eastern (N=1718)	South Asians (N=5793)	Black Canadians (N=2997)
<b>With Chronic Pain, % (95%CI)</b>						
<b>Low</b>		13.0(11.5,14.6)	11.5(9.1,14.0)	15.5(9.7,21.4)	10.7(5.6,15.7)	12.0(6.8,17.2)
<b>Moderate</b>		19.8(18.5,21.2)	18.0(15.6,20.5)	18.3(11.6,25.0)	18.6(15.8,21.5)	14.1(9.9,18.3)
<b>High</b>		23.4(21.7,25.2) ‡	15.7(13.1,18.4)	21.9(9.8,33.9)	19.4(15.8,23.0)	22.5(18.8,26.1)
<b>Pain Intensity, % (95%CI)</b>						
<b>Low</b>	Mild	47.2(41.3,53.1)	57.2(47.0,67.3)	34.5(19.6,49.4)	50.9(34.7,67.0)	36.6(5.5,67.7)
	Moderate	41.0(32.4,49.5)	34.3(19.8,48.9)	40.2(24.2,56.3)	39.7(26.3,53.1)	43.4(17.2,69.6)
	Severe	11.8(5.3,18.3) ‡	8.5(0.0,21.1)	25.3(11.3,39.2)	9.4(0.0,18.8)	20.0(0.0,58.2)
<b>Moderate</b>	Mild	40.0(36.1,44.0)	51.6(42.6,60.6)	38.4(19.2,57.6)	36.4(28.7,44.1)	36.4(20.4,52.4)
	Moderate	45.6(41.6,49.7)	38.7(32.0,45.5)	48.1(26.4,69.7)	46.9(38.4,55.4)	53.1(37.8,68.3)
	Severe	14.3(11.8,16.9) ‡	9.6(2.4,16.9)	13.5(3.9,23.1)	16.7(10.3,23.0)	10.6(2.7,18.5)
<b>High</b>	Mild	38.3(34.9,41.8)	57.8(48.8,66.9)	48.8(27.3,70.3)	34.2(24.7,43.7)	35.2(25.7,44.7)
	Moderate	46.2(42.9,49.6)	34.2(25.5,42.8)	34.3(15.2,53.5)	49.4(39.8,59.1)	46.8(37.8,55.8)
	Severe	15.4(12.8,18.0) ‡	8.0(3.3,12.7)	16.9(0.0,35.2)	16.4(9.0,23.8)	17.9(10.3,25.6)

Activity Limitation due to Pain, % (95%CI)						
<b>Low</b>	None	35.1(27.2,43.0)	37.7(25.9,49.5)	30.0(14.8,45.1)	33.8(21.5,46.0)	37.9(0.9,74.9)
	Some	34.2(23.4,45.1)	30.2(14.4,46.0)	30.7(7.6,53.9)	40.3(19.1,61.4)	26.7(9.6,43.9)
	A Few	22.6(17.3,27.9)	23.2(14.4,32.0)	24.6(10.4,38.7)	23.8(8.8,38.8)	20.5(0.0,62.0)
	Most	8.1(4.7,11.5) ‡	8.9(3.1,14.7)	14.7(2.1,27.3)	2.1(0.0,4.6)	14.9(0.0,37.5)
<b>Moderate</b>	None	28.6(24.9,32.4)	31.9(25.0,38.9)	21.2(10.0,32.3)	26.1(17.8,34.4)	27.6(7.5,47.6)
	Some	33.0(29.5,36.6)	35.2(28.6,41.8)	32.2(16.9,47.5)	27.3(19.0,35.6)	39.6(23.4,55.7)
	A Few	24.5(21.5,27.5)	24.7(18.5,30.9)	29.5(15.8,43.2)	28.4(21.4,35.5)	19.7(4.5,34.8)
	Most	13.8(10.8,16.8) ‡	8.2(2.3,14.1)	17.2(6.3,28.1)	18.2(11.7,24.6)	13.2(3.7,22.6)
<b>High</b>	None	28.4(24.5,32.3)	32.5(20.4,44.6)	15.6(1.8,29.4)	21.2(8.3,34.0)	33.0(22.7,43.2)
	Some	32.1(29.0,35.3)	37.2(24.8,49.6)	39.2(1.7,76.7)	26.5(18.3,34.7)	31.4(22.9,39.8)
	A Few	24.3(20.2,28.4)	22.1(12.9,31.3)	29.7(0.0,64.1)	32.9(20.9,44.9)	21.0(13.1,28.9)
	Most	15.2(12.8,17.6) ‡	8.2(3.3,13.1)	15.5(0.0,34.6)	19.4(10.4,28.4)	14.6(8.6,20.7)

<sup>†</sup>Results are weighted to the Canadians populations and are representative of most of the population.

<sup>‡</sup>Significant differences within the four EM groups ( $p < 0.05$ ) for those marked.

## 4.7 Bio-Psychosocial Factors and Pain Experience (Objective 3)

This section summarizes results for Objective 3. The results from the multiple logistic regression models illustrate the relationship among EM groups and pain experience (yes versus no), pain intensity (high versus low), activity limitation (none versus many, and none versus a few) when adjusted for psychological and social factors from a bio-psychosocial framework (Figure 2.3). The results indicate psychological and social factors that are significantly associated with pain experience in the four EM groups.

### 4.7.1 Psychological Factors and Chronic Pain Experience

The association between chronic pain and EM groups after adjusting for psychological factors are included in Table 4.11. According to the results, East Asians are 0.77 (95%CI: 0.63-0.96) times less likely to experience chronic pain compared to Black Canadians. The odds of East Asians experiencing ‘high’ pain intensity were statistically significantly lower than Black Canadians when adjusting for each psychological factor included in the theoretical framework (Figure 2.3) separately. The odds of East Asians experiencing ‘high’ pain intensity compared to Black Canadians were 0.43 (95% CI: 0.30-0.64) when adjusted for self-perceived mental health, 0.48 (95% CI: 0.33-0.70) when adjusted for depression, 0.48 (95%CI: 0.32-0.71) when adjusted for anxiety, and 0.36 (95% CI: 0.23-0.59) when adjusted for alcohol use frequency.

In the next model (see Table 4.12), even after adjusting for acculturation, the East Asians still had lower odds of experiencing chronic pain compared to Black Canadians. For pain intensity, East Asians had lower odds of experiencing ‘high’ pain intensity compared to Black Canadians and the association remained statistically significant. The final model I ran was a multiple logistic regression adjusting for all of the significant psychological factors (self-perceived mental health, depression, and anxiety) and acculturation to determine if the association between East Asian group membership and chronic pain would remain significant (see Table 4.13).

When adjusting for the three psychological factors and acculturation, the odds ratio for the East Asian group experiencing lower levels of ‘high’ pain intensity relative to Black Canadians was still statistically significant (OR 0.37, 95%CI: 0.21-0.63) (see Table 4.14). Therefore, the results suggest that group differences in acculturation and the included psychological factors do not explain the lowered risk of high pain intensity among the East Asian group compared to the Black Canadian group. High acculturation remained statistically significantly associated with pain expression among EM groups when adjusted for the three psychological factors separately (see Table 4.12) and then altogether (see Table 4.13). Moderate acculturation remained statistically significantly associated with pain expression when adjusted for self-perceived mental health (OR: 1.53, 95%CI: 1.44-2.21), depression (OR:1.59, 95%CI: 1.31-1.92) and anxiety (OR: 1.72, 95%CI: 1.41-2.10) (see Table 4.12).

### Psychological Factors of Chronic Pain

Self-perceived mental health, anxiety, and depression were strongly associated with reporting ‘yes’ to chronic pain (see Table 4.11). EM groups who reported having ‘poor/fair’ self-perceived mental health were 5.99 (95%CI: 4.26-8.43) times to report ‘yes’ to having chronic pain compared to those with ‘excellent’ self-perceived mental health. EM groups who reported suffering depression and anxiety were 4.36 (95%CI: 3.23-5.90) and 4.50 (95%CI: 3.16-6.56) times, respectively, to report ‘yes’ to having chronic pain compared to those without depression and anxiety (see Table 4.11).

**Table 4.11 Odds Ratio of Chronic Pain in EM Group when Adjusted for Psychological Factors**

EM Groups (OR, 95% CI) <sup>1</sup>	Chronic Pain Ref=No Chronic Pain	Pain Intensity Ref=Low Pain Intensity	Activity Limitations <sup>c</sup> Many vs. None	Activity Limitations <sup>d</sup> Some vs. None
<b>Model 1: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2</math> (Self-Perceived Mental Health)</b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.77(0.63,0.96)**	0.43(0.30,0.64)**	0.78(0.49,1.24)	0.77(0.63,0.96)**
Middle Eastern	0.93(0.57,1.51)	0.83(0.48,1.44)	1.63(0.83,3.18)	0.93(0.57,1.51)
South Asians	0.85(0.65,1.12)	0.90(0.57,1.40)	1.60(0.95,2.68)	0.85(0.65,1.12)
Self-Perceived Mental Health				
Excellent(Ref)	1.00	1.00	1.00	1.00
Very Good	1.40(1.11,1.76)**	1.36(0.90,2.06)	1.04(0.52,2.11)	1.40(1.11,1.76)**
Good	2.21(1.70,2.89)**	1.38(0.94,2.03)	1.41(0.81,2.45)	2.21(1.70,2.89)**
Poor/Fair	5.99(4.26,8.43)**	2.46(1.32,4.59)**	3.28(1.49,7.20)**	5.99(4.26,8.43)**
<b>Model 2: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2</math> (Depression)</b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.90(0.71,1.13)	0.48(0.32,0.71)**	0.90(0.57,1.44)	1.03(0.56,1.90)
Middle Eastern	0.96(0.59,1.58)	0.81(0.47,1.38)	1.64(0.89,3.03)	1.38(0.71,2.68)
South Asians	0.91(0.65,1.29)	0.88(0.56,1.38)	1.57(0.97,2.54)	1.08(0.54,2.15)
Depression (Ref=no)	4.36(3.23,5.90)**	2.12(1.07,4.19)	3.71(1.79,7.68)**	1.99(0.78,5.07)
<b>Model 3: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2</math> (Anxiety)</b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.89(0.720,1.107)	0.48(0.32,0.71)**	0.92(0.57,1.47)	1.01(0.55,1.86)
Middle Eastern	1.00(0.637,1.578)	0.82(0.48,1.41)	1.74(0.96,3.14)	1.38(0.71,2.67)
South Asians	0.92(0.682,1.253)	0.89(0.54,1.46)	1.59(0.99,2.56)	1.08(0.55,2.12)
Anxiety (Ref=no)	4.50(3.16,6.56)**	2.19(0.68,7.07)	3.47(1.52,7.91)**	1.76(0.73, 4.22)

