UNDERSTANDING PATHWAYS BETWEEN SOCIAL CONDITIONS AND HEALTH: EVALUATING THE "FUNDAMENTAL" NATURE OF THE RELATIONSHIP BETWEEN SES AND HEALTH IN CANADA AND THE UNITED STATES

by

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B.A., University of Alberta, 2006

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in

THE FACULTY OF GRADUATE STUDIES

(Sociology)

THE UNIVERSITY OF BRITISH COLUMBIA

(Vancouver)

August 2009

ABSTRACT

Link and Phelan (1995) have written extensively on the pervasive and robust association between social conditions (i.e. social determinants) such as SES and health over the course of human history. In what they term "the fundamental cause perspective", they theorize that SES provides flexible resources of power, prestige, and beneficial social connections that create gradients in health which persist through time, even though more proximal determinants of health may change.

This thesis investigates the fundamental cause perspective by testing four specific areas relating to the fundamental nature of the SES/health association. First, it seeks to answer whether or not this theory is contextually or culturally specific by comparing the United States with Canada. Second, it develops the idea that some social conditions (gender, race/ethnicity, and immigrant status) may be *pre-fundamental* to the SES/health association in an attempt to explain where SES disparities come from. Third, it seeks to test whether or not tangible resources (health behaviours and healthcare resources) mediate the SES/health association. Finally, it examines the interaction between each of gender, race/ethnicity and immigrant status with measures of SES in order to determine whether SES is more or less meaningful to specific subsets of the population.

Findings largely support the fundamental cause perspective in that SES is a significant predictor of self-rated health, asthma, and overweight/obesity in both countries and that the strength and direction of these associations are remarkably similar. Although some support exists for the pre-fundamental potential of racial/ethnic inequality to drive the SES/self-rated health association, for the most part gender, race/ethnicity, and immigrant status are not antecedent to the SES/health association. Health behaviours were found to mediate the SES/self-rated health association and healthcare resources suppressed the SES/self-rated health association. Little to no mediation occurred for other health indicators. Finally, significant interactions exist between gender and income, gender and education, and immigrant status and income as health predictors leading to a discussion of the fundamental importance of considering intersections between SES and other social variables.

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ACKNOWLEDGEMENTS

I would like to thank Drs. Gerry Veenstra and Richard Carpiano for their keen mentorship and help in guiding me through this thesis to its completion. Their comments, constructive feedback, and willingness to help me work through the many problems I faced in producing this work was invaluable to the process and has strengthened my academic abilities. Their vast knowledge of this research area accompanied with their statistical acumen was of great benefit to me and I cannot even begin to express my gratitude.

I would also like to thank my friends and especially my family for all their support throughout two wonderful years in the Master of Arts in Sociology graduate program at UBC. They were continually positive, offering help and suggestions along the way, and at the very least, they put up with me through some of the more mentally taxing days.

CHAPTER 1: INTRODUCTION

Introduction: Motivations for Research

The population health movement, which began in the 1990's, has significantly broadened our understanding of the social and economic determinants of health, but we still lack a greater understanding of precisely how social processes influence and shape well-being (Coburn et al. 2002). Various social conditions, but namely socioeconomic status (SES), have been proposed as *fundamental causes* of health (Link & Phelan 1995). Tests of this theory—that some social conditions provide flexible resources of income, education, power, and beneficial social relations that profoundly influence health—have largely been applied in the United States. The importance of cross-national comparisons cannot be stressed enough when considering the variability of various theoretical approaches to health and well-being. A great deal of research details higher rates of morbidity, mortality, and poor health amongst low-SES groups, but the magnitude and direction of these associations are larger in some countries than in others (Mackenbach et al. 2008). A comparative analysis focussed on two similar (but different) countries may illuminate the degree to which the fundamental cause perspective operates outside of the United States. This thesis aims to test several important aspects of the theory of fundamental causes in Canada and in the United States, accounting for the predictive capacity of multiple social conditions beyond SES across three specific health indicators. I investigate associations between various social conditions (SES, gender, race/ethnicity, and immigrant status) across three indicators of health (asthma, overweight/obesity, and self-rated health) in order to address four specific research questions which all relate to the fundamental nature of the SES/health association. Figure 1 conceptualizes the theorized pathways that represent the research questions for the analysis that follows.

Research Question 1: Does the SES/health association vary across different national contexts? The fundamental cause perspective states that as more proximal mechanisms that produce disease change over time, social class has always held a strong association with health outcomes as a distal, fundamental cause of health. The theory of fundamental causes is vague about which social conditions produce fundamental associations with which health outcomes. The primary focus of the theory is on the SES/health association, but any social condition that remains a significant predictor of health over time, especially as more proximal causes of disease change (e.g. the shift from basic sanitation during the industrial revolution to the focus on healthy lifestyles today), could then be considered *fundamental* in its association to health. This research question addresses if an association exists between SES and health in each respective country and whether the theory is contextually specific or dependent upon place; that is, is SES associated with health, and does this relationship operate in similar strengths and directions in Canada and the United States?

Empirically speaking, we know that SES gradients in health are present in Canada and the United States (Singh 2003; Wilkins 2002). The comparative research conducted thus far indicates that SES and health are more weakly associated in socially democratic countries (i.e. Iceland and Canada) than in the United States, a finding that is typically explained through a more equitable redistribution of income and socially egalitarian policies (Olafsdottir 2007; Willson 2009). It therefore seems plausible to imagine that the SES/health association is present in both Canadian and American societies but operates to a stronger degree in the United States.

Research Question 2: To what degree are gender, race/ethnicity, and immigrant status antecedent or pre-fundamental causes of the SES/health association in both Canada and the United States? Link and Phelan often consider how "social conditions" more generally could be fundamental causes of health and health inequalities. However, empirical tests of this theory are

more often centred on SES, despite the well-documented associations between other social variables and health. While Link and Phelan consider what places individuals "at risk of risks", I question what might drive SES inequalities in the first place (Link & Phelan 1995, p.85). Gender, race/ethnicity, and immigrant status all play important roles in manifesting inequality in health outcomes. Further, these axes of social inequality may be antecedent to the procurement of economic and educational resources. Therefore, some social conditions may be *pre-fundamental* to the SES/health association. Relating back to the first research question posed above, what is *fundamental* or *pre-fundamental* for one country may not be for another. If certain social conditions are fundamental in producing SES disparities, they are unlikely to influence SES equally. Some social variables may be *more* or *differently* fundamental in producing SES than others, perhaps varying by societal context.

Research Question 3: Do health behaviours and healthcare resources mediate the SES/health association? The fundamental cause literature claims that SES gradients in morbidity and mortality exist because of SES gradients in resource utilization (Link & Phelan 1995; Phelan & Link 2005); that is, resources of income, education, power, and prestige allow higher-SES individuals to exploit health benefitting resources, which in turn produces an SES/health gradient. Incorporating tangible resources or activities that are beneficial (or indeed, detrimental) to health will test how specific resources/behaviours are differentially accessed and utilized across measures of SES. This research question seeks to determine the relative importance of proximal variables that potentially mediate the fundamental association between social conditions and health across the two national contexts.

Health benefitting resources may be utilized more by individuals from a higher social standing and should therefore mediate the SES/health relationship. The pathway between SES and health by way of health behaviours will be tested through consideration of how frequently

individuals smoke and how physically active they are. The pathways between SES, healthcare resources (having prescription medication insurance) and health will also be tested. According to the fundamental cause perspective, higher-SES respondents should be more likely to have insurance coverage for prescription medications, perhaps as a result of higher paying jobs which are more likely to come with comprehensive benefits packages. Higher physical activity may also be more prevalent among high-SES respondents, perhaps because better paying jobs are typically accompanied by greater amounts of leisure time (Ford et al. 1991). Further, high-SES respondents hold higher levels of education which is important in understanding the importance of physical exercise, proper nutrition, and an all-around healthy lifestyle to produce better health.

The SES/health association may be mediated by health behaviours and/or by healthcare resources. The stronger the mediating affects of these variables, the stronger the support for an argument that SES is fundamental in producing health inequalities through conferred resources made available through SES attainment. Testing the mediating nature of resources is an important intermediary step to complete. As a test of theory, it seeks to understand the pathways in which SES may influence health. If SES is indeed found to be a 'fundamental' cause of health, then health promoting resources should be differentially allocated and utilized (read stratified) across populations. If this is not the case it may be problematic for the fundamental cause perspective, or may indicate that other resources not measured here are mediating the relationship and that those resources examined here do not matter as much as one might expect.

Research Question 4: Does SES interact with gender, race/ethnicity, and immigrant status so that SES matters more (or is more fundamental) for health in some sub-groups of the population than others? We know that many social and economic variables can predict health. As alluded to above, the substantive focus of the fundamental cause perspective is the important relationship between SES and health, but less is known about how SES and other social

predictors interact with one another (Robert & House 2000a). Since incorporating interaction effects is important to understanding how beneficial social resources are distributed or stratified, interaction terms will be incorporated in this analysis to determine for what groups SES may have stronger associations with health. These intersections of inequality are investigated here to produce a more definitive portrait of health and health differences between Canada and the United States.

Incorporating interaction terms into the analysis between the potentially pre-fundamental social conditions (gender, race/ethnicity, and immigrant status) and SES will demonstrate whether or not significant differences in associations between SES and health exist between stratified groupings of individuals. This will shed light on the relative importance of social conditions in relation to SES in an attempt to go beyond explanations of SES being the most important fundamental cause of health. The interactions between numerous axes of inequality may help to demonstrate how SES might be more important for some sub-groups of the population relative to others.

Review of the Literature

The Fundamental Cause Perspective

Assessing the persistent relationship between SES and health, House et al. (1990; 1994) postulate that SES operates in a manner similar to the notion of Lieberson's (1985) *basic causes*, whereby independent variables have continuing effects on a dependent variable via changing mechanisms—that is, a new mechanism emerges when another mechanism declines. Building upon these ideas, Link and Phelan (1995) develop what they term the *fundamental cause perspective* which questions the decontextualized focus of risk factor epidemiology. Risk factor epidemiology is the study of specific risk factors for disease and death which are typically

analyzed at the individual level (e.g. investigating the link between smoking, hypertension, and heart disease). Instead, Link and Phelan consider the broader social structures which place individuals "at risk of risks" (85). While proximal health risk factors change over time, they argue that the relationship between SES and morbidity and mortality outcomes persists, and thus, SES serves as a fundamental cause of health.

The theory of fundamental causes has been tested a number of times and has yet to be refuted (Link et al. 1998; Link et al. 2008; Link & Phelan 2000; Link & Phelan 2002; Lutfey & Freese 2004; Olafsdottir 2007; Phelan et al. 2004; Phelan & Link 2005; Willson 2009). However, with the exceptions of cross-national work completed by Willson (2009) on Canada and the United States and Olafstoddtir (2007) studying Iceland in relation to the United States, all of this research has been conducted in the American context. Olafstoddtir uses Esping-Andersen's (1990) welfare state categorization model to compare the liberal welfare state of the United States with Iceland, a country with a social democratic welfare model, and found that relative affluence or status has a weaker relationship to health in Iceland than in the United States. Iceland's unique social policies may equalize health outcomes by supporting families and removing the cumulative advantages from the wealthier citizenry and redistributing them according to need. SES therefore plays less of a role in predicting health in Iceland than in the United States.

Willson (2009) is, to this author's knowledge, the only other author who has conducted comparative work analyzing the fundamental social causation of health and illness. Willson analyzed data from Canada and the United States and presents findings comparing the effect of SES on preventable and less-preventable mortality. Developed largely through discussion on societal inequality and a comparative analysis of healthcare and social programs, Willson's findings indicate that redistributive social policies likely buffer the effects of resource

deprivation in Canada relative to the United States. Utilizing the *National Population Health Survey* in Canada and the *US Panel Study of Income Dynamics*, Willson also suggests that the theory of fundamental causes is indeed operating in both countries, although to a greater degree in the United States. The primary finding from the study is that income and education play a stronger role in mitigating highly-preventable mortality (e.g. mortality from heart disease) than low-preventability mortality (e.g. mortality from certain types of cancer); that is, SES strongly influences health outcomes which are highly-preventable rather than those that are less preventable. This occurs because low-preventability diseases lack medical procedures, treatments, or preventative practices that can be inequitably utilized by high-SES individuals for diseases with higher-preventability (Phelan & Link 2005). However, the associations between measures of SES (education and income) and highly-preventable diseases appear to be stronger in the United States than in Canada where the results for Canada are not statistically significant.

Willson's work is not without limitations. The analysis lacks precision in operationalizing disease outcomes based on preventability. Indeed, while claiming that social conditions are fundamental causes of health inequalities in Canada, age and gender appear to be the only significant predictors of health. Further, the variables income, education, and race/ethnicity lack specificity in their depiction of relative health outcomes because they were dichotomized to maintain comparisons across two distinct datasets. Further analyses should include other social conditions such as immigrant status, which is potentially just as important as SES.

Beyond SES: Incorporating and Accounting for Other Axes of Social Inequality

Sociologists and social epidemiologists have established that there exist numerous axes of inequality which have profound effects on health beyond SES (Robert & House 2000b).

Dependent upon the society under analysis, these "social determinants" stratify health according to the health benefiting and health degrading circumstances manifested under a particular context. Therefore, the "social determinants" are aptly named in that morbidity, mortality, chronic conditions, quality of life, and health more broadly are stratified across social categories.

Positing that social conditions are fundamental causes of disease therefore warrants attention in light of whether some aspects of the social are differentially associated with health. It is worth mentioning that some authors have argued race/ethnicity to be a fundamental cause of health inequalities in the United States (Phelan & Link 2005; Williams & Collins 2001). Indeed, Link & Phelan (1995) claim that a myriad of social conditions could operate as fundamental causes, but the primary focus of this literature so far has been on SES's unique relationship to health, which is the main focus of this investigation (e.g., Antonovsky 1967; Marmot et al. 1978; Singh 2003; Syme et al. 1964; Wilkins 2002). Indeed, specific determinants may be *more fundamental* to health than others, and if this theory is solely concerned about social conditions and resource utilization, what is *fundamental* will likely depend upon particular national or societal contexts. Little work or research on the fundamental cause perspective tests the causal flow of numerous axes of social inequality through health behaviours/resources into health.

Work completed by Roxburgh (2009) is an example of research that considers social conditions more broadly, not explicitly focussing on the fundamental association between SES and health outcomes. Roxburgh uses the *2003 National Health Interview Study* conducted in the United States to analyze the contextual importance of gender, race and class in producing depression. Using a population between the ages of 18 and 65, the analysis examines the important role of resources as it pertains to the fundamental cause perspective, expanding and re-operationalizing resources as role occupancy and SES. Role occupancy refers to the social support obtained through marital relations and the stability provided through stable employment.

Roxburgh argues that "a structured routine that encourages healthy behaviours and discourages the pursuit of potentially harmful activities" is just as important as the relationship between marital status and depression, citing that marriage, parenthood, and employment are all associated with better health and lower depression (358). Roxburgh's findings indicate that context is important for both resource-rich and resource-poor individuals. Men tend to be less depressed than women overall, but women accumulate greater mental health from resources of education, home ownership, and marriage. Non-Hispanic white women experience fewer benefits from full-time employment than men. Further, African-American men experience fewer depressive symptoms relative to whites as a result of being unmarried. This article provides evidence that different resources have different effects on distinct groups of people.

I now provide a more detailed review of the determinants of health included in this thesis. Gender, race/ethnicity, and immigrant status all have documented associations to varying health outcomes due to their ability to shape access to specific resources, and have the potential to be pre-fundamental to the SES/health association, as well as moderators of SES across three specific health outcomes. Further, a brief review of potentially mediating resources and health outcomes is also included.

Gender

Evidence exists that gender interacts with SES and social integration to produce health, indicating that the role of SES and social integration are dually important for women (Ballantyne 1999). Feminist literature often cites the importance of women's relationship to their labour, which may perpetuate social and economic inequality—for example, the diminishing control over paid and unpaid work as a result of marriage which influences economic and social support opportunities (Robert & House 2000a). Women are more likely to have primary household

responsibilities within the context of marriage which could produce a role strain scenario whereby persistent exposure to certain stress conditions created by a particular role (“mother” , for example) result in women experiencing poorer health relative to men (Pearlin 1989). Socially constructed gender roles interact with social status, race/ethnicity, and social support to produce variations of equality in health (Rieker & Bird 2000).

Rieker and Bird (2000) show that mental health problems occur at approximately the same rates for women and men, but women experience higher rates of depressive disorders while men have higher rates of substance abuse and antisocial disorders. Further, women are more likely to use medical services than men, women below the poverty line have difficulty gaining access to quality medical care, and women are also less likely than men to have medical insurance. While the three leading causes of illness are the same for men and women (i.e. cardiovascular disease, cancer, and cerebrovascular disease), men are more likely than women to die at earlier ages from chronic diseases, but women are more likely to live longer under the burden of disease (including acute conditions) (Lane & Cibula 2000). Explanations for these outcomes cannot simply be reduced to biology; rather, gendered social roles play out differently in producing health. For example, men typically earn more money than women which may account for some of the health differences depicted above (Robert & House 2000b).

