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Obesity and Health Care Utilization Trends in Canada During the Period 1996-7 to 2009-10

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A thesis submitted in partial fulfillment of the requirements for the Master of Science degree in Epidemiology and Biostatistics

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ASSOCIATION BETWEEN OBESITY AND HEALTH CARE UTILIZATION IN CANADA DURING THE PERIOD 1996-7 TO 2009-10

(OBESITY AND HEALTH CARE UTILIZATION IN CANADA)

(Thesis format: Monograph)

by

Michael Lebenbaum

Graduate Program in Epidemiology and Biostatistics

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science

The School of Graduate and Postdoctoral Studies
The University of Western Ontario
London, Ontario, Canada

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THE UNIVERSITY OF WESTERN ONTARIO
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Abstract

In Canada, there have been large improvements in the management of chronic diseases attributed to obesity such as diabetes, hypertension and high cholesterol since the 1990s. How this trend has impacted the health care utilization patterns of individuals living with obesity relative to normal weight individuals is unknown in Canada. This study examined the association between categories of body mass index (BMI) and health care utilization during the time period 1996 to 2010 using the 1996-7 National Population Health Survey and the 2000-1 and 2009-10 Canadian Community Health Surveys. I found that there were significant declines in the intensity of utilization of general practitioner/family physician services for all BMI categories and significant increases in association between obesity and the propensity to visit a specialist without adjusting for chronic conditions. Other hypotheses regarding the changing relationship between obesity and utilization of health care over time were not supported.

Keywords

Obesity, Health Care Utilization, Physician Visits, Hospital Visits, Temporal Trends

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Table of Contents

List of Tables

List of Figures

List of Appendices

List of Abbreviations

BMI = body mass index

kg = kilograms

m = metres

CHEP = Canadian Hypertension Education Program

NPHS = National Population Health Survey

CCHS = Canadian Community Health Survey

FP = Family Physician

GP = General Practitioner

FP/GP = Family Physician/ General Practitioner

RFEI = Retail Food Environment Index

OR = Odds Ratio

RR = Risk Ratio

IRR = Incident Rate Ratio

HR = Hazard Ratios

RR-P = Ratios of Proportions

U.S. = United States

ADL = Activities of Daily Living

OHIP = Ontario Health Insurance Plan

CI = Confidence Interval

N = Sample Size

OLS = Ordinary Least Squares

MEPS = Medical Expenditure Panel Survey

MEPS-HC = Medical Expenditure Panel Survey – Household Component

NMES = National Medical Expenditure Survey

RDD = Random Digit Dialing

ENWB = Elimination of Non-Working Banks

LFS = Labour Force Survey

ESS = Enquête Sociale et de Santé

NFLD = Newfoundland

PEI = Prince Edward Island

NS = Nova Scotia

NB = New Brunswick

QUE = Quebec

ONT = Ontario

MB = Manitoba

SASK = Saskatchewan

AB = Alberta

BC = British Columbia

Ref = Reference Group

W/ = With

W/O = Without

NW = Normal Weight

OB = Living with Obesity

RCT = Randomized Controlled Trial

QALY = Quality Adjusted Life Years

Chapter 1

1 Introduction

1.1 The Obesity Epidemic

The prevalence of obesity is rising rapidly in Canada; based on measured BMI, the prevalence of obesity among adults aged 20-74 increased from 14.0% in 1986-92 to 24.3% in 2007-9, a 74% increase (1). The rising prevalence of obesity in Canada is part of a highly complex phenomenon with a large number of interplaying factors likely involved (2). The obesity epidemic has been of great concern to health policy makers as obesity is associated with many negative effects to health including an increased risk of numerous chronic conditions including type 2 diabetes, cardiovascular disease, arthritis, and other adverse health consequences. Consequently, individuals living with obesity live longer in a state of chronic disease and disability (3, 4).

The effects of obesity have been demonstrated to be a large strain on health care resources (5). Specifically, individuals living with obesity have been shown to have greater utilization of physician and hospital services relative to normal weight individuals, therefore accruing greater health care costs (6-9). This association between obesity and health care utilization is likely causal, as it demonstrates a dose-response relationship with increasing severity and duration of obesity, and has been demonstrated with both prospective cohort studies and with instrumental variable analyses (8, 10). These excess costs are primarily due to the increased co-morbidity associated with obesity, as studies that have controlled for various co-morbidities attributed to obesity have found they attenuate the association between obesity and health care costs (7, 8).

1.2 The Canadian Health Care System

The government-funded Canadian health care system has its roots in legislation passed in 1957 that established universal hospital insurance (11). Soon after in 1968, insurance for physician services were added (11). All provinces complied and provided citizens with hospital and physician care by 1971 (11). Since a consensus on one overall Canadian plan

could not be reached with provincial governments, each province introduced its own health care delivery system as far as the management and delivery of health services are concerned (11). However, the health care system is considered to be a national system partially financed through the federal government and governed by a set of key principles (11). These principles include comprehensiveness (provision of medically necessary services including most physician and hospital services), universality (everyone must be covered), accessibility (no user charges at point of care), portability (can access services in another province), and public administration (12, 13).

Covered physician services include consultation with both family physicians and specialists. The role of family physicians has been to care for a broad range of health issues including treatment of episodic illness, chronic disease diagnosis and management, health promotion and prevention of chronic disease and the provision of numerous other health services (14). In Canada, family physicians act as gatekeepers to specialists who must receive a referral from a family physician to treat a patient or else accept large pay cuts (14). Specialists are involved in specialized care for more severe illnesses and often receive patients who are more complex (15-17). Hospital services include all inpatient care including drugs, all necessary supplies, diagnostic tests, and outpatient services (11).

1.3 Study Rationale

There have been changes in individual characteristics and in the health care system that may be affecting how individuals living with obesity access and use the health care system over time. With the obesity epidemic, each successive cohort has become obese at a younger age in the life course and the duration of obesity in the population is increasing (18, 19). The severity of obesity is also increasing, demonstrated by large significant increases in the prevalence of morbid obesity (BMI $\geq$ 35) and in waist circumference among individuals living with obesity (20-22). Consequently, these factors contribute to greater health risks and higher levels of health care utilization by individuals living with obesity (23-25).

There have been changes in medical technology and practice across Canada such as an increasing focus on effective management of cardiovascular risk factors. For example,

there have been increases in screening and treatment for hypertension, management of high cholesterol and increasing treatment aggressiveness among patients with diabetes (26-29). Individuals with these cardiovascular risk factors, particularly individuals living with obesity where these cardiovascular risk factors are highly concentrated, have likely benefited to a greater extent from these improvements (30, 31). For example, there have been sizeable decreases in the mortality rate of individuals with diabetes and hypertension in Ontario as well as decreases in complication rates for patients with diabetes (32-34). Across Canada, these changes have likely resulted in the effective prevention of cardiovascular complications since there have been decreases in hospitalizations and mortality due to stroke, heart failure and acute myocardial infarction (35, 36). However, the prevalence of hypertension and diabetes has been increasing at a greater rate among individuals living with obesity compared to normal weight individuals (37). Therefore, individuals living with obesity may be living longer in chronic disease states.

Concurrently, within the health care system there have been changes to how physicians practice with increasing focus on group practices and a shift away from fee-for-service reimbursement towards capitation payments (38, 39). In addition, there has been a shift of resources from the hospital sector to other areas of the health care system resulting in a decrease in the supply of hospital services including fewer beds (40, 41). Consequently, given changes in individual characteristics, changes to management of chronic diseases, and changes in the organization of the health care system, it is unclear what will be the overall impact on the health care utilization patterns of individuals living with obesity. If individuals living with obesity are living longer with higher levels of co-morbidities that are receiving more attention within the health care system, it is hypothesized that they will require increasing levels of visits to primary care and specialist physicians relative to normal weight individuals. Since there are declining rates of hospitalization for co-morbidities concentrated among individuals living with obesity, it is hypothesized that hospitalizations will be declining at a faster rate among them compared to normal weight individuals over time. While risk factor and chronic disease levels are rising among individuals with obesity, due to changes in the organization of the health care system and the improved management of these conditions, it is unclear what will be the end result on

the health care utilization patterns of individuals with obesity. Therefore, the objective of this thesis is to analyze trends in the utilization of different types of health care services among individuals living with obesity in response to changes in individual characteristics and changes in the health care system.

1.4 Objectives:

The objectives of this study are to examine the following research question:

Has health care utilization of individuals living with obesity changed relative to normal weight individuals over time (1996-97 to 2009-10) in Canada?

Hypotheses regarding utilization of hospital services:

- The risk ratio of an overnight hospital admission for individuals living with obesity is decreasing compared to those who are normal weight.
- For those with at least one overnight hospital admission, the incidence rate ratio of nights spent in the hospital for individuals living with obesity is decreasing compared to those who are normal weight.

Hypotheses regarding utilization of family physician (FP)/general practitioner (GP) and specialist physician visits:

- The risk ratio of any visit for individuals living with obesity is increasing compared to those who are normal weight.
- For those with at least one visit, the incidence rate ratio of the number of visits for individuals living with obesity is increasing compared to those who are normal weight.

Chapter 2

2 The Conceptual Framework

The conceptual framework for this thesis is developed based on theoretical insights gained from Andersen and Newman's behavioral model of health care seeking and Grossman's model of the demand for health (42, 43). Andersen and Newman's model is a framework directed towards explaining why a broad set of variables at multiple levels may be affecting the type and amount of health care an individual chooses to use (42). Grossman's model is an economic model discerning the explicit mechanisms by which the demand for health care services is derived (43). Both of these models explain why certain individual level characteristics affect the use of health care and explain why the utilization of health care follows certain patterns.

2.1 Andersen and Newman's Model

Andersen and Newman's theoretical framework views the utilization of health care as a behaviour that is affected by characteristics of the individual, the external environment (e.g. structure of the health care system), and the interaction between the two (42). In this framework, there is an explicit recognition that individuals demand health care in order to maintain and improve their health status (44). Within this framework, it is also recognized that the initial contact with the health care system and what happens to the patient upon entry into the system are two distinct processes, and factors that affect these two processes may differ (42).

The type and amount of health care services an individual uses is determined by a series of factors that fall under three broad categories: predisposing, enabling and need (42). Predisposing factors exist before the onset of specific episodes of illness and are not the actual reason as to why individuals seek care (42). These are social and demographic characteristics such as the age, sex, and socioeconomic status of an individual which may affect attitudes or beliefs towards illness and health care and subsequently propensity to use services (42). These predisposing factors can also lead to different levels of future illnesses through mechanisms such as lifestyle choices, health behaviours, and living

conditions (42). Enabling factors facilitate or impede the use of health care once an individual chooses to seek care such as having health insurance coverage and access to regular sources of required care (42). Finally, for individuals to make the decision to use health care, they must perceive there to be a need for health care either because they perceive themselves to be ill, at risk of being ill, or have been evaluated to be ill by a health professional (42).

This framework incorporates macro level factors that may help to explain why health care utilization patterns follow certain time trends (42). This includes technology, social norms, and the organization of and resources available to the health care system (42). Technology refers to physical tools, principles and techniques while societal norms refer to formal legislation and the beliefs and values that a society holds (42). Resources refers to the labour and capital devoted to the health care system including health personnel, facilities and equipment used in providing health care (42). Organization refers to how the health care system coordinates these available resources (42). It consists of access to the medical system and what happens to the patient once they enter (i.e. structure) (42). Enabling variables may be affected by macro level forces such as national policies that may affect an individual's access to essential health care services such as health insurance or availability of physicians (45).

2.1 Grossman's Model

Grossman's model views the notion of health and health care from a quite different perspective. Grossman uses economic theory to specify that the mechanism by which an individual decides to use health care stems from the demand for health in order to maximize lifetime utility (43, 46). The basis of Grossman's model is the human capital framework developed by Becker (43, 46). Grossman postulates that individuals inherit an initial stock of health and as they age, their stock of health depreciates (43, 46). Health behaviours such as smoking or excessive drinking can speed up the rate of depreciation, while beneficial health behaviours such as maintaining a healthy diet combined with physical activity can slow down this depreciation rate (43, 46). In this model, healthy behaviours and medical care act as an investment which in turn helps individuals replenish their level of health (43, 46).The amount of health that is generated from these

investments is governed by an individual's underlying health production function (43, 46). The efficiency of this production is affected by the individual's personal characteristics such as age, education and other predisposing variables (43, 46). The amount an individual can invest in their health is governed by their budget constraints, including time; how an individual decides to invest his/her time is dependent on the marginal rate of substitution between market and non-market activities (43, 46). In the Canadian system, for individuals of the same level of health, time costs can be an important determinant of health care investment as most types of care are free at the point of accessing services. However, income would still matter as pharmaceutical expenses outside of hospitals are only covered for insured individuals. Moreover, healthy diets can be expensive and may be unaffordable to those living in low income households.

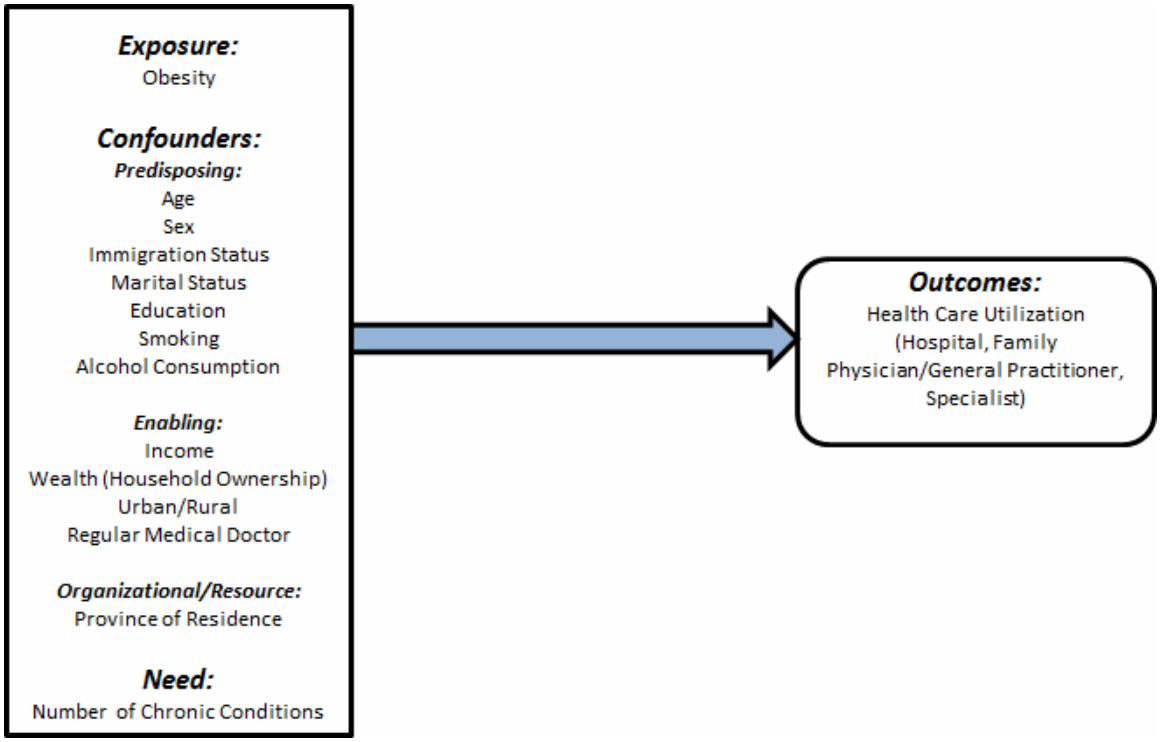
The reason why an individual would choose to make investments in their health rather than other consumption choices is that health is a type of human capital that provides "healthy time" (43, 46). This healthy time allows an individual to spend time on market (i.e. earn a wage) and non-market activities (e.g. enjoy leisure, prepare food) (43, 46). The outcomes of these activities produce utility or satisfaction for the individual (43, 46). In addition, health can also be considered a consumption commodity, as being healthy provides utility and sickness is a source of disutility (43, 46). In this model, health care itself does not directly provide utility; instead, health care provides utility through improvements in health, which is the reason why the demand for health care is considered a derived demand (43, 46). Given their limited resources, the objective of individuals is to maximize their lifetime utility, which is a function of their income, health, health care consumption, leisure activities (sedentary/active), food, weight, and other inputs (47).

2.2 The Conceptual Framework

Andersen and Newman's and Grossman's models were used to specify the following theoretical framework and empirical equations. The role of obesity and its connection to health care utilization will be discussed in section 2.4. The reason why these relationships are expected to change over time will be discussed in section 2.5. Finally, the role of

other confounders in this framework and their connection to both obesity and health care utilization will be discussed in the section 2.6.

Figure 1: Diagram illustrating the conceptual framework including exposure and confounders



2.3 The role of obesity within Andersen and Newman's and Grossman's Models

Obesity is generally defined as a body mass index (BMI) of 30 or greater, where BMI is defined as weight (kg)/height (m^2) (48, 49). Obesity is an important risk factor for the incidence of chronic diseases, disability and mortality (3, 50-52). The main prediction of Grossman's model would be that obesity speeds up the rate of depreciation of health and consequently individuals will require additional investments of health care to maintain health. Under Andersen and Newman's model, obesity may be considered as a predisposing factor in Andersen and Newman's model to the extent that it affects future need and hence increased health care utilization. Obesity would also be considered a need since individuals may seek care explicitly due to their obesity such as visits to physicians or hospitals for weight management or bariatric surgery (53). Alternatively, a doctor may evaluate an individual's need as greater due to their weight status and order additional

laboratory tests or schedule follow up visits (54). For these reasons, both frameworks would predict additional health care consumption by individuals living with obesity. Indeed, empirical studies in Canada and abroad have demonstrated that obesity increases health care utilization and costs (6, 8, 55). As mentioned in the introduction, the relationship between obesity and health care utilization are expected to change over time, the main reasons for the hypothesized relationships are discussed in the following section.

2.4 Rationale for the changing relationship between obesity and health care utilization over time

If there are changes in the relationship between obesity and health care utilization over time, they likely reflect changes in individual and macro level characteristics. Changes in individual characteristics consist of changes in the nature of obesity as such its severity and duration. As the BMI distribution of the Canadian population has increased over time, the prevalence of class II & III obesity has increased dramatically, leading to a greater percentage of individuals living with obesity with a more severe form of obesity today compared to the 1980s (20). In addition, as individuals are progressively becoming obese at younger points in the life course, each successive cohort of adults accumulates greater duration of exposure to obesity and likely experiences greater obesity related consequences as a result (18, 19). There have also been increases in waist circumference within BMI categories, which may be contributing to greater health risk associated with higher BMIs (21). A study that examined waist circumferences within BMI categories from 1981 to 2007-9 demonstrated that the mean increase in waist circumference was much larger in magnitude in individuals living with class I and class II/III obesity placing them at higher risk levels (22). Given the empirical evidence that higher classes of obesity, longer durations of exposure to obesity, and higher waist circumferences all increase the risks due to obesity, these trends would likely contribute to increasing levels of need and therefore increased utilization of health care amongst individuals living with obesity over time relative to their normal weight counterparts (9, 23, 56-59).

Changes in these relationships may also be due to changes in medical technology and practice, particularly increasing focus on effective management of cardiovascular risk

factors over time. Since these risk factors for chronic diseases are elevated amongst individuals living with obesity, it is likely that they have benefited to a greater extent compared to normal weight individuals. This has been the case in the U.S. where the decrease in the prevalence and improvements in the management of cardiovascular risk factors over time has benefited individuals living with obesity to a greater extent than normal weight individuals (30). For example, the difference in prevalence of high cholesterol between normal weight individuals and individuals living with obesity has narrowed over time, perhaps due to better management of cholesterol among individuals living with obesity (30). Concurrently, treatment for hypertension among individuals living with obesity rose swiftly (30). Although, the prevalence of diabetes is increasing over time and to a greater extent among individuals with obesity, there have been improvements in the management of diabetes (30, 60). These changes may account for the decreasing association between obesity and mortality over time in the U.S. (61). Interestingly, during this time period, the association between obesity and total health care costs, and the association between obesity and disability among seniors has become stronger (62, 63). No studies to date have examined how the relationship between obesity and specific types of health care utilization has changed over time in response to changes in chronic disease management.

In Canada, there have been large improvements in the management of cardiovascular risk factors since 1990s including hypertension, diabetes and high cholesterol. The Canadian Hypertension Education Program (CHEP) – a program which involved yearly updates to widely disseminated clinical practice guidelines – is likely responsible for large improvements in the treatment and control of hypertension (26, 27). Due to large randomized controlled trials including the Diabetes Control and Complications Trial and the United Kingdom Prospective Diabetes Study, treatment of diabetes has improved with a greater emphasis being placed on tighter glycemic control (64, 65). These changes have been disseminated in Canadian clinical guidelines and together may be responsible for increasing treatment aggressiveness among diabetic patients in Canada (29, 66). Clinical practice guidelines have also emphasized improvements in the treatment of hypertension and cholesterol amongst patients with elevated risks like obesity and diabetes (29). Lastly, since the 1990s, there have been large increases in prescriptions for

statins, a commonly prescribed drug for patients diagnosed with high cholesterol (67, 68). Evidence from Canada's National Population Health Survey (NPHS) suggests that the increase in statin utilization occurred to a greater extent among individuals living with obesity compared to normal weight individuals (28). Across Canada, there have been decreases in hospitalizations and mortality due to stroke, heart failure and acute myocardial infarction (35, 36). Due to the much higher prevalence of high cholesterol, diabetes and hypertension and increased risk of these chronic diseases (stroke and cardiovascular disease) among individuals with obesity, it is likely they have benefited to a greater extent than normal weight individuals from these trends (31, 37, 50). Not surprisingly, the self-reported diagnosis of these same chronic conditions including diabetes, hypertension and heart disease appears to be rising faster in individuals living with obesity (37). Although there is some evidence suggesting that these increases could partially reflect increases in screening, it is also possible that individuals living with obesity are living longer in chronic disease states which may be affecting their health outcomes (69, 70). Living longer in chronic disease states will require greater utilization of health care services from family physicians and specialists for chronic disease management. Consequently, it is likely that individuals living with obesity are increasing their utilization of these health care services compared to normal weight individuals. Thus, it is likely that the risk ratio (RR) of a visit and incident rate ratios (IRR) of visits associated with obesity has increased. Since hospitalization for obesity related co-morbidities is declining, it is expected that the rate of hospitalizations will be decreasing among individuals living with obesity at a faster rate than normal weight individuals resulting in a lower RR of a visit and decreased incidence rate ratio of visits due to obesity.

2.5 Rationale for the inclusion of other confounders

This section will discuss the role of other confounders in the relationships between obesity and health care utilization presented in Figure 1. For each variable, this section will discuss the theoretical predictions from Andersen and Grossman models, empirical evidence supporting or contradicting the theoretical predictions, direct and indirect

pathways leading from the variable to health/health care utilization and the link between the variable to body mass index or obesity.

2.5.1 Age

Both theoretical frameworks predict that as individuals age their health would deteriorate and they would demand greater levels of health care. Theoretically, under Andersen and Newman's model, age is considered a demographic predisposing factor since it determines future need (42, 71). Aging is a development process along which the risk of chronic diseases, disability and mortality greatly increase leading to greater demand for health care. Under Grossman's model, age is expected to strongly affect the depreciation rate of health (43, 46). As the depreciation rate increases, the cost of maintaining a given level of health increases and the amount of health capital created by a given amount of investment is expected to decrease (43, 46). Therefore, as an individual grows older, their health is expected to deteriorate, and if the amount of health they achieve is less than what they desire, they would be expected to increase the amount of investment in health through increased consumption of health care services (43, 46). Empirically it has been demonstrated that there are large differences in utilization of health care across age groups including visits to FP/GPs, specialists and hospitalizations (72). However, these patterns are not strictly increasing with age for all types of services and depend on whether the propensity or intensity of utilization is being examined (72).