Model 4: $\ln(p/(1-p)) = b_0 + b_1x_1 + b_2$ (Alcohol Use Frequency)				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.70(0.40,1.20)	0.36(0.22,0.58)**	0.76(0.41,1.38)	0.83(0.39,1.78)
Middle Eastern	1.07(0.64,1.79)	0.57(0.21,1.53)	2.19(0.70,6.79)	1.50(0.21,10.28)
South Asians	0.88(0.53,1.44)	0.65(0.39,1.09)	1.57(0.81,3.04)	1.01(0.39,2.59)
Alcohol Use Frequency				
<i>Less than once a month (Ref)</i>	1.00	1.00	1.00	1.00
<i>Once a month</i>	0.74 (0.56,0.97)**	0.80(0.40,1.59)	1.08(0.55,2.11)	1.33(0.66,2.67)
<i>2 to 3 times a month</i>	0.65(0.46,0.92)**	0.95(0.16,5.62)**	0.82(0.09,6.93)	1.03(0.30,3.53)
<i>Once a week</i>	0.61(0.40,0.95)**	0.53(0.28,0.99)	0.58(0.19,1.72)	0.77(0.40,1.4)
<i>2 or more times a week</i>	0.81(0.54,1.20)	0.91(0.46,1.82)	0.85(0.33,2.15)	0.72(0.39,1.31)

*the odds of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' or 'some' to activity limitation due to chronic pain when adjusted for each of the psychological factors separately.*

*p= the probability of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' to activity limitation due to chronic pain when adjusted for each of the factors from the bio-psychosocial model*

*x<sub>1</sub>= the categorical explanatory variable ethnic minority status (Black (ref), South Asian, East Asian, Middle Eastern)*

*c= The probability of reporting 'many' activity limitation compared to 'none'*

*d= The probability of reporting 'some' activity limitation compared to 'none'*

**\*\* Significant at p<0.05**

**Table 4.12 Odds Ratio of Chronic Pain in EM Group when Adjusted for Psychological Factors and Acculturation**

	Chronic Pain Ref=No Chronic Pain	Pain Intensity Ref=Low Pain Intensity	Activity Limitations <sup>c</sup> Many vs. None
Model 1: $\ln(p/(1-p)) = b_0 + b_1x_1 + b_2$ (Self-Perceived Mental Health)+ b <sub>3</sub> (Acculturation)			
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00
East Asians	0.83(0.67,1.04)	0.43(0.29,0.65)**	0.86(0.48,1.55)
Middle Eastern	1.06(0.63,1.77)	0.87(0.47,1.57)	2.00(0.90,4.41)
South Asians	0.91(0.68,1.21)	0.89(0.55,1.41)	1.68(0.91,3.12)
Self-Perceived Mental Health			
Excellent(Ref)	1.00	1.00	1.00
Very Good	1.40(1.09,1.81)**	1.40(0.93,2.12)	1.09(0.53,2.21)
Good	2.22(1.66,2.98)**	1.38(0.95,2.01)	1.47(0.87,2.50)
Poor/ Fair	6.03(4.14,8.79)**	2.52(1.31,4.82)**	3.45(1.69, 7.08)**
Acculturation (Ref=low)			
Moderate	1.53(1.27,1.85)**	1.27(0.68,2.38)	1.58(0.98,2.54)
High	1.79(1.44,2.21)**	1.20(0.79,1.84)	1.85(0.85,4.04)
Model 2: $\ln(p/(1-p)) = b_0 + b_1x_1 + b_2$ (Depression)+ b <sub>3</sub> (Acculturation)			
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00
East Asians	0.94(0.74,1.20)	0.48(0.33,0.7)**	0.98(0.56,1.73)
Middle Eastern	1.07(0.64,1.79)	0.83(0.48,1.44)	1.87(0.95,3.72)
South Asians	0.96(0.68,1.35)	0.87(0.56,1.37)	1.62(0.90,2.92)
Depression (Ref=no)	4.25(3.14,5.75)**	2.11(1.11,4.03)**	3.66(1.78,7.5)**
Acculturation(Ref=low)			
Moderate	1.59(1.31,1.92)**	1.29(0.85,1.98)	1.53(0.99,2.38)
High	1.70(1.40,2.06)**	1.18(0.83,1.69)	1.66(0.88,3.12)
Model 3: $\ln(p/(1-p)) = b_0 + b_1x_1 + b_2$ (Anxiety)+ b <sub>3</sub> (Acculturation)			
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00
East Asians	0.94(0.75,1.17)	0.48 (0.32,0.71)**	0.99(0.55,1.78)
Middle Eastern	1.12(0.71,1.77)	0.84(0.49,1.45)	1.99(1.02,3.85)
South Asians	0.97(0.72,1.30)	0.88(0.53,1.44)	1.64(0.93,2.89)
Anxiety (Ref=no)	4.46(3.11,6.39)**	2.19(0.70,6.86)	3.47(1.58,7.6)**
Acculturation (Ref=low)			
Moderate	1.60(1.31,1.94)**	1.29(0.86,1.94)	1.55(1.00,2.41)
High	1.72(1.41,2.10)**	1.19(0.83,1.69)	1.68(0.92,3.06)



	Model 4: $\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Alcohol Use Frequency}) + b_3(\text{Acculturation})$		
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00
East Asians	0.76(0.44,1.31)	0.37 (0.22,0.61) **	0.87(0.45,1.71)
Middle Eastern	1.17(0.72,1.91)	0.59(0.22,1.53)	2.48(0.71,8.67)
South Asians	0.90(0.56,1.45)	0.64(0.38,1.09)	1.61(0.81,3.18)
<b>Alcohol Use Frequency</b>			
<i>Less than once a month</i> (Ref)	1.00	1.00	1.00
<i>Once a month</i>	0.75(0.57,1.00)	0.81(0.40,1.66)	1.11(0.55,2.22)
<i>2 to 3 times a month</i>	0.64 (0.45,0.91)**	0.99(0.18,5.5)	0.82(0.10,6.99)
<i>Once a week</i>	0.61 (0.39,0.98)**	0.54(0.28,1.04)	0.59(0.20,1.71)
<i>2 or more times a week</i>	0.78(0.52,1.16)	0.90(0.46,1.74)	0.80(0.33,1.95)
<b>Acculturation (Ref=low)</b>			
Low	1.00	1.00	1.00
Moderate	1.36(0.97,1.91)	1.31(0.82,2.08)	1.35(0.71,2.58)
High	1.63(1.15,2.32) **	1.19(0.73,1.93)	1.74(0.85,3.56)

<sup>1</sup>the odds of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' or 'some' to activity limitation due to chronic when adjusted for the psychological factors and acculturation.

p= the probability of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' to activity limitation due to chronic pain when adjusted for each of the factors from the bio-psychosocial model

$x_1$ = the categorical explanatory variable ethnic minority status (Black (ref), South Asian, East Asian, Middle Eastern)

c= The probability of reporting 'many' activity limitation compared to 'none'

\*\* Significant at  $p < 0.05$

**Table 4.13 Odds Ratio of Chronic Pain in EM Group when Adjusted for all Psychological Factors**

<b>Odds Ratio Estimates</b>	<b>Chronic Pain Ref= No Chronic Pain</b>	<b>Pain Intensity Ref=Low Pain Intensity</b>	<b>Activity Limitations<sup>c</sup> Many vs. None</b>
Model 1: $\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Self-Perceived Mental Health}) + b_3(\text{Depression}) + b_4(\text{Anxiety}) + b_5(\text{Alcohol Use Frequency})$			
<b>Black Canadians (Ref)</b>			
East Asians	0.72(0.40,1.27)	0.37(0.21,0.63)**	0.84(0.44,1.61)
Middle Eastern	1.06(0.68,1.65)	0.55(0.26,1.19)	2.21(0.66,7.40)
South Asians	0.84(0.47,1.50)	0.62(0.36,1.08)	1.64(0.70,3.85)
<b>Self-Perceived Mental Health</b>			
Excellent(Ref)			
Very Good	1.32(1.01,1.74)	1.22(0.73,2.02)	0.91(0.50,1.65)
Good	2.06(1.38,3.07)**	1.32(0.78,2.24)	1.38(0.68,2.80)
Poor/Fair	5.48(3.35,8.96)**	1.88(0.80,4.43)	2.88(0.91,9.13)
Depression (Ref=no)	1.65(0.98,2.76)	1.47(0.31,7.00)	2.08(0.50,8.71)
Anxiety (Ref=no)	2.13(1.10,4.11)**	1.21(0.43,3.41)	1.77(0.56,.56)
<b>Alcohol Use Frequency</b>			
<i>Less than once a month</i> (Ref)			
<i>Once a month</i>	0.75(0.56,1.00)	0.74(0.34,1.58)	0.99(0.46,2.11)
<i>2 to 3 times a month</i>	0.62(0.44,0.86)**	0.97(0.18,5.25)	0.85(0.10,7.54)
<i>Once a week</i>	0.65(0.44,0.98)	0.54(0.27,1.07)	0.59(0.21,1.71)
<i>2 or more times a week</i>	0.78(0.55,1.12)	0.87(0.44,1.73)	0.72(0.27,1.91)
<b>Acculturation</b>			
Low(Ref)	1.00	1.00	1.00
Moderate	1.25(0.88,1.78)	1.25(0.77,2.03)	1.30(0.70,2.41)
High	1.55(1.06,2.27)**	1.18(0.70,1.98)	1.70(0.75,3.88)

<sup>1</sup>the odds of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' to activity limitation due to chronic when adjusted for the psychological factors and acculturation.

p= the probability of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' to activity limitation due to chronic pain when adjusted for each of the factors from the bio-psychosocial model

$x_1$ = the categorical explanatory variable ethnic minority status (Black (ref), South Asian, East Asian, Middle Eastern)

c= The probability of reporting 'many' activity limitation compared to 'none'