Race/Ethnicity

Racial/ethnic differences in health stem from cultural differences, historical processes, social factors (namely discrimination and socioeconomic influences), and psychological processes which affect lifestyle and access to healthcare (Pearce et al. 2004). Race/ethnicity measures attempt to capture potential exposures to some of these processes in daily life. In the United States, the majority of the research focuses on the black/white divide in health, and

increasingly on Hispanic populations (Smaje 2000). Further, SES is stratified across race/ethnicity, and racial/ethnic differences in health remain after controlling for SES (Robert & House 2000a; 2000b). This persistent association (particularly in the United States) illustrates how race/ethnicity may be posited as a fundamental social cause of health (Hayward et al. 2000). Increasing amounts of research focus on the origins of racial inequality, many of which theorize discriminatory policy practices and experiences with racism, are at the heart of this ambiguous gap in health (Williams & Collins 2001).

Williams and Collin's (2001) conceptual paper on residential housing makes an argument for the importance of race/ethnicity and social space, delineating the importance of race/ethnicity as a fundamental social cause of health beyond arguments of SES. Williams and Collins contend that race/ethnicity, particularly racial segregation, is a fundamental cause of mortality and morbidity in the United States, but that SES remains fundamental to the health association as originally theorized by Link and Phelan (1995). They support their argument with a conceptualization of systematic discrimination which in turn influences SES, housing, and health. Their hypothesis is an important one to consider when discussing fundamental causes of health and illness, but only offers speculation on the relative importance of other social conditions.

Immigrant Status

Evidence from the United States and Canada (as well as Western European Nations) indicates that immigrants to these countries typically have better health upon arrival than the domestic population; however, after several years, their health (measured in terms of morbidity, mortality, and self-rated health status) eventually worsens until it is similar to the non-immigrant population. Studies have shown that the social factors are particularly important health

determinants for immigrants who are more likely to report poor-health status, but less likely to report unmet health needs (Dunn & Dyck 2000).

This "healthy immigrant effect" appears to be dependent upon two things: length of time spent in the host country and the age of migrants upon arrival (Newbold 2005). Given the nature of Canadian immigration policies, immigrants may be more inclined to emigrate when in good health because of medical screening and employability (Chen et al. 1996). Research conducted in Canada on this topic is mainly collected from the *Canadian Community Health Survey* (CCHS) and the *National Population Health Survey* (NPHS). In addition to being healthier, immigrants to Canada are typically younger and better educated, which promotes self-selection of immigration (Gee et al. 2004). Findings from the NPHS indicate that after 10 years, chronic conditions largely begin to develop, although immigrants are less likely than Canadian-born individuals to have long-term disabilities and health-related dependencies despite little difference in physician contact (Chen et al. 1996).

When examining this effect over the life course, some research suggests that it is an artefact of age effects. Health is significantly better for immigrants aged 45-64 who immigrated less than 10 years ago relative to those who have been in Canada for longer periods of time. In the cohort aged 65 and older, recent immigrants have poorer health than those aged 64 and under, but after controlling for sociodemographic variables (including income, education, and place of emigration) this association disappears (Gee et al. 2004).

Other evidence exists providing mixed support for the healthy immigrant effect. McDonald and Kennedy (2004) analyze the NPHS and the CCHS, finding evidence for the healthy migrant effect with respect to chronic conditions regardless of gender, but that it may not be as strongly supported with respect to morbidity. After controlling for region of origin, year of arrival did not account for the observed effects of the authors' estimate that it takes

approximately 20 years for chronic conditions to approach those of Canadian levels. Evidence suggests that the healthy immigrant effect was found amongst Canadian immigrants using self-rated health as an outcome and may reflect that immigrants have different ideas of what constitutes fair/poor health (Newbold 2005).

In the United States, an altogether different story can be told. While there is some support for the healthy immigrant effect as it exists in Canada (Frisbie et al. 2001; Swallen 1997), foreign born people living in the United States are typically younger, less likely to have a high school diploma, more likely to be poor, and likely to live in large families in dense metropolitan areas relative to the American born population (Dey & Willson 2006). Dey and Willson (2006) found that non-US born individuals were less likely to be obese than the American born, but the odds of obesity increased the longer they lived in America. The same is true of physical health, potentially as a result of differential healthcare access and generally poorer sociodemographic characteristics. It appears that the healthy immigrant effect revolves largely around the notion of acculturation. The adoption of mainstream cultural values and health-risk behaviours is seen to account for some or most of this change (Ali 2002; Chen et al 1996; Perez 2002). However, an entirely different finding from Abraido-Lanza et al. (1999) indicates that the self-selection process into migration, at least for Latinos living in the United States, and the resulting "healthy migrant effect" is not present in America. Given the apparent disagreement between some of the literature in this field, immigrant status remains an important variable to consider in this analysis.

A Brief Review of Primary Mediating Variables Included in the Analysis

Consistent with a long-standing behavioural-focused paradigm of health, extensive literature focuses on behavioural risk factors (e.g., diet, exercise, and smoking) and how they

influence health-related outcomes. However, countless critics of this research argue that this behavioural "risk factor approach" de-contextualizes health behaviours and outcomes by largely ignoring social conditions such as SES (Cockerham 2005; Lantz et al. 2001; Thoits 1995). Furthermore, some research has found that when a variety of common health risk-factors are controlled for the relationship between SES and mortality outcomes remains, reinforcing the role of education, income, and occupation in producing health (Lantz et al. 2001; Marmot et al. 1978; Marmot 2006). This also demonstrates that SES impacts health through a variety of pathways, and health behaviours alone may not be able to fully account for the SES/health relationship.

Several studies also demonstrate the pervasive association between SES and health risk-behaviours, indicating that higher-SES individuals are less likely to participate in risky health behaviours which might explain better health relative to lower-SES individuals (Lynch, Kaplan & Salonen 1997; Adler et al. 2002). Explanations for this include the relative accessibility of health damaging products (i.e. cigarettes, cheap alcohol, fast food, etc.) which seem to be highly clustered in lower-SES neighbourhoods (Lowry et al. 1996).

Incorporating healthcare resources and health behaviours is an important test of theory by considering causal pathways between fundamental social conditions and health outcomes. If the fundamental cause perspective is truly about SES providing access to specific and highly contextual resources, for diseases such as asthma and overweight/obesity which have well-documented risk factors, health behaviours should mediate the SES/health association because of their pervasive and well-demonstrated link as proximal determinants. Two health behaviours, smoking and physical activity, are included in this analysis to determine if health behaviours mediate the SES/health association. The literature indicates that both smoking and low levels of physical activity increase the relative odds of being diagnosed with asthma or as overweight/obese, and are also associated with generally poorer health (Chen et al. 1999; Flegal

et al. 2002; Hancox et al. 2004; Litonjua 1999; Reidpath et al. 2002; Zhang and Wang 2004). Smoking and low levels of physical activity are also known risk-factors for a host of other diseases including cancer, heart disease, complications of the lung and throat, and cerebrovascular disease. The literature indicates that these risk-factors are typically found among individuals of lower-SES, and may be at the heart of SES gradients in disease (Antonovsky 1967; Feinstein 1993; Syme & Berkman 1976; Syme, Hyman & Enterline 1964).

One healthcare resource is included in this analysis: having insurance that covers prescription drug medication. This resource, like health behaviours, is included to test a causal pathway proposed in the theory of fundamental causes, that high-SES confers highly specific and contextual resources that can promote better health. These resources could be anything including, prestige, beneficial social relationships, or simply the ability to obtain employment that provides a comprehensive benefits package. The role of prescription medication coverage is included because it represents an insurable health resource that is not covered under Canada's universal system of access to healthcare. The research conducted on this variable is largely couched within an analysis of elderly health, particularly in the United States where out-patient procedure prescriptions are not covered by Medicaid (Davis et al. 1999). Greater out of pocket costs for prescriptions lead people to be less likely to utilize required medications, increasing the burden of disease, a decline in health, and increased hospital utilization, particularly for those living with chronic conditions (Hiesler et al. 2004).

Indicators of Health: Obesity, Asthma, and Self-Reported Health Status

SES based health gradients are well-documented for self-rated health, asthma, and obesity. Self-reported health status is a stable measure of physical well-being and is predictive

of mortality and the onset of numerous chronic health conditions (Burnstrom & Fredlund 2001; Kennedy et al. 1998; Subramanian et al. 2001).

Asthma is a chronic respiratory disease that causes breathing problems and can be fatal in severe cases. While primarily a childhood problem, a growing number of adults are being diagnosed with asthma due to smoking, a lack of physical exercise, urban pollution, and obesity (Chen et al. 1999). Almqvist et al. (2005) found that there is an inverse association between SES and the risk of asthma which may be related to differences in lifestyle or environment. A host of other studies support these findings across different levels of analysis (Apter et al. 1999; Hancox et al. 2004; Huovinen et al. 2001), and indicate that rates of hospitalization due to asthma related complications are much higher for communities with disproportionate levels of poverty, unemployment, low-levels of education, and high densities of visible minorities (Lin et al. 1999). Further community-level research by Litonjua et al. (1999) explored the association between visible minority status (Blacks and Hispanics) and asthma prevalence, finding that a large proportion of racial/ethnic differences are explained by socioeconomic differences in neighbourhood.

Obesity is a chronic condition commonly measured by the body mass index (BMI) of an individual, which is computed by dividing weight in imperial pounds or kilograms by height squared, measured in inches or metres, respectively. Both the Centres for Disease Control in Canada and the National Institutes of Health in the United States utilize the World Health Organization (WHO) (2006) definition of overweight as having a BMI greater than 25.0 and obesity as having a BMI of 30.0 or over (Ogden et al. 2006). Being overweight/obese is known to be a predictive risk factor for the three diseases with highest rates of incidence and mortality in Canada and the United States which are heart disease, cancer, and cerebrovascular disease. The determinants of obesity/overweight include poor nutrition, lack of physical activity, and

smoking. Many of these determinants are also related to SES, in that high-income, highly educated individuals are more likely to exercise, eat nutritious meals, and less likely to smoke (Black and Macinko 2008; Giles-Corti & Donovan 2002; Jarvis & Wardle 1999). Obesity risk and prevalence is therefore highly stratified across measures of SES (James et al. 1997; Wamala 1997), which may relate to lower-SES individuals being about 2.5 times more exposed to unhealthy fast food outlets than high-SES individuals (Reidpath et al. 2002). However, Stunkard and Sorensen (1993) indicate that while SES may influence obesity, obesity may also influence SES attainment, and that many other factors likely contribute to this complicated bi-directional association. Zhang and Wang (2004) conclude that SES is certainly an important predictor of obesity, but that gender, age, and particularly race/ethnicity also play important roles. Their work identifies that despite the SES/obesity association, visible minorities are far more likely to be obese than whites. Further, women show a stronger inverse association between SES and obesity than men, and obesity is highest amongst the middle-aged people living in the United States.

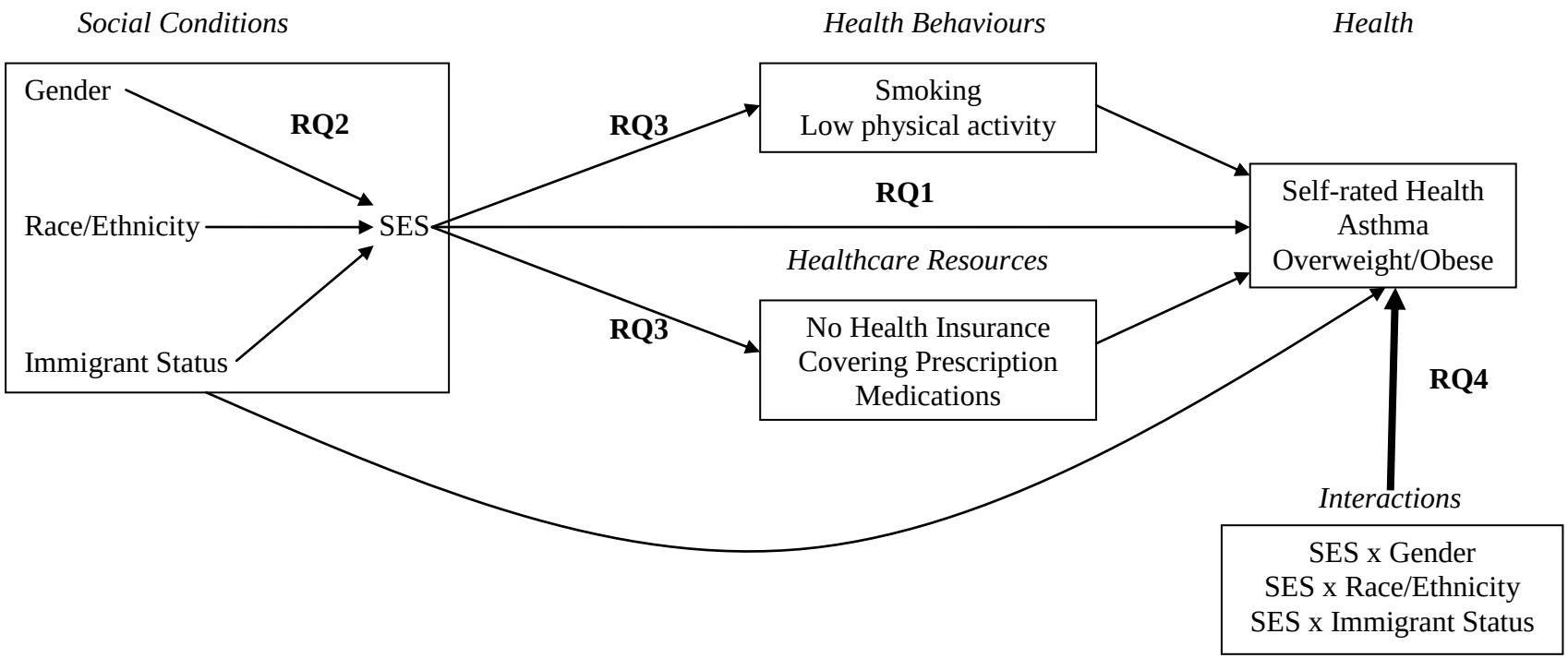
Findings from the Joint Canada/United States Survey of Health

Since this analysis will be using the *Joint Canada/United States Survey of Health* (JCUSH) dataset to draw specific comparisons relative to the theory of fundamental cause theory, it is relevant to review some published findings from JCUSH. Sanmartin et al. (2004) examined basic trends and health differences present in this sample of Americans and Canadians. Their descriptive findings indicate that most respondents report being in good, very good, or excellent health status, although differences between good and bad health are most polarized in the United States, particularly with respect to women reporting poorer health than men. However, when self-rated health is analyzed by income quintiles, lower income Americans

report greater levels of fair/poor health than Canadians of a similar income level, despite no difference in health status among higher income quintiles in either country. Canadians also report higher rates of smoking and lower rates of obesity.

McGrail and colleagues (2009) used the JCUSH data to test the underlying causes of disparities in health. Specifically, their work sought to identify the potential influence of healthcare and other policies on income-related inequalities in health by utilizing a health utility index based upon multiple health attributes. They focused on the relationships between demographic characteristics, SES, individual-level risk factors, and healthcare system factors to understand how determinants of population health are distributed differently across income in these two neighbouring countries. Income inequality is the primary focus of this work considering it is the most likely to be ameliorated by policy. Their findings suggest that risk-factors such as physical activity and obesity contribute more to health inequality in the US than in Canada, with income remaining a significant predictor of health after controlling for all other variables in the model. Individual risk factors and healthcare system characteristics (such as access to care) have similar associations to the health utility index in both countries, but disparities seem to be greater among lower-income Americans. However, McGrail et al. focus on income inequality (see Coburn 2004; Lynch et al. 2000; Wilkinson & Pickett 2006) as the primary determinant of health. This thesis seeks to illustrate that fundamental associations to health are likely to go beyond explanations of income as a primary predictor of health disparities, focussing on the combination of education and income and a host of other social variables.

Figure 1: Conceptual Model of Causal Pathways Between Fundamental Social Conditions and Health Including Testable Hypotheses



CHAPTER 2: DATA AND METHODS

Overview

The main analytical thrust of this investigation entails four aims. First, I investigate the association between SES and health in a comparative fashion to illustrate how and to what degree the theory of fundamental causes operates within Canadian society relative to the United States. Second, I seek to determine whether gender, race/ethnicity, or immigrant status are pre-fundamental to the SES/health association. Third, I seek to test how health behaviours and healthcare resources might mediate the SES/health associations. Fourth and finally, I model interaction effects to establish if SES is stratified across other social conditions in an attempt to determine whether SES is more fundamental for some social groupings than others.