Numerous cross-sectional and longitudinal studies have demonstrated weight gain and higher BMIs with aging (19, 73, 74). Even among some of the most physically active individuals, long distance runners, there is weight gain with increasing age (73). Part of this could be due to physiological changes such as changes in body composition with age resulting in a decrease in active cellular mass (fat-free mass) and metabolic rates (75, 76). There are also declines in total energy expenditure and increasing dysregulation of energy intake in older adults, which accompanied by an environment with an abundant supply of calories may contribute to weight gain (76).

2.5.2 Sex

Sex is a demographic predisposing factor towards health care utilization in Andersen and Newman's model due to its linkage with health and illness (42). Neither model makes an explicit prediction regarding the direction of the association, but it has been empirically demonstrated that men tend to have lower propensity to use FP/GPs, specialists and hospitals (71, 72). Men also have lower intensity of utilization visits to FP/GPs and specialists but utilize higher intensity of hospital services (71, 72). A number of factors could be driving these patterns including differences in health behaviours (e.g. smoking and alcohol consumption), health status, and differences in health/health care beliefs (men may be more reluctant to use health care) (77, 78). Sex specific care (e.g. related to pregnancy) and higher mortality rates among men could also play a role, as one study found that these two factors accounted for much of the difference in physician and hospital costs across sex (79). However, large cost differences remained leaving room for alternative explanations (79). Actual differences in health status likely plays a role as one study demonstrated that the strength of the association between sex and utilization of FP/GPs and specialists decreased after controlling for multiple markers of health status and level of morbidity (15).

In Canada and abroad, numerous studies have shown that BMI and obesity levels vary across males and females. This could be due to stronger social pressures against obesity in women (80). For example, women living with obesity are at an increased risk of being unemployed and being unmarried (80, 81). In addition, smoking, alcohol consumption, and other health behaviours differ across sexes which could affect weight (77). Lastly, variation in metabolic rates possibly due to differences in hormones and body composition may affect weight and propensity towards obesity (82).

2.5.3 Education

In Grossman's framework, education is viewed as making an individual a more efficient producer of health (43, 46). Since educated individuals are better able to produce health through other health inputs, they are hypothesized to demand more health but require less investment of health care (43, 46). In Andersen's model, education is considered a social

structure predisposing factor (42, 71). Since educated individuals have better living and working conditions as well as healthier behaviours including less smoking and more physical activity, they are predicted to have less need and require less health care (77, 83). In one study, without controlling for other factors, education was found to be inversely associated with the utilization of primary and specialty care (84). However, when socio-demographics, health risk behaviours, measures of health status and co-morbidities are controlled for, higher levels of education is positively associated with propensity to visit as well as the intensity of utilization of specialists' services (71, 72). Therefore, due to higher levels of need, individuals with lower levels of education use more health care but these risk factors and illness are accounted for, individuals with higher levels of education are more likely to seek care. This supports an alternative understanding of education as related to informational asymmetries such that educated individuals may have more knowledge and awareness of the health care system and the benefits of its use (72).

The extant literature has consistently shown educational gradients in obesity (85). In Canada, education has been shown to inversely related to obesity in both men and women through its effects on health behaviours including leisure-time physical activity, fruit and vegetable consumption and smoking status (86). Individuals with different education levels may respond differently to societal standards of attractiveness as education has been linked to body dissatisfaction in women (85). Lastly, how individuals respond to health and dietary messages may be affected by their level of education and education may affect expectations of personal achievement towards health that includes maintaining a certain weight (85).

2.5.4 Income

In Grossman's model, the value of healthy time and consequently the amount of health an individual is expected to demand, increases with a rise in the wage rate (43, 46). Since income is not expected to change the efficiency of health production, the model would predict that in order to achieve this higher level of health, individuals with higher wages would require greater investments into their health including increased demand for health care (43, 46). Since the value of their time is increased, the model would predict

individuals with high incomes would be more likely to invest with less time intensive investments (43, 46). Under Andersen and Newman's framework, income acts as an enabling factor since even within Canada's universal health care system, individuals with higher levels of income can afford prescription and supplemental insurance which may affect their health care decisions regarding the use of physician and hospital care (42, 87). However, higher income households have better working and living conditions as well as better health behaviours which would result in income being expected to be positively associated with health and negatively associated with health care utilization (42). Empirically, it has been demonstrated that if health status is not controlled for, there is a significant inverse gradient in the use of health care, with high income individuals using less primary care services (84). This is primarily due to higher use of disease related care rather than preventive care (84). However, when morbidity and health status is controlled for, the relationship between income and health care utilization depends on the type of utilization, after controlling for need (health status) (71, 72, 88). There is a positive income gradient in the propensity to visit a FP/GP and specialist but not in the intensity of visits and there is a negative association with propensity and intensity of inpatient care (72, 88). This may be explained by Grossman's model which would predict that high income individuals use less time intensive care (physician visits) rather than more time intensive care (hospital admissions) (43, 46, 71, 72)

A positive association between income and BMI among males and a negative association between income and BMI among females has been found in a number of cross-sectional studies (85, 89). This could arise due to social pressures whereby thinness is valued highly among women, especially for women of higher incomes (85, 89). In contrast, larger body sizes may be valued among men as it is associated with dominance or authority and this pursuit of physical dominance may be linked with income (85, 89). In addition, high income families consume diets with healthier overall diet quality that consist of foods with lower energy density and higher micronutrient quantities (90). In Canada, there is a consistent relationship over time between income and food expenditures which did show a positive income gradient for macronutrients, diet quality (micronutrient content) and energy density (91). These dietary disparities are possibly contributing to disparities in obesity and may arise due to economic concerns since

healthier foods tend to be more expensive and less available in low-income neighborhoods due to the low availability of supermarkets (90).

2.5.5 Home Ownership

Home ownership serves as a proxy for wealth and material resources (92). In Grossman's model, wealth would be expected to increase an individual's budget and the amount of investments an individual can make into their health (43, 46). If the higher budget allows for investments into health through healthier diets and better living conditions in homes compared to rental units then it is likely that home-ownership would result in decreases in the depreciation rate of health and decreased demand for health care. One study found that without controlling for need, home-owners had lower demand for health care, including decreased propensity and intensity of FP/GP visits and propensity to use a hospital while a different study found that after controlling for need, renters had increased propensity and intensity of use of hospitals as well as increased intensity of use of FP/GPs and specialists (71, 92).

Studies in England and Finland have demonstrated a link between home ownership and obesity (93, 94). Similar to income, material wealth is linked to the types of foods an individual can afford and through this pathway it may explain the link between home ownership and obesity since renters have a higher prevalence of food insecurity than home owners (95).

2.5.6 Marital Status

Since marriage contributes to a person's physical and mental health, marriage acts as a predisposing demographic factor in Andersen and Newman's model and is related to the rate of depreciation in Grossman's model (81, 96). This could be due to a "protective" effect of marriage through increased social support and financial resources or could be due to "selection" effects, where healthy people tend to marry each other or that good health eases the process of starting and maintaining relationships (81, 92, 96). Due to this positive association with health, both models would predict that marriage is associated with lower utilization of health care. Curtis and MacMinn demonstrated that never married individuals over time had consistently lower propensity to use FP/GPs,

specialists, or hospitals while previously married individuals had lower propensity to use FP/GPs and hospitals (72). Similar findings regarding increased propensity of married individuals to seek FP/GPs and hospitals was found by Laporte et al. (92). This could be due to effects of marital status on how individuals seek care, the effect of which may differ depending on the type of care. For example, Atzema et al. found that married men were at lower odds of having a delayed presentation (greater than 6 hours after onset of pain) to an emergency department or hospital after acute myocardial infarction (97). However, Cafferata et al. found that it was living with others rather than marital status that affected care, with utilization decreased as individuals possibly substituted formal care (physician visits) for informal care (bed-days) (98).

Through the mechanisms of selection and protection, marriage is also hypothesized to be linked with weight status. In North American society, there is selection against individuals living with obesity entering marriage due to social stigma, which particularly affects women (80, 81). As a result, it would be expected that single and separated/widowed/divorced women who are interested in remarrying would maintain a lower BMI (81). The selection hypothesis also predicts that once married, individuals will begin gaining weight as maintaining a low BMI is costly and they no longer have to attract a mate (81). Marriage may be also related to BMI due to the increased social obligations encouraging eating including more regular meals or more meals outside the home (81, 99). Empirical evidence supports both selection into marriage being affected by BMI and the effect of marriage on BMI. Studies have demonstrated that lower BMI is associated with increased probability of getting married; once married, there is increased weight gain and incidence of obesity, and weight loss upon divorce (81, 99, 100).

2.5.7 Immigration Status

Due to the strong association of immigration status with health behaviours, chronic disease, and health status, Andersen and Newman's framework would consider immigration status to be a demographic predisposing factor (42). In Grossman's model immigration status would be strongly related to the stock of health and rate of depreciation. Both models would predict that it is associated with decreased utilization of health care. This has been the case with Canadian immigrants having persistently lower

propensity and intensity of use of FP/GPs, specialists and hospitals, and the association is larger for more recent immigrants (72). The reason for the findings of improved health among immigrants in Canada is likely due to selection in those who attempt immigration and those who are accepted (immigrants undergo health screening in order to be accepted) (101, 102). Immigrants also differ from Canadian-born individuals in their health behaviours as they are less likely to be smokers and heavy drinkers but are more likely to be physically inactive (102). As time spent in Canada increases, the difference between immigrants and native born individuals in health behaviours, health, and chronic diseases decreases, which may likely explain similar pattern observed for health care utilization (72, 102, 103). It is unclear what contributes to this convergence in health but different social and economic circumstances that may differentially affect their health once they arrive in Canada may play a role (103, 104). Immigration status may also have indirect effects on utilization due its role in facilitating and creating barriers to accessing care. Immigrants have improved access to a regular medical doctor and less unmet health care needs, but experience greater difficulties accessing immediate care due to language barriers or lack of knowledge about where to go (105, 106).

Importantly, studies have also shown that immigration status is connected to weight status as immigrants initially have lower BMIs that rise as time spent in Canada increases (74, 102). However, there appears to be no convergence to the BMI of Canadian-born individuals for most groups of immigrants (74). These differences could exist due to differences in the ethnic and racial background of immigrants as well as differences in health behaviours. The increase in BMI over time may be due to the changes in income, dietary habits and other lifestyles that accompany increasing time spent in Canada (74).

2.5.8 Alcohol Consumption

Since the level of alcohol consumption determines the effect on health, the prediction from the models would be dependent on the level of consumption such that alcohol consumption may increase or decrease utilization of health care. As alcohol consumption can affect the health of an individual, Andersen and Newman's model considers alcohol to be a predisposing factor whereas in the Grossman's model alcohol consumption would be expected to affect the depreciation rate of health. Alcohol is related to cardiovascular

health outcomes in J-shaped pattern where individuals who consume small daily quantities (≤ 2 drinks for males, ≤ 1 drink for females) are at the lowest risk (107). However, alcohol consumption has been shown to increase the risk of a variety of cancers, liver cirrhosis, hypertension, poor mental health, and injuries/accidents (108, 109). In addition, the pattern of alcohol consumption is important as binge drinking, defined as drinking 5 or more drinks on one occasion, leads to additional health risks (110, 111). Although both models would predict that alcohol consumption may be positively or negatively associated with health care depending on the level of consumption, regardless of level of consumption, drinkers have lower levels of health care utilization compared to abstainers (112). This could be due to the presence of former drinkers among abstainers or potential health benefits of moderate alcohol consumption (112).

Alcohol consumption has been demonstrated to affect nutrient and energy consumption. Short term studies have found that the calories due to alcohol are not compensated with decreases in calories from other sources and alcohol consumption may also increase food intake (113). Studies have generally linked various quantities of alcohol to weight status in a J/U-shaped relationship, with moderate levels of consumption leading to the lowest risk of obesity while abstainers and those who consume high levels of alcohol are at greater risk (113). Binge drinkers are at higher risk but this could be due to residual confounding of personality rather than alcohol consumption *per se* (113). Residual confounding may also be at work as other aspects of lifestyle (e.g. physical activity) may also account for the beneficial effects of moderate alcohol consumption (113).

2.5.9 Smoking Status

Due to the detrimental effects of smoking on health, being a smoker increases the depreciation rate of health, which in turn would predict that smokers would make greater investments in their health with health care. Since smoking affects the incidence of numerous cancers, heart disease, respiratory and other medical conditions, under Andersen and Newman's model, smoking would be considered a predisposing factor that is expected to increase utilization of health care (114). In addition, since a patient may also seek the care of their doctor when they decide to quit, smoking may also act as a

need factor. Empirically, it has been demonstrated that former and current smokers have greater propensity to use hospitals and intensity to use specialists and FP/GPs while former smokers also have greater propensity to use FP/GPs and specialists (115-117).

Smoking has also been shown to be linked to weight and obesity but the relationship between the two is complex. BMIs are usually lower in smokers than non-smokers and those who smoke exhibit a lower prevalence of obesity, however heavy smokers tend to have greater levels of obesity than light smokers (118). There is strong evidence suggesting that smoking cessation is linked to weight gain and that weight gain factors into people's decisions regarding smoking cessation (118). This could play a part in higher levels of obesity in heavy smokers, as they are at increased risk of relapse upon quitting, therefore go through a cycle of quitting, weight gain and relapse that leads to a heavier weight (118). In addition, smoking may be linked to weight status through other mechanisms such as initiation of smoking due to body weight concerns and effects of smoking and nicotine on metabolism and appetite (118).

2.5.10 Rural/Urban

Both theoretical frameworks would predict lower health care utilization among individuals living in rural regions. In the Canadian health care system, since there are no financial costs at the point of access for doctor or hospital care, the key cost is the time spent obtaining care, which people living in rural areas experience to a greater extent due to farther distances from these services (42, 119). Therefore, under Andersen and Newman's framework, living in a rural area represents an enabling factor, acting as a barrier to receiving care; in Grossman's model, living in a rural area represents the opportunity costs of time required to access care (42, 119, 120). Since these costs are higher in rural environments, utilization would be expected to be lower and since health is costlier to maintain, an individual would be expected to demand less (119). Both of these predictions have been demonstrated in Canada as individuals from rural communities are generally less healthy and have higher mortality rates, while individuals living in urban regions have higher propensity to use specialists and FP/GPs but lower propensity to use hospitals and lower propensity to visit the emergency department for less urgent/potentially avoidable causes (92, 121-123). One study that examined the

propensity and intensity to use health care did not find any association between living in an urban area and propensity to use FP/GPs but did find that living in an urban area was positively associated with being a high user of FP/GPs and with propensity and high use of specialists (15). Concurrently, substantial differences in obesity have been observed across the rural urban continuum in Canada (124). Specific reasons for these differences in Canada have not been explored but are likely due to different socio-demographic composition (income, education, race, and immigration status) of rural areas compared to urban environments and potentially environmental differences.

2.5.11 Province

Due to policies that have differentially affected financing to and the supply of different health care services including drugs, physicians, and hospitals, Andersen and Newman's model would predict differences in utilization across provinces that would be dependent on the type of care (11, 88, 125-127). Therefore, province of residence represents an organizational and resource variable that affects the opportunity costs of time and money and thereby influences the demand for health and health care utilization (42). Large differences across provinces in obesity rates have also been observed and may potentially be explained by provincial differences in leisure-time physical activity, food prices, smoking, taxation and social policies and social norms (124, 128).

2.5.12 Regular Medical Doctor

Both models would predict lower utilization of health care among individuals without a regular medical doctor. In Grossman's model, having access to a regular medical doctor could affect an individual's opportunity cost of time in seeking care. In Canada, there are no financial costs at point of access for physicians and hospitals, therefore time costs would be expected to be important in determining individual's use of care. Having a regular medical doctor is considered to be an enabling factor within Andersen's framework since it affects the availability of care when they are required (42, 120). Since time costs are higher for individuals without a regular medical doctor, people without a regular medical doctor experience a barrier to obtaining care and it would be expected they would demand less care. In Canada, having a regular medical doctor has been

demonstrated to be positively associated with the use of FP/GPs, specialists and hospitals (116). Having a regular medical doctor may also affect where an individual seeks care in the health care system as individuals with a regular doctor are less likely to visit the emergency for less urgent medical needs (123).

2.5.13 Chronic Conditions

Both models would predict higher utilization of health care among individuals with greater number of chronic conditions. In Grossman's model, the number of chronic conditions would be strongly related to an individual's current stock of health and the rate of depreciation. The number of chronic conditions is considered to be an indicator of need in Andersen's framework since individuals diagnosed with a chronic condition would have had to been evaluated to be ill by a health professional (42). Empirically, presence of a chronic condition as well as the number of chronic conditions are positively associated with the utilization of the services of FP/GPs, specialists and hospitals, including both the propensity and the intensity of use (15, 71, 129). Although people with multiple chronic conditions represent a small fraction of the population, they often account for a much greater of share of the overall utilization due to the numerous visits and treatments to manage conditions as well as prevent further complications (129). Analyses will be conducted with and without controlling for the number of chronic conditions to understand the role they play in potential changes in the association between obesity and health care utilization over time.

Chapter 3

3 Literature Review

This chapter proceeds as follows. First, there is an overview of the global and Canadian prevalence of obesity with a discussion of some of the factors associated with obesity and how they may be contributing to the obesity epidemic in Canada and abroad. This is followed with a brief summary of evidence demonstrating a relationship between obesity and chronic diseases, disability and mortality. Next, is a brief overview of the literature demonstrating the relationship between obesity and health care utilization, followed by a comprehensive review of previous population based studies examining these associations in Canada. Finally, there is a comprehensive review of previous studies that have examined how these associations have changed over time.

3.1 Prevalence and determinants of obesity

3.1.1 Global and Canadian prevalence of obesity

The obesity epidemic is a major global threat to public health, with global age-standardized prevalence in 2008 reaching 9.8% in men and 13.8% in women, which is nearly double the prevalence in 1980 (130). During this time period, mean BMI increased in both males and females in the vast majority of countries and regions of the world, with a change in mean body mass index (BMI) of 0.4 kg/m^2 per decade for men and 0.5 kg/m^2 per decade for women (130). In 2008, North American men had the highest prevalence of obesity in the world, while the prevalence of obesity in North American women was ranked fourth highest in the world (130).

In Canada, mean BMI and prevalence of obesity increased from 1981 to 2007-2009 in both males and females and across adult age strata with overall obesity prevalence in 2007-2009 reaching 24.1% in Canadian adults age 20-79 (1, 19). The prevalence of morbid obesity (BMI $\geq$ 35) such as class II (35 $\leq$ BMI < 39.9) and class III obesity (BMI $\geq$ 40), have risen dramatically since 1985 (20). The prevalence of class II and class III obesity amongst Canadian adults aged 20-79 in 2007-2009 reached 5.8% and 3.1%, respectively based on measured BMI (1).

3.1.2 Factors contributing to the Obesity Epidemic in Canada and abroad

3.1.2.1 Individual level characteristics:

Due to the swiftly rising prevalence of obesity in Canada, numerous studies have sought to explore which factors related to individuals and their environments contributing to obesity. Early studies of obesity in Canada involved the 1994 National Population Health Survey (NPHS), with Cairney and Wade demonstrating that the odds of obesity (BMI ≥27) significantly increased with age, being male, Canadian-born, being in an unskilled or skilled occupation compared to professional class, and decreased with residence in Quebec or British Columbia compared to Ontario, being a current consumer of alcohol compared to former drinker, and with higher levels of education (secondary and post-secondary compared to primary) (131). The associations of marital status, smoking status and household income adequacy with obesity were not significant (131). Trakas et al. found similar results with the 1994 NPHS with regards to age, education, sex, and household income but did find an association with smoking status with non-smokers having higher odds of obesity compared to occasional or regular smokers, and also found that the odds of obesity decreased with increasing physical activity status and with living in a rural area (6). Subsequent longitudinal investigation of the NPHS by Setia et al. has demonstrated similar associations with these variables with a few exceptions (74). These include positive associations between living with a partner or family in females and being married for males and BMI, and possible differential effects of income and alcohol across sex with positive associations between income and regular drinking status and weight in males and negative effects in females (74).

Research on obesity in Canada has also explored the link between diet and obesity. Utilizing the 2005 CCHS, Slater et al. found higher risk of obesity among individuals experiencing food insecurity but this was observed only in women and was statistically insignificant in men (132). They found no association between fruit and vegetable consumption and risk of obesity (132). In a more detailed examination of the link between nutrition and obesity using the 2004 CCHS - Nutrition,, Langlois et al. found increased odds of obesity among men and women with increases in energy intake, and decreasing odds of obesity among men with increasing levels of fiber (133). The effect of

fiber was in the same direction but not significant in women and none of the macronutrients in terms of percent of energy (carbohydrates, protein, and total fat) were significantly associated with obesity (133).

3.1.2.2 Neighbourhood level characteristics:

Recent Canadian studies have expanded the exploration of weight status in Canada beyond individual level factors by exploring how neighborhood level characteristics may play a role. In their cross-sectional analysis of individual and macro level factors that are associated with BMI in Toronto and Vancouver in the 2003 Canadian Community Health Survey (CCHS), Pouliou and Elliott found BMI decreased with increasing residential density in both cities while land-use mix, street connectivity and walkability index were negatively associated with BMI only in Vancouver (134). None of the accessibility measures including the density of fast-food restaurants, convenience stores, grocery stores or recreational activities were found to be significant in bivariate analyses and therefore were not included in their final models (134).

Other studies have explored the link between the retail food environment and obesity. For instance, Spence et al. investigated how the Retail Food Environment Index (RFEI) was associated with obesity in the Capital Health region of Alberta in the Population Health Survey 2002 (135). The RFEI is calculated as the ratio of the availability of fast food restaurant and convenience stores compared to grocery stores and produce vendors (135). They found decreasing odds ratios (OR) of obesity for decreasing values of the RFEI suggesting that the food environment played a role in determining obesity levels in the neighborhood (135). Prince et al. investigated the independent role of the components of the food environment in Ottawa by examining the association with overweight/obesity in Ottawa using the 2001-2007 CCHS (136). They found significant positive OR of overweight/obesity in females for number of fast food outlets and number of convenience stores while there was no association with specialty stores and negative but non-significant association with number of restaurants (136). Among males, the effect of the number of fast food outlets and restaurants was similar in direction and magnitude to that of females but non-significant (136). Most other neighborhood variables were not significant such as the number of different types of recreation facilities or neighborhood

socioeconomic status although park area was positively associated with overweight/obesity in females and crime rate was inversely associated in both males and females possibly due to its link to population density (136).

In summary, the main findings amongst Canadian studies of individual characteristics have shown that demographic characteristics, socio-economic status, and other health-related lifestyle characteristics are related to BMI or obesity. Among neighborhood characteristics there is mixed evidence, although it does seem that some aspects of the food environment may play a role. Even if the link between these factors and weight is causal, it does not necessarily imply they have played a role in the rising prevalence of obesity in Canada. If there are ubiquitous exposures present that are causing the obesity epidemic to occur, factors that have been shown to be associated with obesity may be acting on individual susceptibility rather acting as a true cause of change in the population distribution of obesity (137). For these variables to have been significant contributors to the obesity epidemic, they should have strong effects on obesity and have changed over time in the direction that would increase the prevalence of obesity in a population (138). Using these criteria, population aging, decreases in the prevalence of smoking, and increases in the supply of fast food are likely contributing to the increases in the prevalence of obesity in Canada (138, 139).

In other countries, research has demonstrated dramatic changes to different domains of diet and physical activity that are likely contributing to the obesity epidemic (140). For example, studies in the United States (U.S.) have shown over time that portion sizes are increasing and individuals are eating at more occasions per day, partially due to increased snacking and increased consumption of sweetened beverages (140-144). These changes to dietary patterns are likely behind the increased caloric intake over time that has been observed (145, 146). In Canada, large increases in estimated energy availability may be a factor in the obesity epidemic (147). Large changes in food consumption patterns have also been observed recently in China with shifts to decreased consumption of grains and increased consumption of animal products although there have been decreases in calories consumed over time (148).