\*\* Significant at  $p < 0.05$

## 4.7.2 Socio-Demographic Factors and Chronic Pain

Table 4.14 presents the ORs for chronic pain in the four EM groups when adjusted for each socio-demographic factor separately. The odds of East Asians reporting 'high' pain intensity were lower compared to the Black Canadians; this difference was found to be statistically significant ( $p < 0.05$ ). The odds of East Asians reporting 'high' pain intensity compared to Black Canadians when adjusted for sex, age, having a regular doctor, marital status, household size, area of residence, income, education, employment, languages and time spent in Canada separately, ranged from 0.40 to 0.48. When adjusted for sex and household size, South Asian groups were 1.62 (95%CI: 1.01-2.60) and 1.74 (95%CI: 1.01-2.83) times as likely to experience 'many' activity limitations due to chronic pain compared to Black Canadians. Middle Eastern groups were 1.90 (95%CI: 1.02-3.52), 1.99 (95%CI: 1.07- 3.71) and 1.94 (95%CI:1.05-3.57) times as likely, respectively, to experience 'many' activity limitations compared to Black Canadians when adjusted for age, income, and time spent in Canada separately (see Table 4.14). When the regression model was adjusted for acculturation, East Asians still had lower odds of experiencing 'high' pain intensity compared to the Black Canadians at an odds ratio of 0.44 (95%CI: 0.32-0.69). However, the odds of experiencing 'many' activity limitations increased in Middle Eastern groups to 2.1 (95% CI: 1.04-4.04) times as likely as Black Canadians when the model was adjusted for acculturation. As in the previous section, I ran the regression models again but adjusting for each socio-demographic variable that was found to be significant, and for acculturation to determine if the latter behaved as confounder (see Table 4.15). After adjusting for household size and acculturation, the odds of the South Asians group experiencing 'many' activity limitations compared to Black Canadians was no longer significant (see Table 4.15). Conversely, the odds of experiencing 'many' activity limitations in Middle Eastern groups compared to Black Canadians increased from 1.84 (95% CI: 0.99-3.42) to 2.05 (95%CI: 1.03-4.12) – a difference that is statistically significant when adjusted for acculturation and household size. The results from a final multiple regression model adjusting for all of the significant socio-demographic factors (age, sex, marital status, household size, income, employment, and time spent in Canada) and acculturation (see Table 4.16) showed that the OR for East Asians experiencing 'high' pain intensity remained statistically significantly reduced relative to Black Canadians (OR 0.4, 95%CI: 0.26-0.76). As well, after adjusting for all of the significant socio-demographic factors, the odds of Middle Eastern Canadians experiencing 'a few' activity limitations compared to 'none' became statistically significant (OR 2.8, 95%CI: 1.09-7.17 – see Table 4.16).

## Socio-Demographic Factors of Chronic Pain

Age, sex, marital status, household size, employment, time spent in Canada, and acculturation were statistically significantly associated with chronic pain in the four EM groups (see Table 4.14). EM in the oldest age groups (85+) had the highest odds of reporting 'yes' to chronic pain (OR 12.81, 95%CI: 7.15-22.95). EM who reported being widowed had the highest experience of chronic pain (OR 5.4, 95%CI: 3.86-7.77). EM who were employed (OR 0.67, 95%CI: 0.50-0.89), had three or more persons in a household (3 persons: OR 0.66, 95%CI: 0.52-0.85; 4 persons: OR 0.62, 95%CI: 0.51-0.75), or who had spent fewer than ten years in Canada (OR 0.52, 95%CI: 0.44-0.61) had lower odds of reporting 'yes' to chronic pain. Moderate (OR 1.6, 95%CI: 1.34-1.96) or high (OR 1.78, 95%CI: 1.46-2.15) acculturation was a significantly associated with chronic pain experience in the three EM groups relative to Black Canadians. Moderate acculturation was statistically significantly associated with experiencing 'many' (OR 1.5, 95%CI: 1.01-2.34) activity limitations (see Table 4.14) relative to Black Canadians. Moderate and high acculturation remained statistically significant when adjusted for sex (Moderate-OR: 1.64, 95%CI: 1.36-1.98; High- OR: 1.78, 95%CI: 1.47-2.16), marital status (Moderate-OR: 1.48, 95%CI: 1.23-1.79; High-OR:1.63, 95%CI: 1.35-1.98), household size (Moderate-OR:1.56, 95%CI: 1.29-1.89; OR: 1.64, 95%CI: 1.34-2.00) and employment (Moderate-OR: 1.54, 95%CI: 1.26-1.87; High- OR: 1.82, 95%CI: 1.49-2.23) for pain expression among EM groups (see Table 4.15). When I adjusted for all of the significant socio-demographic factors (age, sex, marital status, household size, income, employment, and time spent in Canada) and acculturation in the final regression model (see Table 4.16) only age (OR [45 years to 54 years]: 3.30, 95%CI: 2.05-5.35; OR [55years to 69 years] 4.66, 95%CI: 2.98-7.28; OR [70 years to 84 years]: 7.02, 95%CI: 3.51-14.01) and sex (OR:1.49, 95%CI: 1.23-1.80) remained statistically significant.

**Table 4.14 Odds Ratio of Chronic Pain in EM Group when Adjusted for Socio-Demographic Factors**

EM Groups (OR, 95% CI) <sup>1</sup>	Chronic Pain Ref=No Chronic Pain	Pain Intensity Ref=Low Pain Intensity	Activity Limitations <sup>c</sup> Many vs. None	Activity Limitations <sup>d</sup> Some vs. None
<b>Model 1: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Sex})</math></b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.86(0.70,1.07)	0.47(0.32,0.69)**	0.89(0.56,1.42)	1.02(0.55,1.88)
Middle Eastern	1.05(0.67,1.65)	0.86(0.50,1.49)	1.81(0.99,3.29)*	1.42(0.74,2.72)
South Asians	0.95(0.72,1.24)	0.91(0.56,1.46)	1.62(1.01,2.60)**	1.10(0.57,2.11)
Sex (Ref=Male)	1.60(1.38,1.86)**	1.17(0.90,1.52)	1.12(0.73,1.70)	1.09(0.71,1.69)
<b>Model 2: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Age})</math></b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.79(0.63,1.01)	0.443(0.28,0.68)**	0.84(0.51,1.38)	0.79(0.63,1.01)
Middle Eastern	1.16(0.67,2.02)	0.895(0.48,1.65)	1.89(1.02,3.52)**	1.16(0.67,2.02)
South Asians	0.93(0.66,1.32)	0.867(0.56,1.32)	1.55 ( 0.92,2.60)	0.93(0.66,1.32)
Age (Ref=18-25)	1.00	1.00	1.00	1.00
25-39	1.71(1.21,2.42)**	1.32(0.62,2.80)	1.02(0.36,2.87)	0.88(0.41,1.90)
40-54	3.23(2.15,4.87)**	1.44(0.57,3.63)	1.19(0.53,2.69)	0.75(0.37,1.53)
55-69	4.95(3.29,7.43)**	1.73(0.87,3.46)	1.54(0.55,4.32)	0.83(0.32,2.14)
70-84	7.77(5.06,11.93)**	2.28(0.95,5.46)	1.94(0.76,4.90)	0.99(0.42,2.29)
85+	12.81(7.15,22.95)**	2.76(1.04,7.31)**	3.05(0.99,9.39)	0.95(0.28,3.19)
<b>Model 3: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Has a Regular Doctor})</math></b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.87(0.70,1.09)	0.47(0.31,0.69)**	0.88(0.56,1.40)	1.02(0.56,1.86)
Middle Eastern	1.02(0.63,1.64)	0.85(0.48,1.49)	1.78(0.98,3.22)	1.42(0.74,2.72)
South Asians	0.92(0.67,1.27)	0.89(0.57,1.40)	1.60(0.99,2.57)	1.09(0.56,2.11)
Has a Regular doctor (Ref=no)	0.89(0.73,1.10)	0.94(0.66,1.34)	1.33(0.83,2.13)	
<b>Model 4: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Marital Status})</math></b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.85(0.65,1.10)	0.46(0.29,0.73)**	0.88(0.54,1.43)	1.01(0.57,1.76)
Middle Eastern	1.05 (0.62,1.77)	0.84(0.44,1.58)	1.78(0.94,3.37)	1.41(0.72,2.74)
South Asians	0.90(0.62,1.30)	0.88(0.58,1.33)	1.61(0.98,2.66)	1.10(0.58,2.07)
Marital Status				
Single, never married (Ref)	1.00	1.00	1.00	1.00
Married	1.83(1.39,2.42)**	1.04(0.60,1.81)	0.86(0.49,1.51)	0.79(0.49,1.27)
living common-law	1.96(1.18,3.25)**	0.68(0.23,2.00)	0.53(0.15,1.81)	0.47(0.18,1.18)
Widowed	5.42(3.84,7.66)**	1.42(0.71,2.87)	1.41(0.36,5.47)	0.94(0.34,2.63)
Separated	2.31(1.25,4.26)**	1.09(0.50,2.36)	0.94(0.34,2.61)	0.47(0.13,1.61)
Divorced	2.91(1.88,4.51)**	1.46(0.76,2.81)	1.34(0.52,3.42)	0.78(0.30,2.04)
<b>Model 5: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Household Size})</math></b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.91(0.73,1.12)	0.47(0.32,0.70)**	0.90(0.56,1.46)	1.03(0.55,1.93)
Middle Eastern	1.09(0.68,1.74)	0.88(0.48,1.60)	1.84(0.99,3.42)*	1.43(0.74,2.76)
South Asians	1.02(0.75,1.41)	0.96(0.61,1.52)	1.74(1.07,2.83)**	1.13(0.56,2.28)
Household Size (Ref=1 Person)	1.00	1.00	1.00	1.00
2	0.93(0.75,1.15)	0.87(0.56,1.33)	0.83(0.52,1.34)	0.88(0.53,1.45)
3	0.66(0.52,0.85)**	0.69(0.45,1.08)	0.78(0.46,1.30)	0.81(0.31,2.15)
4	0.61(0.50,0.75)**	0.65(0.45,0.95)**	0.64(0.43,0.96)**	0.82(0.54,1.24)
<b>Model 6: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Area of Residence})</math></b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.87(0.69,1.10)	0.47(0.31,0.69)**	0.88(0.56,1.40)	1.01(0.54,1.89)
Middle Eastern	1.02(0.63,1.64)	0.85(0.49,1.47)	1.78(0.98,3.23)	1.41(0.74,2.67)
South Asians	0.93(0.68,1.27)	0.90(0.56,1.43)	1.59(0.98,2.58)	1.09(0.55,2.14)
Area of Residence (Ref=Rural)	1.17(0.61,2.27)	0.87(0.37,2.01)	0.59(0.10,3.47)	
<b>Model 7: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Income})</math></b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.95(0.74,1.22)	0.47(0.32,0.71)**	0.91(0.55,1.50)	1.05(0.63,1.75)