Data: The Joint Canada/United States Survey of Health

The Joint Canada/US Survey of Health (Statistics Canada & the United States National Center for Health Statistics 2004) was completed as a joint project between Statistics Canada and the National Center for Health Statistics. The survey was conducted via a one-time phone call between the period of November 4, 2002 and March 31, 2003. Only individuals with telephones were randomly sampled using random digit dialling procedures and the survey sampled one individual per household who was 18 years or older at the time of data collection. The sampling design excludes respondents living in nursing homes or medical care facilities, people who were at that time currently incarcerated in prisons, and full-time members of the Canadian or American armed forces. In Canada, people living in the far north (i.e. Yukon, Northwest Territories, and Nunavut) were not included in the sampling design and likewise in the US, the American territories (i.e. Puerto Rico, the United Sates Virgin Islands, American Samoa, Guam and the Commonwealth of the Northern Mariana Islands) were not included. The sample is

comprised of approximately 3500 Canadian and 5000 American respondents and is nationally representative in both countries, stratified across geographic areas with samples allocated proportionately to the population residing in those areas. Person estimation weights are provided in the dataset where weighting data leaves researchers with the original N (a strategy employed in this thesis—see Appendix A). It is also important to note that this analysis will be conducted using the Public Use Micro File (PUMF) rather than the master file. The PUMF contains most of the data present in the master file, but some variables (e.g. race/ethnicity, income, immigrant status, education) have been manipulated in order to protect the anonymity of survey respondents.

Limitations of the Data

Besides limitations pertaining to survey design and self-reporting response bias amongst survey participants which are inherent to all survey-based research, several other important limitations are evident. First, the JCUSH response rate was approximately 65%, and non-response poses obvious problems to the representativeness of the data (Statistics Canada 2004). Second, random digit dialling excludes people without a telephone (although the percent of households without telephone is relatively small, 1.8% and 4.4% in Canada and the United States, respectively) (Sanmartin et al. 2006). This may produce a small bias in the data considering that individuals without a phone are likely to be of lower income. Regardless, the use of the same sampling techniques in both national contexts yields highly comparable data.

Measures

Dependent Variables

Health is multifaceted. Three dependent variables are included in this analysis: self-rated health, the diagnosis of asthma by a health professional, and overweight/obesity. These health outcomes were strategically chosen to provide a wide breadth of the sample from which to draw upon due to their high prevalence and the fact that they can occur at any point during the life course which avoids age-bias.

Self-reported health status is determined by asking survey respondents "in general, would you say your health is: poor, fair, good, very good, or excellent?" For the purpose of this analysis, it is collapsed into two categories as per the standard in the literature, where fair/poor responses are compared to the reference category good/very good/excellent.

The presence of asthma is assessed via a single item that asked whether a doctor or health professional had ever diagnosed the respondent with asthma. Individuals then fall into one of two categories: "yes" (coded 1) or "no" (coded 0).

According to the WHO (2006), an individual with a BMI between 25.0 and 29.9 is classified as overweight, whereas an individual with a BMI of 30.0 and greater is classified as obese. While the BMI variable in the JCUSH PUMF is continuous, it is dichotomized in this analysis to present results for those survey respondents who fall into the overweight/obese category relative to individuals of normal weight (BMIs between 18.5 and 24.9). Underweight cases (below a BMI of 18.5) were not included in this analysis. Being underweight, like being overweight/obese, is associated with increased health risks (e.g. osteoporosis) and excess mortality (Flegal et al. 2005). Overweight/obesity is the condition of interest in this research given its high prevalence in North American society and relies on comparing individuals of

normal weight (coded 0) who are likely to be in better health than their overweight/obese counterparts (coded 1).

Independent Variables

Country is a variable coded to represent whether the respondent was living in the United States or in Canada at the time of the survey. Models are run separately for each country.

Three potentially pre-fundamental causes of SES are included in this analysis. *Gender* compares women (coded 1) and men (coded 0). *Race/ethnicity* is also a dichotomous variable. The JCUSH survey reports whether American respondents are of Hispanic, African-American, Native Indian, Asian only, White only, other, or multiple ethnic backgrounds. The Canadian race/ethnicity variable in the JCUSH PUMF is presented as "white only" or "other/multiple races". To maintain the comparative approach of this thesis, the American race/ethnicity variable is dichotomized to match the "white only" (coded 0) versus "other/multiple races" (coded 1) Canadian variable. Finally, *immigrant status* is determined by the respondent's country of birth. Unfortunately, the PUMF does not include the length of time that a respondent has spent in the country after immigrating. Thus, *immigrant status* is a dichotomous variable reporting whether or not the respondent is foreign to Canada (for Canadian respondents) or the United States (for American respondents). Thus, the immigrant status variable is coded 1 for immigrant respondents and 0 for domestic respondents.

SES is measured by household income in quintiles adjusted for household size and by educational attainment. The household income variable from the questionnaire has already been adjusted by JCUSH by dividing the household income by the square root of household size. The quintile points are specific to each nation. *Education* is operationalized as the highest education obtained by the respondent and is a categorical variable comprised of the following four

categories: less than a high school diploma, high school diploma or equivalent, trades certificate/vocational school/community college/CEGEP, and university or college certificate/degree. The highest income and highest education categories serve as the reference categories in regression analyses.

The two health behaviours incorporated in this analysis are *smoking* and *physical activity*. *Smoking* represents how often respondents smoke. Individuals who have smoked less than 100 cigarettes in their lives (including non-smokers) are the reference category. Other categories include non-smokers who have smoked more than 100 cigarettes in their lifetime, occasional smokers who have never smoked daily, occasional smokers who formerly smoked daily, and current daily smokers. Physical activity is a pre-constructed variable that categorized respondents as being "active" (reference group), "moderate", or "inactive" based on the total daily energy expenditure values (kcal/kg/day) calculated across 16 questions pertaining to various activities taking place at work and during leisure time (i.e. participation in sporting events/physical fitness and the frequency/duration of these events). This variable addresses the overall physical activity of survey respondents given a comprehensive examination of previous questions. The physical activity index utilizes the same criteria to categorize individuals as Campbell's Survey on Well Being (Canadian Lifestyle and Fitness Institute 1988).

One healthcare resource is assessed using a single survey item: *has insurance that covers all or part of prescription medications*. Note that Canada's system of universal access does not cover prescription medication. Respondents without prescription medication insurance are coded 1, and all others are coded 0. Finally, *age* is a continuous variable in the JCUSH dataset, measured via year of birth subtracted from the date of survey completion. The survey questions from the JCUSH questionnaire and further information on derived variables can be found in Appendices B and C, respectively.

Missing Cases

One of the unfortunate limitations of this study is the exclusion of cases from the analysis, primarily due to the low response rate for questions used to derive adjusted household quintiles (a problem that exists when absolute dollars are utilized as well). Household income quintiles exclude approximately 21% of the sample. After selecting for all variables included in the analysis, of the original Canadian sample size (N = 3505) and American sample size (N = 5183), there are 1976 and 2266 cases, respectively, with non-missing data for all variables used in the study.

A simple multiple logistic regression model with the dependent variable indicative of respondents who did not respond to the household income question relative to those who did shows that Americans are almost twice as likely to not respond (OR = 1.928, $p < 0.001$), females of the sample are about 1.2 times as likely as males to withhold income information (OR = 1.203, $p < 0.05$), and a one-year increase in age also produces a slight increase in the likelihood that this information would be withheld (OR = 1.019, $p < 0.001$). Finally, individuals with lower levels of education are also associated with a lower likelihood of responding to questions pertaining to income (OR Less than High School Diploma = 1.867, $p < 0.001$; OR High School Diploma = 1.462, $p < 0.001$; OR Some College/Trades = 1.523, $p < 0.01$). Note also that having been diagnosed with asthma or reporting fair/poor health are not associated with non-response, but individuals who are overweight/obese in the sample are 0.817 times less likely to withhold income information than individuals of regular weight ($p < 0.05$). Therefore, it is unlikely that this analysis differentially excludes less healthy (or more healthy) respondents from the sample.

Descriptive Findings

Descriptive statistics (Table 1) show that the Canadian (N = 1976) and American (N = 2266) samples are quite similar in most respects, despite a few significant differences. The education variable of both samples differs slightly. It appears that the American sample has fewer respondents indicating they have less than a high school education than the Canadian sample, and correspondingly a higher proportion of respondents with a university degree or college certification. The proportion of men and women, immigrants and non-immigrants, types of smokers, prescription medication insurance, the presence of asthma, and fair/poor health are all within only a few percentage points between samples. The American sample shows a slightly higher proportion of other/mixed ethnicity respondents than the Canadian sample, a higher proportion of inactive individuals (55.4% and 46.2% respectively), and a slightly higher proportion of individuals who are overweight/obese (57.9% and 53.4% respectively).

Analytical Strategy

All analyses are completed using the Statistical Package for the Social Sciences (SPSS) version 15.0. Given the dichotomous nature of the dependent variables, binary logistic regression models were employed to examine the relationships between determinants and health outcomes (further information on assumptions checking procedures can be found in Appendix D). Results from this analysis are reported as the odds of reporting fair/poor health, having asthma, or being overweight/obese for all independent variables relative to the reference categories indicated above. Statistical significance is achieved when $p < 0.05$, and significant relationships are further flagged if $p < 0.01$ or $p < 0.001$.

Research Question 1: *Is SES a significant predictor of health outcomes in both Canada and the United States, and do the strengths of these associations differ?* By first controlling for

the effects of age on health to eliminate any age bias, successive binary logistic regression models will then enter SES into the model (education alone, then income alone, and finally both of these variables together). Considering each of the SES measures on its own is important because many aspects of health may be affected differently by the separate components (Mischra et al. 2002; Winkleby et al. 1992). This will determine if SES is in fact a statistically significant predictor of health outcomes to replicate findings which support the fundamental cause perspective. T-tests comparing regression coefficients will be used to determine if these associations significantly differ between Canada and the United States. Evidence supporting significant differences will lend well to an argument for the contextual operation of social conditions dependent upon country.

Research Question 2: *Are gender, race/ethnicity and/or immigrant status antecedent (and therefore pre-fundamental) to the SES/health association?* Building on the models utilized in the previous research question, I will then successively add the rest of the social conditions (gender, race/ethnicity, and immigrant status) independent of one another to determine their relative contribution and investigate whether the SES measures change upon incorporating the other social condition variables into the models.

The strategy for testing the second research question relies upon a close examination as to how odds ratios for the health outcomes change for measures of SES when variables that are potentially antecedent to SES are controlled for. A decrease in strength for either income or education contributes to an argument claiming that some social conditions are antecedent to the SES/health relationship, and that greater focus needs to be placed on the flow of different social variables to and from one another.

Research Question 3: *Do health behaviours and healthcare resources mediate the association between SES and health outcomes.* I will then control for health behaviours (type of

smoker and physical activity index), monitoring any changes to the SES/health association. If the odds ratios for the measures of SES across the three health outcomes decrease substantially, there exists evidence for mediation, considering that the association is unlikely to be spurious, nor are health behaviours likely antecedent to the SES/health association. The main focus here is on whether or not the original odds ratios for SES decrease in the United States and Canada. Percent change of SES odds ratios predicting the three health outcomes are documented and presented separately.

Testing whether healthcare resources mediate the SES/health association calls for the same analytic strategy described above. By first controlling for all of the social conditions variables, I will then enter the healthcare resource variable (prescription medication insurance), measuring its main effects and testing mediation through a close examination of how SES measures may change in their relationship to health. As per above, percent change of SES odds ratios predicting the three health outcomes are documented and presented separately.

Research Question 4: *Do interactions between gender, race/ethnicity, immigrant status and SES indicate that SES is more fundamental to health for some groups of the Canadian and American population than for others?* Finally, I will control for all social conditions and mediating variables in the analysis and then introduce interaction terms. Successive models will regress an interaction term (e.g. Gender x SES) on the three health indicators for Canada and the United States separately. I will then remove the initial interaction term (Gender x SES) and substitute a new one for each additional social determinant (i.e. Race/ethnicity x SES, Immigrant status x SES). Interaction models are different from the binary logistic regression models employed in earlier stages of this thesis. Earlier models depict what Jaccard and Turrisi (2003) term "main effects" models, in that they demonstrate the effect of some independent variable on

a dependent variable. Interaction effects are not main effects. Interactions describe moderated relationships; the relationship between two variables depends upon the value of a third variable.

The above mentioned series of research questions and models will be completed first for the United States and then for Canada across each health outcome, thereby representing six analogous investigations in total.

Table 1: Descriptive Statistics

	Canada (N = 1976)		USA (N = 2266)		p-value
	Frequency	***Percent***	**Frequency**	***Percent***	
Age	m = 45.86	M = 45.00	m = 45.91	M = 45.00	p > 0.05
Highest Level of Education					p < 0.001
Less HS	389	*19.7%*	249	*11.0%*	
HS Diploma	634	*32.1%*	853	*37.6%*	
Some College	436	*22.1%*	327	*14.4%*	
Degree or Certification	516	*26.1%*	838	*37.0%*	
Income Quintiles Adjusted for Family Size					p > 0.05
Lowest	389	*19.7%*	437	*19.3%*	
Lower Middle	418	*21.1%*	523	*23.1%*	
Middle	370	*18.7%*	404	*17.8%*	
Upper Middle	419	*21.2%*	445	*19.6%*	
Highest	380	*19.2%*	458	*20.2%*	
Gender					p > 0.05
Male	1104	*55.9%*	1251	*55.2%*	
Female	872	*44.1%*	1016	*44.8%*	
Race/Ethnicity					p < 0.001
White	1716	*84.8%*	1749	*77.2%*	
Other/Mixed	260	*15.2%*	518	*22.8%*	
Immigrant Status					p < 0.01
Immigrant	300	*15.2%*	295	*13.0%*	
Non-Immigrant	1676	*84.8%*	1972	*87.0%*	
Type of Smoker					p < 0.05
Daily	530	*26.8%*	654	*28.8%*	
Occasional - Former Daily	109	*5.5%*	140	*6.2%*	
Occasional - Not Former Daily	51	*2.6%*	66	*2.9%*	
Non-Smoker, Former Smoker	831	*42.0%*	875	*38.6%*	
<100 Cigs Lifetime	456	*23.1%*	532	*23.5%*	
Physical Activity Index					p < 0.001
Active	531	*26.9%*	508	*22.3%*	
Moderate	531	*26.9%*	505	*22.3%*	
Inactive	914	*46.2%*	1254	*55.4%*	
Prescription Insurance					p > 0.05
Yes	1554	*78.6%*	1795	*79.2%*	
No	422	*21.4%*	472	*20.8%*	
Fair/Poor Health					p < 0.05
Yes	249	*12.6%*	342	*15.1%*	
No	1727	*87.4%*	1925	*84.9%*	
Has Asthma					p < 0.05

Yes	205	*10.4%*	274	*12.1%*	
No	1771	*89.6%*	1993	*87.9%*	
Overweight/Obese					$p < 0.001$
Yes	1054	*53.4%*	1313	*57.9%*	
No	922	*46.6%*	954	*42.1%*	

CHAPTER 3: RESULTS

Overview

This chapter presents the findings from testing the four research questions laid out in the introductory section of this work. Tables 2-7 are structured in the following manner: first, health is regressed on age as a control variable, and the social determinants included in this analysis are then incorporated successively. The main effects of SES are presented in models 2-4, where models 5, 6, and 7 control for SES while simultaneously incorporating the potentially pre-fundamental social conditions of gender, race/ethnicity, and immigrant status, respectively. Model 8 controls for all of the social determinants in the analysis before controlling for health behaviours (Model 9) and healthcare resources (Model 10). Model 11 controls for all variables in the analysis, acting as the departure model from which interaction effects are incorporated and reported (Tables 8-13). Results are reported as odds ratios from binary logistic regression equations relative to the respective reference category for each variable as detailed in the previous chapter.

Research Question 1: Significant Differences and Strengths of Association between SES and Health in Canada and the USA

Fair/Poor Health

Findings for all three health indicators indicate that the United States and Canada are extremely similar to one another except for a few key differences. For example, in Model 2 of Tables 2 and 3, education seems to be more important in the United States than in Canada in producing fair/poor health inequalities. These differences disappear after controlling for education and income together in Model 4. SES is important in producing health disparities in both countries, with American respondents (OR = 2.496, $p < 0.01$) who hold less than a high

school diploma being slightly more likely than Canadians (OR = 1.792, $p < 0.05$) to report fair/poor health. Statistically significant associations emerge for the lowest (American OR = 4.406, $p < 0.001$; Canadian OR = 4.726, $p < 0.001$) and lower middle (American OR = 2.212, $p < 0.01$; Canadian OR = 2.134, $p < 0.01$) income quintiles. Note also that these odds ratios are not significantly different between Canada and the United States.

Asthma

Education is not a significant predictor of asthma diagnosis in either country after controlling for income (Tables 4 and 5, Model 4). However, income is a significant predictor of asthma diagnosis. Americans in the lowest income quintile are 0.583 times less likely than respondents in the highest income quintile to report being diagnosed with this disease ($p < 0.05$), and Canadians of the same income quintile are 0.415 times less likely than the wealthiest group ($p < 0.001$). However, none of the SES/health associations between the two countries are significantly different from one another. Further, the lowest income quintile only remains a significant predictor across all models in Canada, whereas in the United States, controlling for gender slightly attenuates this relationship.