With regard to physical activity, studies have shown large decreases in physically demanding occupations over time in the U.S. and China and recent large decreases in domestic physical activity in China (149-151). A larger array of other factors such as changes in sleep patterns, endocrine disruptors, reduction in ambient temperature, pharmaceutical iatrogenesis and increasing gravida age may also be at work (138). In conclusion, the obesity epidemic is a highly complex global phenomenon, affecting most nations in the world. Although numerous changes to nutrition and physical activity are likely major contributors to this epidemic, a wide array of potential causes may also be playing a role.

3.2 Consequences of Obesity: Disease, Mortality and Disability

The rise in the prevalence of obesity in Canada is alarming to public health and health care professionals as overweight and obesity have been linked to a number of adverse health outcomes including numerous chronic diseases, disability and mortality. Guh et al. conducted a series of systematic reviews and meta-analyses of studies examining the association between overweight and obesity and 18 co-morbidities (50). They included only prospective cohort studies of the general population of a Western country (countries in Europe or North America, Australia or New Zealand), studies with a sample size of 200 or more subjects, and studies that included disease incidence rather than mortality rate of the disease as the outcome (50). They calculated unadjusted incidence rate ratios (IRR) when person-time was available and ratios of proportions (RR-P) otherwise (50). They found that obesity was significantly associated with numerous cancers, including increased risk of post-menopausal breast [IRR 1.13], endometrial [IRR 3.22], ovarian [IRR 1.28], colorectal [female IRR 1.66, male IRR 1.95], kidney [female IRR 2.64, male IRR 1.82], and pancreatic [female IRR 1.60, male IRR 2.29] cancers (50).

Guh et al. also reviewed the link between obesity and non-cancer outcomes (50). They found pooled estimates of increased risk for type II diabetes [female IRR 12.41, male IRR 6.74] and numerous cardiovascular diseases including hypertension [female IRR 2.42, male IRR 1.84], stroke [female RR-P 1.49, male RR-P 1.51], coronary artery disease [female IRR 2.69, male RR-P 1.72], pulmonary embolism [IRR 3.51] and congestive heart failure [female RRP 1.78, male IRR 1.79] (50). Lastly, they investigated

other non-cancer, non-cardiovascular disease outcomes and found increased risks for asthma [female RR-P 1.78, male RR-P 1.43], gallbladder disease [female pooled RR-P and IRR 2.32,male pooled RR-P and IRR 1.43], osteoarthritis [female RR-P1.96, male IRR of 4.20], and chronic back pain [RR-P 2.81] (50). Pooled estimates for overweight were generally significant and in the same direction although not as strong as the estimates for obesity with the exception of prostate cancer, where only overweight and not obesity was statistically significant (50).

Furthermore, overweight and obesity have also been linked to increased mortality. A recent study that combined 57 prospective cohort studies with 894, 576 participants from mostly Western Europe and North America, found that mortality was lowest in the 22.5-25 BMI category (52). Beyond this range, each additional 5 kg/m^2 increase in BMI on average is associated with about 30% higher overall mortality (52). For cause specific mortality, each additional 5 kg/m^2 is associated with increased risk of mortality due to ischemic heart disease, stroke, diabetes, renal, hepatic, neoplastic, respiratory, and other diseases of 39%, 39%, 116%, 59%, 82%, 12%, 20%, and 20% respectively (52).

Although obesity leads to an increased risk of mortality, the effects on disability appear to be even stronger in magnitude. In a study that directly compared the effects of obesity on mortality and disability, class I obesity did not increase the risk of mortality in males or females but did have a strong effect on the incidence of activities of daily living (ADL) disabilities (Hazard Ratio (HR) of 1.69 in males, 1.66 in females) (3). Although morbid obesity had significant effects on mortality in males and females (HR of 1.62 for males, 1.86 for females), the association between obesity and ADL disabilities was even greater (HR of 2.54 for males, 2.81 for females) (3). Other studies, including a recent study with samples from 9 countries across Europe have come to the same conclusion regarding the greater magnitude of effects of obesity on disability versus mortality (4).

3.3 Consequences of Obesity: Health Care Utilization/Costs

Due to the rise in obesity and its associated co-morbidities, numerous studies have explored the consequences of obesity for health care systems, including its association with the utilization of health care services and costs. A number of studies in different

populations have shown that obesity is associated with increased total health care costs (8, 152). This is a result of increased utilization of outpatient care by doctors, prescription medicines, increased risk of hospitalizations and longer in-patient stays (7-9, 152-160). Although it is impossible to randomly assign obesity to individuals, a recent study by Cawley and Meyerhoefer attempted to account for potential reverse causality and measurement errors through the instrumental variable approach (10). Using the BMI of the respondents' oldest biological child as an instrument, they found even stronger effect of obesity on inpatient, outpatient, prescription drug, and total medical expenditures (10). Obesity-related co-morbidities such as diabetes, hypertension, and cardiovascular disease have been found to account for the association between obesity and health care utilization/costs (7, 8).

Although obesity is associated with an increase in utilization or costs, studies have found large variation in utilization and costs across individuals living with obesity with additional increases in utilizations or costs in class II and class III obesity as compared to class I obesity (7, 9, 153). In addition, variability in utilization and costs amongst individuals living with obesity may also be due to differences in duration of exposure to obesity which has shown a positive relationship with health care utilization (23, 24).

3.3.1 Canadian Research on Obesity and Health Care Utilization/Costs

Rising health care costs in Canada are a serious concern and numerous studies in Canada have specifically examined the types of health care utilization and costs that are associated with obesity. Trakas et al. were the first in Canada to examine the association between obesity (BMI $\geq$ 27) and the utilization of different types of health care among Canadian adults aged 20-64 in the 1994 NPHS (Sample Size (N) =12, 318) (6). Using logistic regression they found an association between obesity and increased use of FP/GP visits with an OR for 3 or more visits of 1.40 (95% confidence interval (CI): 1.29, 1.52 and OR for more than 3 visits of 1.55 (95% CI: 1.41, 1.69) (6). Similar results held for any type of physician visit with an OR of more than 2 visits of 1.32 (95% CI: 1.22, 1.43) and an OR of more than 3 visits of 1.49 (95% CI: 1.37, 1.62) (6). Although they found increased utilization of FP/GPs and physician visits, they found decreased risk of a hospital admission with an adjusted OR of 0.83 (95% CI: 0.47,0.96) (6).The analyses

controlled for age, sex, smoking status, level of physical activity, education level and household income (6). The key limitation of this study is the dichotomous categorization of obesity with a cut-point that is no longer in use. This categorization would misclassify a large number of overweight individuals into the obesity category and compare them with individuals who are underweight, normal weight and overweight. Another limitation of this study was the use of self-reported height and weight which overestimates height and underestimates weight and therefore underestimates the prevalence of obesity (161). Furthermore, categorizing health care utilization in the manner conducted in this study does not allow for an understanding of how obesity affects the propensity or intensity of utilization and the cut-point is arbitrary.

Finkelstein explored the health care costs of obesity and smoking by linking individuals aged 40 to 79 from the 1995/6 NPHS to the Ontario Health Insurance Plan (OHIP) to get costs of physician services for the year prior to the survey (N = 2,170) (162). Through generalized additive modelling, his analysis showed that the relationship between BMI and physician costs was 'J' shaped with minimum costs at a BMI of 22 and near linear relationship between BMI and costs above a BMI of 20 (162). Estimates from multiple linear regression showed that average expenditures increased by $8.90 for each additional BMI unit above 20 and there was no interaction between BMI and smoking ($p = 0.14$) (162). Analyses controlled for age, sex and household income (162). The strength of this study included administrative linkage that allows for more accurate estimates of utilization and allows for estimations of costs. However, the key limitation with administrative databases is that each province and each type of health care often has its own unique administrative database which typically limits the scope of these analyses to one province and one type of health care. In addition, the study did not take advantage of one of the key benefits of administrative databases which is to obtain prospective health care costs (162). Instead they measured costs in the year prior to the survey, which as the author notes limits their sample to be a survivor population and excludes utilization and costs due to dying (162).

Chen et al. specifically investigated hospital utilization including admissions and the number of nights spent in the hospital and their relationships with weight status in

Canadian adults aged 20 and older in the 2002-2003 CCHS (N = 113 603) (160). Using logistic regression, they found that the adjusted OR for being an inpatient in the last 12 months for obesity was 1.25 (95% CI: 1.14, 1.37) (160). To examine the risk of an admission with different number of nights they first used ordinal logistic regression but once they found that the ORs were not the same across categories, they used multinomial regression (160). They found a significant relationship between obesity and an admission with 2 or 3 nights, 4-7 nights, 8 or more nights in men with ORs of 1.56 (95% CI: 1.22,2.01), 1.41 (95% CI: 1.11, 1.80) and 1.27 (95% CI: 1.01, 1.60) respectively (160). For women, only admissions with 1 night and 4-7 nights were significantly elevated in the adjusted analyses with ORs of 1.45 (95% CI: 1.21,1.73) and 1.33 (95% CI:1.13,1.59) respectively (160). Analyses controlled for income, education, smoking, alcohol consumption, physical activity, age, marital status, immigration status, race, allergy history, household size, and number of bedrooms (160). The main limitation with this study was that the outcome combined the number of nights and the probability of an admission into one variable, therefore the effect of obesity on length of stays was not identified. This would require separating the sample into those with at least one night and identifying the effect of obesity on number of nights for this sample. Another limitation of this analysis is that given the nights variable could contain more than one admission, these are not true lengths of stay. In addition, there was no further examination of the effect of different obesity classes which have been shown to have differential effects on hospitalizations (9).

Janssen et al. examined physician costs of different BMI categories in Ontario through linkage of the 2000/1 CCHS to prospective cost from 2002-2003 from OHIP (N = 32,848) (163). This study expanded on the existing Canadian literature by examining the costs across age strata and was the first study to examine individual level costs associated with being overweight among youth (age 12-17 years) (163). Their analysis, which used a two-part model (1st part logistic regression, 2nd part Generalized Linear Model with log link and gamma distribution), showed that physician costs were only elevated for obesity amongst the oldest group, aged 60 years or more, by $227 (95% CI: 132, 324) or 28.3% (163). Costs were elevated in both males and females but were higher in females (163). Analyses for adults controlled for age, income adequacy, smoking status, alcohol

consumption and physical activity and with adolescents they additionally controlled for gender (163). The advantage of this study included the use of administrative databases that allowed for measurement of prospective costs. However, the study was limited by the presentation of only total physician costs with no breakdown across type of physicians (primary or specialist) or across the first and second part of the regression.

Tarride et al. expanded the investigation of obesity related costs by estimating the costs due to obesity across a range of services by linking the 2000-1 CCHS to administrative databases for hospitalizations, day procedures and physicians services for Ontario (N = 28,797) (55). They used the same statistical model as Janssen et al. with control for age, gender, physical activity, personal income, and smoking status (55). Individuals living with obesity had significantly increased hospitalization costs ($67.00), physician costs ($108.10), and total costs ($176.10) compared to normal weight individuals while day procedure costs were not significantly different (55). Results from the logistic regression showed that individuals living with obesity had significantly increased hospitalizations (OR 1.3) compared to normal weight individuals (55). Although total costs for the second part were higher among those living with obesity ($6,413 vs. $5,846), the difference in costs was not statistically significant (55). Total costs were only significantly elevated among females and were significantly elevated among all age groups with similar cost differences in the top two age strata (18-39 cost difference: $82.00, 40-59 cost difference: $245.60) (55). The main strength of this study was administrative data on several types of costs. However, since only one year of data was available and six months were prior to the interview, therefore costs were only partially prospective (55). Although per-capita physician costs were similar to per capita expenditures on physicians for Canada during this time period, per-capita hospital costs were less than 25% of per capita hospital expenditures possibly putting the validity of these results into question (55).

Twells et al. conducted two investigations of the 2000-1 CCHS in Newfoundland and Labrador (164, 165). In the initial study, they investigated the effect of obesity on self-reported health care utilization among adults age 20-64 years (N = 2,345) (164). In this study they found a significant relationship between obesity and the median number of general practitioner visits (164). However, there was no significant relationship with

median number of specialist visits, prevalence of a hospitalization, or median number of nights (164). In a follow-up investigation of the same cohort with linkage to administrative databases for the period 1998-2002, Twells et al. found a significantly higher median number of FP/GP visits for individuals living with morbid obesity and found higher prevalence and median number of specialist visits, however these results were not statistically significant (165). They did not find any relationship with any measure of use of hospital care including number of inpatient admissions, length of stay per episode, average resource intensity weight or day procedure group (165). Multivariable Poisson regression analysis was also conducted controlling for age, sex, marital status, urban/rural, education, income, disability days, self-perceived health, health utility index, smoking status, alcohol consumption, fruit and vegetable consumption, and level of physical activity (165). Twells et al. found a significant positive relationship between morbid obesity and general practitioner visits and class I obesity was associated with shorter lengths of stays (165). When further control for the number of chronic conditions was done, the effect of morbid obesity on general practitioner visits was attenuated but still significant while the effect of class I obesity on length of stays increased slightly (165). Both of these studies were limited by their small sample size which likely limited power in investigation of specialist and hospital care (165). In addition, the follow-up investigation was limited by most of the observational period being retrospective and adjustment for disability days, self-perceived health, health utility index which likely constitutes over-adjustment.

In their examination of how smokers used acute care hospitals, Wilkens et al. also analysed the relationship between obesity and hospitalizations in adults age 45 to 74 from all of Canada except Quebec in the 2000-1 CCHS (117). They used logistic regression to analyze the OR of a hospitalization over the subsequent four years while controlling for smoking status, age, sex, education, income, urban/rural, consulted a family physician/general practitioner, leisure-time physical activity and level of alcohol consumption (117). They found that all classes of obesity were significantly associated with the propensity to use hospitals with ORs of 1.2, 1.7, and 1.8 for obesity class I-III individuals respectively (117). The strength of this study was that it is the only study to use administrative data on hospitalizations at the national level (117).

In her thesis, McMahon analyzed the association between obesity and health care utilization among individuals aged 18-75 years using the 2005 CCHS (N =88,020) (116). A two-part modeling strategy was used with logistic regression for the first part and ordinary least squares (OLS) on the log of utilization for the second part (116). All analyses controlled for regular medical doctor, smoking status, alcohol consumption, sex, age, age^2, female*age interaction (full sample), province (full sample)/region (for age-stratified analyses), urban/rural, marital status, immigration status, race, education level, household income, and employment status (116). The analysis showed a dose response relationship between increasing classes of obesity and intensity of FP/GP utilization, propensity to be admitted to the hospital, and utilization of home care (116). For propensity to use FP/GPs and specialists, and intensity of visits to specialist, individuals living with obesity had significantly increased utilization, although it did not follow dose-response patterns across obesity classes (116). For intensity of hospitalization, only obesity class II had significantly increased utilization, with no significant association for class I or III obesity (116). Only propensity to use FP/GPs, hospitals and intensity of FP/GP utilization remained significant after controlling for chronic disease and chronic disease squared (116). Analyses were also examined across age strata (18-44, 45-59, 60-75) (116). Analysis of FP/GP propensity showed all three classes of obesity were significantly elevated for each age strata with strongest effects in the adults 45-59 while for FP/GP intensity, all classes were significantly elevated in all age strata, with increasing effects of obesity with increasing age (116). Most obesity classes were significant across all age strata for propensity and intensity of specialist utilization, with no clear patterns in effect across age for propensity, and increases in effect across age for intensity for class I and III obesity but not class II obesity (116). Most obesity classes were significant across all age strata for propensity to use hospitals, with increasing effects observed across age groups (116). The main strength of McMahon's study is its examination of both parts of the distribution (yes/no utilization and intensity of utilization conditional upon one visit/stay) for different types of health care and across age groups.

The Canadian literature clearly shows that obesity is positively associated with the utilization of a number of types of health care including hospital and physician services and the associations are robust to different study design and sample selection. No study in

the Canadian context has examined how the relationship between obesity and health care utilization/costs may be changing over time due to changes in individual characteristics or contextual effects as discussed in Chapter 2. Studies that have examined this question in other countries are discussed in the following section.

3.3.2 The relationship between obesity and health care costs/utilization over time

As previously discussed, numerous studies in Canada and abroad have demonstrated a positive association between obesity and health care utilization or costs using individual-level data. Recently, studies have begun exploring in further detail on how obesity contributed to rising national medical expenditures and how it will affect future medical expenditures. In order to accomplish this, these studies have explored and demonstrated significant changes in how obesity is related to health care costs over time.

Thorpe et al. investigated whether the association between obesity and health care costs changed over time in the U.S. by examining the 1987 National Medical Expenditure Survey (NMES) and 2001 Medical Expenditure Panel Survey Household Component (MEPS-HC) (62). Among adults 19 and older, they found that the rise in health care costs was significant amongst individuals living with obesity with per capita costs increasing 63% compared to the non-significant rise of 37% in normal weight individuals (62). Using a two-part regression model and controlling for age, sex education, smoking status, health insurance status, race, income, marital status, and region, they showed that that the excess total per capita health care costs of individuals living with obesity relative to normal weight individuals increased significantly from $321 to $1069 ($p < .05$) (62). Thorpe et al. subsequently examined the same question among privately insured adults 18-64 years of age in the 1987 NMES and 2002 Medical Expenditure Panel Survey (MEPS) (166). They found that the total per capita health care costs for individuals living with obesity rose substantially from $272 (an 18 percent increase) above normal weight individuals to $1244 (a 56 percent increase) (166). Although it is clear that the cost burden of obesity may be shifting over time, it is not clear what parts of the health care system were affected as there was no breakdown of total costs into costs for different services.

Finkelstein et al. investigated how per capita costs have changed across BMI strata using the 1998 and 2006 MEPS (167). They used two-part models and controlled for sex, race, age, region, household income, education, marital status, smoking status, and insurance status (167). Over this shorter time period, they found that the difference in per capita costs between individuals living with obesity and normal weight individuals rose from $1,145 to $1,429 but the change was not significant (167). Similar to Thorpe et al., there was no further breakdown of changes over time into costs due to different services. Another study conducted by the U.S. Congressional Budget Office also examined this question and extended the analysis to 2007 (168). They showed that from 1987 NMES to 2007 MEPS, per-capita spending in the U.S. increased by 65% amongst normal weight individuals, and by 111% for individuals living with obesity (168). When obesity was further stratified, they found that costs grew by 102% amongst those with a BMI between 30 and <40, and increased by 177% amongst those with BMI ≥ 40, suggesting that the increasing prevalence of more severe forms of obesity likely did not account for all of the rise in costs (168). As a result, the gap in spending between normal weight and individuals living with obesity rose from 8% to 38% (168). In addition, they investigated how a wide array of obesity related chronic diseases accounted for the increasing gap in spending such as coronary heart disease, type 2 diabetes, certain cancers, hypertension, dyslipidemia, stroke, liver and gallbladder disease, osteoarthritis, certain gynecological problems, and some depressive disorders (168). They found that these chronic diseases accounted for approximately 60% of the difference in spending between individuals living with obesity and normal weight individuals in 2007, and about 50% of the growth in the gap in per-capita expenditure (168). The key limitations of this study were no further breakdown of costs across types of service and no mention of confounder adjustment such that the estimates may be confounded by other characteristics such as age and smoking status.

One study in the U.S. examined how the relationship between obesity and health care costs has changed among adults 65 and over. Alley et al. explored the relationship between obesity and overall per capita costs in a sample of Medicare recipients from 1997 to 2006 Medicare Current Beneficiary Survey (169). They used generalized linear models with log link and gamma distribution controlling for age, sex, race, marital status,

education, income, prior Social Security Disability Insurance status, census region, metropolitan status, and for whether the individual died during follow-up (169). Initially, they found that obesity was associated with significantly lower costs (169). However, total costs increased at more than twice the rate among individuals living with obesity compared to normal weight individuals (excess cost per year $149, p= 0.001) (169). Further adjustment for 10 chronic conditions commonly linked to obesity (diabetes, hypertension, ischemic heart disease, hyperlipidemia, heart failure, chronic lung disease, osteoarthritis, hypothyroidism, gastroesophageal reflux disease, and sleep apnea) largely attenuated the effects such that it was no longer statistically significant (169).

The focus of these studies has largely been on determining the changing "burden" of obesity. They did not examine how individuals living with obesity access and use the health care system differently over time. Therefore, they are limited in their examination of only total costs and their understanding of the driving forces behind these trends. The exception to this is the study by Thorpe et al., which demonstrated that these increased costs are likely due to an increase in the prevalence of treated disease (166). However, how and where individuals living with obesity are accessing the health care system to treat these conditions was not discussed. In addition, most of these studies did not examine how per-capita costs for obesity changed across different strata (e.g. age, sex), which may better illuminate the reason for these trends.

Two European studies have examined whether the relationship between obesity and health care utilization is changing over time. Wildenschild et al. investigated the link between obesity and different types of physician utilization across the time periods 1987–2005 in individuals 16 and older in Denmark (170). Their main outcome included all types of doctor visits with three sub-categories further generated which included general practitioner, secondary sector (physician from the emergency service, emergency ward, outpatient clinic, and hospitalization), and primary sector/other (medical specialist, industrial medical officer, and other physician) doctors visited in the last 3 months (170). They found a significant increase in contact over time in women but this was only among women who were normal weight (170). Among men, they found significant increases in utilization for normal weight, overweight and individuals living with obesity with the

largest increases for men living with obesity (170). There were no differences among the sub-categories of doctors over years for women living with obesity but all sub-categories increased for men living with obesity (170). In a study conducted in Estonia, Tekke et al. investigated the relationship between obesity and two or more outpatient visits, which included both family physicians and specialists (171). From 1990 to 2004, they found that the association increased for women but not for men (171). Both of these studies limited their analysis to examining propensity or an arbitrary cut-point (2 or more physician visits) rather than analysis of propensity and intensity of utilization.

3.4 Summary

The prevalence of obesity is rising, both in Canada and world-wide. This rising prevalence is a concern as obesity has been associated with numerous chronic conditions, disability, and increased risk of mortality. Numerous studies in Canada and abroad have demonstrated that obesity is significantly associated with increased utilization of various health services and increased costs. Studies from the U.S. have demonstrated that the association between obesity and total costs has increased over time, however at this point, no studies have examined what types of care may be affected. In addition, there is no research on how the health care utilization of individuals living with obesity may be changing over time in Canada. This is an important gap in the literature considering the large changes in individual characteristics of individuals living with obesity and changes in the treatment of obesity related co-morbidities as discussed in the theoretical framework. The next chapter will discuss in detail how I plan to fill this gap.

Chapter 4

4 Methods

I used three nationally representative health surveys conducted by Statistics Canada to examine whether or not the relationship between obesity and three types of health care utilization have changed over time. This chapter presents the characteristics of the survey data, characteristics of the respondents, variable construction, and the appropriateness of statistical methods.

4.1 Survey and Sample Characteristics

4.1.1 Survey Characteristics

The proposed study will be a secondary analysis of the 1996-7 National Population Health Surveys (NPHS), the 2000-1 and 2009-10 Canadian Community Health Surveys (CCHS). All three cross-sectional surveys collected detailed information on health care utilization and rich socio-economic and health determinants of the Canadian population (172-174). These specific surveys were chosen since they are nationally representative, contain all questions of interest in all surveys, have large sample sizes, and have nearly identical sample inclusion and exclusion criteria (172-174).

4.1.2 Survey Sampling Methods

The response rates, sample sizes, and sampling methods used in each survey are shown in Table A. 1. The different surveys use a combination of sampling methods including two-stage stratified cluster designs, Random Digit Dialing (RDD), and telephone list frames. The following two paragraphs describe the methodology of the different sampling methods.