Middle Eastern	1.02(0.58,1.78)	0.89(0.53,1.50)	1.99(1.07,3.70)**	1.61(0.82,3.15)
South Asians	0.97(0.67,1.41)	0.93(0.54,1.60)	1.74(0.99,3.05)*	1.16(0.66,2.04)
Income (Ref= No Income)	1.00	1.00	1.00	1.00
Lower-Middle Income	2.31(0.65,8.23)	1.86(0.10,35.12)	1.37(0.01,134.65)	2.31(0.65,8.23)
Middle Income	1.55(0.44,5.43)	1.48(0.07,31.57)	1.08(0.01,104.71)	1.55(0.44,5.43)
Upper-Middle Income	1.38(0.37,5.17)	1.46(0.07,30.67)	0.96(0.01,93.68)	1.38(0.37,5.17)
Highest Income	1.46(0.35,6.06)	0.80(0.04,15.75)	0.74(0.01,90.09)	1.46(0.35,6.06)
<b>Model 8: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2</math> (Education)</b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.81(0.55,1.19)	0.47(0.28,0.78)**	0.91(0.50,1.65)	1.07(0.54,2.12)
Middle Eastern	0.94(0.48,1.84)	1.01(0.54,1.89)	2.36(0.84,6.63)	2.24(1.03,4.86)**
South Asians	0.81(0.57,1.16)	0.92(0.52,1.64)	1.69(0.68,4.14)	1.21(0.58,2.52)
Education (Ref=High school)	1.00	1.00	1.00	1.00
Non-University certificate	0.78(0.45,1.36)	1.27(0.77,2.11)	1.27(0.38,4.30)	
Bachelors Degree	0.78(0.56,1.09)	1.14(0.74,1.77)	1.13(0.60,2.11)	
Graduate	0.62(0.45,0.86)	1.28(0.67,2.42)	1.04(0.45,2.39)	
<b>Model 9: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2</math> (Employment)</b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.81(0.61,1.09)	0.47(0.31,0.71)**	0.81(0.49,1.33)	1.05(0.45,2.46)
Middle Eastern	0.99(0.57,1.70)	0.86(0.48,1.52)	1.68(0.86,3.29)	1.53(0.72,3.22)
South Asians	0.89(0.66,1.19)	0.84(0.52,1.36)	1.52(0.90,2.56)	1.19(0.51,2.76)
Employment (Ref=no)	0.50(0.43,0.64)**	0.65(0.53,0.92)	0.62(0.30,1.23)	0.52(0.46,0.64)**
<b>Model 10: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2</math> (Languages)</b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.86(0.67,1.11)	0.44(0.30,0.66)**	0.98(0.55,1.72)	1.09(0.54,2.19)
Middle Eastern	1.01(0.61,1.66)	0.79(0.45,1.41)	1.93(0.98,3.77)*	1.53(0.75,3.14)
South Asians	0.92(0.67,1.27)	0.86(0.55,1.33)	1.70(0.96,3.03)*	1.16(0.52,2.60)
Languages (Ref=Other than Eng)	1.00(0.86,1.17)	1.14(0.86,1.51)	0.82(0.48,1.40)	
<b>Model 11: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2</math> (Time Spent in Canada)</b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.88(0.71,1.10)	0.47(0.31,0.70)**	0.90(0.55,1.47)	1.02(0.56,1.84)
Middle Eastern	1.10(0.68,1.77)	0.90(0.51,1.58)	1.94(1.05,3.57)**	1.43(0.74,2.76)
South Asians	0.95(0.71,1.27)	0.90(0.57,1.43)	1.60(0.97,2.63)**	1.10(0.59,2.05)
Time Spent in Canada (Ref=more than 10 yrs)	0.52(0.44,0.61)**	0.72(0.53,0.96)**	0.67(0.47,0.95)**	0.90(0.47,1.72)
<b>Model 12: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2</math> (Acculturation)</b>				
<b>Black Canadians (Ref)</b>	1.00	1.00	1.00	1.00
East Asians	0.92(0.73,1.17)	0.46(0.31,0.68)**	0.96(0.53,1.72)	1.04(0.53,2.03)
Middle Eastern	1.14(0.70,1.86)	0.86(0.48,1.53)	2.05(1.04,4.04)**	1.53(0.77,3.04)
South Asians	0.98(0.72,1.32)	0.88(0.56,1.39)	1.66(0.91,3.02)	1.14(0.55,2.38)
Acculturation (Ref=Low)				
Moderate	1.62(1.34,1.96)**	1.29(0.84,1.97)	1.54(1.01,2.34)**	1.27(0.66,2.44)
High	1.77(1.46,2.15)**	1.18(0.82,1.68)	1.70(0.94,3.08)	1.31(0.75,2.29)

<sup>1</sup>the odds of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' or 'some' to activity limitation due to chronic when adjusted for the socio-demographic factors.

*p* = the probability of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' to activity limitation due to chronic pain when adjusted for each of the factors from the bio-psycho-social model

*x<sub>1</sub>* = the categorical explanatory variable ethnic minority status (Black (ref), South Asian, East Asian, Middle Eastern)

*c* = The probability of reporting 'many' activity limitation compared to 'none'

*d* = The probability of reporting 'some' activity limitation compared to 'none'

\*\* Significant at *p* < 0.05

**Table 4.15 Odds Ratio of Chronic Pain in EM Groups when Adjusted for Socio-Demographic Factors and Acculturation**

EM Groups (OR, 95% CI) <sup>1</sup>	Chronic Pain Ref=No Chronic Pain	Pain Intensity Ref=Low Pain Intensity	Activity Limitations <sup>c</sup> Many vs. None
<b>Model 1: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Sex}) + b_3(\text{Acculturation})</math></b>			
<b>Black Canadians (Ref)</b>			
East Asians	0.92(0.74, 1.14)	0.47(0.32, 0.69)**	0.97(0.55, 1.66)
Middle Eastern	1.19(0.75, 1.89)	0.88(0.50, 1.55)	2.09(1.07, 4.19)**
South Asians	1.01(0.77, 1.31)	0.89(0.56, 1.44)	1.69(0.94, 3.09)
Sex (Ref=Male)	0.62(0.53, 0.72)**	0.84(0.65, 1.09)	0.88(0.59, 2.75)
<b>Acculturation (Ref=Low)</b>			
Moderate	1.64(1.36, 1.98)**	1.28(0.84, 1.95)	1.53(1.01, 4.27)**
High	1.78(1.47, 2.16)**	1.17(0.82, 1.68)	1.70(0.94, 4.60)
<b>Model 2: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Age}) + b_3(\text{Acculturation})</math></b>			
<b>Black Canadians (Ref)</b>			
East Asians	0.81(0.64, 1.03)	0.44(0.29, 0.65)**	0.91(0.50, 1.66)
Middle Eastern	1.20(0.70, 2.06)	0.88(0.47, 1.65)	2.08(1.04, 4.19)**
South Asians	0.95(0.68, 1.32)	0.85(0.55, 1.30)	1.62(0.84, 3.09)
<b>Age (Ref)</b>			
1 (18-25)			
25-39	1.68(1.17, 2.39)**	1.33(0.62, 2.85)	0.96(0.34, 2.75)
40-54	3.11(2.07, 4.68)**	1.42(0.54, 3.73)	1.07(0.48, 2.41)
55-69	4.73(3.08, 7.26)**	1.70(0.79, 3.69)	1.32(0.41, 4.27)
70-84	7.39(4.64, 11.78)**	2.21(0.84, 5.85)	1.72(0.64, 4.60)
85+	11.98(6.43, 22.33)**	2.57(0.93, 7.04)	2.49(0.77, 8.00)
<b>Acculturation (Ref=Low)</b>			
Moderate	1.08(0.89, 1.32)	1.09(0.65, 1.84)	1.29(0.82, 2.06)
High	1.14(0.92, 1.42)	1.01(0.67, 1.51)	1.44(0.70, 2.96)
<b>Model 3: <math>\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Marital Status}) + b_3(\text{Acculturation})</math></b>			
<b>Black Canadians (Ref)</b>			
East Asians	0.89(0.68, 1.16)	0.48(0.29, 0.70)	0.96(0.53, 1.76)
Middle Eastern	1.15(0.69, 1.93)	0.85(0.45, 1.62)	2.04(0.99, 4.20)
South Asians	0.93(0.65, 1.34)	0.87(0.58, 1.32)	1.68(0.88, 3.20)
<b>Marital Status (Ref)</b>			
Single, never married			
Married	1.87(1.41, 2.48)**	1.04(0.57, 1.90)	0.48(0.46, 1.55)
living common-law	1.89(1.13, 3.19)**	0.66(0.22, 2.07)	0.51(0.17, 1.52)
Widowed	5.13(3.50, 7.52)**	1.37(0.74, 2.56)	1.33(0.42, 4.20)
Separated	2.19(1.14, 4.20)**	1.02(0.46, 2.28)	0.85(0.28, 2.56)
Divorced	2.78(1.82, 4.17)**	1.41(0.72, 2.80)	1.20(0.44, 3.30)
<b>Acculturation (Ref=Low)</b>			
Moderate	1.48(1.23, 1.79)**	1.23(0.79, 1.91)	1.45(0.93, 2.27)
High	1.63(1.35, 1.98)**	1.47(0.79, 1.66)	1.63(0.28, 3.22)
<b>Model 4: <math>\ln(p^2/(1-p)) = b_0 + b_1x_1 + b_2(\text{Household Size}) + b_3(\text{Acculturation})</math></b>			
<b>Black Canadians (Ref)</b>			
East Asians	0.95(0.76, 1.18)	0.46(0.31, 0.68)**	0.97(0.53, 1.75)
Middle Eastern	1.19(0.74, 1.91)	0.87(0.47, 1.60)	2.05(1.03, 4.12)**
South Asians	1.06(0.78, 1.43)	0.93(0.59, 1.47)	1.77(0.97, 3.22)
<b>Household Size (Ref= 1 Person)</b>			
2	0.95(0.76, 1.18)	0.87(0.59, 1.30)	0.85(0.51, 1.42)
3	0.70(0.55, 0.90)**	0.70(0.46, 1.08)	0.83(0.50, 1.35)
4	0.65(0.53, 0.80)**	0.67(0.46, 0.97)	0.70(0.46, 1.07)
<b>Acculturation (Ref=Low)</b>			
Moderate	1.56(1.29, 1.89)**	1.21(0.79, 1.87)	1.47(0.96, 2.26)
High	1.64(1.34, 2.00)**	1.06(0.74, 1.53)	1.58(0.83, 3.00)
<b>Model 5: <math>\ln(p^2/(1-p)) = b_0 + b_1x_1 + b_2(\text{Employment}) + b_3(\text{Acculturation})</math></b>			
<b>Black Canadians (Ref)</b>			
East Asians	0.89(0.66, 1.20)	0.47(0.32, 0.70)**	0.91(0.50, 1.64)
Middle Eastern	1.14(0.65, 2.00)	0.89(0.50, 1.59)	2.02(0.97, 4.18)
South Asians	0.95(0.72, 1.27)	0.85(0.52, 1.37)**	1.63(0.85, 3.15)
Employment (Ref=no)	0.55(0.47, 0.65)**	0.68(0.50, 0.91)	0.63(0.33, 1.21)
<b>Acculturation (Ref=Low)</b>			