Overweight/Obesity

There is a weak negative relationship between income and being overweight/obese in the United States (Table 6), but only in Model 3. Note that the income/overweight/obesity associations of Model 3 differ significantly between countries. This is a result of income holding little relationship to overweight/obese in Canada (Table 7). Controlling for education and income together in Model 4 demonstrates that income does not hold any association to overweight/obesity in the United States or in Canada above and beyond income, but that in both

countries, respondents without a high school diploma are more than 1.4 times as likely to be overweight/obese as highly educated respondents ($p < 0.05$).

Summary

Findings illustrate that SES operates in similar fashions in both countries when producing self-rated health inequalities. When controlling for education and income together, none of the odds ratios are significantly different between Canada and the United States. SES appears to be fundamental in its association to self-rated health in both Canada and the United States. However, education is an important determinant of overweight/obesity in both countries, but income is not, and asthma diagnosis lacks an association with SES in the expected inverse direction which demonstrates that this health outcome may not produce a fundamental association with SES. Thus, the fundamental nature of SES seems to depend on the specific health outcome under analysis.

Research Question 2: Pre-fundamental Social Conditions

Gender

Gender is likely temporally antecedent to obtaining an education or monetary wealth. When controlling for gender, the output for self-rated health (comparing models 4 and 5 of Tables 2 and 3) and asthma (comparing models 4 and 5 of Tables 4 and 5) in both countries shows the effects of education and income on health remain relatively unchanged, suggesting that gender is not pre-fundamental to the SES/self-rated health and SES/asthma relationships.

In both the United States and Canada, women are far less likely than men to be obese ($p < 0.001$) and the addition of gender to the binary logistic regression equation significantly improves model fit (Tables 6 and 7, model 5). However, controlling for gender in Canada

produces a slight decrease in the association between income and overweight/obese from model 4, and a small decrease in the association between education and overweight/obese. In the same models, the USA also exhibits a slight decrease in the association between education and overweight/obese. In summary, gender may play a small role as a pre-fundamental cause of the SES/overweight/obese association in Canada and in the United States, but these changes are so minute that it is an unlikely pre-fundamental cause.

Race/Ethnicity

Race/ethnicity is another potentially antecedent variable to the SES/health association. For self-rated health, controlling for race/ethnicity makes a significant improvement in model fit for the USA and accounts for concurrent declines in the SES/health association by approximately 5-10% across both education and income (Table 2, comparing models 4 and 6). Individuals of multiple races or a race/ethnicity other than white are more than 1.5 times as likely as whites to exhibit fair/poor health ($p < 0.001$). In Canada (Table 3), the odds ratios for both education and income remain unchanged after comparing models 4 and 6. Therefore, race/ethnicity appears to be pre-fundamental to the SES/self-rated health association only in the United States.

For asthma, race/ethnicity does not make a strong contribution in either country with odds ratios for education and income remaining largely unchanged (Tables 4 and 5, comparing models 4 and 6). Thus, it is an unlikely pre-fundamental cause of asthma.

When analyzing the results for overweight/obesity as a health outcome, race/ethnicity also seems to be unimportant in Canada, whereas in the USA, individuals who are non-white or from mixed race/ethnicities are about 1.6 times more likely to be overweight/obese than whites ($p < 0.001$). However, the addition of race/ethnicity produces a negligible change in the strength of association between SES and overweight/obese indicating that race/ethnicity is not important

as a pre-fundamental cause of health inequality in the USA, but that it might play a small role as an independent predictor of overweight/obesity status.

Examining the bivariate relationships more closely, it becomes clear how race/ethnicity may influence SES and ultimately health. Interestingly, in Canada, a slightly higher proportion of individuals from other/multiple races/ethnicities hold university degrees or college certificates, and a larger proportion of whites reside in higher income quintiles. However, neither of these relationships are statistically significant. The latter relationship holds true in the United States (Chi-square = 148.669, $p < 0.001$), only the disparity is much greater, favouring whites relative to other/multiple races/ethnicities. In the United States, it seems that whites are also better educated than other/multiple races/ethnicities (Chi-square = 112.223, $p < 0.001$). Racial inequality seems a likely explanation as to why whites typically earn more, are better educated, and have better resultant health and lower likelihood of overweight/obesity, although asthma does not produce statistically significant results. These stark differences also likely account for the difference in strength of association between Canada and the United States, where in Canada, race/ethnicity is not a significant predictor of any of the three health outcomes, with odds ratios approaching 1.000. Results therefore indicate that race/ethnicity is an unlikely pre-fundamental cause of the SES/health association, but for the exception of self-rated health in the United States.

Immigrant Status

Finally, despite immigrant status presenting a strong association with asthma diagnosis in both countries (USA OR = 1.556, $p < 0.05$; Canada OR = 1.684, $p < 0.05$), and self-rated health in the United States (OR = 1.753, $p < 0.01$), comparing models 4 and 7 across Tables 2-7 suggest

it is not antecedent to any SES/health association in either Canada or the United States. Note also that immigrant status does not predict significant odds of being overweight/obese.

Summary

In summary, social conditions such as gender, race/ethnicity, and immigrant do not play a strong role as pre-fundamental causes of SES/health associations. While these variables may be temporally antecedent to SES and health, according to the multivariate findings, little evidence supports that gender, race/ethnicity, and immigrant status stratify income and education in a way that meaningfully influences the SES/health association.

Research Question 3: Health Behaviours and Healthcare Resources as Mediating Variables between SES and Health

Health Behaviours

Fair/Poor Health

As a predictor of fair/poor health in both countries, health behaviours do indeed produce statistically significant associations. In both countries (Tables 2 and 3, model 9), physically inactive individuals are about twice as likely to report fair/poor health ($p < 0.001$), but smoking is only significant in America; daily smokers and non-smokers who have smoked are both about 1.7 times as likely to exhibit fair/poor health ($p < 0.01$).

In the United States (Table 2, comparing models 8 and 9), there is a decline in statistical significance and a decrease in the odds of reporting fair/poor health by about 9.4% and 9.2% for the lowest education categories when controlling for physical activity and smoker type. Even then, the mediating role of health behaviours is small as the changes in the odds ratios are minute. While there is no decrease in the level of significance reported across income

categories, odds ratios decrease by 9.9% and 7.8% across the lowest and lower middle income quintiles respectively, with little to no change across the middle and upper middle income quintiles. This indicates that smoking and physical inactivity are likely mediators of self-reported health status. Removing the effects of smoking and physical activity further illustrate the importance of income based explanations of health, particularly the disparity between the rich and the poor.

For Canada (Table 3), there is also a decrease in the odds ratios across the lowest three education categories by 11.9%, 9.5%, and 10.3%, respectively, and a decline in the level of statistical significance, with the odds of income predicting fair/poor health declining across all four of the represented quintiles (a 7.6%, 8.7%, 7.5%, and 5.2% decrease, respectively). This reduction illustrates that health behaviours partially mediate the SES/self-rated health association, and that SES provides health benefitting resources, or the ability to simply avoid unhealthy behaviours in the United States and in Canada.

Asthma and Overweight/Obesity

Health behaviours do not always produce statistically significant associations with all three health outcomes. For example, physical activity is not a statistically significant predictor of being diagnosed with asthma in either country (Tables 4 and 5), but in America, non-smokers who have previously smoked are about half as likely to have asthma as those who have smoked less than 100 cigarettes in their lifetime ($p < 0.001$); a relationship that does not exist in Canada. The odds of being overweight/obese in America (Table 6) are influenced by physical inactivity, with inactive persons being about 1.7 times more likely than active individuals to be overweight/obese ($p < 0.001$). Smoking daily seems to be protective of this health condition ($OR = 0.735$, $p < 0.05$). In Canada (Table 7), physical activity is not a significant predictor of

overweight/obese, but like their American counterparts, daily smokers are also about 0.7 times less likely to be overweight/obese ($p < 0.01$).

Likely as a result of the behaviours chosen in this analysis, health behaviours do not mediate all SES/health associations. Upon controlling for these behaviours, there exists little to no decrease in the odds of SES predicting asthma diagnosis (Tables 4 and 5) or overweight/obesity (Tables 6 and 7), with the percent change between models 8 and 9 ranging between approximately 0.0 and 5.0%. There still remains potential for the SES/health associations to be mediated by other resources which are perhaps more important to asthma and overweight/obesity. It may be the case that these particular resources are not the most important ones to consider as determinants of these two health outcomes.

Healthcare Resources

Overview

Prescription medication insurance only produces a statistically significant relationship with self-rated health (Table 3, Model 10) and overweight/obesity (Table 7, Model 10) in Canada. Respondents with no prescription insurance were 0.603 times less likely to report fair/poor health ($p < 0.01$), and 0.709 times less likely to be overweight/obese ($p < 0.001$). These findings seem to be counter intuitive, in that we would expect individuals without prescription insurance, as a health benefitting resource, to report higher odds of having fair/poor health. The relationship between prescription medication and overweight/obesity is less certain given the outcome presented above. No significant association exists between prescription medication insurance and health outcomes in the United States (Tables 2, 4, and 6; Model 10).

Fair/Poor Health

As a potential mediator between social conditions (namely SES) and health, it is expected that some of the SES/health association be accounted for after controlling for prescription insurance; that is, a decrease in the association between education/health and income/health (comparing Model 10 to Model 8 across all health outcomes). For the American sample, we notice the odds of income and education predicting fair/poor health (Table 2) actually increase when controlling for prescription medication insurance (10.6% and 3.8% for the lowest two income quintiles and 6.3% for respondents who have not graduated high school), and the same is true in the Canadian sample (Table 3), although to a lesser extent and only for the lowest two income quintiles (11.8% and 4.6%, respectively). In other words, prescription medication plays a small role as a suppressor variable for individuals of lower-SES.

When suppressor variables are controlled for in multiple regression, they substantially improve the predictive capacity of another variable in the equation. This suppressor is typically uncorrelated or holds little association to the criterion variable, but is related to another predictor or set of predictors (Thompson & Levine 1997). Exploring bivariate relationships between the original predictor of interest (SES), the suppressor (prescription medication insurance), and self-rated health in Canada and the United States has the potential to explain this unique finding.

In the United States, education and prescription medication insurance hold a strong positive relationship (Cramer's $V = 0.211$, $p < 0.001$), where higher levels of education correspond to a higher proportion of respondents having insurance (Chi-square = 100.912, $p < 0.001$). Income and prescription insurance hold an even stronger association (Cramer's $V = 0.337$, $p < 0.001$), where like education, as income increases, so too does the proportion of individuals with insurance (Chi-square = 257.922, $p < 0.001$).

The relationship between having (or not having) prescription medication insurance and reporting fair/poor health is also significant (Cramer's $V = 0.061$, $p < 0.01$). It seems that approximately 86.9% of respondents who do have insurance report being in good/very good/excellent health. For respondents without prescription insurance, approximately 80.7% of respondents report good/very good/excellent health (Chi-square = 8.488, $p < 0.01$). A slightly higher proportion of respondents without insurance report fair/poor health, and controlling for prescription medication insurance allows for the SES/health relationship to be better revealed.

The same holds true for Canada and the relationship between SES, prescription medication insurance, and self-rated health. However, as noted above, the only true suppression effect was taking place between household income quintiles and self-rated health upon including prescription medication as a control. In Canada, higher income is also significantly associated with higher rates of prescription medication insurance (Chi-square = 47.989, $p < 0.001$). Further, there appears to be little difference in the proportion of respondents reporting fair/poor health between respondents who do and do not have prescription medication insurance, although this relationship is not statistically significant (Chi-square = 2.739, $p < 0.10$).

Asthma and Overweight/Obesity

Findings comparing Models 8 and 10 across the remaining two health outcomes indicate that there is no mediating effect of this particular healthcare resource on the SES/health association. For example, controlling for prescription medication insurance produces a negligible change in the capacity of SES to predict asthma and overweight/obese for the American sample (Tables 4 and 6, respectively). The same is also true for the Canadian sample (Tables 5 and 7 for asthma and overweight/obese, respectively) where there appears to be no real effect on the SES/health relationships for either of these two diseases.

Research Question 4: The Contribution and Importance of Interactions between Social Conditions

Overview

Interaction terms were added to model 11. Results can be found in Tables 8 – 13. Model 11 serves as the departure model—that is, the interaction terms are incorporated while controlling for all variables included in Model 11. Category-specific estimates were computed by incorporating a multiplicative interaction term into the syntax of the multiple regression models after controlling for all other variables in the analysis (e.g. income x gender) (see Veenstra et al. 2005). This allows for an assessment of whether interaction terms hold a significant association to each of the three health outcomes. The dichotomized variables It appears that gender, race/ethnicity, and immigrant status have the ability to moderate the SES/health association, but that this moderation is dependent upon both national context and the health outcome under analysis.

Few of the interactions between SES and the other included social variables produce statistically significant associations to the three health outcomes. Regardless, interesting differences exist between groups based on gender, race/ethnicity, and immigrant status when analyzed in combination with education and income. These results have the ability to provide further explanation for testing the first research question analyzed in this work, and illustrate the importance of SES to sub-sets of the population which previously remained unexamined. SES may therefore be more fundamental to some groups relative to others. Income and education are driving forces behind health for most of the population of the world; a well-documented phenomenon. Interactions developed here signify the importance of considering multiple social backgrounds when analyzing SES/health relationships.

Fair/Poor Health

Tables 8 and 9 indicate the interaction of gender, race/ethnicity, and immigrant status with education and income on self-rated health in the United States and Canada. A closer examination of Table 9 shows the odds of Canadian men with less than a high school education reporting fair/poor health is 2.337 times as high as for men with a university degree. Canadian women with less than a high school education are 0.751 times less likely to report fair/poor health relative to university educated women. When these two odds ratios are compared against one another—that is, the difference between the odds of men and women with less than a high school diploma—the results are significantly different from one another ($p < 0.05$). Therefore, education has a strong positive effect on the self-rated health of men but not women in Canada. There are no other interactions of note in Canada or the United States.

Asthma

The odds of being diagnosed with asthma for men versus women and whites versus other/mixed races are virtually identical across education and income for both the American (Table 10) and Canadian (Table 11) samples. Immigrant status proves to be the exception, but only in Canada, where education has a strong negative influence on asthma among immigrants but not among native-borns ($p < 0.01$).

Overweight/Obesity

Americans (Table 12) and Canadians (Table 13) who have lower education and lower income are more likely to be overweight/obese, with few differences existing between whites/mixed/other races/ethnicities and immigrants/non-immigrants. However, significant differences do exist between men and women in lower income quintiles in both Canada and the

United States. In the American sample, men from the lowest income quintile are about 0.7 times less likely than men of the highest income quintile to be overweight/obese which is significantly different than women of the lowest income quintile who are 1.951 times more likely than women of the highest income quintile to be overweight obese ($p < 0.01$). Similar findings exist for the lower middle income quintile where men are about 0.960 times less likely to be overweight/obese than the highest income quintile, and women of the same income quintile are 1.668 times more likely than those in the highest income quintile ($p < 0.05$). In Canada, men of the lowest and lower middle income quintiles are less likely to be overweight/obese than men from the highest income quintile, but only the lowest income quintile is significantly different than women who are 1.763 times more likely to be overweight/obese ($p < 0.05$). Thus, poorer women are much more likely than wealthy women to be overweight/obese, but this is not the case among men.

Comparing Canada and the United States

The American sample (Table 8) and the Canadian sample (Table 9) demonstrate some SES gradients in self-rated health, but little exists by way of differences between categories of gender, race/ethnicity, and immigrant status. No significant differences exist between whites and other/multiple races/ethnicities when combined with income and education in either country. However, both whites and other/multiple races/ethnicities occupying successively lower income and education categories in the United States appear to have higher odds of reporting fair/poor health than their Canadian counterparts.

While no differences exist between countries for the diagnosis of asthma, similar results exist for the analysis of interaction terms predicting overweight/obese as forself-rated health. Gender is important in both countries, and the patterning of the odds ratios across these

categories for both countries is very similar, indicating that the social interactions as predictors of overweight/obesity operate similarly in each country. The only difference to note between the two countries is that for immigrant status where two unique events are taking place. First, in the Canadian sample (Table 13), immigrants in the lowest and lower-middle income quintiles are much less likely than non-immigrants of the same income categories to be overweight/obese ($p < 0.01$ and $p < 0.05$, respectively). Thus, income matters more for Canadian immigrants than native-borns. Second, while education differences are not significantly different in either country, differences for immigrants based on income quintiles when comparing the two countries are drastically different. For example, lower income immigrants to Canada appear to be protected from overweight/obesity, whereas in America, immigrants are far more likely to be overweight/obese if they occupy lower social standing.