In a two-stage stratified cluster design, Canada is stratified into provinces which are then further stratified based on geographical and/or socio-economic characteristics (172-174). Independent clusters (usually census enumeration areas) are randomly chosen and then dwellings (households) are randomly selected from each cluster (172-174). From each

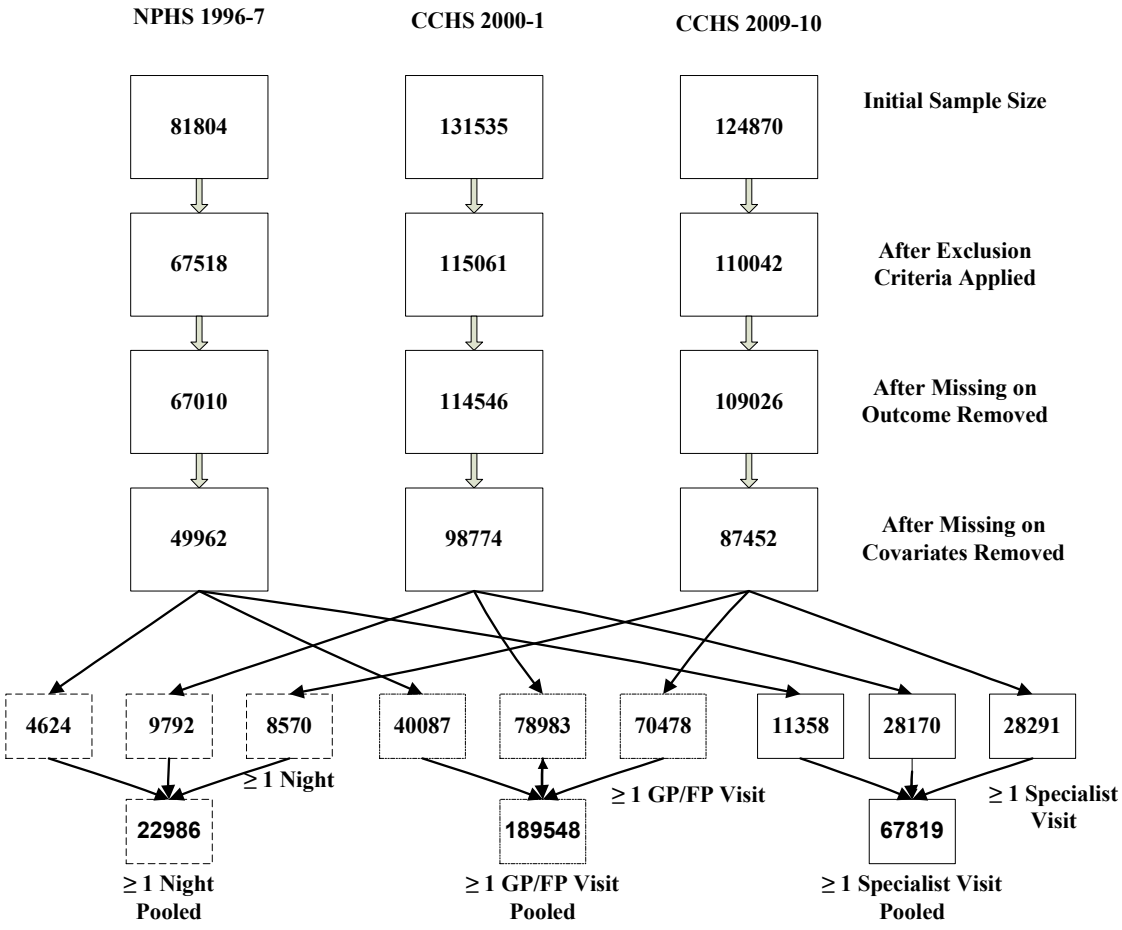
household, an individual is randomly selected to participate in the survey (172-174). This sampling frame uses either telephone or in-person interviews.

There are two sampling frames that exclusively use telephones, the Elimination of Non-working Banks (ENWB) Random Digit Dialing (RDD) and telephone list frames (172, 173). With ENWB, a list of all possible banks (the first 8 digits of a telephone number) is created and then individual banks are removed if they do not have any residential numbers (172, 173). Banks are then grouped to form strata, from which a bank is randomly chosen and then combined with a random number between 00 to 99 to generate a 10 digit telephone number (172, 173). For individuals sampled from the list frame, a database of telephone numbers was divided into stratum based on geography, from which individuals are selected based on simple random sampling (173, 174).

4.1.3 Participants

The inclusion and exclusion criteria that are determined by the survey are shown in Table A. 2. Additional criteria were applied including the exclusion of youth (those less than 18 years old), residents of territories and pregnant women. Anyone under 18 years of age is excluded as the primary focus of the study is on adults. Residents of territories are excluded to improve consistency as individuals from territories are not included in the NPHS. Pregnant individuals are excluded since the use of BMI is not appropriate in these individuals. Individuals with missing responses on any question were excluded. A flow diagram of the sample creation is shown in Figure 2.

Figure 2: Flow diagram demonstrating the sample size at each step of sample creation



4.2 Variables

Variables used in this study are largely consistent across three nationally representative surveys. Although there are slight differences in wording/number of categories for some of these variables over time, variables were re-categorized in a manner to maximize the consistency (175-178). Differences in wording/categories as well as changes to improve consistency are shown in Table 1.

Table 1: The comparability of variables across the surveys and the changes made to improve comparability for specific variables (175-178)

Variable	Differences in Wording/Categories	Changes Made to Ensure Comparability
Outcome Variables:		
Family physician/general practitioner & Specialist	Both outcomes: 2009-10: first asks any use then how many times 1996-7, 2000-1: only asks how many times Specialist: slight differences in wording: 1996-7: Any other medical doctor: e.g. surgeon, allergist, psychiatrist, gynaecologist 2000-1: Any other medical doctor: e.g. surgeon, allergist, psychiatrist, gynaecologist, orthopaedist 2009-10: Any other medical doctor or specialist: e.g. surgeon, allergist, psychiatrist, gynaecologist, orthopaedist	None
Independent Variables:		
Height	1996-7: only asks height 2000-1, 2009-10: asks height in feet, then asks inches	None
Age	1996-7. 2000-1: DOB 2009-10: respondent age asked	None
Marital Status	1996-7 extra category: Living with a partner	Grouped with Married/Common-Law
Income (Equivalised Household Income)	Refers to total household income all members before taxes and deductions 1996-7: only categories of income asked 2000-1, 2009-10: best estimates and categories of income asked 1996-7, 2000-1: top category 80K 2009-10: top category 100K	Derived equivalised household income as described in methods
Education	Total number of educational categories varies across years and slight wording change between first and second survey.	Categorized into a 4 level variable as described in methods
Home Ownership	1996-7: Is this dwelling owned by a member of this household (even if being paid for)? 2000-1: Is this dwelling owned by a member of this household? 2009-10: Is the dwelling you live in currently owned by a member of this household?	None

Type of Smoker	1996-7: "Ever smoked cigarettes at all" 2000-1, 2009-10: "Ever smoked a whole cigarette" 1996-7, 2000-1: "How many cigarettes do you smoke each day now?" 2009-10: "How many cigarettes did you usually smoke each day?"	None
Chronic Conditions	Differences in availability, wording, and who is asked across years.	Described in methods section

4.2.1 Health Care Utilization

The study used self-reported measures of health care utilization for visiting a family doctor or general practitioner, specialist and hospitalization (convalescent home/nursing home). These measures were chosen since their utilization has been shown to be affected by obesity in the literature, are available with similar wordings across three surveys, and are relevant to the Canadian health care system (representing 42 % total expenditures in 2008). Questions on health care utilization refer to the last 12 months prior to the survey (175-178). Two variables were derived for each type of health care utilization. The first is a binary indicator representing whether or not the individual utilized the specific type of care. The second is a count variable representing the intensity of utilization conditional on utilization being greater than 0.

4.2.2 Exposure

The key exposure is obesity as measured by BMI. Height and weight are self-reported and are converted into body mass index values by the equation weight (kilograms)/height (meters)^2. Since the relationship between BMI and health care utilization has been repeatedly been shown to be non-linear and the interest is in the health care utilization of individuals living with obesity, BMI will be categorized into underweight, normal weight, overweight, and obesity according to the World Health Organization (Table 2) (48). This will allow examination of the primary question of how health care utilization has changed over time for individuals living with obesity relative to normal weight individuals. For all surveys, BMI was derived in accordance with Statistics Canada's derived BMI for the 2009-10 CCHS. Individuals were assigned to missing for BMI if

they did not report their pregnancy status or if they had a height above 2.108 or below 0.914 metres (179).

Table 2: The range of BMI values used to define each BMI category

BMI Category	BMI (units)
Underweight	<18.50
Normal Weight	18.50-24.99
Overweight	25.00-29.99
Obesity	≥ 30.00

4.2.3 Confounders

The variables to be included in the model as confounders were previously discussed in the Conceptual Framework Chapter, where a rationale for their inclusion was provided. Included variables and their categorization are shown in Table 3. The following paragraphs provide the rationale for the categorization of these variables.

Table 3: The number of categories for each confounder (the reference group in bold format)

Variable	Number of Categories	Categories
Predisposing		
Age	8	**18-24**, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, 85+
Sex	2	**Female**, Male
Marital Status	3	**Single**, Married, Divorced/Separated/Widowed
Immigration Status	3	**Canadian Born**, Immigrated Canada <10 years ago, Immigrated to Canada >=10 years ago
Education	4	**Less than high school**, Graduate of High School with no completed post-secondary education, Completed a Diploma/Certificate, Completed a Bachelor's degree or higher
Type of Smoker	6	**Never smoker**, Former smoker, Occasional, Daily Light, Daily Moderate/Heavy
Type of Drinker	5	**No alcohol consumption in the last 12 months**, Occasional, Regular-Non Binge, Regular- Binge
Enabling		
Equivalized Household Income	6	**Quintile 1** - Quintile 5, Missing
Home Ownership	2	**No**, Yes
Urban/Rural	2	**Urban**, Rural
Regular Medical Doctor	2	**Yes**, No
Organization/Resource		
Provinces	10	**Ontario**, 9 other provinces

Need		
Chronic Conditions	1	**Number**

Age was categorized into dummy variables due to its non-linear relationship with health care utilization. Marital status was derived based on differential effects on BMI across individuals who are married, single and individuals whose relationship ended (divorced/separated/widowed). Immigration status was derived as Canadian born, individuals who immigrated to Canada within the last 10 years, and individuals who immigrated to Canada 10 or more years ago. This categorization was chosen to maintain parsimoniousness and consistency with the some of the previous literature. Education was categorized into four levels: less than high school, graduate of secondary school/not completed post-secondary education, diploma/certificate and bachelor's degree or higher. This formulation likely better captures the benefits of education, which occurs with credentials rather than years of schooling (180). This formulation of education has been used in previous studies using the NPHS and CCHS (181, 182).

Type of smoker and type of drinker were derived in accordance with Statistics Canada's derivation with the exception of collapsing former smoker categories, separating daily smokers into light and heavy smokers, and separating regular drinkers into regular drinkers who engaged in binge drinking at least once in the previous year and regular drinkers who did not (183). Former smoker categories were collapsed in order to improve consistency over time as the derivation of former occasional smoker changed between the first two surveys (183,184). An additional category was used for smoking status to separate light and moderate/heavy smokers due to worse health outcomes for smokers of greater intensity and possible differential effects on body mass index as discussed in the conceptual framework. The definition of light/moderate/heavy smokers is arbitrary and the cut-points used across studies are inconsistent (185). In this study, the cut point for light smokers is based on the definition provided by Health Canada (<10 cigarettes per day), which has been used in Canadian surveillance studies (181, 186). Additional categories were used to separate regular drinkers who engage in binge drinking and regular drinkers who do not engage in binge drinking due to the possible differential effects on health and weight outcomes as discussed in the conceptual framework.

Provinces were treated as distinct units as the prevalence of obesity, access, utilization and equity of utilization have all been shown to vary even within regions (88, 124). Urban/rural was derived by Statistics Canada based on characteristics of the Enumeration Area in the previous census. An area is considered urban if it is a continuously built-up (i.e. no discontinuities exceeding 2 km) with a population concentration of 1,000 or more and a population density of 400 or more per square km (179).

Statistics Canada provides an Income Adequacy variable based on total household income and household size. However, this variable was not used in this analysis. The rationale for this decision was that Income Adequacy uses values of income defined in 1994-5 to generate income adequacy categories and the income values used to generate these categories was not updated (183, 184). As a result individuals will artificially move up the income adequacy categories over time. In addition, the income categories over time are inconsistent such that grouping income would not be feasible. Instead, equivalized household income was used as it has the advantage of taking into account the size of the household while also maintaining relative order of income categories over time (187, 188). Although there are multiple derivations, a commonly used derivation is calculated as total household income divided by the square root of household size (187, 188). Individuals were then categorized into quintiles due to the typical non-linear relationship between household income and health outcomes and to maintain order of income over time, as equivalized household income levels increased over time. If a continuous value for household income was available this value was used. For all cases in 1996-7 and a small percentage of cases in 2000-1 and 2009-10, only a categorical and no continuous total household income estimate was available. For these cases, a random number was generated within the interval of the category. For individuals in the highest category, the median value from the Survey of Labour and Income Dynamics for each province and closest year available (1996 for 1996-7, 2000 for 2000-1, and 2007 for 2009-10) was used to specify an income value (179, 184). This is the methodology that Statistics Canada uses to generate continuous household income values for those with a category in its derivation of the Household Income Ratio (179). The Household Income Ratio is the household income variable that replaced Income Adequacy, although it was

not used for this study as the size of the community which is required to calculate it was not available for the first two surveys.

4.3 Statistical Models

As discussed in Chapter 2, Andersen's framework recognizes that the propensity to use health care and intensity of utilization for those with at least some use are two distinct processes (42). Chapter 2 also discussed how many of the variables could differentially affect these two processes. In order to account for this, a two-part modeling strategy will be used. This method is commonly used in the literature to investigate health care utilization and involves a binary regression model to investigate the decision to use (propensity) and an appropriate regression model that can model the amount of care used for those with at least one use (intensity) (71, 92). Consistent with the theoretical arguments presented in Chapter 2, appropriate statistical models are chosen to estimate the following equations; equations 1-3: propensity to seek health care (use of FP/GP, Specialist and Hospital) = f(P, E, N, RMD, Obesity, T, Obesity*T) and equations 4-6: intensity of utilization (counts of FP/GP, Specialist and Hospital visits) = f(P, E, N, RMD, Obesity, T, Obesity*T). In these equations, f refers to the function operator, P is a vector of predisposing variables including age, sex, immigration, marital status, education, smoking and alcohol consumption, E is a vector of enabling variables including income, wealth (home ownership), urban/rural, and regular medical doctor, O is a measure of health care organization/resources (province of residence), N is a measure of need (the number of chronic conditions), and T refers to time periods. The statistical model to estimate equations 1-3 is the Poisson regression model and the statistical model to estimate equations 4-6 is the zero truncated Poisson regression model. The rationale for choosing these statistical models is discussed in the following paragraphs.

The first part in this study will be modeled with the use of Poisson regression for survey data. When outcomes are rare, the estimated OR approximates closely the RR (189). However, when outcomes are common, the estimated OR provides a poor approximation of the RR and may even produce large estimates when the RR is small (189). Poisson regression can produce unbiased estimates of the RR, which allow for direct discussion of the risk of individuals to use specific types of services rather than the odds, resulting in

simpler and more policy relevant interpretation of results. However, the confidence intervals may be too conservative since the variance of the Poisson distribution is greater than that of the binomial distribution (190). This can be resolved with robust estimation with a sandwich estimator or with bootstrapping that provides correct variance estimates (190, 191).

The second part in this study will be modeled with the use of zero-truncated Poisson regression model. Among those with at least one visit/admission, the amount of health care an individual uses can only be positive and is highly skewed. While most individuals have low levels of utilization, typically there is a small proportion of individuals who consume large amounts of health care. Due to these distributional features, a count model such as Poisson regression is often used (192). However, there are two problems with the basic Poisson regression for positive health care counts. First, there is often a problem with over-dispersion which occurs when the variance is greater than the mean (192). Over-dispersion indicates correlation in the data or that there is excess variation between response counts (192). This occurs with health care data as one visit can lead to additional follow up events, such that events are not completely independent (192). Over-dispersion can affect model fit and the underestimation of the standard error of parameter estimates (192). The Negative Binomial regression model relaxes the distributional assumption regarding over-dispersion by including another component in the variance function (192). As a result, the use of negative binomial regression typically improves model fit and provides more accurate estimates of standard error for parameters (192). Even though the negative binomial model relaxes some assumptions of the Poisson model, it still has other distributional assumptions including a non-zero probability of obtaining a zero (192). Since the second part will exclude 0 counts, a zero-truncated regression model is necessary (192). However, a zero-truncated negative binomial regression model failed to converge for most of the analyses conducted in this thesis. This is may be due to over fitting sparse nature of outcome data. Instead, zero-truncated Poisson regression will be used with bootstrap and robust variance estimation as the best alternative model specification (192, 193).This is accomplished with the “svy command” of STATA which by default uses robust (Eicker-Huber-White heteroskedastic-consistent)

standard errors (194). Bootstrapping method of variance estimation accounts for the survey design feature and it will be discussed in section 4.6.

4.4 Primary Analyses

The primary analysis involved estimating multivariable models to examine the association between obesity and the propensity to use and the intensity of utilization of health care in each survey year. Subsequently, all surveys were pooled and dummies for 2000-1 and 2009-10 were included to explore the overall time trend. Then the interaction terms between year and BMI category was included to explore differences in time trends across BMI categories. Period effects were categorized into dummies to relax assumptions of linearity over time. Through inclusion of dummies in the regression model, the time trend between 1996-7 and 2000-1 and 1996-7 and 2009-10 were examined. Further tests were conducted to analyze the difference from 2000-1 to 2009-10 and determine the specific time period during which any changes occurred. RRs for propensity to use health care and IRRs for intensity of utilization of health care were presented. Data preparation and analyses were conducted with Stata 11 software package. The “svy poisson” and “svy ztp” commands of Stata were used for the analysis of contact decision and the intensity of health care utilization decision, respectively.

4.5 Secondary Analyses

4.5.1 Controlling for the number of chronic conditions

Including the number of chronic conditions in the regression will help determine their importance in determining the association between obesity and health care utilization over time. Chronic conditions that are available in all surveys, highly consistent in wording, and for which the age range of applicable respondents would only require a minimal number of individuals being set from the Not Applicable category to the No category were included. These included asthma, arthritis, back problems, high blood pressure, diabetes, heart disease, cancer, stroke, stomach or intestinal ulcers, migraine headaches, urinary incontinence and Alzheimer’s disease. A previous systematic review demonstrated that simple counts of the number of chronic conditions is the most common measure of co-morbidity in primary care research measuring disease burden and

comparable to more complex measures of co-morbidity (195). Therefore, the total number of chronic conditions will be included in the regression.

4.5.2 Stratification across age and sex

Stratification across other characteristics will help identify which individuals in the population may be most greatly affected by any potential changes in these relationships. Analyses will be further stratified across age (less than 65 years, 65 or more years) and sex. Obesity has been shown to have differential impacts on different health outcomes for people of different age groups, with older individuals experiencing decreased mortality but increased demand for health care due to obesity (55, 154). This could possibly be due to physiological changes associated with age such as changes in fat distribution or differential timing of becoming obese and accumulated exposure to obesity, as older individuals may have been living with obesity for longer (196). As the prevalence of obesity has risen differentially across age groups, it is possible that any changes over time in the relationship between obesity and health care utilization may differ across age cohorts (19). The age cut-off to define older persons is arbitrary (~55-65) but given the importance of age 65 years as a cut-point in defining patients in health care (elderly/non-elderly), this value was chosen (55, 197). In addition, it has been demonstrated that there are differences in how obesity affects males and females, with greater costs in females (55). This could be due to higher prevalence of more severe forms of obesity or physiological differences across males and females, such as hormonal differences and different responses to obesity like inflammation (198). Therefore, this study will also investigate whether period effects may differ for males and females.

4.5.3 Sensitivity analysis with missing income included

Missing data are presented in Table A. 6. Individuals who are missing on any confounder were excluded from this sample as the sample size is large and missingness of observations was minimal for most confounders. Inclusion of a missing indicator in the regression models may introduce unknown bias (199). However to explore how sensitive the results are to missing on income, I conducted a sensitivity analysis where individuals

missing on income (the variable with the greatest amount of missing observations in any year) were included as a separate dummy in the regression.

4.6 Weighting/Bootstrapping

Due to the multi-stage cluster design of these surveys both proper weighting and bootstrapping are required to derive correct estimates with appropriate standard deviations/CIs/p-values. Since individuals are not chosen randomly, each individual has a different probability of being selected for inclusion into the survey (173). As a result, sampling weights that represent the inverse of the probability of inclusion are needed and allow for unbiased estimation of parameters that are representative of the population of interest (173). Sampling weights provided by Statistics Canada will be included in all analyses.

Since individuals are chosen non-randomly from strata and clusters, they are not truly independent, which will result in underestimation of standard errors (172-174, 200). In order to calculate correct variances ("design-based variance estimates"), analyses must account for stratification, cluster sampling and the probability of inclusion, which are called design effects (200). However, for purposes of maintaining confidentiality, this design information is not provided to users of Statistics Canada data sets (201). Instead, bootstrap weights are provided that allow for estimates of the variance that are close to exact (201). These bootstrap weights are calculated by randomly sampling with replacement from clusters within each stratum of the survey (201). This is done repeatedly (equal to the number of bootstrap samples N) and weights are recalculated for each sample (201). When a parameter is estimated, it is done repeatedly with each of these sample bootstrap weights and the variance of the N estimates is the estimate of the variance of the point estimate of interest (N = 500 times in accordance with Statistics Canada) (201, 202). Application of bootstrap weights will not affect parameter estimates, but will allow for more accurate estimates of variance, standard errors, confidence intervals and p-values (202). Application of bootstrap weights typically increases variance and typically affects inferences when the results are marginally significant (202). Bootstrap weights are applied using the "vce (bootstrap)" option under the

"svyset" command (202). By using the "svy" prefix at the beginning of all estimation commands, both sampling weights and bootstrapping will be applied (202).

Chapter 5

5 Results

This chapter begins with an examination of the trends in the prevalence of each BMI category over time followed by a presentation of the descriptive characteristics of the full sample, normal weight respondents, and individuals living with obesity. This is followed by in-depth analyses of the results of propensity to use (first part) and the intensity of utilization (second part) for each of hospital admissions, FP/GP visits and specialist visits. Finally, each sub-section presents a description of the relationship between all other confounders and the given outcome.

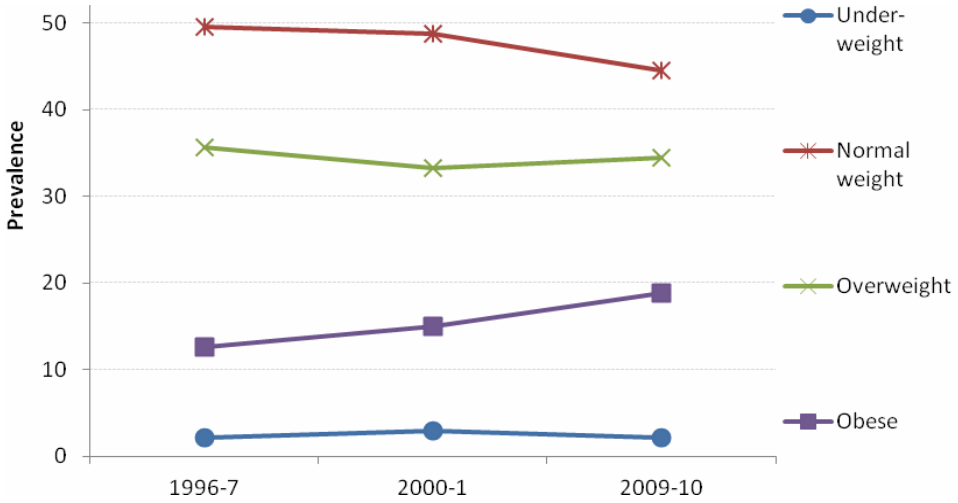
5.1 Descriptive Statistics

After exclusion criteria were applied, 49,962 respondents in 1996-7, 98,774 respondents in 2000-1, and 87,452 respondents in 2009-10 were available for analysis.