Moderate	1.54(1.26,1.87)**	1.23(0.77,1.99)	1.40(0.89,2.20)
High	1.82(1.49,2.23)**	1.18(0.81,1.71)	1.70(0.97,2.98)
Model 6: $\ln(p^2/(1-p)) = b_0 + b_1x_1 + b_2(\text{Time Spent in Canada}) + b_3(\text{Acculturation})$			
<b>Black Canadians (Ref)</b>			
East Asians	0.84(0.66,1.08)	0.44(0.29,0.65)**	0.96(0.53,1.73)
Middle Eastern	1.05(0.64,1.73)	0.83(0.47,1.48)	2.04(1.03,4.05)**
South Asians	0.92(0.68,1.24)	0.85(0.55,1.33)	1.66(0.91,3.04)
Time Spent in Canada (Ref=more than 10 yrs)	0.44(0.32,0.61)**	0.58(0.33,1.03)	0.92(0.42,1.99)
Acculturation (Ref=low)			
Moderate	0.83(0.60,1.16)	0.81(0.41,1.59)	1.43(0.66,3.10)
High	0.77(0.52,1.13)	0.68(0.34,1.35)	1.56(0.51,4.80)

*the odds of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' activity limitation due to chronic when adjusted for the socio-demographic factors and acculturation.*

*p= the probability of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' to activity limitation due to chronic pain when adjusted for each of the factors from the bio-psychosocial model*

*x<sub>1</sub>= the categorical explanatory variable ethnic minority status (Black (ref), South Asian, East Asian, Middle Eastern)*

*c= The probability of reporting 'many' activity limitation compared to 'none'*

*\*\* Significant at p<0.05*



**Table 4.16 Odds Ratio of Chronic Pain in EM Groups when Adjusted for all Socio-Demographic Factors**

Odds Ratio Estimates	Chronic Pain Ref= no chronic pain	Pain Intensity Ref=Low Pain Intensity	Activity Limitations <sup>c</sup> Many vs. None
Model 1: $\ln(p/(1-p)) = b_0 + b_1x_1 + b_2(\text{Sex}) + b_3(\text{Age}) + b_4(\text{Marital Status}) + b_5(\text{Household Size}) + b_6(\text{Employment}) + b_7(\text{Acculturation})$			
<b>Black Canadians (Ref)</b>			
East Asians	0.81(0.55,1.20)	0.44(0.26,0.76)**	1.04(0.51,2.13)
Middle Eastern	1.16(0.57,2.36)	1.05(0.55,2.00)	3.08(0.33,12.02)
South Asians	0.90(0.61,1.34)	0.89(0.46,1.74)	1.91(0.58,6.33)
Sex (Ref=Male)	1.49(1.23,1.80)**	1.07(0.63,1.83)	1.06(0.68,1.67)
Age			
1 (18-25) (Ref)			
25-39	1.77(1.04,3.01)	1.65(0.71,3.81)	1.70(0.42,6.59)
40-54	3.30(2.05,5.35)**	1.65(0.69,3.93)	1.87(0.56,6.32)
55-69	4.66(2.98,7.28)**	1.72(0.65,4.52)	2.19(0.47,10.13)
70-84	7.02(3.51,14.01)**	2.03(0.41,10.07)	2.20(0.44,10.95)
Marital Status			
Single, never married (Ref)			
married	1.12(0.71,1.79)	0.98(0.39,2.43)	0.60(0.21,1.69)
living common-law	1.55(0.69,3.48)	0.53(0.18,1.56)	0.23(0.05,0.98)
widowed	1.10(0.34,3.56)	0.89(0.17,4.76)	0.87(0.16,4.68)
separated	1.20(0.65,2.19)	0.73(0.18,2.97)	0.59(0.06,5.46)
divorced	1.50(0.92,2.44)	1.04(0.35,3.0)	0.83(0.10,7.19)
Household Size			
1 person (Ref)			
2	1.06(0.75,1.49)	0.91(0.50,1.66)	1.31(0.51,3.34)
3	1.13(0.80,1.60)	0.82(0.43,1.58)	1.34(0.65,2.75)
4	0.92(0.67,1.28)	0.72(0.38,1.35)	1.18(0.49,2.82)
Employment (Ref=no)	0.69(0.56,0.85)	0.76(0.35,1.65)	0.66(0.40,1.10)
Acculturation			
Low (Ref)	1.00	1.00	1.00
Moderate	0.99(0.72,1.39)	0.86(0.40,1.82)	1.45(0.47,4.51)
High	1.08(0.81,1.45)	0.79(0.27,2.37)	1.84(0.40,8.53)

<sup>i</sup>the odds of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' to activity limitation due to chronic when adjusted for the socio-demographic factors and acculturation.

*p* = the probability of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' to activity limitation due to chronic pain when adjusted for each of the factors from the bio-psychosocial model

*x<sub>i</sub>* = the categorical explanatory variable ethnic minority status (Black (ref), South Asian, East Asian, Middle Eastern)

*c* = The probability of reporting 'many' activity limitation compared to 'none'

\*\* Significant at *p* < 0.05

### 4.7.3 Adjusting for Psychological and Socio-Demographic Factors

Multiple regression models combining the psychological and socio-demographic factors were produced to determine whether there existed an association among the four EM groups and chronic pain experience after these variables were controlled (Table 4.17). The results show that after adjusting for the significant psychological and socio-demographic factors, the East Asian group still had statistically significantly lower odds of experiencing 'high' pain intensity when compared to Black Canadians. Only self-perceived mental health (OR [good]: 1.99, 95CI%: 1.23-3.23; OR [poor/fair]: 5.68, 95%CI: 3.50-9.20), anxiety (OR: 2.55, 95%CI: 1.53-4.25) and age (OR [40 years to 54 years]: 3.23, 95%CI: 1.73-6.03; OR [55years to 69 years] 4.45, 95%CI: 2.34-8.46; OR [70 years to 84 years]:



5.41, 95%CI: 2.10-13.93) were statistically significantly associated with pain expression when adjusted for the other variables from the framework used in this study.

**Table 4.17 The Odds Ratio of Chronic Pain when adjusting for Psychological and Socio-Demographic Variables**

Odds Ratio Estimates	Chronic Pain Ref= no chronic pain	Pain Intensity Ref=Low Pain Intensity	Activity Limitations <sup>c</sup> Many vs. None
Model 1: $\ln(p/(1-p)) = b_0 + b_1x_1 + b_2$ (Self-Perceived Mental Health)+ $b_3$ (Anxiety)+ $b_4$ (Alcohol Use Frequency)+ $b_5$ (Sex)+ $b_6$ (Age)+ $b_7$ (Employment)+ $b_8$ (Acculturation)			
<b>Black Canadians (Ref)</b>			
East Asians	0.71(0.40,1.25)	0.38(0.22,0.64)**	0.69(0.22,2.14)
Middle Eastern	1.19(0.76,1.87)	0.61(0.24,1.55)	1.30(0.11,16.06)
South Asians	0.89(0.55,1.44)	0.62(0.35,1.10)	1.59(0.51,4.94)
Self-Perceived Mental Health			
Excellent(Ref)			
Very Good	1.32(1.00,1.76)	1.27(0.70,2.28)	0.63(0.23,1.73)
Good	1.99(1.23,3.23)**	1.31(0.68,2.52)	1.46(0.45,4.73)
Poor/Fair	5.68(3.50,9.20)**	2.15(1.01,4.55)**	2.10(0.37,11.75)
Anxiety (Ref=no)	2.55(1.53,4.25)**	1.34(0.33,5.57)	1.45(0.24,8.59)
Alcohol Use Frequency			
Less than once a month (Ref)			
once a month	0.87(0.64,1.18)	0.77(0.40,1.50)	1.46(0.22,9.45)
2 to 3 times a month	0.82(0.57,1.18)	1.08(0.22,5.40)	0.65(0.06,6.86)
2 or more times a week	0.86(0.52,1.40)	0.56(0.26,1.23)	0.58(0.12,2.74)
once a week	0.87(0.53,1.42)	0.85(0.47,1.51)	0.41(0.14,1.18)
Sex (Ref=Male)	1.50(0.94,2.40)	0.98(0.50,1.91)	0.83(0.29,2.43)
Age			
18-24 (Ref)			
25-39	1.79(0.90,3.58)	1.53(0.58,4.01)	NS
40-54	3.23(1.73,6.03)**	1.54(0.58,4.11)	NS
55-69	4.45(2.34,8.46)**	1.86(0.75,4.64)	NS
70-84	5.41(2.10,13.93)**	2.41(0.42,14.02)	NS
Employment (Ref=No)	0.82(0.62,1.09)	0.98(0.49,1.94)	0.50(0.20,1.27)
Acculturation (Ref=low)			
Moderate	0.93(0.65,1.33)	1.09(0.63,1.87)	1.42(0.31,6.46)
High	1.01(0.71,1.45)	1.04(0.60,1.80)	1.59(0.39,6.43)

<sup>1</sup>the odds of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' to activity limitation due to chronic when adjusted for all the significant psychological and socio-demographic factors.

$p$ = the probability of reporting 'yes' to chronic pain, 'high' to pain intensity and 'many' to activity limitation due to chronic pain when adjusted for each of the factors from the bio-psychosocial model

$x_1$ = the categorical explanatory variable ethnic minority status (Black (ref), South Asian, East Asian, Middle Eastern)

$c$ = The probability of reporting 'many' activity limitation compared to 'none'

\*\* Significant at  $p < 0.05$

NS: The OR reporting for these variables were insignificant therefore not included in the table

## CHAPTER 5: DISCUSSION

This chapter will summarize the key findings of this thesis, including: i) key findings and comparison with the extant literature, and findings in relation to the theoretical model used, ii) limitations and strengths of this study, and iii) implications, conclusions, and future research directions.