Table 2: Logistic Regression Models Predicting Fair/Poor Self-Rated Health in the United States											
	1	2	3	4	5	6	7	8	9	10	11
Age	1.037***	1.035***	1.033***	1.033***	1.033***	1.035***	1.035***	1.036***	1.034***	1.033***	1.033***
Education		p < 0.001		p < 0.001	p < 0.001	p < 0.01	p < 0.001	p < 0.01	p < 0.05	p < 0.01	p < 0.01
< High School Diploma		**5.627*** **		2.496***	2.471***	2.262***	2.443***	2.261***	2.048**	2.404***	2.077**
High School Diploma		**2.508*** **		1.704**	1.705**	1.699**	1.751**	1.734**	1.575*	1.761**	1.571*
Some College/Trades		**2.074*** **		1.628*	1.631*	1.607*	1.633*	1.611*	1.541*	1.632*	1.541*
Income Quintiles			p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001
Lowest			6.539***	4.406***	4.482***	3.882***	4.136***	3.837***	3.458***	4.242***	3.792***
Lower Middle			2.873***	2.212**	2.236***	2.048**	2.116**	2.024**	1.866**	2.101**	1.923**
Middle Lowest			1.634*	1.367	1.374	1.304	1.325	1.292	1.259	1.308	1.282
Upper Middle			1.071	0.992	0.997	0.972	0.998	0.983	0.963	1.005	0.963
Women					0.917			0.969	0.920	0.937	0.906
Other/Multiple Races/Ethnicities						1.672***		1.499**	1.522**	1.505**	1.507**
Immigrant Status							**1.753** **	**1.493***	**1.511***	**1.615** **	**1.565***
Type of Smoker									p < 0.05		p < 0.05
Daily									1.756**		1.753**
Occasional Former Daily									1.425		1.383
Occasional Not Former Daily									1.308		1.305
Non-Smoker, Smoked > 100 Cigs. Lifetime									1.776**		1.765**
Physical Activity Index									p < 0.001		p < 0.001
Moderate									1.204		1.217
Inactive									1.999***		2.028***
No Prescription Insurance										0.889	0.767
Nagelkerke R-Square	0.071***	**0.134*** **	**0.171*** **	**0.185*** **	0.185***	**0.193*** **	**0.192*** **	**0.197*** **	**0.217*** **	**0.203*** **	**0.219*** **
Note. Bolded ORs represent significant differences between countries; bolded Nagelkerke R-Square represents a significant increase in model fit; the reference categories for Education, Income, Gender, Race/Ethnicity, Immigrant Status, Type of Smoker, Physical Activity Index and No Prescription Insurance are 'University/College Degree', 'Highest', 'Male', 'White', 'Non-Immigrant' '<100 Cigarettes Lifetime', 'Active', and 'Has Prescription Medication Insurance', respectively; N = 2266; * p < 0.05, ** p < 0.01, *** p < 0.001											

Table 3: Logistic Regression Models Predicting Fair/Poor Self-Rated Health in Canada

	1	2	3	4	5	6	7	8	9	10	11
Age	1.044***	1.040***	1.039***	1.037***	1.037***	1.037***	1.038***	1.038***	1.037***	1.036***	1.038***
Education		p < 0.001		p < 0.01	p < 0.05	p < 0.01	p < 0.05	p < 0.05	p > 0.05	p < 0.05	p > 0.05
< High School Diploma		**2.988*** **		1.792*	1.743*	1.795*	1.727*	1.672*	1.473	1.671*	1.503
High School Diploma		**2.100*** **		1.578*	1.557*	1.581*	1.550*	1.527	1.383	1.583*	1.420
Some College/Trades		**1.232**		0.963	0.977	0.966	0.948	0.962	0.863	1.005	0.898
Income Quintiles			p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001
Lowest			5.750***	4.726***	4.957***	4.701***	4.795***	5.003***	4.625***	5.593***	4.998***
Lower Middle			2.487**	2.134**	2.225**	2.128**	2.157**	2.246**	2.050**	2.349**	2.087**
Middle Lowest			1.235	1.134	1.181	1.131	1.154	1.200	1.109	1.219	1.105
Upper Middle			1.544	1.479	1.501	1.481	1.479	1.503	1.426	1.496	1.414
Women					0.754			0.751	0.729*	0.717*	0.727*
Other/Multiple Races/Ethnicities						1.084		1.129	1.162	1.135	1.139
Immigrant Status							**0.762**	**0.734**	**0.727**	**0.727**	**0.721**
Type of Smoker									p > 0.05		p > 0.05
Daily									1.504		1.500
Occasional Former Daily									0.659		0.696
Occasional Not Former Daily									0.796		0.880
Non-Smoker, Smoked > 100 Cigs. Lifetime									1.261		1.225
Physical Activity Index									p < 0.001		p < 0.001
Moderate									1.064		1.055
Inactive									2.065***		0.569**
No Prescription Insurance										0.603**	0.569**
Nagelkerke R-Square	0.096***	**0.127*** **	**0.171*** **	**0.181*** **	0.184***	0.181***	0.183***	0.186***	**0.211*** **	**0.203*** **	**0.219*** **

Note. Bolded ORs represent significant differences between countries; bolded Nagelkerke R-Square represents a significant increase in model fit; the reference categories for Education, Income, Gender, Race/Ethnicity, Immigrant Status, Type of Smoker, Physical Activity Index and No Prescription Insurance are 'University/College Degree', 'Highest', 'Male', 'White', 'Non-Immigrant' '<100 Cigarettes Lifetime', 'Active', and 'Has Prescription Medication Insurance', respectively; N = 1976; * p < 0.05, ** p < 0.01, *** p < 0.001

Table 4: Logistic Regression Models Predicting Asthma Diagnosis in the United States

	1	2	3	4	5	6	7	8	9	10	11
Age	**1.008**	**1.009***	**1.008***	**1.009***	**1.008***	**1.008***	**1.009***	**1.009***	1.016***	**1.012****	1.016***
Education		p < 0.05		p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05
< High School Diploma		0.590**		0.796	0.740	0.809	0.776	0.757	0.738	0.692	0.724
High School Diploma		1.014		1.176	1.165	1.177	1.193	1.187	1.181	1.148	1.180
Some College/Trades		1.039		1.148	1.147	1.152	1.145	1.158	1.156	1.124	1.150
Income Quintiles			p < 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05
Lowest			0.554**	0.583*	0.632	0.594*	0.556*	0.631	0.602*	0.599*	0.567*
Lower Middle			0.630*	0.622*	0.650*	0.629*	0.602***	0.645*	0.630*	0.632*	0.615*
Middle Lowest			0.853	0.839	0.863	0.844	0.826	0.864	0.809	0.873	0.801
Upper Middle			0.940	0.923	0.943	0.925	0.924	0.949	0.929	0.931	0.927
Women					0.681*			0.698**	0.699**	0.727*	0.707*
Other/Multiple Races/Ethnicities						0.928		0.807	0.761	0.813	0.764
Immigrant Status							1.556*	1.597*	1.663*	1.470	1.620*
Type of Smoker									p < 0.001		p < 0.001
Daily									0.910		0.907
Occasional Former Daily									1.199		1.208
Occasional Not Former Daily									0.989		0.993
Non-Smoker, Smoked > 100 Cigs. Lifetime									**0.489*****		**0.489*****
Physical Activity Index									p > 0.05		p > 0.05
Moderate									0.971		0.967
Inactive									0.932		0.927
No Prescription Insurance										1.037	1.203
Nagelkerke R-Square	**0.003**	**0.01***	**0.014****	**0.018****	**0.025****	0.018*	**0.022****	**0.029*****	**0.049*****	**0.039*****	**0.050*****

Note. Bolded ORs represent significant differences between countries; bolded Nagelkerke R-Square represents a significant increase in model fit; the reference categories for Education, Income, Gender, Race/Ethnicity, Immigrant Status, Type of Smoker, Physical Activity Index and No Prescription Insurance are 'University/College Degree', 'Highest', 'Male', 'White', 'Non-Immigrant' '<100 Cigarettes Lifetime', 'Active', and 'Has Prescription Medication Insurance', respectively; N = 2266; * p < 0.05, ** p < 0.01, *** p < 0.001

Table 5: Logistic Regression Models Predicting Asthma Diagnosis in Canada

	1	2	3	4	5	6	7	8	9	10	11
Age	**1.022*** **	**1.025*** **	**1.022*** **	**1.024*** **	**1.025*** **	**1.024*** **	**1.023*** **	**1.023*** **	1.024***	**1.026*** **	1.024***
Education		p > 0.05		p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05
< High School Diploma		0.658		0.818	0.811	0.816	0.872	0.866	0.825	0.881	0.827
High School Diploma		1.087		1.227	1.219	1.225	1.267	1.259	1.209	1.259	1.211
Some College/Trades		0.874		0.959	0.959	0.956	1.000	0.993	0.966	0.976	0.968
Income Quintiles			p < 0.01	p < 0.05	p < 0.05	p < 0.05	p < 0.05	p < 0.05	p < 0.05	p > 0.05	p < 0.05
Lowest			0.415***	0.429***	0.434**	0.430***	0.421**	0.428***	0.419***	0.428**	0.422**
Lower Middle			0.726	0.740	0.746	0.741	0.720	0.726	0.721	0.714	0.723
Middle Lowest			0.651	0.660	0.666	0.660	0.642	0.643	0.655	0.635	0.655
Upper Middle			0.722	0.720	0.725	0.719	0.722	0.723	0.739	0.717	0.738
Women					0.944			0.955	0.971	1.034	0.970
Other/Multiple Races/Ethnicities						0.956		0.818	0.823	0.787	0.822
Immigrant Status							1.684*	1.785*	1.789*	1.769*	1.789*
Type of Smoker									p > 0.05		p > 0.05
Daily									1.316		1.315
Occasional Former Daily									1.012		1.016
Occasional Not Former Daily									0.954		0.960
Non-Smoker, Smoked > 100 Cigs. Lifetime									**0.979**		**0.979**
Physical Activity Index									p > 0.05		p > 0.05
Moderate									0.840		0.838
Inactive									0.881		0.879
No Prescription Insurance										0.887	0.957
Nagelkerke R-Square	0.021***	0.027***	**0.036*** **	**0.040*** **	0.040***	0.040***	**0.044*** **	0.045***	**0.049*** **	0.045***	0.049***

Note. Bolded ORs represent significant differences between countries; bolded Nagelkerke R-Square represents a significant increase in model fit; the reference categories for Education, Income, Gender, Race/Ethnicity, Immigrant Status, Type of Smoker, Physical Activity Index and No Prescription Insurance are 'University/College Degree', 'Highest', 'Male', 'White', 'Non-Immigrant' '<100 Cigarettes Lifetime', 'Active', and 'Has Prescription Medication Insurance', respectively; N = 1976; * p < 0.05, ** p < 0.01, *** p < 0.001

Table 6: Logistic Regression Models Predicting Overweight/Obese in The United States

	1	2	3	4	5	6	7	8	9	10	11
Age	1.014***	1.013***	1.014***	1.013***	1.013***	1.015***	1.014***	1.014***	1.012***	1.012***	1.012***
Education		p < 0.01		p < 0.05	p < 0.05	p < 0.05	p < 0.05	p > 0.05	p > 0.05	p < 0.05	p > 0.05
< High School Diploma		1.561**		1.439*	1.335	1.308	1.430*	1.223	1.215	1.289	1.238
High School Diploma		1.130		1.084	1.077	1.083	1.087	1.070	1.080	1.088	1.081
Some College/Trades		1.499**		1.460**	1.464**	1.430*	1.458**	1.436**	1.422*	1.460**	1.423*
Income Quintiles			p < 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05
Lowest			**1.312***	1.151	1.267	1.020	1.137	1.139	1.095	1.222	1.175
Lower Middle			1.289	1.195	1.263	1.117	1.185	1.192	1.194	1.227	1.231
Middle Lowest			1.043	0.986	1.020	0.945	0.983	0.980	0.990	0.987	1.004
Upper Middle			1.088	1.059	1.087	1.043	1.059	1.070	1.070	1.086	1.074
Women					**0.636*** **			**0.642*** **	**0.612*** **	**0.624*** **	**0.604*** **
Other/Multiple Races/Ethnicities						**1.645*** **		**1.677*** **	**1.696*** **	**1.672*** **	**1.688*** **
Immigrant Status							1.109	0.843	0.823	0.882	0.844
Type of Smoker									p > 0.05		p > 0.05
Daily									0.735*		0.740*
Occasional Former Daily									1.031		1.029
Occasional Not Former Daily									0.724		0.728
Non-Smoker, Smoked > 100 Cigs. Lifetime									0.973		0.975
Physical Activity Index									p < 0.001		p < 0.001
Moderate									1.155		1.161
Inactive									**1.701*** **		1.714***
No Prescription Insurance										0.876	0.813
Nagelkerke R-Square	0.015***	**0.023*** **	0.019***	**0.025*** **	**0.041*** **	**0.037*** **	0.025***	**0.052*** **	**0.072*** **	**0.057*** **	**0.074*** **

Note. Bolded ORs represent significant differences between countries; bolded Nagelkerke R-Square represents a significant increase in model fit; the reference categories for Education, Income, Gender, Race/Ethnicity, Immigrant Status, Type of Smoker, Physical Activity Index and No Prescription Insurance are 'University/College Degree', 'Highest', 'Male', 'White', 'Non-Immigrant' '<100 Cigarettes Lifetime', 'Active', and 'Has Prescription Medication Insurance', respectively; N = 2266; * p < 0.05, ** p < 0.01, *** p < 0.001

Table 7: Logistic Regression Models Predicting Overweight/Obese in Canada											
	1	2	3	4	5	6	7	8	9	10	11
Age	1.020***	1.019***	1.020***	1.019***	1.020***	1.019***	1.019***	1.019***	1.016***	1.018***	1.016***
Education		p > 0.05		p < 0.05	p > 0.05	p < 0.05	p < 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05
< High School Diploma		1.362*		1.491**	1.340	1.484**	1.533**	1.359***	1.394*	1.367*	1.409*
High School Diploma		1.140		1.196	1.112	1.193	1.213	1.118	1.164	1.127	1.176
Some College/Trades		1.043		1.081	1.093	1.076	1.098	1.093	1.111	1.110	1.127
Income Quintiles			p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05	p > 0.05
Lowest			**0.865**	0.764	0.898	0.769	0.758	0.907	0.956	0.963	1.011
Lower Middle			0.959	0.876	1.000	0.880	0.867	1.000	1.023	1.035	1.057
Middle Lowest			1.037	0.984	1.135	0.986	0.972	1.126	1.118	1.147	1.137
Upper Middle			0.996	0.971	1.058	0.969	0.973	1.054	1.040	1.047	1.033
Women					**0.398*** **			**0.395*** **	**0.385*** **	**0.386*** **	**0.382*** **
Other/Multiple Races/Ethnicities						**0.913**		**0.779**	**0.787**	**0.776**	**0.779**
Immigrant Status							1.218	1.207	1.206	1.219	1.215
Type of Smoker									p < 0.01		p < 0.01
Daily									0.687**		0.686**
Occasional Former Daily									0.788		0.815
Occasional Not Former Daily									0.822		0.866
Non-Smoker, Smoked > 100 Cigs. Lifetime									1.106		1.102
Physical Activity Index									p > 0.05		p > 0.05
Active									1		1
Moderate									1.086		1.075
Inactive									**1.199**		1.182
No Prescription Insurance										0.709***	0.708**
Nagelkerke R-Square	0.032***	0.035***	0.033***	0.038***	**0.100*** **	0.038***	0.040***	**0.102*** **	**0.113*** **	**0.108*** **	**0.119*** **

Note. Bolded ORs represent significant differences between countries; bolded Nagelkerke R-Square represents a significant increase in model fit; the reference categories for Education, Income, Gender, Race/Ethnicity, Immigrant Status, Type of Smoker, Physical Activity Index and No Prescription Insurance are 'University/College Degree', 'Highest', 'Male', 'White', 'Non-Immigrant' '<100 Cigarettes Lifetime', 'Active', and 'Has Prescription Medication Insurance', respectively; N = 1976; * p < 0.05, ** p < 0.01, *** p < 0.001