5.1.1 Overall Population

Between 1996-7 and 2009-10, there was a 49% increase in the prevalence of obesity, a 10% decrease in the prevalence of normal weight, and a 3% decrease in prevalence of overweight (Figure 3, Table B. 1).

Figure 3: The prevalence of obesity, overweight, normal weight, and underweight during 1996-7 to 2009-10.



Over time, an increase in the average age of the population from 44.3 to 46.6 years and a decrease in the proportion of younger age groups (<44) from 56.5% to 46.9% were found (Table 4). The proportion of the population that is male and of different marital status categories remained similar over time, while the proportion of immigrant population increased from 18.3% to 23%. The proportion of the population with higher levels of education was increasing for a bachelor's degree (15.8% to 24.6%) and certificate/diploma (19.2% to 37.5%). The prevalence of daily heavy smokers decreased over time from 19.3% to 10.8% and former smokers increased from 30.5% to 41%. The prevalence of regular drinkers who binged at least once in the last year increased from 30.9% to 38.3%, while a decreases in the prevalence of occasional drinkers from 20.2% to 15.3% and non-drinkers from 20.7% to 17.7% were found. The proportion of individuals living in rural region was similar over time. The proportion of individuals without a regular medical doctor increased over the survey years from 13.4% to 15.7%. The mean equivalized household income increased (unadjusted for inflation) over the survey years and the proportion of the population who are homeowners increased from 71.4% to 73.7%. The proportion of the population living in the Atlantic Provinces, Quebec, and British Columbia decreased over time (52.8% to 45%) while the proportion living in Ontario and Alberta increased (40% to 48.7%). Finally, the proportion of individuals with at least one chronic condition increased from 44.1% to 51.8% and the average number of chronic conditions increased over time from 0.72 to 0.95.

Table 4: Descriptive Statistics (means or proportions) of variables by year of survey

	1996-7	***2000-1***	***2009-10***
		Mean/Proportion	
Predisposing			
Exposure			
Body Mass Index			
Body Mass Index (continuous)	25.21	25.52	26.15
Underweight	2.2	2.9	2.1
Normal weight (Ref.)	49.6	48.8	44.6
Overweight	35.7	33.3	34.5
Obesity	12.6	15	18.8
Other Predisposing Variables			
Age (years)			
Age (continuous)	44.3	44.9	46.6
Age 18 to24 (Ref.)	11.7	11.8	10.4
Age 25 to 34	20.5	18	17
Age 35 to 44	24.3	23.6	19.5
Age 45 to 54	17.2	19.5	21
Age 55 to 64	11.4	12.1	16.3
Age 65 to 74	9.3	9	9.4
Age 75 to 84	4.6	4.9	5.1
Age 85 +	1.1	1.1	1.3
Sex			
Male	50.5	50.3	51.3
Marital Status			
Married	63.8	64.8	65.8
Single (Ref.)	22.5	21.9	21.1
Divorced/widowed/separated	13.7	13.3	13.1
Immigration status			
Canadian born (Ref.)	81.7	78.6	77
Immigrant < 10 years	4.1	5.5	6.1
Immigrant ≥ 10 years	14.2	15.9	16.9
Education Level			
Less than secondary school (Ref.)	23.3	22.2	13.8
Secondary school	41.7	28.8	24.1
Diploma/Certificate	19.2	31	37.5
Bachelor's Degree	15.8	18	24.6
Smoking Status			
Never Smoker (Ref.)	40	32.8	36.9
Former Smoker	30.5	39.6	41
Occasional Smoker	3.8	4.5	5
Light Daily Smoker	6.4	6.6	6.4
Heavy Daily Smoker	19.3	16.6	10.8
Alcohol Consumption			
Regular Drinker – Non Binge	28.2	29	28.8
Regular Drinker – Binge	30.9	33.2	38.3

Occasional Drinker	20.2	19	15.3
Non-Drinker (Ref.)	20.7	18.8	17.7
Enabling Variables			
Urban/Rural			
Rural	17.7	17.8	17.9
Regular Medical Doctor			
No	13.4	16.4	15.7
Equivalized Household Income			
Income (continuous)	27561	35231	48994
Income_q1(Ref.)	20	20	20
Income_q2	20	20.8	20.7
Income_q3	20	20.5	20.5
Income_q4	20	20	19.8
Income_q5	20	18.8	18.9
Home Ownership			
Homeowner	71.4	70.3	73.7
Organization/Resource Variable			
Province			
Newfoundland	2.2	1.9	1.7
Prince Edward Island	0.5	0.4	0.4
Nova Scotia	3.6	3.1	2.9
New Brunswick	3.1	2.5	2.4
Quebec	28.2	25.4	24.6
Ontario(Ref.)	31.9	38.5	38.3
Manitoba	3.6	3.5	3.4
Saskatchewan	3.5	3	2.8
Alberta	8.1	9.3	10.4
British Columbia	15.2	12.4	13
Need			
Chronic Conditions			
Prevalence (1+)	44.1	49.3	51.8
Average Count	0.72	0.85	0.95

5.1.2 Normal Weight and Individuals Living with Obesity

The descriptive characteristics of individuals who are normal weight and individuals living with obesity are shown in Table 5. During 1996-7 to 2009-10, the average BMI for normal weight individuals remained the same while it increased by 0.8 kg/m^2 among individuals living with obesity. Over time there was an increase in the average age of normal weight individuals from 41.8 to 44.1 years and individuals living with obesity from 47.2 to 48.7 years. The proportions of male and of different marital status categories were similar over time for both normal weight and obesity categories. The proportion of the normal weight population who are immigrants increased across this time period from

19.2% to 25.3%, while for individuals living with obesity this proportion remained similar over time. For normal weight individuals the proportion of respondents with a bachelor's degree and certificate/diploma increased over time (19.3% to 35.6%, 18 to 29.1% respectively); the corresponding proportions for individuals living with obesity also increased (19.7% to 40.9%, 10.7% to 16.2% respectively). The proportion of daily heavy smokers decreased from 19.7% to 10.7% and 17.6% to 11.5% for normal weight and individual living with obesity respectively; the proportion of former smokers increased from 27% to 37.2% and 35.5% to 46.4% among normal weight individuals and individuals living with obesity, respectively. The proportion of regular drinkers who binged at least once in the last year increased from 30.7% to 37.9% for normal weight individuals and 26.3% to 36.6% for individuals living with obesity. The proportion of occasional drinkers and non-drinkers decreased among normal weight individual and those living with obesity from 39.6% to 31.8% and 50.8% to 38.5%, respectively. The proportion of the population living in rural region was similar over time. The proportion of individuals without a regular medical doctor increased from 15.2% to 18% for normal weight individuals and from 10.6% to 12.4% for individuals living with obesity. The proportion of normal weight individuals was similar across income quintiles in all years. However, the proportion of individuals living with obesity in lower income quintiles decreased from 24.4% to 21.4%. The proportion of respondents who were homeowners was similar over time. Over time, the proportion of normal weight respondents are living in Atlantic provinces, Quebec and British Columbia declined (53.8% to 46.3%) whereas those residing in Ontario and Alberta increased (40.1% to 48.4%). Similarly, over time a smaller proportion of individuals living with obesity are living in Atlantic provinces, Quebec and British Columbia (50.8% to 43.2%) and a higher proportion of individuals are living in Ontario and Alberta (39.6% to 49.4%). The prevalence of at least one chronic condition and the average number of chronic conditions increased for normal weight individuals (38.7% to 44%, 0.60 to 0.73 respectively) and individuals living with obesity (56.2% to 66.9%, 1.06 to 1.41 respectively).

Table 5: Descriptive Statistics (means or proportions) of variables by BMI categories and year of survey

	(1) NW	*(1) OB*	*(2) NW*	*(2) OB*	*(3) NW*	*(3) OB*
			Mean/Proportion			
Predisposing						
Exposure						
Body Mass Index						
Body Mass Index (continuous)	22.20	33.31	22.34	33.69	22.39	34.12
Other Predisposing Variables						
Age (years)						
Age (continuous)	41.84	47.24	42.86	47.17	44.12	48.70
Age 18 to24	16.3	4.9	16.1	5.8	14.8	5.5
Age 25 to 34	22.5	17.6	19.8	16.2	19.9	14.5
Age 35 to 44	24.9	24	23.7	23.6	19.4	20.2
Age 45 to 54	14.3	22.6	16.9	24.1	18.7	23.8
Age 55 to 64	9	15.6	9.7	15.3	13.3	20.1
Age 65 to 74	7.3	11.2	7.7	10.4	7.5	11
Age 75 to 84	4.3	3.8	4.9	3.9	5	4.2
Age 85 +	1.4	0.2	1.2	0.6	1.5	0.7
Sex						
Male	42.4	52.5	44.8	52.5	43.4	54.6
Marital Status						
Married	58.7	69.8	60.3	67.9	60.8	69.9
Single (Ref.)	27.8	15	26.6	17.2	26.2	16.8
Divorced/widowed/separated	13.5	15.1	13	14.8	13	13.3
Immigration status						
Canadian born (Ref.)	80.8	84.4	77.3	83.4	74.7	83.2
Immigrant < 10 years	5.2	3	7.1	2.3	7.6	3.2
Immigrant ≥ 10 years	14	12.6	15.6	14.4	17.7	13.6
Education Level						
Less than secondary school (Ref.)	19.9	30.9	19.2	28.3	11.6	17.4
Secondary school	42.8	38.8	29.7	27.5	23.7	25.5
Diploma/Certificate	19.3	19.7	30.4	32.3	35.6	40.9
Bachelor's Degree	18	10.7	20.6	11.9	29.1	16.2
Smoking Status						
Never Smoker (Ref.)	41.4	39.1	34.1	30.7	39.3	33.2
Former Smoker	27	35.5	36	45.2	37.2	46.4
Occasional Smoker	4.3	2.7	5	3.6	5.6	3.7
Light Daily Smoker	7.5	5.1	7.8	4.4	7.2	5.2
Heavy Daily Smoker	19.7	17.6	17.1	16	10.7	11.5
Alcohol Consumption						
Regular Drinker – Non	29.7	22.8	30.4	24.8	30.2	24.9

Binge						
Regular Drinker – Binge	30.7	26.3	33.8	29.8	37.9	36.6
Occasional Drinker	19.9	25.2	17.8	23.4	14.2	20
Non-Drinker (Ref.)	19.7	25.6	18	22	17.6	18.5
Enabling Variables						
Urban/Rural						
Rural	16.4	20.7	16.1	21.2	15.8	22.1
Regular Medical Doctor						
No	15.2	10.6	18.2	12.2	18	12.4
Equivalized Household Income Quintile						
Income (Continuous)	27670	25657	35289	33226	49159	47833
Income_q1(Ref.)	20	24.4	19.9	22.5	19.8	21.4
Income_q2	19.6	21.2	20.4	22.2	20.7	20.4
Income_q3	19.6	19.7	20.3	19.5	20.2	21.2
Income_q4	20.6	17.6	20.3	19	19.9	19.5
Income_q5	20.3	17.1	19	16.8	19.4	17.5
Home Ownership						
Homeowner	69.2	72.8	68.5	71.1	71.7	74.4
Organization/Resource Variable						
Province						
Newfoundland	1.9	2.9	1.5	2.6	1.3	2.6
Prince Edward Island	0.4	0.6	0.4	0.5	0.4	0.5
Nova Scotia	3	5.5	2.7	4.3	2.4	4
New Brunswick	2.4	4.5	2.1	3.3	1.8	3.7
Quebec	29.5	24.8	27.1	21.6	25.5	22.6
Ontario(Ref.)	32.2	31.9	37.8	38.9	38.2	38.5
Manitoba	3.2	4.6	3.3	4.3	2.8	4.3
Saskatchewan	2.9	5	2.7	3.9	2.5	3.3
Alberta	7.9	7.7	9.1	10	10.2	10.9
British Columbia	16.6	12.5	13.4	10.5	14.9	9.8
Need						
Chronic Conditions						
Prevalence (1+)	38.7	56.2	43.5	63.4	44	66.9
Average Count	0.60	1.06	0.70	1.27	0.73	1.41

Note: NW = Normal Weight, OB = Obesity, (1) = 1996-7, (2) = 2000-1, (3) = 2009-10

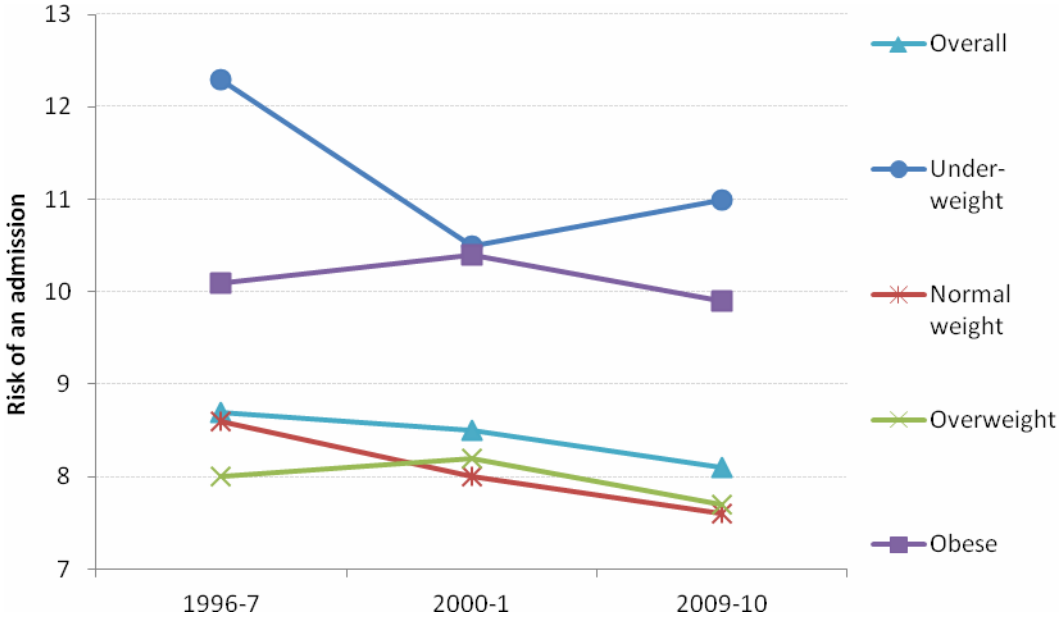
5.2 Utilization of Hospital Care

5.2.1 Hospital Utilization – Propensity

5.2.1.1 Trends over time in the risk of a hospital admission

The risk of a hospital admission by BMI category and year is shown in Figure 4. In the full sample, there was a 6% decline in hospitalizations from 1996-7 to 2009-10 ($p < 0.10$) (Table B. 3). However, looking at the RRs across BMI categories, I find that only normal weight individuals experienced a decline in the risk of a hospital admission by 12% ($p < 0.05$).

Figure 4: The risk of a hospital admission by BMI category and year.



5.2.1.2 Trends in the relationship between obesity and the risk of hospital admission

Obesity was positively associated the risk of a hospital admission with 19% and 27% greater risk among individuals living with obesity in 2000-1 and 2009-10, respectively ($p < 0.01$) relative to normal weight individuals (Table 6). After controlling for the number of chronic conditions, the association between obesity and the risk of a hospital admission was attenuated and in no year did the association remain statistically significant.

In pooled multivariable analysis, there were no statistically significant differences over time in the risk of a hospital admission relative to 1996-7 with or without adjusting for chronic conditions (Table 7). In addition, there were no differences in the RR for the association between obesity and the risk of a hospital admission between any two pairs of years) as demonstrated by statistically insignificant year and obesity interaction terms individually. Results were not changed after adjusting for chronic conditions.

In normal weight individuals aged 65 years and older, there was a decrease of 18% in the risk of a hospital admission in 2009-10 relative to 1996-7 ($P < 0.05$) (Table 8). In all other stratified analysis, both the trends over time for normal weight individuals and differences in the RR over time for the association between obesity and the risk of a hospital admission were not statistically significant. The conclusion of the primary analysis was not sensitive to the inclusion of respondents with missing values on income (Table D. 1) or to robust variance estimation procedure. These findings do not agree with the hypothesis that the relationship between obesity and the risk of a hospital admission would decrease over time.

Table 6: The association between obesity and the risk of a hospital admission: multivariable Poisson regressions

Year	***1996-7***	***2000-1***	***2009-10***
	RR (95% CI)	RR (95% CI)	RR (95% CI)
Obesity	1.08	1.19***	1.27***
	(0.889 - 1.311)	(1.102 - 1.286)	(1.154 - 1.392)
Obesity and Chronic Conditions	0.94	1.01	1.06
	(0.773 - 1.148)	(0.931 - 1.089)	(0.965 - 1.166)
Observations	49962	98774	87452

Note: the full models are in Table C. 1 and Table C. 2. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Trends in the risk of a hospital admission: pooled multivariable Poisson regressions

	Pooled W/O Interaction Terms RR (95% CI)	***Pooled W/O Interaction Terms and Chronic Conditions*** RR (95% CI)	***Pooled W/ Interaction terms*** RR (95% CI)	***Pooled W/ Interaction terms and Chronic Conditions*** RR (95% CI)
Obesity	1.18***	1.01	1.10	0.98
	(1.104 - 1.27)	(0.937 - 1.079)	(0.912 - 1.320)	(0.813 - 1.171)
2000-1	1.01	0.97	0.97	0.94
	(0.948 - 1.085)	(0.911 - 1.041)	(0.874 - 1.078)	(0.851 - 1.047)
2009-10	1.02	0.95	0.97	0.93
	(0.95 - 1.094)	(0.884 - 1.019)	(0.869 - 1.081)	(0.829 - 1.034)
2000-1×Obesity			1.10	1.05
			(0.908 - 1.334)	(0.872 - 1.273)
2009-10×			1.12	1.04
Obesity			(0.918 - 1.376)	(0.849 - 1.264)
Observations	236188	236188	236188	236188

Note: the full models are in Table C. 1 and Table C. 2. *** p<0.01, ** p<0.05, * p<0.1

Table 8: Trends in the risk of a hospital admission: stratified pooled multivariable Poisson regressions

	Age ≤ 64 years RR (95 % CI)	***Age ≥ 65 years*** RR (95 % CI)	***M ale*** RR (95 % CI)	***Female*** RR (95 % CI)
Obesity	1.10	1.13	0.92	1.24**
	(0.885 - 1.375)	(0.803 - 1.586)	(0.675 - 1.263)	(1.003 - 1.543)
2000-1	1.00	0.90	0.94	1.00
	(0.888 - 1.135)	(0.755 - 1.082)	(0.758 - 1.160)	(0.896 - 1.125)
2009-10	1.04	0.82**	0.94	1.00
	(0.913 - 1.178)	(0.678 - 0.993)	(0.756 - 1.163)	(0.893 - 1.121)
2000-1×Obesity	1.13	1.03	1.26	1.03
	(0.895 - 1.420)	(0.709 - 1.496)	(0.902 - 1.772)	(0.809 - 1.300)
2009-10×	1.15	1.07	1.30	1.04
Obesity	(0.899 - 1.460)	(0.740 - 1.539)	(0.919 - 1.837)	(0.824 - 1.305)
Observations	185144	51044	111642	124546

Note: the full models are in Table C. 3. *** p<0.01, ** p<0.05, * p<0.1

5.2.1.3 Relationship between other confounders and the risk of a hospital admission

Compared to adults aged 18-24 years, adults between 35-64 years of age had lower risk of a hospital admission while adults 75-84 years had a higher risk in 2000-1 (Table C. 1).

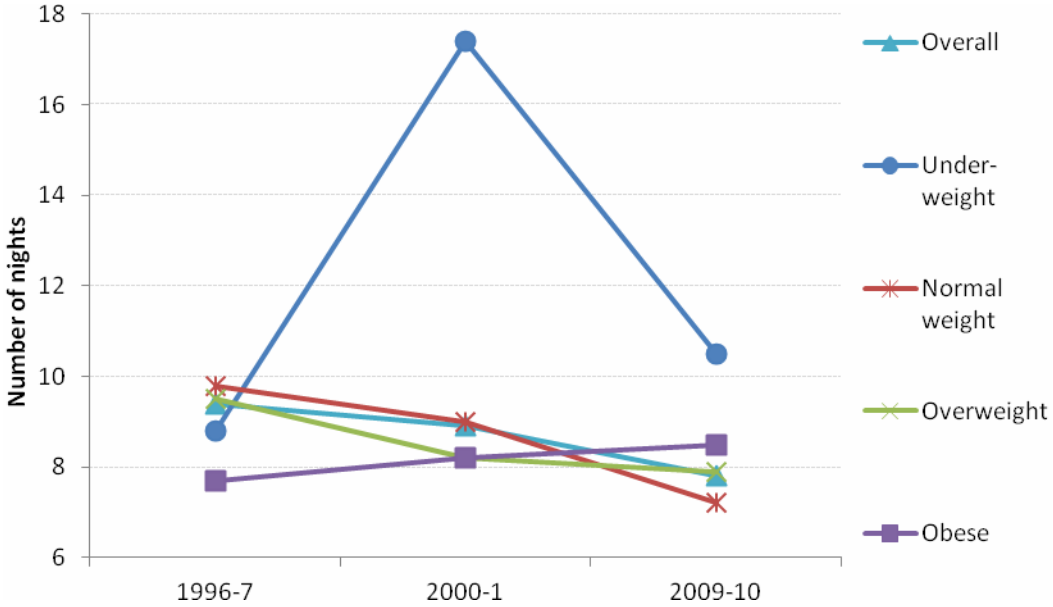
Adults aged 85 years and older had higher risk of hospital admission in 2000-1 and 2009-10. Male sex was negatively associated with the risk of a hospital admission. Being married and widowed/separated/divorced was positively associated with the risk of a hospital admission compared to singles. Recent immigrant status (i.e. immigrated to Canada within last 10 years) was negatively associated with risk of a hospital admission in 2000-1 and 2009-10, while long-term immigrant status (i.e. immigrated to Canada 10 or more years ago) was negatively associated with the risk in 2000-1. There was no association between education and the risk of a hospital admission except secondary education which was negatively associated with the risk in 2000-1. Compared to never smoking, former smoking, current light and heavy daily smoking were positively associated with the risk of a hospital admission in all years, while occasional smoking was positively associated with the risk in 2009-10. Alcohol consumption was negatively associated with the risk of an admission to hospital in all years. Living in a rural region was not associated with the risk of a hospital admission, while not having a regular medical doctor was negatively associated with the risk. There was a negative association between quintiles of equivalized household income and the risk of a hospital admission in 2000-1 and 2009-10, but not 1996-7. Similarly, home-ownership was negatively associated with the risk of a hospital admission. Compared to living in Ontario, living in New Brunswick and Quebec was positively associated with the risk in all years while living in Prince Edward Island, Saskatchewan and Alberta was positively associated with the risk in 2000-1 and 2009-10.

5.2.2 Hospital Utilization – Intensity

5.2.2.1 Trends over time in the intensity of utilization of hospital nights

The intensity of utilization of hospital nights by BMI category and year is shown in Figure 5. Although a 16% decline ($p < 0.10$) in the number of nights spent as an inpatient from 1996-7 to 2009-10 was observed in the full sample, analysis by BMI category revealed that only normal weight individuals experienced a decline of 26% ($p < 0.05$) (Table B. 5).

Figure 5: Intensity of utilization of hospital nights by BMI category and year



5.2.2.2 Trends in the relationship between obesity and the intensity of utilization of hospital nights

Obesity was negatively associated with the intensity of utilization of hospital nights with 33% ($p < 0.05$) and 14% ($p < 0.05$) less nights spent in the hospital by individuals living with obesity in 1996-7 and 2000-1, respectively relative to normal weight individuals (Table 9). In 2009-10, the corresponding association was statistically insignificant. When the number of chronic conditions variable was included in the model, obesity was associated with 39% ($p < 0.01$) and 22% ($p < 0.01$) less nights spent in the hospital in 1996-7 and 2000-1, respectively.