### 5.1 Key Findings and Comparisons with Extant Literature

#### 5.1.1 Objective 1. Pain Expression among White Canadians and the Combined four EM Groups

The prevalence of chronic pain expression in White Canadians was found to be 19.3% (95%CI: 16.9%-21.6%), a result similar to those in previous literature looking at pain prevalence in the general Canadian population using the CCHS data, which ranged from 15.3% (95%CI: 14.2%-16.3%) to 19.5% (95% CI: 18.3%-20.7%)<sup>13</sup> (Reitsma et al., 2010). My own results indicated chronic pain expression was statistically significantly lower (13.1%, 95% CI: 10.8%-15.4%) among the combined four EM groups (Black Canadians, South Asians, Middle Eastern and East Asians) included in this study when compared to White Canadians (19.3% , 95%CI: 16.9%-21.6%). The latter also reported statistically significantly higher pain intensity (17.3%, 95%CI: 16.3%-18.1%) and daily activity limitation (19.7%, 95%CI: 10.7%-14.7%) due to chronic pain relative to the combined four EM groups (pain intensity: 13.5%, 95%CI: 11.1%-15.8%; activity limitation: 12.7%, 95%CI: 10.7%-14.7%).

Previous studies comparing pain expression among White and EM groups have yielded mixed results (Ang, Ibrahim, Burant, & Kwoh, 2003; Edwards & Fillingim, 1999). However, the major body of the literature has found EM groups (e.g., African Americans and/or Latinos) to usually have *higher* pain expression when compared to non-Hispanic Whites and have concluded that EM status is an important factor to consider in pain expression (Defrin, Eli, & Pud, 2011; Dhingra et al., 2011; Jimenez, Garrouette, Kundu, Morales, & Buchwald, 2011). One possible reason that the findings from my study contradict the results of the majority of the previous studies investigating pain expression differences among EM groups and White Canadians may be that all other cross-sectional studies compared pain expression between each EM group taken separately and White American and Europeans (Allison et al., 2002; Meghani & Cho, 2009; Portenoy, Ugarte, Fuller, & Haas, 2004), whereas my results show the differences between combined EM groups and White Canadians and my findings did not adjust for age. In this case, any variation among the different EM groups might be diluted when I combined all four EM groups into one comparison group. However, a study of the difference in temporomandibular joint and muscle disorders, low back and neck pain among White Americans, African Americans, and

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<sup>13</sup> The range for the chronic pain expression is for each year of the CCHS from 1994 to 2008

Hispanics was conducted using a large national USA database (Plesh et al., 2011). Based on the findings from this study, which bears similarities with my own, the authors concluded significant racial/ethnic differences for pain reporting in chronic low back pain. Whites were more likely to report these pain conditions than African Americans, which is broadly similar to my findings of greater chronic pain among Whites than the four EM groups combined.

The four EM groups combined report statistically significantly lower pain expression, intensity and activity limitation compared to White Canadians. However it is important to recognize heterogeneity within minority groups. Therefore it is necessary to investigate pain expression in different EM groups, in order to see whether there exists a difference and, after adjusting for certain biological, psychological, and socio-demographic factors, to determine whether that difference is still evident. This is important in understanding pain experience in different ethnic groups (Ang et al., 2003; Edwards et al., 2005).

### **5.1.2 Objective 2. Pain Expression Among the Four EM Study Groups in Canada**

The results from my study indicated that there was no significant difference in chronic pain expression among the four EM groups. Chronic pain expression ranged from 14.9% (95% CI: 13.7%-16.0%) to 16.8% (95% CI:14.8%-18.8%), with Middle Eastern and Black Canadians reporting the highest prevalence of pain expression and the other two groups falling in-between with the confidence intervals overlapping. However, the odds of reporting severe pain intensity and activity limitations due to pain did differ by EM group. The results indicated that the East Asian group had statistically significant lower odds (OR: 0.47, 95%CI: 0.31-0.69) of reporting 'severe' pain intensity when compared to Black Canadians; the other two groups were similar to Black Canadians. Although not statistically significant, Middle Eastern (OR: 1.78, 95%CI: 0.98-3.25) and South Asian (OR:1.60, 95%CI: 0.99-2.59) groups had higher odds of reporting 'most' daily activities being limited due to chronic pain activity when compared to Black Canadians.

The findings in regards to East Asian groups are consistent with those of previous studies, such as the results from a national survey conducted in Singapore examining self-reported pain intensity in East Asians by Chan and colleagues (2011), which found that Malaysian and Chinese<sup>14</sup> participants tended to have lower pain intensity reporting compared to East Indians. The differences in pain severity reporting in the East Asian group compared to the other three EM groups may be explained by the factors included bio-psychosocial framework set out in Chapter 2, Figure 2.3. According to this framework, differences in pain expression might be linked to social learning and cultural factors. In the

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<sup>14</sup> The Malaysian and Chinese participants belong to the East Asian groups.

East Asian culture, stoicism is highly valued and showing emotions such as anger or expressing pain are often considered a sign of weakness of character (Giger & Davidhizar, 2004). Thus, people belonging to this ethnic group prefer to endure pain and not report it until it becomes unbearable (Chen et al., 2008; Leininger & McFarland, 2002). Regardless of the cause of the East Asian group showing significantly lower reporting of pain intensity, the inter-ethnic differences in pain perception and reporting have important implications for assessment and treatment of pain. The results from my study suggest the value of understanding the cultural background and cultural attitudes of patients towards pain expression, and of being even more attentive to non-verbal cues that might contradict verbal communication.

### **Acculturation and Pain Expression**

My findings show the heterogeneity<sup>15</sup> that exists in pain intensity reporting and I tested the possibility of the influence of acculturation to explain the differences. The literature (Alisson et al., 2007; Palmer et al., 2009) indicates that differences in pain expression may be due to cultural influences for particular ethnic groups. I used 'acculturation' as a measure quantifying the extent to which respondents of the survey are likely to embrace the 'host culture' versus their original culture. My findings also show that the majority of the East Asians (52.9%, 95%CI: 48.6%-57.1%), South Asians (43.9%, 95%CI: 41.3%-46.5%), and Middle Eastern Canadians (40.1%, 95%CI: 35.4%-44.7%) were only moderately acculturated, whereas the majority of Black Canadians (48.6%, 95%CI: 41.4%-55.8%) were highly acculturated. I considered a moderate level of acculturation as a successful balance between the culture-of-origin and the Canadian cultural identity (Phiney, 2001). When looking at acculturation and chronic pain unadjusted for other socio demographic variables, I found that chronic pain expression was statistically significantly higher (23.4%, 95%CI: 21.7%-25.2%) in EM groups with high acculturation. I investigated acculturation levels and chronic pain severity within each EM group and found no consistent uniform pattern of relationship between acculturation levels and pain severity reporting.

My results contradict findings from the Palmer et al. (2007) study looking at acculturation and chronic pain among South Asian groups. The results from that study found that low acculturation had a strong influence on reporting higher pain intensity compared to groups with higher acculturation levels. However, a review conducted by Amaro and colleagues (2002) found that more acculturated EM groups (i.e., Latinos or Hispanics) were more at risk for depression, partner violence, and drug use, while less acculturated EM groups experienced fewer health problems but were also less likely to use healthcare services when they needed them, particularly preventative and mental healthcare services.

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<sup>15</sup> In the context of this study *heterogeneity* is defined as differences among various EM groups.

The findings of the literature as well as my own study indicate a correlation between different levels of acculturation and EM health experience. However the direction of this relationship is not consistent across health experience including chronic pain experience. Despite the widespread acceptance of pain expression disparities among EM groups' respective cultures, the measure of acculturation is rarely used in health literature pertaining to them. For this reason, I included acculturation as an important factor in my regression models and discussed it further below.

### **5.1.3 Objective 3. Psychological and Socio-Demographic Factors Associated with Pain among the Four EM Groups**

#### **Psychological Factors**

I found self-reported mental health, depression, anxiety, and alcohol dependence were all associated with chronic pain, pain intensity and activity limitation in EM groups in the bi-variable analysis adjusted for EM status only. EM groups with poor self-perceived mental health were 5.99 (95% CI: 4.6-14.4) times the odds to report chronic pain compared to those with excellent self-perceived mental health, and EM groups with depression or anxiety were, respectively, 4.3 (95% CI: 3.2-5.8) times and 4.5 (95% CI: 3.2-6.6) times the odds to do so than those who do not report those forms of psychological distress. Even when adjusted for all other psychological variables and acculturation these factors remained statically significantly associated with pain expression in EM groups. When adjusted for all significant psychological and socio-cultural variables, *self-perceived* mental health was still significantly (OR: 5.68, 95%CI: 3.50-9.20) associated with higher rates of pain expression. Interestingly, when adjusted for self-perceived mental health, depression, anxiety and alcohol use separately, East Asians were 0.43 (95%CI: 0.29-0.65), 0.48 (95%CI: 0.33-0.70), 0.48 (95%CI: 0.32-0.71) and 0.37 (95%CI: 0.22-0.61) times less likely to report high pain intensity than Black Canadians. Even after adjusting for all psychological factors and acculturation, East Asian groups were still 0.37 (95%CI: 0.21-0.63) times the odds to report high pain intensity when compared to Black Canadians.

These findings are consistent with those of the literature on psychological factors in chronic pain expression. A Norwegian study looking at the association between musculoskeletal pain and psychological distress among five immigrant groups (from Sri Lanka, Turkey, Pakistan, Iran, and Vietnam) found respondents with psychological distress were 7.5 times (95%CI: 5.87-9.61) the odds to report musculoskeletal pain than those without distress (French, 2009).

To conclude, the results indicate that in general, EM groups with any psychological distress have higher odds of pain expression. My findings also show these psychological factors did not account for EM group differences in chronic pain. As these EM group differences persisted even after controlling

for self-perceived mental health, depression, anxiety and alcohol frequency in the logistic regression models.

## **Socio-Cultural Factors**

In the EM groups I examined, chronic pain expression was higher in women (OR:1.60, 95%CI:1.38-1.86) compared to men, in people who were 85 years of age or older (OR:12.81, 95%CI: 7.15-22.95) compared to those aged 18 to 24 years, and in those living common-law (OR:1.96, 95%CI: 1.18-3.25), married (OR: 1.89, 95%CI: 1.39-2.42), widowed (OR: 5.42, 95%CI: 3.84-7.66), divorced (OR: 2.9, 95%CI: 1.88-4.51) or separated (OR: 2.31, 95%CI: 1.25-4.26), compared to single EM groups. EM groups with employment were 0.50 (95%CI: 0.43-0.64) times less likely to report chronic pain expression than those without employment. When factors specific to EM status (i.e. time spent in Canada, languages most often spoken at home, and acculturation) were taken into account, the results from my study indicate that both the length of time spent in Canada and acculturation were associated with chronic pain. EM groups who spent fewer than 10 years in Canada had significantly reduced odds of reporting chronic pain (OR: 0.53, 95%CI: 0.44-0.61), pain intensity (OR: 0.72, 95%CI: 0.53-0.96), and activity limitation due to pain (OR: 0.67, 95%CI: 0.47-0.95). EM groups with moderate or high acculturation had significantly higher odds of reporting chronic pain (OR: 1.62, 95%CI: 1.34-1.96; OR: 1.77, 95%CI: 1.46-2.15) and EM groups with moderate acculturation had increased odds (OR: 1.54, 95%CI: 1.01-2.34) of reporting 'many' activity limitations due chronic pain relative to 'none'. As the acculturation factor took into account both languages spoken most often at home and time spent in Canada, this factor may be a more suitable variable to adjust for than time spent in Canada and languages spoken most often at home separately when looking at different ethnic groups.