Table 8: Interactions on Self-Rated Health, American Sample

1. Education by gender				
	Men	OR less High School	=	1.842 (comparison with 2.491 produces p > 0.05)
		OR High School Diploma	=	1.325 (comparison with 1.985 produces p > 0.05)
		OR Some College	=	1.253 (comparison with 2.027 produces p > 0.05)
		OR University Degree	=	1.000
	Women	OR less High School	=	2.491
		OR High School Diploma	=	1.985
		OR Some College	=	2.027
		OR University Degree	=	1.000
2. Income by gender				
	Men	OR Lowest	=	3.966
		OR Lower Middle	=	1.969
		OR Middle	=	1.565
		OR Upper Middle	=	1.268
		OR Highest	=	1.000
	Women	OR Lowest	=	3.320
		OR Lower Middle	=	1.753
		OR Middle	=	0.916
		OR Upper Middle	=	0.592
		OR Highest	=	1.000
3. Education by Race/Ethnicity				
	White	OR less than High School	=	2.364
		OR High School Diploma	=	1.269
		OR Some College	=	1.369
		OR University Degree	=	1.000
	Other/Mixed	OR less than High School	=	2.457
		OR High School Diploma	=	3.101
		OR Some College	=	2.414
		OR University Degree	=	1.000
4. Income by Race/Ethnicity				
	White	OR Lowest	=	3.446
		OR Lower Middle	=	1.794
		OR Middle	=	1.399
		OR Upper Middle	=	0.916
		OR Highest	=	1.000
	Other/Mixed	OR Lowest	=	5.272
		OR Lower Middle	=	2.634
		OR Middle	=	1.071
		OR Upper Middle	=	1.293
		OR Highest	=	1.000
5. Education by Immigrant Status				
	Immigrant	OR less than High School	=	1.709
		OR High School Diploma	=	0.977
		OR Some College	=	1.387
		OR University Degree	=	1.000
	Non-Immigrant	OR less than High School	=	2.166
		OR High School Diploma	=	1.720
		OR Some College	=	1.573
		OR University Degree	=	1.000
6. Income by Immigrant Status				
	Immigrant	OR Lowest	=	32.112
		OR Lower Middle	=	18.103
		OR Middle	=	14.743
		OR Upper Middle	=	11.179
		OR Highest	=	1.000
	Non-Immigrant	OR Lowest	=	3.383
		OR Lower Middle	=	1.669
		OR Middle	=	1.064
		OR Upper Middle	=	0.822
		OR Highest	=	1.000

Note. N = 2266; *p < 0.05, **p < 0.01, ***p < 0.001

Table 9: Interactions on Self-Rated Health, Canadian Sample

1. Education by gender				
	Men	OR less High School	=	2.337* (comparison with 0.751 produces p < 0.05)
		OR High School Diploma	=	1.696 (comparison with 1.170 produces p > 0.05)
		OR Some College	=	1.073 (comparison with 0.720 produces p > 0.05)
		OR University Degree	=	1.000
	Women	OR less High School	=	0.751
		OR High School Diploma	=	1.170
		OR Some College	=	0.720
		OR University Degree	=	1.000
2. Income by gender				
	Men	OR Lowest	=	5.709
		OR Lower Middle	=	2.278
		OR Middle	=	1.375
		OR Upper Middle	=	1.109
		OR Highest	=	1.000
	Women	OR Lowest	=	3.873
		OR Lower Middle	=	1.718
		OR Middle	=	0.729
		OR Upper Middle	=	1.888
		OR Highest	=	1.000
3. Education by Race/Ethnicity				
	White	OR less than High School	=	1.589
		OR High School Diploma	=	1.477
		OR Some College	=	1.024
		OR University Degree	=	1.000
	Other/Mixed	OR less than High School	=	1.060
		OR High School Diploma	=	1.149
		OR Some College	=	0.321
		OR University Degree	=	1.000
4. Income by Race/Ethnicity				
	White	OR Lowest	=	4.546
		OR Lower Middle	=	1.943
		OR Middle	=	0.926
		OR Upper Middle	=	1.383
		OR Highest	=	1.000
	Other/Mixed	OR Lowest	=	11.872
		OR Lower Middle	=	4.315
		OR Middle	=	4.118
		OR Upper Middle	=	1.566
		OR Highest	=	1.000
5. Education by Immigrant Status				
	Immigrant	OR less than High School	=	2.315
		OR High School Diploma	=	1.443
		OR Some College	=	0.541
		OR University Degree	=	1.000
	Non-Immigrant	OR less than High School	=	1.389
		OR High School Diploma	=	1.403
		OR Some College	=	0.955
		OR University Degree	=	1.000
6. Income by Immigrant Status				
	Immigrant	OR Lowest	=	2.200
		OR Lower Middle	=	1.565
		OR Middle	=	0.754
		OR Upper Middle	=	1.561
		OR Highest	=	1.000
	Non-Immigrant	OR Lowest	=	5.794
		OR Lower Middle	=	2.193
		OR Middle	=	1.179
		OR Upper Middle	=	1.406
		OR Highest	=	1.000

Note. N = 1976; *p < 0.05, **p < 0.01, ***p < 0.001

Table 10: Interactions on Asthma, American Sample

1. Education by gender				
	Men	OR less High School	=	0.761 (comparison with 0.661 produces p > 0.05)
		OR High School Diploma	=	1.001 (comparison with 1.354 produces p > 0.05)
		OR Some College	=	0.977 (comparison with 1.323 produces p > 0.05)
		OR University Degree	=	1.000
	Women	OR less High School	=	0.661
		OR High School Diploma	=	1.354
		OR Some College	=	1.323
		OR University Degree	=	1.000
2. Income by gender				
	Men	OR Lowest	=	0.787
		OR Lower Middle	=	0.606
		OR Middle	=	0.788
		OR Upper Middle	=	1.048
		OR Highest	=	1.000
	Women	OR Lowest	=	0.439
		OR Lower Middle	=	0.609
		OR Middle	=	0.798
		OR Upper Middle	=	0.804
		OR Highest	=	1.000
3. Education by Race/Ethnicity				
	White	OR less than High School	=	0.742
		OR High School Diploma	=	1.265
		OR Some College	=	0.978
		OR University Degree	=	1.000
	Other/Mixed	OR less than High School	=	0.678
		OR High School Diploma	=	0.953
		OR Some College	=	2.154
		OR University Degree	=	1.000
4. Income by Race/Ethnicity				
	White	OR Lowest	=	0.633
		OR Lower Middle	=	0.718
		OR Middle	=	0.837
		OR Upper Middle	=	1.122*
		OR Highest	=	1.000
	Other/Mixed	OR Lowest	=	0.127
		OR Lower Middle	=	0.124
		OR Middle	=	0.226
		OR Upper Middle	=	0.140
		OR Highest	=	1.000
5. Education by Immigrant Status				
	Immigrant	OR less than High School	=	2.232
		OR High School Diploma	=	0.827
		OR Some College	=	2.828
		OR University Degree	=	1.000
	Non-Immigrant	OR less than High School	=	0.598
		OR High School Diploma	=	1.229
		OR Some College	=	1.054
		OR University Degree	=	1.000
6. Income by Immigrant Status				
	Immigrant	OR Lowest	=	1.999
		OR Lower Middle	=	0.762
		OR Middle	=	1.124
		OR Upper Middle	=	0.555
		OR Highest	=	1.000
	Non-Immigrant	OR Lowest	=	0.494
		OR Lower Middle	=	0.619
		OR Middle	=	0.784
		OR Upper Middle	=	0.977
		OR Highest	=	1.000

Note. N = 2266; *p < 0.05, **p < 0.01, ***p < 0.001

Table 11: Interactions on Asthma, Canadian Sample

1. Education by gender				
	Men	OR less High School	=	0.662 (comparison with 0.994 produces p > 0.05)
		OR High School Diploma	=	1.032 (comparison with 1.401 produces p > 0.05)
		OR Some College	=	0.755 (comparison with 1.246 produces p > 0.05)
		OR University Degree	=	1.000
	Women	OR less High School	=	0.994
		OR High School Diploma	=	1.401
		OR Some College	=	1.246
		OR University Degree	=	1.000
2. Income by gender				
	Men	OR Lowest	=	0.403
		OR Lower Middle	=	0.611
		OR Middle	=	1.100
		OR Upper Middle	=	1.151
		OR Highest	=	1.000
	Women	OR Lowest	=	0.468
		OR Lower Middle	=	0.912
		OR Middle	=	0.456
		OR Upper Middle	=	0.550
		OR Highest	=	1.000
3. Education by Race/Ethnicity				
	White	OR less than High School	=	0.908
		OR High School Diploma	=	1.327
		OR Some College	=	1.075
		OR University Degree	=	1.000
	Other/Mixed	OR less than High School	=	0.438
		OR High School Diploma	=	0.681
		OR Some College	=	0.475
		OR University Degree	=	1.000
4. Income by Race/Ethnicity				
	White	OR Lowest	=	0.508
		OR Lower Middle	=	0.854
		OR Middle	=	0.659
		OR Upper Middle	=	0.828
		OR Highest	=	1.000
	Other/Mixed	OR Lowest	=	0.109
		OR Lower Middle	=	0.193
		OR Middle	=	0.738
		OR Upper Middle	=	0.244
		OR Highest	=	1.000
5. Education by Immigrant Status				
	Immigrant	OR less than High School	=	0.122**
		OR High School Diploma	=	0.404
		OR Some College	=	0.522
		OR University Degree	=	1.000
	Non-Immigrant	OR less than High School	=	1.026
		OR High School Diploma	=	1.378
		OR Some College	=	1.051
		OR University Degree	=	1.000
6. Income by Immigrant Status				
	Immigrant	OR Lowest	=	0.362
		OR Lower Middle	=	0.820
		OR Middle	=	2.595
		OR Upper Middle	=	0.702
		OR Highest	=	1.000
	Non-Immigrant	OR Lowest	=	0.430
		OR Lower Middle	=	0.712
		OR Middle	=	0.584
		OR Upper Middle	=	0.738
		OR Highest	=	1.000

Note. N = 1976; *p < 0.05, **p < 0.01, ***p < 0.001

Table 12: Interactions on Overweight/Obese, American Sample

1. Education by gender				
	Men	OR less High School	=	0.976 (comparison with 1.794 produces p > 0.05)
		OR High School Diploma	=	1.005 (comparison with 1.179 produces p > 0.05)
		OR Some College	=	1.358 (comparison with 1.512 produces p > 0.05)
		OR University Degree	=	1.000
	Women	OR less High School	=	1.794
		OR High School Diploma	=	1.179
		OR Some College	=	1.512
		OR University Degree	=	1.000
2. Income by gender				
	Men	OR Lowest	=	0.699**
		OR Lower Middle	=	0.960*
		OR Middle	=	1.123
		OR Upper Middle	=	0.896
		OR Highest	=	1.000
	Women	OR Lowest	=	1.951
		OR Lower Middle	=	1.668
		OR Middle	=	0.901
		OR Upper Middle	=	1.403
		OR Highest	=	1.000
3. Education by Race/Ethnicity				
	White	OR less than High School	=	1.000
		OR High School Diploma	=	1.127
		OR Some College	=	1.462
		OR University Degree	=	1.000
	Other/Mixed	OR less than High School	=	1.549
		OR High School Diploma	=	0.886
		OR Some College	=	1.249
		OR University Degree	=	1.000
4. Income by Race/Ethnicity				
	White	OR Lowest	=	1.170
		OR Lower Middle	=	1.167
		OR Middle	=	0.984
		OR Upper Middle	=	1.064
		OR Highest	=	1.000
	Other/Mixed	OR Lowest	=	1.393
		OR Lower Middle	=	1.646
		OR Middle	=	1.218
		OR Upper Middle	=	1.210
		OR Highest	=	1.000
5. Education by Immigrant Status				
	Immigrant	OR less than High School	=	1.450
		OR High School Diploma	=	0.693
		OR Some College	=	1.720
		OR University Degree	=	1.000
	Non-Immigrant	OR less than High School	=	1.166
		OR High School Diploma	=	1.140
		OR Some College	=	1.378
		OR University Degree	=	1.000
6. Income by Immigrant Status				
	Immigrant	OR Lowest	=	1.968
		OR Lower Middle	=	1.793
		OR Middle	=	1.589
		OR Upper Middle	=	1.697
		OR Highest	=	1.000
	Non-Immigrant	OR Lowest	=	1.108
		OR Lower Middle	=	1.195
		OR Middle	=	0.963
		OR Upper Middle	=	1.033
		OR Highest	=	1.000

Note. N = 2266; *p < 0.05, **p < 0.01, ***p < 0.001

Table 13: Interactions on Overweight/Obese, Canadian Sample

1. Education by gender				
	Men	OR less High School	=	1.236 (comparison with 1.667 produces p > 0.05)
		OR High School Diploma	=	1.080 (comparison with 1.307 produces p > 0.05)
		OR Some College	=	1.126 (comparison with 1.141 produces p > 0.05)
		OR University Degree	=	1.000
	Women	OR less High School	=	1.667
		OR High School Diploma	=	1.307
		OR Some College	=	1.141
		OR University Degree	=	1.000
2. Income by gender				
	Men	OR Lowest	=	0.647**
		OR Lower Middle	=	0.890
		OR Middle	=	1.153
		OR Upper Middle	=	1.153
		OR Highest	=	1.000
	Women	OR Lowest	=	1.763
		OR Lower Middle	=	1.403
		OR Middle	=	1.270
		OR Upper Middle	=	0.953
		OR Highest	=	1.000
3. Education by Race/Ethnicity				
	White	OR less than High School	=	1.415
		OR High School Diploma	=	1.343*
		OR Some College	=	1.142
		OR University Degree	=	1.000
	Other/Mixed	OR less than High School	=	1.565
		OR High School Diploma	=	0.547
		OR Some College	=	1.146
		OR University Degree	=	1.000
4. Income by Race/Ethnicity				
	White	OR Lowest	=	0.922
		OR Lower Middle	=	1.021
		OR Middle	=	1.166
		OR Upper Middle	=	1.016
		OR Highest	=	1.000
	Other/Mixed	OR Lowest	=	1.708
		OR Lower Middle	=	1.354
		OR Middle	=	0.993
		OR Upper Middle	=	1.158
		OR Highest	=	1.000
5. Education by Immigrant Status				
	Immigrant	OR less than High School	=	1.026
		OR High School Diploma	=	0.759
		OR Some College	=	1.187
		OR University Degree	=	1.000
	Non-Immigrant	OR less than High School	=	1.494
		OR High School Diploma	=	1.284
		OR Some College	=	1.135
		OR University Degree	=	1.000
6. Income by Immigrant Status				
	Immigrant	OR Lowest	=	0.340**
		OR Lower Middle	=	0.400*
		OR Middle	=	0.598
		OR Upper Middle	=	0.503
		OR Highest	=	1.000
	Non-Immigrant	OR Lowest	=	1.120
		OR Lower Middle	=	1.235
		OR Middle	=	1.240
		OR Upper Middle	=	1.145
		OR Highest	=	1.000

Note. N = 1976; *p < 0.05, **p < 0.01, ***p < 0.001

CHAPTER 4: DISCUSSION

Introduction

This chapter will attempt to not only clarify the findings depicted in the previous chapter but also serve as a forum for which to discuss the research questions more broadly. It will consider why some groups are more successful than others in achieving better health, and will comment on the importance of context in conducting health research relating to the fundamental cause perspective.

The Cross-National Relevance of SES as a Fundamental Cause of Health Disparities

The results above demonstrate the role of SES as a potential fundamental cause of health inequalities in Canada and the United States. Considering the lack of significant differences between education and income across both countries, it seems clear that SES remains an incredibly important determinant of health outcomes. Further, it seems that SES is associated with health outcomes in remarkably similar fashions across both contexts. As predicted, lower-SES respondents are more likely to have fair/poor self-rated health and more likely to be overweight/obese. Interestingly, income is not associated with overweight/obesity. Considering that being overweight or obese is a condition that is highly preventable, individuals of high-SES should be more likely to inequitably access health promoting resources by way of higher income. However, the lack of an association across income categories may point to the fact that the obesity epidemic is prevalent across North America, irrespective of income. High rates of sedentary lifestyle coupled with the increasingly widespread availability of food with low nutritional quality may affect respondents to similar degrees across all classes.

Income and education operate somewhat differently in predicting asthma diagnosis. The results section details how asthma appears to be a disease of affluence, where occupying

successively lower income quintiles are a protective factor. Despite income being a significant predictor of asthma diagnosis in Canada across models 3-11, education did not produce a significant relationship with this health outcome. Similar results are also found for the United States. The fundamental cause perspective details how for diseases with relatively low-preventability, there are few resources which may be differentially accessed and utilized by high-SES individual, and thus, there is no discernible SES gradient for those conditions or diseases. If asthma is difficult to prevent, and social conditions like SES do confer advantageous resources which promote good health, then there should be no SES gradient in asthma diagnosis. It therefore seems unlikely that lower-income respondents have greater access to a particular resource than higher-income respondents to stave off this disease. For example, lower-income respondents in both countries are more likely to smoke and less likely to be physically active (Sanmartin et al. 2004) which are previously documented determinants of this disease.

The importance of neighbourhood and exposure to airborne pollution was not investigated in this analysis, but has the potential to explain why lower-SES respondents are protected from asthma. The increasing suburbanization of North American cities has led to relatively inexpensive housing and long gone are the days where a city's disenfranchised individuals solely occupy the often polluted urban core, increasingly occupied by expensive condominium and apartment buildings. It may be that the as the demand to live in gentrified city centres increases, it too produces a shift in the prevalence of asthma diagnoses to favour individuals who cannot afford to live in the heart of the city. This reasoning suggests resources of wealth by way of property location could actually be detrimental to health.