In pooled multivariable analysis, without adjusting for chronic conditions, there were no statistically significant differences over time in the intensity of utilization of hospital nights among the overall population. However, after adjustment for chronic conditions, there was an18% ($p < 0.1$) reduction between 1996-7 and 2009-10 (Table 10). Normal weight individuals did not experience a difference between 1996-7 and 2000-1 in the intensity of hospital utilization, but did experience a decrease of 22% between 1996-7 and 2009-10 ($p < 0.10$). This was due to a decline between 2000-1 and 2009-10 ($p <$

0.05). The differences in the IRR for the association between obesity and intensity of nights spent were not statistically significant between 1996-7 and 2000-1 or between 2000-1 and 2009-10. However, between 1996-7 and 2009-10, the association between obesity and the intensity of nights spent increased (ratio of IRR = 1.45, $p < 0.10$). Controlling for chronic conditions resulted in a 25% decline in hospital utilization among normal weight individuals ($p < 0.05$). The difference over time in the association between obesity and intensity of utilization of nights was not altered after the number of chronic conditions was controlled for.

In stratified analysis, normal weight individuals aged 65 years and older and females experienced a decline in the intensity of hospital utilization in 2009-10 by about 20% ($p<0.10$) and 29% ($p<0.10$), respectively (Table 11). The IRR for the association between obesity and intensity of nights spent increased over time only for women (ratio of IRR = 1.80, $p<0.05$). The inclusion of individuals missing on income resulted in a change of significance level from 10% to 5% but did not affect the IRRs for the association between obesity and intensity of nights over time (Table D. 2). The primary results were not sensitive to robust variance estimation procedure. Overall, these results do not agree with the hypothesis that the relationship between obesity and intensity of nights spent in the hospital would decrease over time.

Table 9: The association between obesity and the intensity of utilization of hospital nights: multivariable zero truncated Poisson regressions

	1996-7 (IRR, 95 % CI)	***2000-1*** (IRR, 95 % CI)	***2009-10*** (IRR, 95 % CI)
Obesity	0.67**	0.86**	1.08
	(0.474 - 0.951)	(0.737 - 0.998)	(0.823 - 1.414)
Obesity and Chronic Conditions	0.61***	0.78***	0.93
	(0.425 - 0.868)	(0.668 - 0.911)	(0.703 - 1.232)
Observations	4624	9792	8570

Note: the full models are in Table C. 4 and Table C. 5. *** p<0.01, ** p<0.05, * p<0.1

Table 10: Trends in the intensity of utilization of hospital nights: pooled multivariable Poisson regressions

	Pooled W/O Interaction Terms (IRR, 95 % CI)	***Pooled W/O Interaction Terms and Chronic Conditions*** (IRR, 95 % CI)	***Pooled W/ Interaction terms*** (IRR, 95 % CI)	***Pooled W/ Interaction terms and Chronic Conditions*** (IRR, 95 % CI)
Obesity	0.87*	0.78***	0.72**	0.65***
	(0.757 - 1.006)	(0.669 - 0.901)	(0.528 - 0.975)	(0.481 - 0.890)
2000-1	0.95	0.93	0.92	0.92
	(0.814 - 1.104)	(0.8 - 1.078)	(0.720 - 1.185)	(0.717 - 1.169)
2009-10	0.86	0.82**	0.78*	0.75**
	(0.724 - 1.032)	(0.69 - 0.977)	(0.594 - 1.012)	(0.578 - 0.975)
2000-1×Obesity			1.18	1.15
			(0.846 - 1.647)	(0.830 - 1.598)
2009-10×			1.45*	1.39*
Obesity			(0.982 - 2.153)	(0.947 - 2.042)
Observations	22986	22986	22986	22986

Note: the full models are in Table C. 4 and Table C. 5. *** p<0.01, ** p<0.05, * p<0.1

Table 11: Trends in the intensity of utilization of hospital nights: stratified pooled multivariable Poisson regressions

	Age ≤ 64 years (IRR, 95 % CI)	***Age ≥ 65 years*** (IRR, 95 % CI)	***M ale*** (IRR, 95 % CI)	***Female*** (IRR, 95 % CI)
Obesity	0.78	0.66	0.70*	0.72
	(0.571 - 1.066)	(0.371 - 1.165)	(0.467 - 1.046)	(0.452 - 1.142)
2000-1	1.01	0.86	1.01	0.87
	(0.789 - 1.300)	(0.563 - 1.312)	(0.721 - 1.421)	(0.637 - 1.195)
2009-10	0.80*	0.77	0.88	0.71*
	(0.626 - 1.024)	(0.492 - 1.217)	(0.619 - 1.256)	(0.498 - 1.004)
2000-1×Obesity	1.10	1.19	1.05	1.31
	(0.771 - 1.576)	(0.651 - 2.167)	(0.653 - 1.672)	(0.822 - 2.102)
2009-10×	1.36	1.52	1.15	1.80**
Obesity	(0.915 - 2.008)	(0.764 - 3.008)	(0.672 - 1.953)	(1.049 - 3.091)
Observations	15197	7789	8929	14057

Note: the full models are in Table C. 6. *** p<0.01, ** p<0.05, * p<0.1

5.2.2.3 Relationship between other confounders and the intensity of utilization of hospital nights

Adults aged 45 years and older had elevated number of nights spent in the hospital in all years with the exception of individuals 55-64 years in 1996-7 compared to adults aged 18-24 years (Table C. 4). Male sex was positively associated with hospital intensity in 2000-1. Widowed, separated and divorced status was negatively associated with the intensity of utilization in 1996-7 and 2000-1, while being married was negatively associated with the intensity in 2000-1 and 2009-10. Immigration status was unrelated to hospital intensity with the exception of long-term immigrant status that was negatively associated with the intensity in 2000-1. Education was not associated with the intensity of utilization of nights in any year. Urban status was not associated with intensity of hospital utilization, while having no regular medical doctor was negatively associated with intensity of nights. Income was not associated with the intensity of nights with the exception of the third quintile being negatively associated with intensity in 2000-1, while household ownership was not associated with the number of nights in any year. Province of residence was not associated with the intensity of hospital utilization.

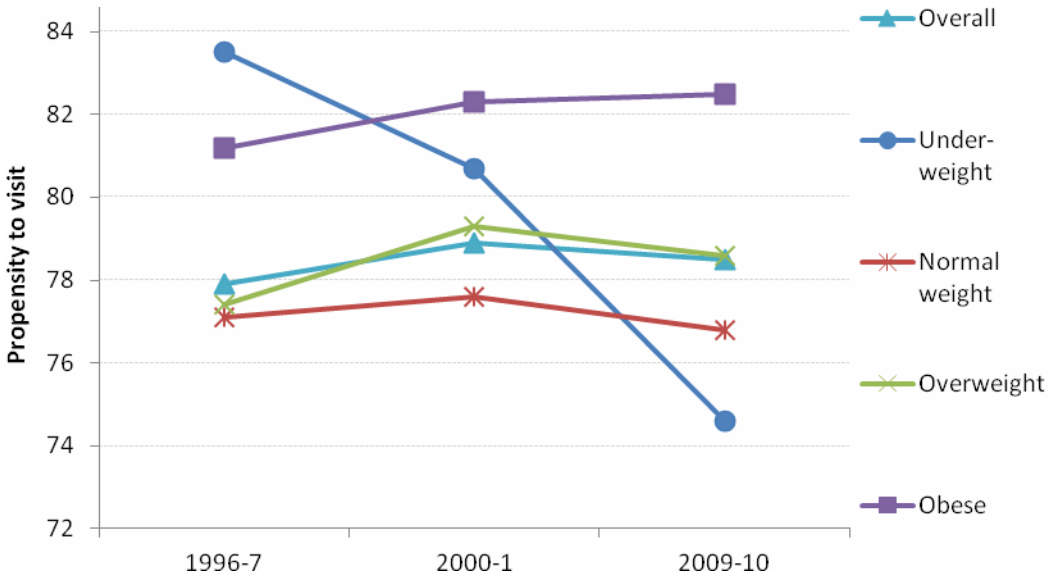
5.3 Family Physician/General Practitioner Visits

5.3.1 Family Physician/General Practitioner Visits – Propensity

5.3.1.1 Trends over time in the propensity to visit a FP/GP

The propensity to visit a FP/GP by BMI category and year is shown in Figure 6. In the full sample, there was a 1% increase in the propensity to visit a FP/GP in 2000-1 ($p < 0.05$) (Table B. 7). Across BMI categories, the propensity to visit a FP/GP among overweight individuals increased by about 2% in 2000-1 ($p < 0.05$) while among underweight individuals it decreased by 11% in 2009-10 ($p < 0.01$).

Figure 6: Propensity to visit a FP/GP by BMI category and year



5.3.1.2 Trends in the relationship between obesity and the propensity to visit a FP/GP

In all years, obesity was positively associated with 4% to 5% greater propensity to visit a FP/GP ($p < 0.05$) relative to normal weight (Table 12). Controlling for the number of chronic conditions attenuated these associations with the association remaining statistically significant only in 2009-10 by about 2% ($p < 0.01$) greater propensity to visit a FP/GP among individuals living with obesity.

In pooled multivariable analysis, there was a 2% increase ($p < 0.01$) between 1996-7 and 2000-1 in the propensity to visit a FP/GP, but no statistically significant differences between 1996-7 and 2009-10 was found (Table 13). For normal weight individuals, the difference between 1996-7 and 2009-10 was not statistically significant. However, the differences between 1996-7 and 2000-1, and 2000-1 and 2009-10 were both statistically significant at 1% level. The differences in the RR for the relationship between obesity and the propensity to visit a FP/GP between 1996-7 and 2000-1 or between 1996-7 and

2009-10 were not statistically significant. However, between 2000-1 and 2009-10 the association between obesity and propensity to visit a FP/GP decreased by 1% ($p < 0.05$).

Across age and sex strata, none of the corresponding associations were statistically significant (Table 14). The primary analyses were not sensitive to the inclusion of individuals missing on income (Table D. 3) or to robust variance estimation procedure. Overall, these results do not agree with the hypothesis that the relationship between obesity and propensity to visit a FP/GP would increase over time.

Table 12: The association between obesity and the propensity to visit a FP/GP: multivariable Poisson regressions

	1996-7 (RR, 95 % CI)	***2000-1*** (RR, 95 % CI)	***2009-10*** (RR, 95 % CI)
Obesity	1.04**	1.04***	1.05***
	(1.006 - 1.067)	(1.028 - 1.052)	(1.039 - 1.071)
Obesity and Chronic Conditions	1.01	1.01	1.02***
	(0.980 - 1.039)	(0.998 - 1.021)	(1.006 - 1.038)
Observations	49962	98774	87452

Note: the full models are in Table C. 7 and Table C. 8. *** p<0.01, ** p<0.05, * p<0.1

Table 13: Trends in the propensity to visit a FP/GP: pooled multivariable Poisson regressions

	Pooled W/O Interaction Terms (RR, 95 % CI)	***Pooled W/O Interaction Terms and Chronic Conditions*** (RR, 95 % CI)	***Pooled W/ Interaction terms*** (RR, 95 % CI)	***Pooled W/ Interaction terms and Chronic Conditions*** (RR, 95 % CI)
Obesity	1.04***	1.01**	1.01*	1.01
	(1.034 - 1.055)	(1.003 - 1.024)	(0.998 - 1.029)	(0.986 - 1.043)
2000-1	1.02***	1.01**	0.99	1.01
	(1.007 - 1.029)	(1 - 1.022)	(0.978 - 1.010)	(0.993 - 1.024)
2009-10	1.00	0.99*	1.00	0.99
	(0.989 - 1.012)	(0.979 - 1.001)	(0.971 - 1.032)	(0.972 - 1.004)
2000-1×Obesity			1.02	0.99
			(0.987 - 1.055)	(0.964 - 1.023)
2009-10× Obesity			1.01*	1.00
			(0.998 - 1.029)	(0.973 - 1.038)
Observations	236188	236188	236188	236188

Note: the full models are in Table C. 7 and Table C. 8. *** p<0.01, ** p<0.05, * p<0.1

Table 14: Trends in the propensity to visit a FP/GP: stratified pooled multivariable Poisson regressions

	Age ≤ 64 years (RR, 95 % CI)	***Age ≥ 65 years*** (RR, 95 % CI)	***M ale*** (RR, 95 % CI)	***Female*** (RR, 95 % CI)
Obesity	1.04**	1.04*	1.03	1.05***
	(1.005 - 1.074)	(0.996 - 1.077)	(0.979 - 1.087)	(1.017 - 1.080)
2000-1	1.01	1.01	1.03	1.01
	(0.996 - 1.032)	(0.987 - 1.035)	(0.995 - 1.057)	(0.992 - 1.025)
2009-10	0.99	1.01	1.00	0.99
	(0.971 - 1.009)	(0.988 - 1.035)	(0.970 - 1.034)	(0.975 - 1.013)
2000-1×Obesity	1.00	0.99	1.01	0.99
	(0.969 - 1.039)	(0.944 - 1.031)	(0.955 - 1.067)	(0.959 - 1.024)
2009-10×	1.02	1.00	1.05	0.99
Obesity	(0.986 - 1.065)	(0.957 - 1.044)	(0.986 - 1.109)	(0.954 - 1.028)
Observations	185144	51044	111642	124546

Note: the full models are in Table C. 9. *** p<0.01, ** p<0.05, * p<0.1

5.3.1.3 Relationship between other confounders and the propensity to visit a FP/GP

Compared to adults aged 18-24 years, respondents aged 65 years and older had higher propensity to visit a FP/GP in all years, while adults aged 55-64 years had greater propensity to visit a FP/GP in 2000-1 and 2009-10 (Table C. 7). Male sex was negatively associated with the propensity to visit a FP/GP, while being married was positively associated with the propensity to visit a FP/GP in all years. Immigration status was not associated with the propensity to visit a FP/GP. A bachelor's degree was positively associated with the propensity to visit a FP/GP in 2000-1 and 2009-10. Former smoking status was positively associated with the propensity to visit in all years, while current smoking status was not associated with the propensity to visit with the exception of being a current heavy smoker which was negatively associated in 2000-1. Current drinking status was not associated with the propensity. Living in a rural region and not having a regular medical doctor were both negatively associated with the propensity to visit a FP/GP. There was no association between income and propensity to visit a FP/GP except for income quintiles 4 and 5 having significantly elevated propensity in 2009-10. Homeownership was negatively associated with the propensity to visit a FP/GP in 2000-1

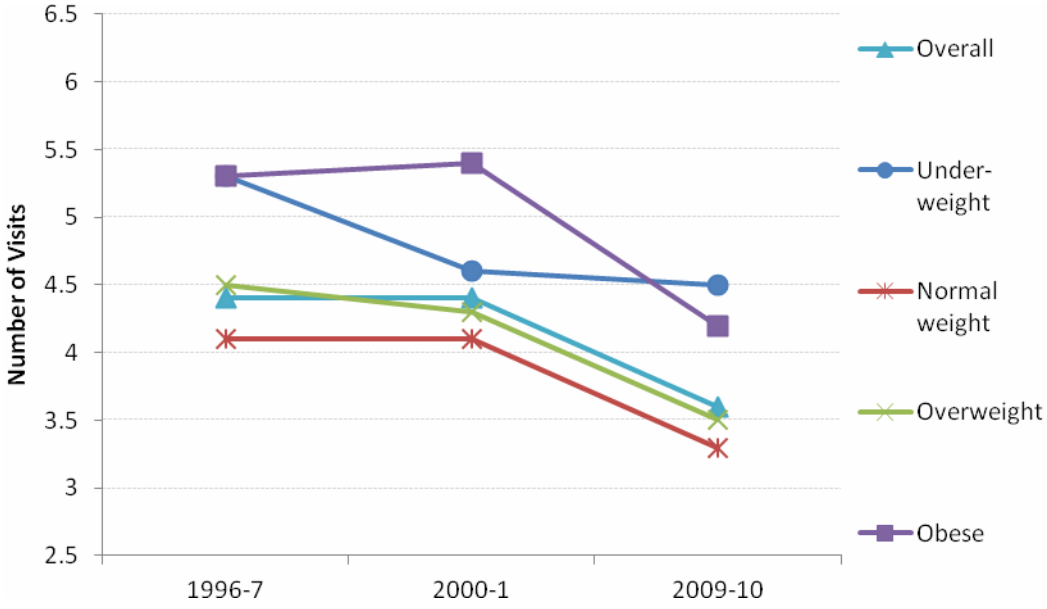
and 2009-10. Living in Quebec was negatively associated with the propensity to visit a FP/GP in all years, while living in Saskatchewan and British Columbia was positively associated with the propensity to visit a FP/GP in 2000-1 and 2009-10.

5.3.2 FP/GP Visits – Intensity

5.3.2.1 Trends over time in the intensity of visits to FP/GP

The intensity of visits to FP/GPs by BMI category and year is shown in Figure 7. Overall, the intensity of visits to FP/GPs did not differ between 1996-7 and 2000-1 ($p > 0.1$) but a 20% decline in 2009-10 ($p < 0.01$) relative to 1996-7 was found (Table B. 9). From 1996-7 to 2009-10, normal weight, overweight and individuals with obesity experienced a significant decline of 21-23 % ($p < 0.01$) visits to FPs/GPs while underweight individuals experienced a 16% decline in FP/GP visits ($p < 0.10$).

Figure 7: Intensity of visits to FP/GPs by BMI category and year



5.3.2.2 Trends in the relationship between obesity and the intensity of visits to FP/GP

In all years, obesity was positively associated with the intensity of visits to FP/GPs with greater utilization among individuals living with obesity in the range of 21-29% ($p < 0.01$) relative to normal weight individuals (Table 16). Controlling for the number of chronic conditions resulted in the association between obesity and the intensity of visits

to FP/GP association becoming statistically insignificant in 1996-7. Although attenuated, the associations between obesity and intensity of utilization remained statistically significant with 8% and 11% greater intensity of FP/GP utilization among individuals living with obesity in 2000-1 and 2009-10, respectively ($p < 0.01$).

In pooled multivariable analysis, the intensity of visits to FP/GPs decreased between 1996-7 and 2009-10 by about 23% and 19% with and without adjusting for chronic conditions, respectively ($p < 0.01$) (Table 17). For normal weight individuals, the intensity of visits to FP/GPs did not differ between 1996-7 and 2000-1 but there was an 18% decline in FP/GP visits between 1996-7 and 2009-10 ($p < 0.01$). This was due to a decline in the intensity of visits to FP/GPs between 2000-1 and 2009-10 ($p < 0.01$). The IRR for the association between obesity and intensity of visits to FP/GPs was not statistically significantly different between any two pairs of years.

Normal weight individuals in all age and sex strata experienced a decline of 14-31% ($p < 0.01$) visits to FPs/GPs (Table 18). Across age and sex strata, the association between obesity and intensity of visits to FP/GPs did not differ over time with the exception of adults 65 years and older where the IRR for the association between obesity and intensity of visits to FP/GPs increased over time (ratio of IRR = 1.24, $p < 0.01$). The primary analyses were not sensitive to the inclusion of individuals missing on income or to robust variance estimation procedure (Table D. 4). Overall, these results do not agree with the hypothesis that the relationship between obesity and intensity of visits to FP/GPs would increase over time.

Table 15: The association between obesity and the intensity of visits to FP/GP: multivariable zero truncated Poisson regressions

	1996-7 (IRR, 95 % CI)	***2000-1*** (IRR, 95 % CI)	***2009-10*** (IRR, 95 % CI)
Obesity	1.21***	1.26***	1.29***
	(1.107 - 1.334)	(1.203 - 1.316)	(1.234 - 1.355)
Obesity and Chronic Conditions	1.06	1.08***	1.11***
	(0.969 - 1.169)	(1.037 - 1.132)	(1.061 - 1.168)
Observations	40087	78983	70478

Note: the full models are in Table C. 10 and Table C. 11. *** p<0.01, ** p<0.05, * p<0.1

Table 16: Trends in the intensity of visits to FP/GPs: pooled multivariable zero truncated Poisson regressions

	Pooled W/O Interaction Terms (IRR, 95 % CI)	***Pooled W/O Interaction Terms and Chronic Conditions*** (IRR, 95 % CI)	***Pooled W/ Interaction terms*** (IRR, 95 % CI)	***Pooled W/ Interaction terms and Chronic Conditions*** (IRR, 95 % CI)
Obesity	1.26***	1.09***	1.23***	1.10**
	(1.217 - 1.303)	(1.052 - 1.127)	(1.126 - 1.343)	(1.011 - 1.203)
2000-1	0.99	0.96**	1.01	0.98
	(0.95 - 1.031)	(0.919 - 0.996)	(0.960 - 1.058)	(0.938 - 1.032)
2009-10	0.81***	0.77***	0.82***	0.79***
	(0.781 - 0.85)	(0.734 - 0.797)	(0.775 - 0.862)	(0.748 - 0.831)
2000-1×Obesity			1.03	1.00
			(0.936 - 1.133)	(0.906 - 1.095)
2009-10×			1.03	0.96
Obesity			(0.935 - 1.145)	(0.870 - 1.065)
Observations	189548	189548	189548	189548

Note: the full models are in Table C. 10 and Table C. 11. *** p<0.01, ** p<0.05, * p<0.1

Table 17: Trends in the intensity of visits to FP/GPs: stratified pooled multivariable zero truncated Poisson regressions

	Age ≤ 64 years (IRR, 95 % CI)	***Age ≥ 65 years*** (IRR, 95 % CI)	***M ale*** (IRR, 95 % CI)	***Female*** (IRR, 95 % CI)
Obesity	1.33***	0.94	1.23**	1.23***
	(1.193 - 1.476)	(0.827 - 1.065)	(1.042 - 1.452)	(1.113 - 1.350)
2000-1	1.05	0.87***	0.94	1.05*
	(0.989 - 1.110)	(0.802 - 0.955)	(0.846 - 1.038)	(0.994 - 1.113)
2009-10	0.86***	0.69***	0.76***	0.85***
	(0.805 - 0.917)	(0.630 - 0.752)	(0.689 - 0.849)	(0.799 - 0.905)
2000-1×Obesity	0.97	1.32***	1.04	1.05
	(0.865 - 1.086)	(1.135 - 1.524)	(0.864 - 1.241)	(0.938 - 1.167)
2009-10×	0.99	1.24***	1.04	1.05
Obesity	(0.875 - 1.117)	(1.081 - 1.417)	(0.866 - 1.258)	(0.934 - 1.172)
Observations	143859	45689	82430	107118

Note: the full models are in Table C. 12. *** p<0.01, ** p<0.05, * p<0.1

5.3.2.3 Relationship between other confounders and intensity of visits to FP/GPs

Compared to adults aged 18-24 years, adults 75 years and older had higher intensity of visits to FP/GPs (Table C. 10). Male sex was negatively associated with the intensity of

visits. Being married was weakly associated with the intensity of visits to FP/GPs while being widow/separated/divorced was positively associated with the intensity of visit in 2009-10. Recent immigrant status was negatively associated with the intensity of visit in 2000-1 and 2009-10. Having completed a bachelor's degree was negatively associated with intensity of visit in all years, while having completed secondary school but not any further education was negatively associated with intensity of visits to FP/GPs in 1996-7 and 2000-1. All categories of smoking status were positively associated with the intensity of utilization of FP/GP visits in all years with the exception of occasional smoking status in 1996-7. All alcohol consumption variables were negatively associated with the intensity of visits to FP/GPs in all years. Living in a rural region was negatively associated with the intensity of visit only in 2009-10, while not having a regular medical doctor was negatively associated with the intensity of visits to FP/GPs in all years. A negative association between income and intensity of visits was found in all years. Homeownership was negatively associated with the intensity of visits to FP/GPs. In all years, living in Quebec was negatively associated with the intensity of visits to FP/GPs, while living in Alberta or British Columbia was positively associated with the intensity of visits to FP/GPs.