My study findings are supported in previous literature by Reitsma (2010) who also found that in the general Canadian population, age, marital status and gender were significant factors in predicting chronic pain. For instance, Reitsma (2010) reports that Canadian women in the oldest age group (70+) had the greatest risk of developing chronic pain (OR: 2.24, 95%CI: 1.37-3.67) and in my study, I also found that in EM groups, the oldest age group also had the greatest risk of both reporting chronic pain (OR:12.8, 95%CI: 7.15-22.95) and experiencing greater pain intensity (OR:2.76, 95%CI: 1.04-7.31) compared to those aged 25 to 39 years. Reitsma (2010) also found that for marital status, being widowed/ separated or divorced was only significantly associated with chronic pain expression in Canadian women and they were 1.61 (95%CI: 1.16-2.23) times as likely to report chronic pain compared to Canadian men.

As very few studies have looked at factors specific to EM status and pain expression in different EM groups, it is very difficult to compare my findings about acculturation with previous literature.

From my literature review, I didn't find any study that considered length of time spent in the host country when looking at pain expression. However, I found one Australian study that looked at country of birth when comparing back pain, specifically ethnic Italians born in Italy and those born in Australia (Stanaway et al., 2011). The results from the study indicated that county of birth was an important factor in chronic pain and that those born in Italy had a significantly higher odds (OR: 1.93,  $p < 0.05$ ) of reporting higher pain severity and activity limitation than those both in Australia. Palmer and colleagues (2007) found that acculturation was significantly associated with chronic widespread pain expression (OR: 1.17, 95%CI: 1.03-1.33) amongst South Asian minority groups in the United Kingdom. However, unlike my results, the authors found that lower levels of acculturation were correlated with higher pain expression. The results of my study suggest a different relationship between acculturation and chronic pain where higher levels of acculturation were associated with greater pain. This could be due to EM groups experiencing health differently in Canada compared to EM groups in other countries. For instance in Canada we have the healthy-immigrant effect<sup>16</sup> (McDonald & Kennedy, 2004) . The low acculturated immigrants may be healthier in Canada and this is why we see lower chronic pain expression in this groups.

To conclude, I found that some psychological (self-perceived mental health and anxiety) and socio-cultural (age) factors identified from previous literature and the theoretical framework to be significantly associated with pain chronic pain expression in the four EM groups for both the unadjusted and adjusted regression models.

## **5.2 Findings in Relation to the Theoretical Framework**

A bio-psychosocial theoretical framework from the literature was used to guide my study. I used this framework to guide my analysis about factors that are significantly associated with pain expression within each of the four EM groups. This is the first study to examine factors associated with chronic pain separately for the four EM groups using a holistic approach, including psychological, socio-demographic, and acculturation factors. East Asian groups consistently had significantly lower odds of reporting chronic pain intensity when adjusted for all of the psychological and socio-demographic factors from the theoretical framework. In the South Asian group, being female and living in a household size with three or more people was significantly associated with reporting 'many' activity limitations compared to Black Canadians (see Table 4.14). In the Middle Eastern group, activity limitation due to chronic pain was associated with higher income, moderate to higher acculturation, and the length of time (>10 years) spent in Canada (see Table 4.14). Interestingly, there

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<sup>16</sup> Healthy Immigrant Effect is a observed time path in which the health of immigrants just after migration is substantially better than that of comparable native-born people (McDonald & Kennedy, 2004).

were no psychological factors that were significantly associated with pain expression in the South Asians and Middle Eastern groups.

To conclude, among the four EM groups, East Asians are significantly different in reporting lower pain intensity than the other three EM groups. Even after controlling for psychological and socio-demographic factors, this group still had significantly reduced odds of reporting 'severe' pain intensity when compared to Black Canadians.

## **5.3 Strengths and Limitations of this Study**

### **5.3.1 Strengths**

One major strength of this study is that the data came from a large population-based survey of the Canadian population with a very good response rate, thus making available relatively large sample sizes for the four EM groups it sought to examine. The CCHS also provides comprehensive data on descriptive variables: this made it possible to adjust for psychological, socio-demographic, and acculturation variables potentially associated with pain experience among the four EM groups.

### **5.3.2 Limitations**

The nature and purpose of a study such as this one is primarily to apply the methods, tools and techniques of epidemiology in order to test a particular hypothesis, using secondary data sources as opposed to data collected in an original field study over time through observation and/or questionnaires. Therefore with a cross-sectional study one is able only to describe the association but not to infer causation.

Within the parameters of the CCHS survey data, an important limitation comes from the chronic pain questions used in the survey. These questions did not specify a time frame, but rather asked about 'usual' pain. Without a specific time frame, 'usual' pain may be interpreted differently by each individual responding to the questionnaire. Another limitation resides in the fact that the CCHS questions were not validated specifically for each one of the EM groups. It should be noted as well that the CCHS survey was developed within a Canadian (predominantly Western) framework, with questions that may be more or less applicable or relevant, and/or may be interpreted differently according to the level of acculturation of each individual, as well as the particular ethnic group with which he or she identifies. I sought to address these limitations by conducting a data quality assurance test where I looked at pain experience in EM groups with arthritis or low back pain. This was done to test the definition of chronic pain used in the survey. The results indicated that there still was no statistical difference in pain expression, intensity and activity limitation among the subset EM groups and pain experience and the general EM group. At a more general level, which is for the most part beyond the purview of this study, it should be noted that the experience and expression of pain are



profoundly linked to a wide and complex assortment of factors, only some of which are touched upon in the primary sources I have used. These factors are addressed by a number of social science disciplines (sociology, anthropology, gender and labour studies), as well as by health sciences and psychology (notably pain psychology). How pain is expressed and dealt with may be determined, at least in part, by the power relations that feature more or less prominently in an individual's current life. Two examples will illustrate this point. EM newcomers often find themselves in low-paying, low status work where they may lose money or, in some cases their jobs, if they absent themselves from work for medical treatment (Sikora, 2013). This can constitute a powerful motivation for downplaying or even denying the existence of pain. Power relations may also affect the expression of pain within a single household: in some cultures, the expression of pain by one individual may elicit anger from another member of the family, leading to suppression of the normal, instinctive reaction. In other cultures, it is the husband who decides whether or not his wife will be treated when she is ill, and may even go to the clinic or hospital, presenting his wife's symptoms as his own (Huijnk, 2011; Karlsen, 2002). This may cause distortions in the nature of pain expression by the wife to the husband, and pain reporting by the husband to the health professional (Huijnk, 2011; Karlsen, 2002).

## **5.4 Implications, Conclusion and Future Research Directions**

### **5.4.1 Implications**

My results suggest that increased reporting of chronic pain is associated with the following factors with respect to EM status:

- 'Poor/fair' self-perceived mental health, and the presence of anxiety when adjusted for other factors in the theoretical model
- Female sex, age (55 years or older when adjusted for other factors in the theoretical model
- Spending over 10 years in Canada and having moderate or high acculturation when unadjusted for psychological and social variables

When assessing chronic pain expression in different EM groups, it is important for healthcare professionals to consider their time spent in Canada and cultural factors to properly address chronic pain. Specific attention should be given when working with EM groups who have immigrated and lived in Canada for more than 10 years. Although previous literature investigating health in different EM groups has looked at acculturation, the findings from my study indicate that linear measures of acculturation may not tap the important cultural-traits and value differences (e.g. values about health and illness) between different ethnic groups. These are the factors that need to be examined further as they influence health and/or modify health outcomes (e.g. Pain expression). Given this suggestion

of diversity of health experience among different EMs, future studies should consider EM characteristics (e.g. ethnic background) of their samples.

### **5.4.2 Conclusions**

A secondary exploratory data analysis investigating pain expression by EM groups using the Canadian Community Health Survey was conducted. One key finding of this study was that after adjusting for all significant factors from my theoretical framework, East Asian groups had statistically significantly lower pain intensity reporting compared to Black Canadians. I also found self-perceived mental health and age to be statistically significantly associated with pain expression among EM groups. It is important to note that the prevalence estimates for pain expression in all EM groups across acculturation levels showed that higher levels of acculturation was associated with higher reporting of pain expression and this trend diapered when adjusted for other variables. This study suggests that pain expression by EM groups in Canada may need more attention by pain researcher.

### **5.4.3 Future Research Directions**

The assessment and treatment of pain is a universally important healthcare issue, but modern healthcare still has no systematic way of accurately measuring pain, beyond verbal reports by patients and, in some cases, facial expressions denoting pain (Jensen, Karoly, & Braver, 1986; Williamson & Hoggart, 2005). As pain tolerance and how it is experienced, as well as its outward expression and communication, are very different across cultures, reporting of pain by EMs must be recognized as culturally bound. To understand EMs' pain expression and accurately measure it for appropriate treatment requires high levels of 'cultural competence' across the entire range of healthcare professionals. It would seem that, given the growing presence of EMs in Canada, the health system as a whole would benefit from a better understanding of the cultural dimensions of the experience, expression, management, and treatment of pain.

The mechanisms underlying ethnic differences in pain expression are multi-factorial and complex and should be tested further with longitudinal anthropological studies. These studies should take into account bio-psychosocial factors that have been associated with pain expression in EM groups. The findings from my own limited study also indicate that more qualitative studies such as anthropological studies examining pain experience in different EM groups are needed. These studies would help us in understanding differences and perceptions in expressing pain in different EM groups and contribute to better overall treatment protocols.