Summary

There appear to be few differences between Canada and the United States. Both countries differ somewhat when examining social determinants beyond SES, depending on the health outcome being analyzed. However, with the main focus of the fundamental cause perspective revolving around SES and the ability to garner and wield protective resources if an individual is socially privileged or from a higher social class, it is interesting that income and education are not significantly different between these two countries. Canada is often viewed as a more socially democratic welfare state than the United States, despite being classified as a 'liberal democratic welfare state' under Esping-Anderson's (1990) system of categorization, the same label given to the United States. Canada is apparently able to tackle social inequality in health more effectively than the United States through a more egalitarian distribution of resources and potentially lower levels of gender and racial discrimination. It remains interesting that given the popular perception of Canada and the United States, they perform incredibly similar to one another when gauging the relative impacts of education and income, which supports Esping-Anderson's classification. Income and educational inequalities drive many of the health disparities between these countries, but certainly not all. Education has little influence over the diagnosis of asthma, and income's association with asthma is also weak wherein lower-SES individuals seem to be protected from the disease ($p < 0.05$ in the USA, $p < 0.001$ in Canada).

To reiterate, these findings do indeed replicate the original research conducted by Link and Phelan (1995). However, little research exists as to why two similar countries differ so greatly in health in some respects, and not at all in others. Canada is allegedly a more equitable society than America, but income and education disparities are still at the heart of health inequalities in Canada as much as they are in the United States. Future research needs to attempt

to untangle the importance of national context, keeping in mind that health is a highly contextual outcome driven by a highly contextual set of determinants that operate differently under competing societal structures and paradigms of treatment. For example, universal healthcare in Canada is often touted as one of the reasons why Canadians exemplify better health than their neighbours to the south. This is not necessarily the case. In fact, universal healthcare is not able to adequately explain differences in health between Canada and the United States (Marmot 1994). It seems that despite all the inherent differences between these two societies, the largest being racial/ethnic inequality and potential discriminatory practices towards immigrant populations, they are virtually identical in how SES predicts health and disease.

The Role of Pre-fundamental Causes

The role of so-called "pre-fundamental" causes of SES and resulting health inequalities is important for the fundamental cause perspective. With the main focus of this research being upon the dominant and widespread predictive capabilities of income and education, little emphasis is placed on why income and education inequalities may exist in the first place. SES measures may be stratified across certain social categories, but when controlled for in multivariate logistic regression models, produce little change to the SES/health association.

For example, an obvious relationship exists between gender and SES, and an obvious relationship between SES and health. Although gender is indeed temporally antecedent, it does not influence any SES/health association in a meaningful way. The fundamental cause perspective focuses almost solely on the role of SES and its many beneficial pathways to health promoting (or degrading) resources such as the ability to afford health insurance or simply a have a better understanding of basic health. The interconnectedness of social conditions is often disregarded and has largely gone without much consideration.

The present findings demonstrate some contextual effects of social conditions in producing disease; an area of the fundamental cause perspective that has received little attention. Testing the pre-fundamental nature of gender, race/ethnicity, and immigrant status across several health outcomes, and indeed two different countries, clearly illustrates that context of disease and country can produce varied results. My results demonstrate that gender, race/ethnicity and immigrant status are not pre-fundamental causes of health inequalities since they produce negligible changes in the SES/health association in either country.

The only exception to this is the pre-fundamental role of race/ethnicity to the SES/self-rated health association. Racial inequality appears to drive SES attainment and ultimately self-rated health, but only in the United States, likely as a result of historical processes of discrimination and racism. Self-rated health is a reliable measure of individual health, and it is interesting that race/ethnicity is not pre-fundamental to either of the other two health outcomes in this analysis, only playing a small role as an antecedent variable for the predictive capacity of education on overweight/obese and income on the diagnosis of asthma. This suggests that previously documented social inequality may no longer have the same potential as it once did to drive SES disparities in health. Note that gender inequality is changing in North America, with a larger proportion of women entering post-secondary university than men, and a more equitable distribution of income than in the past.

Differences in race/ethnicity and immigrant status indicate that, in Canada, racial minorities experience fewer health inequality than in the United States, and immigrants are typically healthier upon entering Canada relative to America. I speculate that immigration policies and multiculturalism are likely at the crux of this difference. Current immigration policies in Canada require candidates to undergo a thorough screening process and background check, which includes an assessment of health. Healthy immigrants are more likely to self-select

themselves into immigration, and the practices and policies of Canadian immigration services reinforce the fact that Canada does not necessarily make consolations for the sick, the tired, the hungry, or the poor, rather opting to accept immigrants who come from more privileged backgrounds.[1] The United States on the other hand receives a larger proportion of less-wealthy, lower-educated individuals despite similar immigration policies (Dey et al. 1996) which might account for some of this difference.

Canada appears to combat social inequality, but namely racial/ethnic inequalities, far more effectively than the United States, likely as a result of a more egalitarian society with greater investments in the welfare of its citizenry (i.e. universal healthcare, universal education, policies driving multiculturalism and perhaps a more staunch approach towards the protection of human rights) (Crystal 2006). This is a result of historical, political, and social processes taking place in both countries (Willson 2009). Policies targeting inequality seem to ameliorate the issue of social inequality to a greater extent in Canada than the United States, although, as indicated above, education and income disparities still remain at the heart of health inequalities in both countries.

Findings suggest that social causes that are antecedent to the SES/health relationship offer the ability to further understand pathways of privilege and the disadvantageous nature of certain social categorizations as they influence SES. However, due to the unchanging nature of the odds ratios of income and education in predicting health (but for the exception of race/ethnicity and self-rated health status), gender, race/ethnicity, and immigrant status play little pre-fundamental role to the SES/health association. The fundamental role of SES is therefore

[1] This is in reference to the sonnet "New Colossus" by Emma Lazarus which can be found on a plaque on the pedestal of Statue of Liberty reading: '*Give me your tired, your poor, Your huddled masses yearning to breathe free, The wretched refuse of your teeming shore. Send these, the homeless, tempest-tossed to me, I lift my lamp beside the golden door!'*

supported as a primary social mechanism determining health inequalities in Canada and the United States.

The Mediating Nature of Health Behaviours and Healthcare Resources

Health Behaviours

The fundamental cause perspective claims that as a result of higher wages and higher education, resources of power and prestige allow individuals access to resources which can benefit their health. The pathway from SES to health within this context would suggest that higher-SES individuals are more educated and perhaps have a greater general knowledge of their health and what they can do to maintain it, physically. Higher paying jobs are often accompanied by greater amounts of leisure time which can often translate into having the time to exercise and stay in good health relative to potentially over-worked and underpaid lower class workers. In fact, this is exactly what is found when analyzing self-rated health.

Health behaviours do not mediate the SES/asthma or SES/overweight/obese relationships. This is interesting considering the demonstrable associations between smoking and physical activity with both asthma and overweight/obese. The selection of these particular health behaviours was strategic in this respect, in that they exhibit well-documented relationships to the health outcomes under analysis, and that as health behaviours they have the most widespread and documented effects. After controlling for these behaviours, the SES/health associations remain significant with no change in the odds of predicting asthma or overweight/obesity prevalence. SES is therefore likely to operate through multiple pathways that simultaneously and differentially influence human health. The importance of what Link and Phelan refer to as *flexible resources* is therefore supported and maintained in this analysis.

However, health behaviours do appear to mediate the SES/self-rated health association as hypothesized. Self-rated health, as a subjective measure of physical well-being, is problematic in itself in that it is not a physical health outcome like that of asthma or overweight/obesity, but it has been proven to be a reliable measure of health. The partial mediation of the SES/self-rated health association by health behaviours supports the fundamental cause perspective, in that SES largely has the ability to provide unseen advantages (i.e. leisure time) which may benefit health. The fact that the mediating effect of these resources is small goes to further demonstrate how *flexible resources* provided by SES are likely of ultimate importance to the fundamental cause perspective.

The mediating effect of health behaviours was not present across two specific health outcomes in Canada or the United States. Of course, this does not mean that the fundamental cause perspective has been falsified in any way. Rather, the health behaviours (acting as "resources") under analysis may not be the most health promoting or health damaging resources applicable to either of these outcomes, although this may seem unlikely given the strategic inclusion of health behaviours with documented associations to both overweight/obesity and asthma diagnosis. Regardless, there are many other variables that cause health problems.

The fundamental cause perspective claims that SES holds a significant association to health as more proximal determinants change over the course of time. The supposition could then be made that smoking and physical activity are decreasing in importance as determinants of these two specific health outcomes, and that new intervening mechanisms have taken their place. Other variables such as the proximity to fast food restaurants or green grocers might influence overweight/obesity more strongly and successfully mediate the SES health relationship. For asthma, the importance of neighbourhood of residence and exposure to airborne pollution are

variables to consider as potential mediators of the SES/health association, but could not be included in this analysis due to limitations of the data.

Healthcare Resources

Results indicate that insurance covering prescription medications does not mediate the SES/health relationship. As a healthcare resource variable that improves access to the healthcare system and reduces the burden of cost for individuals, it seems clear that having insurance is more important for low-SES individuals. High-SES individuals, through their ability to garner health benefitting resources, would not be as affected if they were to suddenly lose this insurance because they could utilize other resources to buffer or cushion such a loss. Lower-SES individuals however, might rely on prescription medication insurance to a greater degree to better their health and keep healthcare expenditures down.

These findings support the fundamental cause perspective, but in a unique way not previously hypothesized, showing that indeed, higher-SES respondents were more likely to have prescription insurance and were also likely to have better health, but that removing the effects of prescription insurance matter little to those individuals who have a wealth of other resources at their availability. For example, if an individual from the lowest income quintile who coincidently did not graduate high school were to suddenly lose prescription medication insurance covering the cost of medication required to treat some chronic condition (i.e. asthma), paying these new prescription medication bills could be difficult. However, a highly educated individual who is from a higher income quintile would not be as affected by this loss. They would still have the financial and social resources necessary to maintain a high standard of health despite this potential set back.

The suppression effects detailed above are important to the fundamental cause perspective, but as the theory postulates, gradients in health across SES are largely produced as a result of inequitable resource utilization. Prescription insurance coverage is inequitably accessed by individuals of high-SES who as we know, also have better health. This pathway seems clear, but when tested across multiple contexts did not produce any significant mediation.

Selecting prescription medication insurance as a variable indicative of a healthcare resource may be problematic here. For example, there is an obvious effect when controlling for this variable on self-rated health, but the link between prescription medication insurance and asthma or overweight/obese seems less clear. Recent findings from the American Academy of Allergy Asthma and Immunology indicate that despite coverage and accessibility to health providers, individuals with and without insurance covering asthma prescriptions had similar rates of medication utilization, symptoms, hospitalization and emergency care among school aged children (Kruzick et al. 2009). This finding may reflect the lack of association between this variable and asthma as a health outcome.

Fundamental Interactions?

Little to no work exists analyzing the combined effects of social conditions—the intersections of different axes of inequality—on the production of health outcomes and health inequalities, particularly utilizing the fundamental cause perspective as a testable theory. This argument informs the analysis of the importance of context and the relative disadvantage some social groups may face resulting from stigma, discrimination, poverty, or the patriarchy in North American society. However, three and four way interactions analyzing a host of social determinants together are complicated to complete and difficult to discuss. The focus here is therefore to examine the two-way interactions between social conditions and SES. SES is of

course a social condition in its own right, but the substantial focus on SES within the fundamental cause perspective literature largely ignores the potential importance of interactions relating the relative influence of SES for some groups relative to others.

The Interaction between Gender and SES

Gender differences between men and women—and indeed between Canada and the United States—were reported for the odds of being overweight/obese. The multivariate findings from the initial phase of this analysis indicate men in the lowest income categories are less likely to be overweight/obese than men from higher ones, whereas women of lower-income categories are more likely than higher-income women to be overweight/obese, and concurrently, more likely to be overweight/obese than lower income men ($p < 0.01$).

For men, this may be a food security issue, and it is important to note that individuals who were "underweight" were removed from this particular analysis. New research indicates that lower income men are much less likely to have consumed adequate amounts of healthy foods, but particularly fruits and vegetables (Tjepkema 2005; Travers 1996). In both Canada and the United States, obesity rates have been found to vary between neighbourhoods where exposure to poor-quality food serves as an amplificatory risk-factor for obesity, especially since low-income individuals typically consume relatively low-cost food which is energy dense (Cummins & Macintyre 2005). Higher-income men have been found to have higher-rates of overweight/obesity due to an increasingly sedentary lifestyle accompanied with a rise in "restaurant culture" and the consumption of expensive, fatty foods (McLaren 2007). This analysis controlled for physical activity as a means of explaining this association, indicating that other health behaviours, but particularly the consumption of a balanced and nutritious diet, are likely at the heart of these differences.

It is interesting that women of lower income quintiles are more likely to be overweight/obese than women who occupy higher income quintiles, and especially men who occupy the same income quintiles. This finding seems to be supported by the points raised above, but may be amplified because of the gendered nature of work. Women are still considered to be the primary care givers in North American society, and too often are they forced to work to support their family before returning home to play the role of "mother". This "double shift" may illustrate that lower-income women are typically more likely to consume cheap, fatty foods which require little preparation and contain little nutritional value, simply as a product of not having the time to shop for nutritious foods and prepare proper meals.

The Interaction between Immigrant Status and SES

The interaction effects between immigrant status and income are also interesting, and very different in Canada than in the United States. On one hand, Canada exemplifies that low-income immigrants are less likely to be overweight/obese than non-immigrants occupying the same income quintiles. This is likely a result of two things. First, immigrants are already likely to be in good health when entering the country as per the Canada's Immigration Act. Second, overweight/obesity has been proffered as a North American problem. Overweight/obesity is a growing problem worldwide, but is still heavily concentrated in more "Western" or "Developed" nations (WHO 2006). North America appears to produce a definitive obesogenic environment with more than half of individual dietary intake comprised of fat and sugar (Chopra & Darnton-Hill 2004). Schroder et al. (2004) found that the Mediterranean diet high in fresh fruits, vegetables, fish, nuts, and wine produces an inverse association with overweight/obesity. It seems plausible that other regional diets high in fresh fruits, vegetables, and grains, and low in heavily processed meats are also likely protective factors. The multicultural nature of Canada,

accompanied with the widespread availability of ethnic restaurants and grocery stores (particularly in urban areas) seems to offer a cultural explanation as to why immigrants of lower class are less likely to be overweight/obese than the domestic population at large.

In the United States, the reverse is true. Some research suggests that rates of cancer and overweight/obesity are higher amongst visible minorities and immigrant populations in the United States because of discriminatory marketing practices targeting low-income groups (Koplan & Dietz 1999). Again, the availability of high-energy food, low in nutritional value cannot be understated, and their prevalence in low-income, ethnic neighbourhoods is quite high in the United States (Cummins & Macintyre 2005). In this analysis, low-income immigrants are more likely than non-immigrants to be overweight/obese, although these results were not statistically significant. Therefore, findings demonstrate that interactions between immigrant status and income are more important in Canada.

Summary

The few significant differences across social categories when stratified across measures of SES demonstrate the importance of SES for some groups of individuals. Gradients in the odds of reporting or bearing some negative health outcome serve to illustrate the predictive capacity of SES even when divided according to other social conditions with known associations to health, and also support the fundamental role of SES in producing health. With the patterning of odds ratios appearing to be very similar between Canada and the United States, this finding further supports the claim that the social determinants of health in both countries operate in nearly identical fashions but for a few exceptions.

The primary exception is the difference between immigrant status and race/ethnicity between Canada and the United States. It seems that these two axes of social inequality manifest

themselves much differently in both countries, as reflected in the multivariate "main effects" and the interaction effects. Being an immigrant in the United States is disadvantageous for health, as is being of other/mixed race/ethnicity relative to the domestic white population. In Canada, this inequality is not as stark, and is in fact reversed when considering the social category of immigrant. The interaction effects presented here show that there are indeed gradients in health across SES, and that they have the potential to be moderated or stratified according to other unique social locations.

Indeed, a secondary finding from this data is the unique way that other social conditions (i.e. gender, race/ethnicity, and immigrant status) can produce remarkably different associations with health outcomes in different countries. For example, the main effects of race/ethnicity appear to be stronger in predicting self-rated health and overweight/obesity in the United States than in Canada. Likewise, significant differences exist on the basis of gender and immigrant status. The interaction effects detail how these main effects might differ when analyzed in combination with income and education.

CHAPTER 5: CONCLUSION

Summary of Findings

The complexities of social causation and human health are overwhelming (Weiner 1992). This thesis has attempted to understand some of the pathways between social conditions and human health, couched within a broader analysis of the fundamental cause perspective. The primary goal of this thesis has been to comment on the "fundamental" nature of the association between SES and health, considering the contextual effects of country of residence, pre-conditions which might drive SES disparities in health, the mediating nature of health behaviours/healthcare resources, and interaction effects between SES and other social conditions.

Primary findings clearly demonstrate that social conditions manifest effects differently across separate health outcomes and countries of residence, but that few significant differences exist between Canada and the United States on the basis of SES. It seems that while gender, race/ethnicity, and immigrant status are all temporally antecedent and have the potential to influence SES attainment, this pathway is more complex and dependent upon multiple contexts. Canada appears to be more successful than the United States in reducing racial/ethnic inequalities, likely as a result of a more socially egalitarian society and government policies relating to multiculturalism. The only pre-fundamental relationship that was found was between race/ethnicity and self-rated health status in the United States, but that does not mean that other potential antecedent variables (e.g. parental SES) could not drive SES disparities in health. Therefore, the role of "pre-fundamental" causes of the SES/health association warrants further investigation given the results reported here.