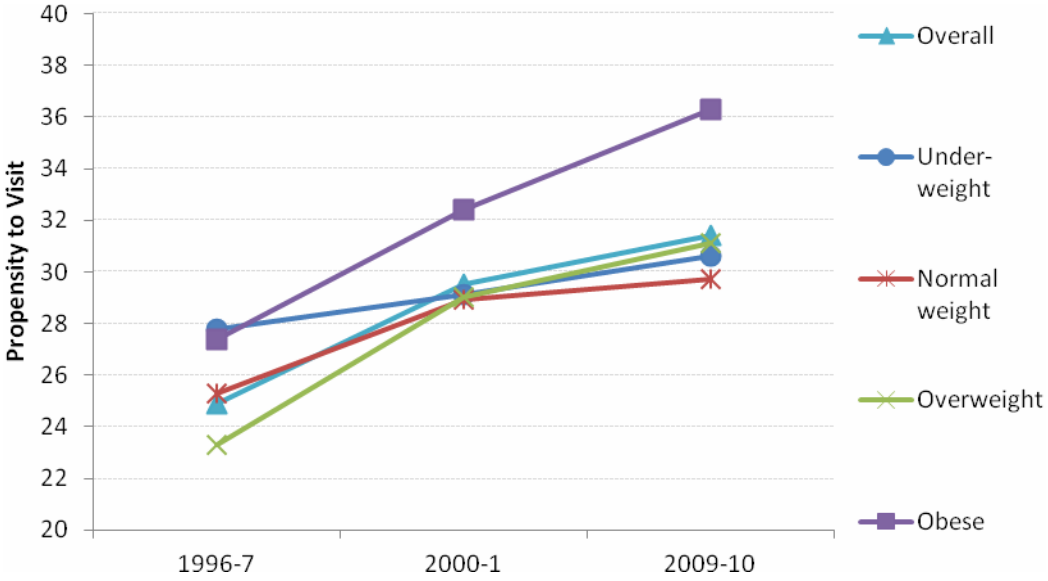
5.4 Specialist Physician Visits

5.4.1 Specialist Physician Visits – Propensity

5.4.1.1 Trends over time in the propensity to visit a specialist physician

The propensity to visit a specialist by BMI category and year are shown in Figure 8. In the full sample, an increase in the propensity to visit a specialist by about 26% during 1996-7 to 2009-10 ($p < 0.01$) was found (Table B. 11). All BMI categories experienced an increase the propensity to visit a specialist in the range of 16% to 33% in 2009-10 ($p < 0.01$) compared to 1996-7 except for underweight individuals.

Figure 8: Propensity to visit a specialist physician by BMI category and year



5.4.1.2 Trends in the relationship between obesity and the propensity to visit a specialist physician

Obesity was found to be positively associated with the propensity to visit a specialist with 11% greater propensity in 1996-7 ($p < 0.1$), and 11% and 22% greater propensity in 2000-1 and 2009-10, respectively ($p < 0.01$) (Table 18). Controlling for the number of chronic conditions largely attenuated the association between obesity and propensity to visit a specialist in each year. The association remained statistically significant only in 2009-10, with obesity associated with a 7% greater propensity ($p < 0.01$) to visit a specialist.

In pooled multivariable analysis, a 21% increase in the propensity to visit a specialist between 1996-7 and 2009-10 was found, which remained statistically significant after adjusting for chronic conditions ($p < 0.01$) (Table 19). For normal weight individuals, the propensity to visit a specialist increased by 13% during 1996-7 to 2009-10 ($p < 0.01$). This result seems to be driven by an increase of 13% in the propensity to visit from 1996-7 to 2000-1. Controlling for chronic conditions did not attenuate the difference over time among normal weight individuals. The RR for the association between obesity and propensity to visit a specialist was not statistically significant between 1996-7 and 2000-

1, but increased from 1996-7 and 2009-10 (ratio of RR = 1.13, $p < 0.05$) and between 2000-1 and 2009-10 (ratio of RR = 1.10, $p < 0.05$). After controlling for the number of chronic conditions in risk ratio for the association between obesity and propensity to visit a specialist was no longer significant (ratio of RR = 1.06, $p > 0.1$).

The rise in the propensity to visit a specialist amongst normal weight individuals was statistically significant across all strata (Table 20). The difference in the RR for the association between obesity and the propensity to visit a specialist was statistically significant only those under 65 years (ratio of RR of 1.14, $p < 0.05$). The primary analyses were not sensitive to the inclusion of individuals missing on income (Table D. 5) or to robust variance estimation procedure. Overall, the results agree with the hypothesis that the relationship between obesity and propensity to visit would increase over time if chronic conditions are not controlled for.

Table 18: The association between obesity and the propensity to visit a specialist physician: multivariable Poisson regressions

	1996-7 (RR, 95 % CI)	***2000-1*** (RR, 95 % CI)	***2009-10*** (RR, 95 % CI)
Obesity	1.11*	1.11***	1.22***
	(0.994 - 1.240)	(1.070 - 1.160)	(1.167 - 1.276)
Obesity and Chronic Conditions	0.99	0.98	1.07***
	(0.885 - 1.100)	(0.939 - 1.021)	(1.022 - 1.121)
Observations	49962	98774	87452

Note: the full models are in Table C. 13 and Table C. 14. *** p<0.01, ** p<0.05, * p<0.1

Table 19: Trends in the propensity to visit a specialist physician: pooled multivariable Poisson regressions

	Pooled (RR, 95 % CI)	***Pooled and Chronic Conditions*** (RR, 95 % CI)	***Pooled With Interaction terms*** (RR, 95 % CI)	***Pooled With Interaction terms and Chronic Conditions*** (RR, 95 % CI)
Obesity	1.16***	1.01	1.09	1.00
	(1.119 - 1.195)	(0.981 - 1.05)	(0.980 - 1.207)	(0.899 - 1.103)
2000-1	1.17***	1.13***	1.13***	1.12***
	(1.126 - 1.206)	(1.096 - 1.171)	(1.078 - 1.195)	(1.061 - 1.174)
2009-10	1.21***	1.15***	1.13***	1.11***
	(1.163 - 1.251)	(1.111 - 1.193)	(1.072 - 1.199)	(1.047 - 1.169)
2000-1×Obesity			1.03	0.99
			(0.923 - 1.152)	(0.889 - 1.105)
2009-10×			1.13**	1.06
Obesity			(1.012 - 1.265)	(0.948 - 1.179)
Observations	236188	236188	236188	236188

Note: the full models are in Table C. 13 and Table C. 14. *** p<0.01, ** p<0.05, * p<0.1

Table 20: Trends in the propensity to visit a specialist physician: stratified pooled multivariable Poisson regressions

	Age ≤ 64 years (RR, 95 % CI)	***Age ≥ 65 years*** (RR, 95 % CI)	***M ale*** (RR, 95 % CI)	***Female*** (RR, 95 % CI)
Obesity	1.11*	1.03	1.12	1.11*
	(0.994 - 1.246)	(0.824 - 1.297)	(0.928 - 1.363)	(0.990 - 1.240)
2000-1	1.14***	1.14**	1.21***	1.11***
	(1.079 - 1.206)	(1.020 - 1.280)	(1.091 - 1.339)	(1.050 - 1.171)
2009-10	1.13***	1.20***	1.23***	1.10***
	(1.063 - 1.201)	(1.071 - 1.339)	(1.110 - 1.373)	(1.033 - 1.162)
2000-1×Obesity	1.01	1.15	0.99	1.04
	(0.892 - 1.135)	(0.902 - 1.470)	(0.808 - 1.209)	(0.919 - 1.179)
2009-10×	1.14**	1.11	1.13	1.09
Obesity	(1.005 - 1.283)	(0.873 - 1.400)	(0.920 - 1.387)	(0.968 - 1.227)
Observations	185144	51044	111642	124546

Note: the full models are in Table C. 15. *** p<0.01, ** p<0.05, * p<0.1

5.4.1.3 Relationship between other confounders and the propensity to visit a specialist physician

Compared to adults 18-24 years, adults aged 55-84 years had higher propensity to visit a specialist in all years (Table C. 13). Male sex was negatively associated with the propensity to visit a specialist physician, while there was no association between marital

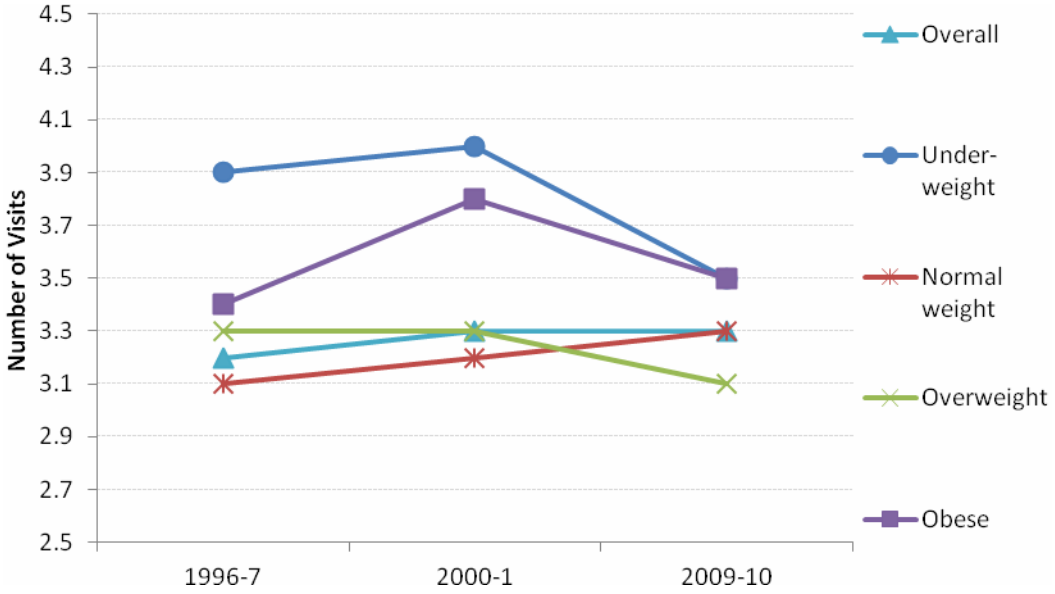
status and propensity to visit a specialist physician. Recent immigrant status was negatively associated with the propensity to visit a specialist in 2000-1 and 2009-10. There was a positive association between level of education and propensity to visit a specialist physician. Former smoking status was positively associated with the propensity to visit in all years, while daily smoking status was positively associated with the propensity to visit only in 2000-1 and occasional smoking status was positively associated with propensity to visit in 2000-1 and 2009-10. There was generally no relationship between alcohol consumption and propensity to visit a specialist physician. Living in a rural region was negatively associated with propensity in 2000-1 and 2009-10, while being without a regular medical doctor was negatively associated with propensity to visit a specialist physician in all years. There was no relationship between income quintiles and propensity to visit with the exception of the positive association between the highest income level and propensity to visit a specialist in 2000-1. Homeownership was negatively associated with the propensity to visit a specialist physician in 1996-7 and 2000-1. In all years, living in Quebec was positively associated with the propensity to visit a specialist physician, while living in Alberta was negatively associated with the propensity to visit relative to Ontario. Living in Saskatchewan or British Columbia was negatively associated with the propensity to visit a specialist physician in 2000-1 and 2009-10.

5.4.2 Specialist Physician Visits – Intensity

5.4.2.1 Trends over time in the intensity of visits to specialist physicians

The intensity of visits to specialists by BMI category and year are shown in Figure 9. Across the overall population and BMI categories, there were no significant differences in the intensity of visits to specialist physicians over time (Table B. 13).

Figure 9: Intensity of visits to specialist physicians by BMI category and year



5.4.2.2 Trends in the relationship between obesity and the intensity of visits to specialist physicians

The association between obesity and intensity of visits to specialist physicians was statistically significant only in 2000-1 with 22% ($p < 0.01$) greater intensity of visits to specialists among individuals living with obesity relative to normal weight individuals (Table 21). This association was no longer statistically significant upon control for chronic conditions.

In pooled multivariable analysis, in the overall population, no significant differences over time in the intensity of visits to specialist, before or after adjustment for chronic conditions were found (Table 22). There was an 11% increase among normal weight individuals from 1996-7 to 2009-10 ($p < 0.05$), but no differences from 1996-7 to 2000-1 or 2000-1 to 2009-10. There were no statistically significant differences in the IRR for the relationship between obesity and intensity of visits to specialists between any two pairs of years.

Across age groups, the increase from 1996-7 to 2009-10 for normal weight individuals was significant with an 11% increase among adults younger than 65 years ($p < 0.10$) (Table 23). Across sex, there was an 13% increase from 1996-7 to 2009-10 for normal

weight females ($p < 0.10$). In no strata were there significant differences in the IRR for the association between obesity and intensity of specialist visits. The primary analyses were not sensitive to the inclusion of individuals missing on income (Table D. 6) or to robust variance estimation procedure. Overall, these results do not agree with the hypothesis that the relationship between obesity and the intensity of visits to specialist would increase over time.

Table 21: The association between obesity and the intensity of visits to specialist physicians: multivariable zero truncated Poisson regressions

	1996-7 (IRR, 95 % CI)	***2000-1*** (IRR, 95 % CI)	***2009-10*** (IRR, 95 % CI)
Obesity	1.13	1.22***	1.09
	(0.968 - 1.326)	(1.100 - 1.342)	(0.971 - 1.216)
Obesity and Chronic Conditions	1.00	1.06	1.00
	(0.855 - 1.177)	(0.951 - 1.190)	(0.872 - 1.137)
Observations	11358	28170	28291

Note: the full models are in Table C. 16 and Table C. 17. *** p<0.01, ** p<0.05, * p<0.1

Table 22: Trends in the intensity of visits to specialist physicians: pooled multivariable zero truncated Poisson regressions

	Pooled (IRR, 95 % CI)	***Pooled and Chronic Conditions*** (IRR, 95 % CI)	***Pooled With Interaction terms*** (IRR, 95 % CI)	***Pooled With Interaction terms and Chronic Conditions*** (IRR, 95 % CI)
Obesity	1.11***	1.02	1.11	1.05
	(1.025 - 1.193)	(0.945 - 1.102)	(0.949 - 1.294)	(0.897 - 1.220)
2000-1	1.05	1.04	1.06	1.05
	(0.969 - 1.14)	(0.958 - 1.126)	(0.951 - 1.180)	(0.946 - 1.172)
2009-10	1.05	1.03	1.11**	1.10*
	(0.972 - 1.144)	(0.952 - 1.12)	(1.003 - 1.239)	(0.993 - 1.225)
2000-1×Obesity			1.04	1.02
			(0.861 - 1.253)	(0.843 - 1.224)
2009-10× Obesity			0.96	0.92
			(0.786 - 1.162)	(0.760 - 1.119)
Observations	67819	67819	67819	67819

Note: the full models are in Table C. 16 and Table C. 17. *** p<0.01, ** p<0.05, * p<0.1

Table 23: Trends in the intensity of visits to specialist physicians: stratified pooled multivariable zero truncated Poisson regressions

	Age ≤ 64 years (IRR, 95 % CI)	***Age ≥ 65 years*** (IRR, 95 % CI)	***M ale*** (IRR, 95 % CI)	***Female*** (IRR, 95 % CI)
Obesity	1.13	1.04	1.14	1.12
	(0.951 - 1.348)	(0.735 - 1.464)	(0.864 - 1.495)	(0.924 - 1.354)
2000-1	1.04	1.22*	1.14	1.03
	(0.920 - 1.165)	(0.973 - 1.532)	(0.950 - 1.358)	(0.909 - 1.175)
2009-10	1.11*	1.14	1.10	1.13*
	(0.990 - 1.250)	(0.915 - 1.430)	(0.923 - 1.306)	(0.987 - 1.288)
2000-1×Obesity	1.04	1.01	0.89	1.14
	(0.844 - 1.288)	(0.667 - 1.535)	(0.645 - 1.235)	(0.904 - 1.441)
2009-10×	0.97	0.89	0.96	0.96
Obesity	(0.776 - 1.206)	(0.612 - 1.300)	(0.671 - 1.381)	(0.767 - 1.200)
Observations	50313	17506	26682	41137

Note: the full models are in Table C. 18. *** p<0.01, ** p<0.05, * p<0.1

5.4.2.3 Relationship between other confounders and the intensity of visits to specialist physicians

Compared to adults aged 18-24 years, adults 25-34 years had higher intensity of visits, while adults 85 years and older had lower intensity of visits to specialist physicians in all years (Table C. 16). Sex was not associated with the intensity of visits. Although marital status was not statistically significant in most years, a negative association between being married or widowed/separated/divorced and the intensity of visits was found in 2000-1. Recent immigrant status was negatively associated with the intensity of visits to specialist physicians in 2000-1 and 2009-10, while long-term immigrant status was negatively associated with the intensity of visits to specialist physicians only in 2000-1. There was no association between education and the intensity of visits except for completing a bachelor's degree or secondary which were positively associated with the intensity of visits only in 2000-1. Smoking status was not associated with the intensity of visits with the exception of heavy daily smoking status which was positively associated with the intensity of visits in 2000-1 and 2009-10. Regular drinking status was negatively associated with the intensity of visits to specialist physicians in all years. Living in a rural region was negatively associated with the intensity of visits in 2000-1 and 2009-10, while not having a regular medical doctor was negatively associated with the intensity of visits to specialist physicians in 1996-7 and 2009-10. In 1996-7 there was a weak

association between income and the intensity of visits, but in 2000-1 and 2009-10 there was a negative association between income and intensity of visits to specialist physicians with the exception of the 4th quintile in 2009-10 and the 2nd and 3rd income quintiles in 2000-1. Living in Newfoundland, New Brunswick or Quebec was negatively associated with the intensity of visits to specialist physicians in all years, while living in Manitoba or Saskatchewan was negatively associated with the intensity of visits in 1996-7 and 2009-10.

5.5 Summary of Results

A summary of the results in terms of the original hypothesis and the results found in this study are presented in Table 24.

Table 24: Summary of hypotheses and supporting evidence

	Hypothesis	Evidence supports hypothesis?
Hospital Utilization		
Propensity	The risk ratio of an overnight hospital admission for individuals living with obesity is decreasing compared to those who are normal weight.	Does not support
Intensity	For those with at least one overnight hospital admission, the incidence rate ratio of nights spent in the hospital for individuals living with obesity is decreasing compared to those who are normal weight.	Does not support
FP/GP Care		
Propensity	The risk ratio of any visit for individuals living with obesity is increasing compared to those who are normal weight.	Does not support
Intensity	For those with at least one visit, the incidence rate ratio of the number of visits for individuals living with obesity is increasing compared to those who are normal weight.	Does not support
Specialist Physician Care		

Propensity	The risk ratio of any visit for individuals living with obesity is increasing compared to those who are normal weight.	Supports *if* the number of chronic conditions was not controlled for
Intensity	For those with at least one visit, the incidence rate ratio of the number of visits for individuals living with obesity is increasing compared to those who are normal weight.	Does not support

Although most of the hypotheses were not supported in this study, a number of interesting results are still relevance in understanding the association between obesity and publicly funded health care utilization in Canada. First, obesity was found to be positively associated with the propensity to use hospitals and visit to FP/GPs and specialist physicians. These results are largely consistent with the existing literature. As expected, I found that these associations were attenuated after adjusting for the number of chronic conditions. Second, obesity was positively associated with the intensity of visits to FP/GPs and specialist physicians and these associations were also attenuated after controlling for chronic conditions, while obesity was negatively associated with intensity of nights spent in the hospital. Finally, most BMI groups experienced a decrease in the intensity of visits to FP/GPs and an increase in propensity of visits to specialist physicians without controlling for chronic conditions.

Chapter 6

6 Discussion

This thesis examined the association between obesity and utilization of various publicly funded health care services over time in Canada. Using nationally representative health survey data from Canada, utilization of self-reported visits to FP/GPs, visits to specialists and hospitalizations during 1996-7 to 2009-10 were analyzed. Possible explanations of the findings of this study are discussed in the following sub-sections.

6.1 Hospital Utilization

Utilization of hospital services were hypothesized to decrease over time primarily due to improvements in the management of cardiovascular risk factors and subsequent reduction in hospitalizations associated with cardiovascular diseases. Due to higher concentration of cardiovascular risk factors and greater prevalence of cardiovascular disease among individuals living with obesity, this group was hypothesized to experience a reduction in the utilization of hospital services over time relative to normal weight counterparts. The univariate analysis showed that over time the risk of a hospital admission for the overall and normal weight populations decreased by about 6% ($p< 0.10$) and 12% ($p< 0.05$), respectively. Obesity was associated with an increased risk of a hospital admission in the last two surveys of 19 and 27% ($p<0.01$), but these associations disappeared once chronic conditions were controlled for. In contrast with the original hypothesis, the RR of a hospital admission for individuals living with obesity did not decrease over the time period of this study.

In 1996-7 and 2000-1, individuals living with obesity spent fewer nights in the hospital compared to normal weight individuals. However, during this time period, normal weight individuals experienced a significant decline in the number of nights spent in hospital, while individuals living with obesity did not experience any such decline. Consequently, the incidence rate ratio for the association between obesity and number of nights increased over time (ratio of IRR = 1.45, $p < 0.10$). Therefore, these findings contradict

the hypothesis regarding the decreasing relationship between obesity and the intensity of hospital utilization.

The hypothesis that the association between obesity and hospital utilization for individuals living with obesity is decreasing compared to normal weight counterparts was based on arguments pertaining to cardiovascular related hospitalizations. One explanation could be that all BMI groups experienced declines in cardiovascular hospitalizations to a similar extent. In addition, studies that have examined cause-specific hospitalizations across BMI categories found that hospitalizations for cardiovascular conditions accounted for approximately 25% of all hospitalizations (203, 204). Therefore, if hospitalizations for causes other than cardiovascular disease increased during this time period, this may explain why there are no significant declines in hospitalizations for individuals living with obesity as hypothesized. For instance, there have been large increases in the rate of bariatric surgeries and surgeries for obesity related complications including hip and knee arthritis (205-207). In addition, the hospital outcome variable in this study includes all types of self-reported hospitalization, including admissions for nursing and convalescent home stays. If changes in hospitalizations due to other causes unrelated to cardiovascular disease or nursing home admissions have been different across BMI categories, then this may potentially explain the results found in this study.

Since the decline in propensity to be admitted to a hospital was observed only in univariable and not multivariable analysis, other confounders play some role in explaining these results. In this study, smokers had consistently elevated propensity to use hospitals; smoking has been shown to be a risk factor for hospital admissions (117). Decline in smoking rates that have been observed over time may explain a part of the decrease in hospital utilizations (37). Also, changes to the resources provided to the health care system likely affected the utilization of hospitals during this time period; in particular, the total number of beds per 1000 people decreased from 1996-7 to 2000-1 and from 2000-1 to 2008 (40, 41). The number of hospital beds has been found to be a determinant of hospital admission rates (208).

Although trends in the utilization of hospital services across BMI categories have not been examined previously, some Canadian studies analyzed the link between obesity and hospital utilization. For example, Chen et al. demonstrated that obesity is associated with increased admission to hospitals (160). However, Chen et al. did not examine the number of nights as their outcome combined the probability of an admission with the numbers of nights (160). McMahon examined the propensity and intensity of hospitalizations and demonstrated that while increasing obesity classes had a dose-response relationship with propensity of hospital admissions, there was no clear relationship between obesity and number of nights with an association being found for only class II obesity (116). Similarly, US studies have shown a positive link between obesity and inpatient admissions (9, 24). Therefore, the results of this study on the association between obesity and hospitalization are generally consistent with the previous literature. Taken together, these findings suggest that improved management of cardiovascular risk factors did not translate into decreased overall utilization of hospital services over time for individuals living with obesity.