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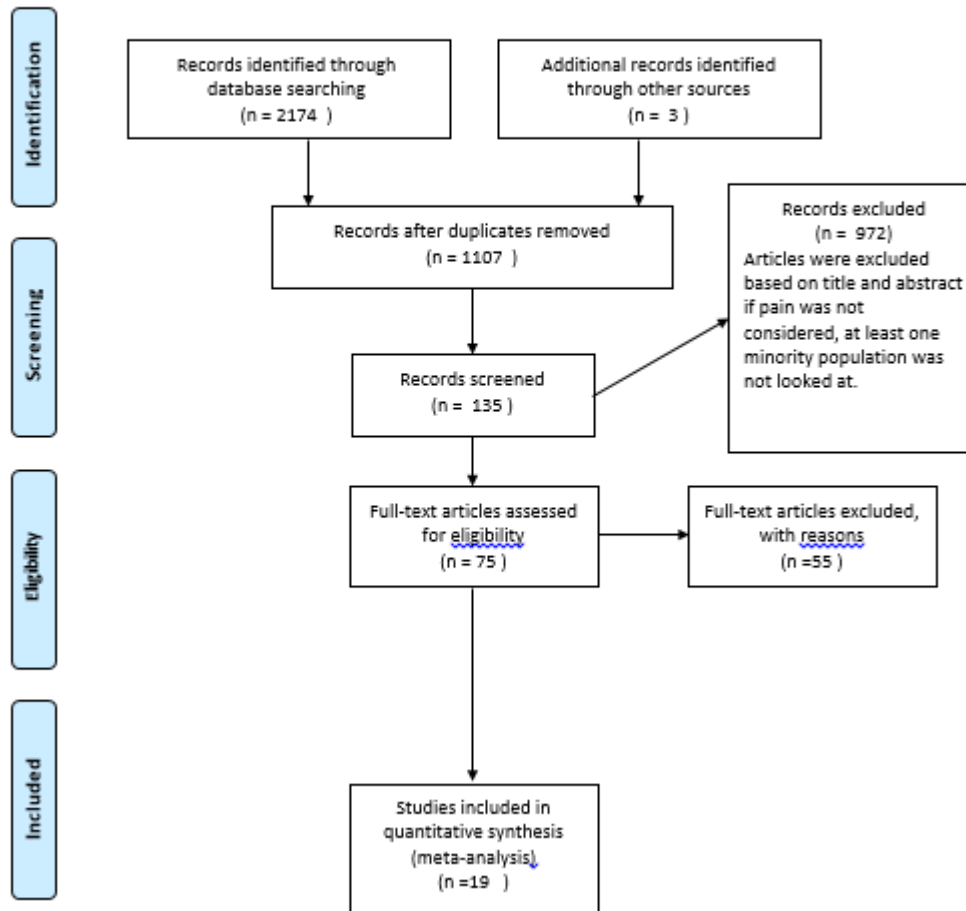
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# APPENDICES

## Appendix A: The literature search selection of included studies.



PRISMA 2009 Flow Diagram



## Appendix B : Response rates from the Canadian Community Health Survey

Survey	Response Rates
CCHS 2007/2008	Household-level response rate: 84.6% Person-level response rate: 91.7% Combined Response rate: 77.6%
CCHS 2009/2010	Household-level response rate: 81.0% Person-level response rate: 89.3% Combined Response rate: 72.3%
CCHS 2010/2011	Household-level response rate: 80.7% Person-level response rate: 88.6% Combined Response rate: 71.5%
CCHS 2011/2012	Household-level response rate: 77.3% Person-level response rate: 86.7% Combined Response rate: 67.0%
CCHS 2013	Household-level response rate: 79.8% Person-level response rate: 86.3% Combined Response rate: 68.9%

## Appendix C: Dependent variable and variable coding

Outcome Variable	CCHS Question	Variables from CCHS	CCHS groups	Groups for this study
Pain and Discomfort	Are you usually free of pain or discomfort?	HUP_01	Yes No	<b>Yes (Ref.)</b> No
	How would you described the usual intensity of your pain or discomfort?	HUP_02	0-100 0:no pain 100: Severe pain	<b>No pain (Ref.)</b> Mild Moderate Severe
	How many activities does your pain or discomfort prevent (both inside the home and outside)?	HUP_03	None A Few Some Most	<b>None (Ref.)</b> A Few Some Most

## Appendix D: The independent variables and variable coding

VARIABLE	CODED VARIABLES	VARIABLES OF THE CCHS	CCHS QUESTIONS	CCHS GROUPS	GROUPS FOR THIS STUDY
Sex	SEX	DHH_SEX	Is respondent male or female?	Male=1 Female=2	<b>Male (Ref.)</b> Female
Age	AGE	DHH_AGE	What is your age?	Years 12-103	<b>18-24 years (Ref.)</b> 25-39 years 40-54 years 70-84 years 85+
Province	PRV	GEO_PRV	Province of residence of respondents	Newfoundland and Labrador =10 Prince Edward Island=11 Nova Scotia=12 New Brunswick=13 Quebec=24 Ontario=35 Manitoba=46 Saskatchewan=47 Alberta=48 British Columbia=59 Yukon=60 Northwest Territories=61 Nunavut=62	<b>British Columbia (Ref.)</b> Alberta Saskatchewan Manitoba Ontario Quebec New Brunswick Nova Scotia Prince Edward Island Newfoundland & Labrador Yukon The Northwest Territories Nunavut
Urban and Rural Areas - 2 levels	AOR	GEODUR	Based on the respondents postal code and 2001 census geography	Urban=1 Rural=2	<b>Rural (Ref.)</b> Urban
Education	EDUA	EDU_4	What is the highest degree, certificate or diploma have you obtained?	Less than high school diploma or its equ= 1  High school diploma or its equivalent=2  Trade certificate or diploma from a vocational school or apprenticeship Training =3  Non-university certificate or diploma from a community college, CEGEP, school of nursing, etc.=4	<b>High School (Ref.)</b> Non-university certificate Bachelor's degree Graduate

				<p>University certificate below bachelor's level=5</p> <p>Bachelor's degree=6</p> <p>University degree or certificate above bachelor's degree=7</p> <p>Not Applicable=96</p> <p>Don't know=97</p>	
Income	INCM	INCEDHH	Based on INCE_3A, INCE_3B, INCE_3C, INCE_3D, INCE_3E, INCE_3F, INCE_3G.	<p>NO INCOME</p> <p>LESS THAN \$5,000</p> <p>\$5,000 TO \$9,999</p> <p>\$10,000 TO \$14,999</p> <p>\$15,000 TO \$19,999</p> <p>\$20,000 TO \$29,999</p> <p>\$30,000 TO \$39,999</p> <p>\$40,000 TO \$49,999</p> <p>\$50,000 TO \$59,999</p> <p>\$60,000 TO \$79,999</p> <p>\$80,000 TO \$99,999</p> <p>\$100,000 LESS THAN \$150,000</p> <p>\$150,000 OR MORE</p>	<p><b>No Income (REF)</b></p> <p>Lowest Income (less than 40 000)</p> <p>Lower Middle Income (\$40 000 or more but less than \$80 000)</p> <p>Upper Middle Income (\$80 000 or more but less than 150000)</p> <p>Highest Income (\$150 000 and over)</p>
Employment status	EMPLYMT	LBSEDWSS	Working status last week - 4 groups - (D).	<p>Had a job-at work last week=1</p> <p>Had a job-absent from work last week=2</p> <p>Did not have a job last week=3</p> <p>Permanently unable to work =4</p> <p>Not applicable=6</p> <p>Not stated =9</p>	<p><b>Did not have a job (Ref.)</b></p> <p>Has a job</p>
Marital Status	MARITASUS	DHH_MS	What is the respondent's marital status?	<p>Married</p> <p>Living common-law</p> <p>Widowed</p> <p>Separated</p> <p>Divorced</p> <p>Single, never married</p>	<p><b>Single, never married (Ref.)</b></p> <p>Married</p> <p>Living common-law</p> <p>Widowed</p> <p>Separated</p> <p>Divorced</p>
Household size	HHLDSZ	DHHDSZ	What are the names of all persons who usually live here?	1-20	<p><b>1 person (Ref.)</b></p> <p>2 person</p> <p>3 person</p> <p>4+ person</p>
Ethnic Minority Groups	EMSP	SDCDCGT	Cultural / racial background - (D)	<p>White</p> <p>Black</p> <p>Korean</p> <p>Filipino</p> <p>Japanese</p> <p>Chinese</p> <p>South Asian</p> <p>Southeast Asian</p> <p>Arab</p> <p>West Asian</p> <p>Latin American</p>	<p><b>Black Canadians (Ref.)</b></p> <p>East Asians</p> <p>South Asians</p> <p>Middle Eastern</p>



				Other racial or cultural origins Multiple Racial/ Cultural Origins Not Applicable Not Stated	
Immigration Status	IMMS	SDC_2	Where you born a Canadian citizen?	Yes No	<b>Yes (Ref.)</b> No
Length of time spent in Canada	ACC	SDC_3	In what year did you first come to Canada to live?	Min: year of birth Max: Current year	<b>&gt;10 years</b> <10 years
Languages spoken	LPSKN	SDC_5AA	Language spoken most often at home		<b>English (Ref.)</b> Other than English
Health Behaviours	REG_DOC	HCU_1AA	Has a regular doctor?	Yes No	<b>No (ref)</b> Yes
Self-perceived health	SPHLTH	GEN_01	Would you say your health is?	Excellent Very good Fair Poor Don't know	<b>Good (Excellent &amp; Very good) (Ref.)</b> Fair Poor
Depression	DEPR	CCCE_280	Do you have a mood disorder such as depression?	No Yes	<b>No (Ref.)</b> Yes
Anxiety	ANX	CCC_290	Do you have an anxiety disorder such as a phobia, obsessive-compulsive disorder or a panic disorder?	No Yes	<b>No (Ref.)</b> Yes
Alcohol Frequency	ALCHDEP	ALC_2	During the past 12 months, how often did you drink alcoholic beverages?	Less than once a month  Once a month  2 to 3 times a month  Once a week  2 to 3 times a week  4 to 6 times a week  Every day	<b>Once a month or less (Ref.)</b>  Once a week or less  2 to 3 times a week  Everyday
Pain medication	PMED	MED_1A	In the past month did you take aspirin or other acetylsalicylic acid) medication every day or every second day?	Yes No	<b>No (Ref.)</b> Yes
Chronic Conditions	CHRONARTH	CCC_051	Do you have arthritis, excluding fibromyalgia?	No Yes	<b>No (Ref.)</b> Yes
	CHRBACK	CCC_061	Do you have back problems, excluding fibromyalgia and arthritis?	No Yes	<b>No (Ref.)</b> Yes
Injuries	INJ	INJ_01	In the past 12 months, that is, from [date one year ago] to Yesterday, were you injured?	No Yes	<b>No (Ref.)</b> Yes

## Appendix E. Acculturation Scale

Acculturation Scale		
1 (score=2)	2 (score=3)	3 (score=4)
Low Acculturation	Moderate Acculturation	High Acculturation

Example of Scoring: A person who speaks English at home and has lived in Canada for 10 years or more will receive a score of four (2+2=4) and will be considered as high acculturation

<b>What language do you speak most often at home?</b>	
English	Other
2	1
<b>In what year did you first come to Canada to live?</b>	
≥10	<10
2	1