Health behaviours do indeed serve as mediators of the SES/health association in Canada and the United States as hypothesized by the fundamental cause perspective, but only for self-

rated health. It appears that the health outcomes under investigation here, despite producing previously documented associations with the health behaviours included in this analysis, are not significant mediators of the SES/asthma association or the SES/overweight/obese association. Evidence of mediation does indeed signify the importance of health behaviours to the fundamental cause perspective, and I suggest that the highly contextual resources likely determining these specific health outcomes is likely outside of the scope of this analysis.

Healthcare resources (namely prescription medication insurance) did not mediate any of the SES/health associations, and in fact suppressed the SES/self-rated health relationship. Again, the lack of mediation is problematic for a theory which indicates that health is driven by resource utilization and access. This storyline did not play out for this particular healthcare resource, but that is not to say that other resources are not of greater importance. The suppression effect documented here supports the fundamental cause perspective, but in a way not previously theorized. Insurance covering prescription medication insurance matters more for low-SES individuals than high-SES individuals. Removing its influence from the analysis clearly illustrates that high-SES individuals are unaffected after controlling for this variable. Healthcare resources can therefore be incredibly important to human health, but high-SES individuals are likely more able to utilize more diverse sets of resources available to them through their social location than low-SES individuals, whose health are most affected once this form of insurance is taken away.

Interaction effects attempt to illustrate how other social conditions might intersect with SES and produce significant differences between groups. Specific combinations of social conditions and SES (two-way interactions) matter more for some groups of the American and Canadian population than others, and differences between these two countries certainly exist, but again typically along racial/ethnic divides and along the lines of immigration. The fact that few

significant differences exist between the newly stratified measures of SES supports the fundamental role of SES in producing health inequalities. However, the predictive capacity of SES can be limited and even dependent upon its importance across multiple social conditions.

Limitations

This research has important limitations. First, as a result of utilizing the PUMF for this dataset, some variables lack the specificity otherwise indicated in the master file (particularly immigrant status and race/ethnicity). Indeed, it would be more beneficial and precise to be able to include the length of time since immigration or the exact racial/ethnic background reported by respondents. This analysis is left with a comparison of the dominant white racial/ethnic background relative to all other racial/ethnic backgrounds.

Second, the data is cross-sectional which only provides us with a snap-shot of the social forces at work within these two societies, framed within a very specific point in time (2002/2003). Indeed, theses axes of inequality being tested in relation to one another may have drastic implications over the life-course which may only be teased out through an analysis of longitudinal data. Social conditions as fundamental causes may be more predictive of specific health outcomes depending upon how social inequality may change and affect an individual over time.

Third, in regards to testing the cultural relativity and specificity of the theory, claims may only be made within the context of the analysis at hand. That is, the results of this thesis only speak to the comparison between Canada and the United States. Further national-level analysis is required to tease out how fundamental social conditions are in relation to one another, and indeed, the social and political climate of a country is likely to have profound effects on these social conditions in some countries more than others.

Fourth, this work has a problem with the missing cases eliminated from the analysis due to respondents' unwillingness to divulge their household income. Further stratification of the 'pre-fundamental' social causes across SES measures leaves some categories (i.e. American immigrants falling within the highest income quintile) with a relatively low N compared to the rest of the income categories.

Fifth, the small sample size also poses problems for the interaction terms in that some of the odds ratios appear to be quite different from one another but do not achieve statistical significance. When immigrant status is divided across four education categories and five income categories, the new N for each category can become quite small. For example, there are only 54 immigrants in the Canadian sample who occupy the highest income category. Only 45 individuals of other/multiple races/ethnicities occupy the highest income quintile for the Canadian sample. The limitation of low per-cell responces also relates to the prevalence of certain health outcomes in question. In this analysis, asthma prevalence is low which also makes it difficult to detect a statistically significant relationship. In short, statistical power for finding meaningful interactions can be quite low on occasion.

Finally, the variable overweight/obese is also potentially problematic in that it is a biased measure of weight and does not accurately represent pregnant women or athletes. Unfortunately, this analysis was not able to control for or eliminate some of these potentially problematic cases However, as we can clearly see from the results, men are much more likely to be overweight/obese than women, and the analysis did control for high levels of physical activity.

Directions for Future Research

This work is important for three primary reasons. First, it begins to shed light on the complicated pathways between social conditions and health outcomes. Second, it contributes to an argument focussing on the importance of context (of place, disease, and resources) when

analyzing such pathways. Third, it highlights the importance of the complicated and inter-related effects of social conditions and resources in promoting health.

A great deal of research needs to be completed testing not only the original hypotheses laid out by Link and Phelan (1995) but also replicating the results found here and expanding the analysis to include a wider array of social conditions measured across multiple contexts. A more successful analysis of the fundamental cause perspective could be completed by incorporating multi-level modelling to examine the disproportionate utilization of social resources across different levels analysis to confirm the individual, community, and national level contextuality of the theory. That is, different contextual layers proffer different layers of cultural exposure. If the fundamental cause perspective is not culturally relativist, does it predict the importance of social conditions across these contexts?

Context is obviously important, as indicated by results varying across health outcomes and even across Canada and the United States. To date, only three authors have attempted to utilize this theory in countries other than the USA—two in Canada, including this work, and one in Iceland. An in depth analysis of social conditions in other countries, focussing on how they might precipitate health effects within the context of accessing resources through avenues of power, prestige, and status may be of further interest.

The interactions presented in this thesis should be used as a foundation from which further research needs to build upon. Two-way interactions are useful in untangling some of the complexities in relationships between social conditions, but other interactions should also be considered. Further, despite the inherent complexity in developing more complicated methods of analysis, three and even four way interactions would be extremely beneficial in identifying which sub-groups of a given population are more disenfranchised than others. Why this is important to the fundamental cause perspective can be made clear through two points.

First, social conditions are difficult to untangle from one another and tracing a causal path from one to the next is inherently complicated. Identifying individuals who are already "at risk of risks"—a single mother of a visible minority who is uneducated and relatively low income, for example—is simple enough and much literature exists on depicting the health of these sub-groups both qualitatively and quantitatively. The task then becomes thinking more abstractly about power, prestige, and beneficial social relations which some groups may have more of relative to others. In other words, more complicated interaction effects have the potential to not only identify these sub-groups, but diagnose in which areas investments can be made to produce the greatest concurrent gains in health.

Second, multiple interaction terms can be helpful in depicting whether or not health behaviours and healthcare resources (i.e. prescription medication insurance) are differentially accessed through social mechanisms—namely income and education—which have the ability to positively or negatively influence health. The research presented here attempts to test a causal pathway between social conditions, health resources, and health outcomes. Incorporating multiple interactions would further illustrate how some groups may inequitably utilize resources and whether or not these things have drastic implications for health. Further multiple interactions accounting for genetic variation, the environment, and material/ psychosocial/behavioural determinants of health need to be taken into account (Siegrist 2000).

The pathways between SES and resource utilization also need to be better conceptualized. Link et al. (2008) claim that it is difficult to outline one specific set of intervening resources which influence health, and that the flexible resources allotted via SES mechanisms is what is most important. However, not all social conditions provide the same flexible resources as SES. The contextual effects of specific resources will have varying effects across individuals of different social classes. A more theoretical approach to resource utilization

as a product of SES would be useful. If the resources provided by greater SES attainment amount to power, prestige, and beneficial social connections, than surely social capital measures—the embedded norms of trust and reciprocity at the heart of human interaction and social network dynamics (Granovetter 1985; Putnum 1993)—not only speak to these exact types of resources, but should mediate the SES/health association in a meaningful way as hypothesized by Link and Phelan (1995).

One final area of research pertaining to the fundamental cause perspective also deserves greater attention—that being, an in-depth analysis of the fundamental cause perspective over the life-course. Life-course explanations of health and wellness provide more stable interpretations of health outcomes stemming from a broader understanding of what resources, social circumstances, behavioural risk factors, and exposures are important at different times in life. Tracing the flow of social resources from parents to children at birth, for example, all the way through the life-course has the potential to illustrate what resources accessed through a highly contextual set of social conditions are most important at certain times in life.

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APPENDIX A – WEIGHTING PROCEDURES

The JCUSH dataset has been devised so that the data may be representative of both the target populations in Canada and the United States. The original weighting scheme for the dataset can be found in the User Guide Manual provided by Statistics Canada. The initial weight was developed through random digit dialling whereby the total number of telephone numbers in the sampling frame is divided by the total number of telephone numbers that were randomly sampled from that sampling frame. Adjustments in weighting included removing out-of-scope telephone numbers, adjusting for non-response, adjusting for multiple telephone lines in one household, the creation of person-level weights, person non-response adjustment, and post stratification to ensure final weights sum to population estimates. In Canada, population estimates are based on the 1996 Census of Population, and in the USA, estimates are based on the 2002 Current Population Survey.

This analysis utilizes one sample weight variable per country (WeightVarCanada and WeightVarUSA). The weighting variables were created by selecting all of the variables included in the analysis, selecting for each country independently of the other, and obtaining descriptive statistics for the master weight variable (WT_SAM). WT_SAM is then transformed into a new weight variable for both Canada and the United States by dividing WT_SAM by the mean score for both countries. The resulting variables are then applied as new weight variables for their respective samples.

APPENDIX B – QUESTIONS FROM JCUSH QUESTIONNAIRE RELEVANT FOR INCLUDED VARIABLES

Independent Variables

DHJ1_AGE – What is the respondent's year of birth?

Age calculated accordingly.

DHJ1_SEX – What is the sex of the respondent?

1) Male
2) Female

INS_Q02 – Do you have insurance that covers all or part of the cost of your prescription medications?

1) Yes
2) No

SDE_Q02 – What is the HIGHEST level of school you have completed or the highest degree you have received?

1) Less than High School
2) High School degree or equivalent (GED)
3) Trades certificate or diploma from a vocational school or apprenticeship training
4) Non-university/college certificate or diploma from a community college, CEGEP, school of nursing, etc.
5) University or College certificate below bachelor's level, i.e. associates degree
6) Bachelor's degree
7) Master's degree, Professional school degree, or a Doctoral degree

SDE_Q03 – In what country were you born?

1) Canada
2) China
3) Dominican Republic
4) Germany
5) India
6) Italy
7) Mexico
8) Netherlands/Holland
9) United Kingdom
10) United States

11) Other – Specify

SDE_Q04B – People living in Canada come from many different cultural and racial backgrounds. Are you:

1) White?
2) Chinese?
3) South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)?
4) Black?
5) Filipino?
6) Latin American?
7) Southeast Asian (e.g., Cambodian, Laotian, Indonesian, Vietnamese, etc.)?
8) Arab?
9) West Asian (e.g. Afghan, Iranian, etc.)?
10) Japanese?
11) Korean?
12) North American Indian, Métis, Inuit (Eskimo)?
13) Other – Specify

SDE_Q08 – Which one of these groups would you say BEST represents your race?

1) White
2) Black/African American
3) Native American
4) Alaska Native
5) Native Hawaiian
6) Guamanian
7) Samoan
8) Other Pacific Islander
9) Asian Indian
10) Chinese
11) Filipino
12) Japanese
13) Korean
14) Vietnamese
15) Other Asian
16) Other – Specify

Dependent Variables

GHJ1_01 – In general, would you say your health is:

1) …excellent?
2) …very good?
3) …good?
4) …fair?
5) …poor?

CHJ1_1 – Have you even been told by a doctor or other health professional that you have asthma?

1) Yes
2) No

HWT_Q02 – How tall are you without shoes in feet or metres?

HWT_Q03 – How much do you weigh in pounds or kilograms?

BMI = weight (kg) / height^2 (m^2)

APPENDIX C – INFORMATION ON DERIVED AND DUMMY VARIABLES

Independent Variables

DHJ1_SEX recoded into dummy variable Gender reflecting:

1 = Female; 0 = Male

Race/Ethnicity created as a dichotomous dummy variable from the categories above to reflect:

1 = Other/Multiple; 0 = White

Immigrant Status created as a dichotomous dummy variable from the countries listed above to reflect place of birth:

For Canada: 1 = Other; 0 = Canada

For the USA: 1 = Other; 0 = USA

Type of Smoker (SMJDTOS) is a six part categorical variable derived from a series of other variables included in the dataset (SMJ1_01A, SMJ1_01B, SMJ1_4, SMJ1_9). Based upon respondent smoking habits, this variable describes the type of smoker the respondent is in logical fashion where:

1 = Current daily smoker

2 = Current occasional smoker but former daily smoker for at least three months

3 = Current occasional smoker, but never formerly smoked daily for at least three months

4 = Currently non-smoker, but has smoked at least 100 cigarettes in lifetime

5 = Currently non-smoker, has not smoked at least 100 cigarettes in lifetime but has smoked a whole cigarette before

6 = Current smoking patterns unknown.

Physical Activity Index is a three part categorical variable based upon complex calculations of the total daily energy expenditure values calculated for a series of questions pertaining to leisure

time physical activity. This is calculated by the number of times a respondent engaged in an activity over a 12 month period, the duration in hours of the activity, and the energy cost of the activity. This index follows similar methods employed in the Campbell Survey on Well-being in Canada: http://www.cflri.ca/cflri/pa/surveys/88survey.html

1 = Active

2 = Moderate

3 = Inactive

Income quintiles adjusted for family size first determine cut points based on 20% increments which roughly divide the population counts for household income into quintiles. Using weighted income data rounded to the nearest thousand, household income is next divided by the square root of household size to produce household income quintiles adjusted for family size.

1 = Lowest Income Quintile

2 = Lower Middle Income Quintile

3 = Middle Income Quintile

4 = Upper Middle Income Quintile

5 = Highest Income Quintile

Education was recoded in the JCUSH dataset to protect anonymity of respondents so that the new variable reflects:

1 = Less than High School

2 = High School Degree or Equivalent

3 = Trades certificate, vocational school, community college, CEGEP

4 = University degree, College Certificate Including below Bachelor's level

Dependent Variables

Self-Rated health was dichotomized from its original five categories to reflect:

1 = Fair/Poor Health

0 = Good/Very Good/Excellent Health

Overweight/Obesity is a dichotomous dummy variable created using the BMI measurement. This analysis omitted cases with an "underweight" BMI. Coding of this variable therefore reflects:

1 = Overweight/Obese

0 = Normal Weight

Asthma was recoded into a dummy variable for the sake of this analysis reflecting:

1 = Has asthma

0 = Does not have asthma

APPENDIX D – ASSUMPTIONS CHECKING PROCEDURES

Logistic regression analysis is not complete without checking the assumptions of any given model. For the purposes of this study, JCUSH ensures that all observations are independent of one another given that only one individual from one household is ever sampled. This dataset is also large enough to engage in this type of analysis, and binary dependent variables are coded to represent the outcome of greatest interest (i.e. fair/poor health, overweight/obese, and diagnosed with asthma).

While binary dependent variables are not suitable for linear regression, this technique is useful in testing multicollinearity which tests that dependent variables are unique in and of themselves; that is, each variable is unique in that it does not explain the other variables in the model. The tolerance statistic devised for each model indicated no problems with multicollinearity. Further, the variance inflation factors (the reciprocal of tolerance) for each model were no greater than three, where a value of greater than four indicates moderate multicollinearity.

Logistic regression also assumes a linear relationship between the independent variables and the logit of a given dependent variable. When checking assumptions, it is clear that most categorical variables (namely education and income) illustrate a linear progression from category to category.

While regression is a robust technique, results may still be influenced by influential points. To analyze and document these, several stages were completed. First, leverage values, Cook's D, standardized DFBETA values, and standardized residuals are plotted against the dependent variable in order to detect points with relatively high influence. Leverage values greater than 0.5 were treated as potential outliers. Values of Cook's D greater than one should also be analyzed in some detail, however, these values were rarely greater than 0.10. The

arbitrary cut-off point for DFBETA is values greater than 2/sqrtN (0.04 for the American sample and about 0.045 for the Canadian sample). Standardized residuals were also explored, noting any residuals greater than three standard deviations away from centre (there were none).

Any case found to violate the rules outlined above was treated as a potentially influential point. These cases were then removed from the analysis to determine if they impacted the model enough to change the odds ratios or significance. In all cases, removing influential points from the model had little effect and the cases were therefore retained in the sample. For example, in checking the assumptions of the departure model predicting the odds of Overweight/Obese for the American sample, case 1027 has an accompanying leverage value of approximately 0.06. While this value is still far below the cut off point, as were most potential influential points, it still warrants a potential explanation as to why it is not clustered with the other points. Upon closer inspection, we find that case 1027 is a 35 year old, non-white, non-immigrant female who holds a university degree, is in the upper middle adjusted income distribution, occasionally smokes, is physically inactive, and has prescription medication insurance coverage. Removing this case from the analysis does not change the odds ratios or the significance for variables included in this model, and case 1027 is therefore included in the analysis.