6.2 Family Physician/General Practitioner Visits

From 1996-7 to 2009-10, the propensity to visit a FP/GP did not differ for the overall population as well as for most BMI categories except for underweight individuals who experienced a significant 11% decrease in 2009-10 relative to 1996-7. In multivariable analysis, obesity was associated with a 4-5 percent relative increase in the propensity to visit a FP/GP in all years compared to normal weight individuals. This relationship was largely attenuated once the number of chronic conditions was controlled for with the exception of the final year. Year and obesity interaction terms revealed that the RR of a visit to a FP/GP for individuals living with obesity did not differ over time relative to that of normal weight individuals.

While the intensity of visits to FP/GP for the overall population did not differ between 1996-7 and 2000-1, it declined between 2000-1 and 2009-10. An overall decrease of 20% ($p < 0.01$) in FP/GP visits between 1996-7 and 2009-10 was observed. When examined across four BMI categories, with the exception of underweight group, all BMI categories

experienced similar declines in FP/GP visits. These results did not agree with the hypotheses that the intensity of visits to FP/GPs would increase over time due to effective management of diabetes and hypertension among individuals living with obesity.

Given the ubiquitous decrease in FP/GP visits across most BMI categories, these differences likely reflect primary care reform initiatives undertaken in the health care system. During 2004 to 2010, significant changes were seen in the organization of primary care, especially a shift away from the solo fee-for-service physician remuneration towards team-based non fee-for-service payment systems across provinces in Canada (38, 39). The percentage of physicians receiving 90% of their income from fee-for-service declined from 67.5% in 1990 to about 40% in 2010 (209-211). Among FPs/GPs, fee-for-service payment is associated with increased hours of direct patient care activities compared to non-fee-for-service counterparts (212, 213). Fee-for-service payment is generally associated with higher number of patient visits to FP/GP offices compared to other modes of remuneration such as capitation (213, 214). Therefore, it is likely that the increase in non-fee-for-service group practices and decreased percentage of family physicians paid under FFS over time could explain the decline in the intensity of visits to FPs/GPs.

Previous cross-sectional studies have demonstrated a positive association between obesity and the utilization of primary care physician services. For example, Trakas et al. found that obesity was associated with higher family physician visits with OR of 1.4 for more than 2 visits and OR of 1.55 for more than 3 visits among 1994-5 NPHS respondents (6). Similarly, McMahon found that obesity was positively associated with both propensity and intensity of FP/GP visits in the 2005 CCHS (116). Studies from other countries such as the U.S. and United Kingdom also found increased utilization of primary care doctors and increased ambulatory care visits/costs among adults with obesity (7, 154, 215, 216). Similar cross-sectional associations are corroborated in this study even in the face of primary care reforms.

6.3 Specialist Physician Visits

This study demonstrated that over time there was a significant increase in the intensity of visits to specialists among normal weight individuals but no such differences over time were observed among individuals living with obesity. In addition, no differences in the IRR for the relationship between obesity and intensity of specialist visits over time were found.

In 1994/95, individuals living with obesity did not significantly differ compared to normal weight individuals in their propensity to visit a specialist. However, over the course of this time period, there was a significant increase of 26% in the propensity to visit a specialist ($p < 0.01$) and individuals living with obesity had significantly greater propensity to visit specialists compared to normal weight individuals. Consequently, the magnitude of the RR for the association between obesity and propensity to use specialists increased over time (ratio of RR of 1.13, $p < 0.05$). However, the association between obesity and propensity to visit a specialist was largely attenuated in all years once the number of chronic conditions was controlled for. Similarly, the increase in RR for the association between obesity and propensity to visit a specialist disappeared after adjusting for chronic conditions (ratio of RR of 1.06, $p > 0.1$). These results are in agreement with the original hypothesis that the RR for the association between obesity and propensity to visit specialists would increase and that the IRR for the association between obesity and intensity of specialist visits would increase.

Typically individuals living with obesity disproportionately suffer from cardiovascular disease, hypertension, diabetes, chronic neck/back pain, asthma and musculoskeletal disease relative to their normal weight counterparts. These conditions have been demonstrated to be positively associated with referrals to specialists and may explain the finding of increased propensity to visit a specialist among individuals living with obesity when the number of chronic conditions was not controlled for (217). In addition, the rising prevalence of chronic diseases such as hypertension and diabetes, particularly among individuals living with obesity, may be contributing to increases in the RR for the association between obesity and the propensity to visit a specialist (37). In the U.S., there

have been large increases in referral rates to specialists from 2.9% in 1999 to 7.3% in 2009 (218). The authors argued that these trends likely reflect increasing treatment complexity over time, an issue that is likely occurring in Canada as the average number of chronic conditions is rising, especially among individuals living with obesity (218). This is supported by the finding that controlling for the number of chronic conditions largely accounted for the association between obesity and the propensity to visit a specialist and for the increases in the RR for the association between obesity over time.

The factors leading to the decline in FP/GP visits may also have contributed to rising propensity to visit a specialist as primary care payment mechanisms other than fee-for-service have been associated with greater referral rates (210, 219, 220). This is likely due to increases in payment mechanisms such as capitation providing a strong incentive for a primary care physician to have more patients enrolled in their practice rather than provide more services per patient (210, 219, 220).

Although a number of previous Canadian studies have examined the link between obesity and physician costs, few have investigated specialist utilization. The two studies conducted by Twells et al. did not find any association with specialist utilization, but these studies were limited to small samples (164, 165). McMahon, investigated both specialist propensity and intensity of utilization and found all obesity classes tend to be associated with significantly higher propensity to visit a specialists but only class I and II obesity were associated with greater intensity of utilization (116). Studies from the U.S. find obesity to be associated with increased outpatient visits and on average approximately half of outpatient visits are consultations to specialists (7, 154). However, U.S. studies that examined obesity and the association with specialty care found no association and similar findings were also found in a study of 10 European countries with adults aged 50 to 70 years (157, 158, 215). The results of this study suggest that the association between obesity and propensity to visit a specialist increased over time, but was largely accounted for by chronic conditions.

6.4 The relationship between confounders and health care utilization

The following section discusses the results regarding the relationship between the confounders and health care utilization found in this study. Discussed below are the results from tables C. 1 -C. 18 presented in appendix C. The following are from analyses without controlling for chronic conditions with a few noted exceptions.

This study demonstrated that predisposing, enabling and need factors affect the utilization of health care. As individuals age, the rate of depreciation in health increases and hence the need increases (43). Therefore, it is expected that demand for health care would increase as individuals grow older. This was generally the case as the propensity and intensity of FP/GP increased with age, and with the exception of age 85 and older group, the propensity to visit a specialist increased in a dose-response fashion. However, not all types of health care utilization showed a dose-response trend with age. Although there was a dose response with increasing age for the intensity of nights spent in the hospital, only the oldest group of adults had higher propensity to visit a hospital compared to the youngest group. Adults in the middle age groups actually had a lower propensity to visit a hospital. Curtis and MacMinn also found that the highest propensity to visit a hospital in the lowest and highest age groups (72). This could potentially reflect pregnancies in younger women and greater need among older adults. This is indeed supported by sex stratified analyses of this study; women in the middle age groups had a lower propensity to visit a hospital, while the propensity to visit a hospital across age groups increased in a dose response fashion in men.

A number of other predisposing factors such as sex, education and immigration status were found to be associated with health care utilization, but the results differ across various models. For example, recent immigrant status was related to lower propensity to be hospitalized, but no such association with the intensity of nights spent in the hospital was found. The associations between immigration status and propensity to be hospitalized likely reflect lower levels of need among recent immigrants. It may also reflect enabling aspects of language/knowledge regarding the health care system as recent

immigrants have greater difficulties in accessing immediate care (101, 106). Education was found to be positively associated with the propensity to visit a FP/GP and specialist. Curtis et al. and Asada et al. both found similar findings which could reflect differences in preferences, expectations, and information regarding the health care system among educated individuals (15, 71, 72).

Consistent with previous studies, one of the strongest determinants of health care utilization was the enabling factor of whether the individual had a regular medical doctor; individuals without a regular medical doctor had lower utilization of health care (116, 120). Since insurance coverage for physician and hospital services is universal, the differences in utilization likely reflect differences in accessing the health care system, including time costs. Grossman's model would predict lower demand for health care in individuals without a regular medical doctor due to potentially higher time costs (43, 46). Household income was another enabling factor found to affect health care utilization. Consistent with previous studies, household income was found to be negatively associated with the utilization of hospital services, negatively associated with intensity of family physician visits, and positively associated with propensity to visit family physicians and specialists, after controlling for the number of chronic conditions (72, 120). Grossman's model would predict that individuals with higher levels of income would demand more health and more health care in order to maintain greater level of health (43, 46). This prediction is likely reflected in the increased propensity to visit a specialist. Income could also be related to greater utilization of health care due to higher levels of supplementary insurance coverage for hospital and medications which have been shown to be positively associated with utilization (87). The positive association between income and the propensity to visit a specialist increased after controlling for need, which may be explained by differences in preferences, expectations, and communication with providers (221).

This study also demonstrated provincial differences in the utilization of health care. For example, residents of Quebec had lower propensity to visit FP/GPs but had the highest propensity to visit a specialist relative to Ontario. This was observed in other studies and

likely reflects different referral patterns as Quebec had by far the lowest percentage of referrals to specialists from family physicians and the greatest percentage of referrals to specialists from other specialists (122, 125). In addition, Quebec also has the greatest proportion of specialist visits that did not require a referral (125). These differences in referral patterns result from differences in the organization of the Quebec health care system, as Quebec residents are less likely to have a regular medical doctor but often obtain care from nurses or other health care professionals working in local community service centres (122, 125, 222). The differences in the utilization of health care services across provinces could also be due to differences in organization of and resources available to health care systems, including coverage for pharmaceuticals, supply of physicians, and other policies (11, 88, 125-127). Finally, one measure of need, the number of chronic conditions, was examined and found to be significantly positively related to both the propensity and intensity of utilization of all types of health care. A number of other studies have reported similar findings with respect to the number of comorbidities (120, 129).

6.5 Strengths

This is the first study to examine trends in the association between obesity and health care utilization in the Canadian population. The key strength of this study is the use of three nationally representative surveys conducted by Statistics Canada that are highly consistent over time. With the exclusion criteria applied, the sample is consistent over time with regards to age groups and geography sampled as well as other inclusion and exclusion criteria. When inconsistencies were detected, significant effort was put forth in order to provide an appropriate resolution. For example, equivalized income quintiles were derived in order to improve consistency of the income variable and other variables such as BMI values were re-calculated in order to ensure consistency over time. Other variables such as education and smoking were re-categorized into meaningful categories across NPHS and CCHS surveys (181). In addition, Statistics Canada conducted all surveys with computer assisted interviewing such that errors are minimized as out of range values are not accepted and inconsistent or invalid answers are identified immediately to be resolved (172-174). Other strengths of this study include the large

sample sizes that allowed for examination of effects across various subgroups and to examine both propensity to use and the intensity of health care utilization. This was important for the number of nights spent in hospital as low prevalence of hospitalizations would be difficult to analyze with small sample sizes.

6.6 Limitations

A key limitation of this study is the use of self-reported measures of height and weight. It has been shown that individuals on average over-estimate their height and under-estimate their weight (223). Consequently, self-reported BMI generally underestimates measured BMI and some individuals living with obesity may be categorized as overweight (223). Although, this may significantly affect the inference in any one year, it is unlikely to bias the difference in the relationship over time (223). It is inconclusive whether the bias is changing across time with studies demonstrating increasing, similar and decreasing levels of bias over time (224-226). Few surveys have examined measured height and weight in Canada and those that have are typically quite small relative to the CCHS.

Another limitation is the use of self-reported health care utilization. Studies have shown some concerns with the validity of self- reported health care utilization (227). Individuals have been shown to typically under-estimate their 12 month utilization and accuracy decreases with increasing frequency of utilization (227). This suggests that this issue is of greater concern for the second part (count) than the first part (yes/no). In addition, this may be a concern across BMI categories as individuals living with obesity use health care to a greater extent (227). However, the greater concern regarding this bias would be if it is changing over time, which no studies have examined to date. The hospitalization outcome variable is limited in that it consists of different types of health care such as hospital, nursing and convalescent home visits. In addition, the health care utilization variables do not specify the reason for utilization, which would have provided further information towards understanding these trends. However, the use of self-reported health care utilization allowed for an examination of this research question at the national level and inclusion of a rich set of socio-economic variables consistent with the conceptual framework which would not be possible with administrative databases.

The time period during which health care utilization was measured is also a limitation of this study. Ascertainment of health care utilization in the year prior to the interview results in a survivor population (162). This will exclude the utilization due to deaths and thus will likely produce an underestimate of actual population utilization. This will have the largest effect on the use of hospital care as this type of care has been shown to be most elevated in the year before death (228). However, given that obesity results in minimal excess risk of mortality in Canada, this bias likely has a minimal effect on the results (229). The other limitation of the time period of ascertainment is that this study is cross-sectional and increases the chance of reverse causality (diseases that affecting use of health care may be affecting weight). By linking these surveys to administrative databases, future studies could determine the relationship between obesity and prospective measures of health care utilization/costs.

Although highly comparable with regards to inclusion/exclusion criteria, wording of most questions, and sampling methods, these three surveys are not perfectly comparable over time. There are some minor differences in the wording of some questions and ascertainment of some exposures (income (continuous 2001/2009-10 vs. categorical 1996), smoking (difference in wording in 1996)), different response rates, and different proportion interview by phone/in person (172-178). These differences have previously not precluded the combined use of the NPHS and CCHS for surveillance of obesity, smoking, chronic conditions (diabetes, hypertension, heart disease, and arthritis), and health care utilization (37, 72, 181, 230, 231). Although it is not possible to rule out the effects of these differences over time, the effects are expected to be minor affecting the entire population rather than one specific BMI category. Thus, it is unlikely that they would systematically bias the results.

6.7 Conclusions - Implications of this study & directions for future research

This study demonstrated that there was a ubiquitous decline in the utilization of FP/GP visits across most BMI categories. Changes in management of cardiovascular risk factors

did not have the expected effects of increasing primary care visits among individuals living with obesity. These results likely reflect on-going changes in the health care system regarding physician work hours, payment schemes and collaborative practices that are a result of primary health care reform.

The propensity to visit specialists increased over time and the association between obesity and the propensity to use a specialist increased. These changes are likely due to increases in patient complexity with rising levels of chronic disease and are possibly a consequence of changes within primary care sector. Other hypotheses regarding changes in the association between obesity and the propensity to visit FP/GPs and intensity of visits to specialists were not supported.

Although normal weight individuals experienced a significant decline in propensity of a hospital admission and intensity of utilization of hospital nights, individuals living with obesity did not experience significant changes in either outcome over time. This led to a marginally significant increase in the association between obesity and intensity of utilization of hospital nights, which is in contrast with the initial hypothesis. Therefore, it appears that utilization of hospital care is becoming more concentrated among individuals living with obesity. The key implication of these results is that improvements in the management of cardiovascular risk factors did not appear to have resulted in a decrease in overall utilization of hospital services for individuals living with obesity. Further research could explore trends in cause-specific hospitalization across BMI categories.

The results of this study suggest that the relationship between obesity and the utilization of more costly forms of health care services (hospitals/specialists) may be increasing over time. How the relationship between obesity and health care costs has changed over time in Canada could not be explored with the data available for this thesis. However, this could be explored with survey data linked to administrative databases which would allow for direct and in-depth examination of health care utilization and costs, including utilization of specific types of specialist services, cause-specific hospitalizations, and examination of health care costs (15, 55).

The results of this study demonstrate that the prevalence of obesity is rising in Canada. The relationship between obesity and propensity to visit specialists did increase over time but for other types of care this association did not differ over time. Although the relationship between obesity and most types of health care utilization has not changed over time, obesity continues to be a key determinant of health care utilization in Canada including the risk of hospital admission, propensity to visit primary care and specialist physicians, and the intensity of visit to primary care physicians. The positive associations between obesity and the propensity of a hospital admission, FP/GP visit, specialist visit, and intensity of utilization of FP/GP visits were largely attenuated once the number of chronic conditions was controlled for.

Given the large number of individuals living with obesity and the high costs associated with interventions targeted at high-risk individuals, identifying cost-effective interventions is an area for future research. In fact, a number of interventions are proposed to combat the obesity epidemic through both lifestyle (diet and exercise) and medical interventions (pharmaceuticals and surgery) by targeting high-risk individuals in the extant literature (232). A number of studies conclude that access to the services of nutritionists, exercise therapists, and community resources may help improve obesity treatment within the primary health care system (233-235). Future research could explore the potential implications of increases in inter-professional collaborative practice patterns that have resulted due to health care reform initiatives in Canada, such as family health teams in Ontario, for obesity prevention and management within the primary care sector (14). In addition to targeting high risk individuals, a number of potential population interventions have been suggested including taxing junk food and caloric sweetened beverages, improving nutrition labels, banning certain foods, and limiting the availability of unhealthy food outlets like fast food restaurants (236). However, the evidence base is currently weak or non-existent for many of these interventions (237, 238). Considering the rising prevalence of obesity, policies may need to be implemented even in the face of incomplete or limited information regarding their effectiveness. However, future research should evaluate these policy options in order to identify the most effective and cost-effective options to strengthen the evidence base for future policy decisions (239). The findings of this study clearly emphasize the burden of obesity on publicly funded health

care services in Canada. Thus, investigation of various strategies that can reduce the incidence of obesity through lifestyle interventions and other policies is needed.

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Appendices

8 Appendix Tables

8.1 Appendix A: Methods Appendix

Table A. 1: The response rates, initial sample size by province, and sampling methods for each survey (172-174)

Survey	% Overall Response Rate	Initial Sample Sizes (Total and for each province)		Sampling Methods:
1996-7 NPHS	82.6%	Total:	81804	~18%: Longitudinal sample: Based on the Labour Force Survey (LFS) - a two-stage stratified cluster survey; Quebec – two-stage stratified cluster based on Enquête Sociale et de Santé (ESS) with different number of strata/clusters selected 95% telephone Cross-sectional Top-Up: RDD 100% telephone
		NFLD	963	
		PEI	918	
		NS	986	
		NB	1032	
		QUE	2788	
		ONT	39394	
		MB	14828	
		SASK	1047	
		AB	18305	
		BC	1543	
2000-1 CCHS	84.7%	Total:	131,535	83%: Area frame: Based on the LFS - a two-stage stratified cluster survey In-person % ~60% Telephone % ~ 40% 10%: List frame Telephone 7%: RDD Telephone
		NFLD	3,870	
		PEI	3,651	
		NS	5,319	
		NB	4,996	
		QUE	22,012	
		ONT	39,278	
		MB	8,470	
		SASK	8,009	
		AB	14,456	
		BC	18,302	
		Y/NWT/NV	2,517	
2009-10 CCHS	72.3%	Total:	124,870	49.5%: Area frame: (LFS sampling frame - multistage stratified cluster design) In-person % ~77% Telephone % ~23% 49.5%: List frame Telephone 1% RDD sampling frame Telephone
		NFLD	3,768	
		PEI	1,913	
		NS	4,712	
		NB	4,835	
		QUE	23,135	
		ONT	42,495	
		MB	6,825	
		SASK	7,449	
		AB	11,618	
		BC	15,038	
		Y/NWT/NV	3,082	

Note: Although three provinces are oversampled in 1996-7, this sample was weighted to give nationally representative estimates representative of the covered population and has been used in numerous previous national level surveillance studies (37, 172, 240, 241).

Table A. 2: The exclusion and inclusion criteria applied by Statistics Canada (172-174)

Survey	Excluded	Included
1996-7 NPHS	1994/5 Sample and Follow-up People living on Indian Reserves, institutions or collective dwellings, Canadian Forces Bases Some remote areas in Ontario/Quebec 1996/7 Top Up: People living on Indian Reserves, Canadian Forces Bases, institutions or collective dwellings	Household residents Only Provinces Top up is from 3 provinces (Alberta, Manitoba, and Ontario)
2000-1 CCHS	Full-time members of Canadian Armed Forces, Residents of Indian Reserves and Crown Lands, Institutionalized and certain remote regions	Age 12 and older Private dwellings
2009-10 CCHS	Full-time members of Canadian Forces Residents of Indian Reserves and Crown Lands, Institutionalized and certain remote regions	Age 12 and older Private dwellings

Table A. 3: The percent missing for each variable by survey year

	1996-7	***2000-1***	***2009-10***
Missing on:	*%*	*%*	*%*
Any variable	25.7	14	20.1
Any Outcome	0.8	0.4	0.9
Hospital	0.1	0.1	0.1
FP/GPs	0.6	0.3	0.7
Specialist	0.2	0.1	0.2
Any Confounder	23.3	12.1	17.6
BMI	3.9	2.2	2.9
Marital Status	0.2	0.1	0.2
Immigration	0.4	0.7	2.1
Rural	0.1	0	0
Income	21.4	10.7	16.5
Education	1.1	1.1	2.7
Home Ownership	0.9	0.4	2.1
Regular Medical Doctor	0	0	0
Smoking status	0.6	0.3	0.6
Alcohol consumption	1.8	0.8	1.7
Any Chronic Condition	0.5	0.6	1.4

8.2 Appendix B: Descriptive Tables

Table B. 1: Trend in prevalence of each BMI category in 2000-1 and 2009-10 relative to 1996-7

	2000-1 (RR, 95% CI)	***2009-10*** (RR, 95% CI)
Underweight	1.34***	0.97
	(1.170 - 1.532)	(0.839 - 1.128)
Normal Weight	0.98	0.90***
	(0.963 - 1.005)	(0.879 - 0.921)
Overweight	0.93***	0.97**
	(0.906- 0.961)	(0.938 - 0.998)
Obesity	1.20***	1.49***
	(1.134 - 1.260)	(1.417 - 1.572)

*** p<0.01, ** p<0.05, * p<0.1

Table B. 2: The risk of a hospital admission by BMI category and year

	1996-7 (%, 95% CI)	***2000-1*** (%, 95% CI)	***2009-10*** (%, 95% CI)
Overall	8.7	8.5	8.1
	(8.1 - 9.2)	(8.3 - 8.7)	(7.8 - 8.4)
Underweight	12.3	10.5	11.0
	(9.0 - 15.7)	(9.0 -12.1)	(8.5 - 13.5)
Normal weight	8.6	8.0	7.6
	(7.8 - 9.5)	(7.6 - 8.4)	(7.2 - 8.0)
Overweight	8.0	8.2	7.7
	(7.1 - 8.8)	(7.8 - 8.6)	(7.2 - 8.1)
Obesity	10.1	10.4	9.9
	(8.5 - 11.7)	(9.8 - 11.0)	(9.1 - 10.6)

Table B. 3: The risk of a hospital admission for each BMI category in 2000-1 and 2009-10 relative to 1996-7

	2000-1 (RR, 95% CI)	***2009-10*** (RR, 95% CI)
Overall	0.98	0.94*
	(0.913 - 1.054)	(0.869 - 1.011)
Underweight	0.85	0.89
	(0.629 - 1.159)	(0.617 - 1.295)
Normal Weight	0.93	0.88**
	(0.832 - 1.035)	(0.782 - 0.987)
Overweight	1.03	0.96
	(0.912 - 1.154)	(0.855 - 1.088)
Obesity	1.03	0.98
	(0.870 - 1.211)	(0.823 - 1.159)

*** p<0.01, ** p<0.05, * p<0.1

Table B. 4: The intensity of nights by BMI category and year

	1996-7 (mean, 95% CI)	***2000-1*** (mean, 95% CI)	***2009-10*** (mean, 95% CI)
Overall	9.4	8.9	7.8
	(7.802 - 10.912)	(8.293 - 9.507)	(7.014 - 8.646)
Underweight	8.8	17.4	10.5
	(5.879 - 11.624)	(12.386 - 22.410)	(7.298 - 13.707)
Normal weight	9.8	9	7.2
	(7.180 - 12.360)	(8.010 - 9.938)	(6.305 - 8.137)
Overweight	9.5	8.2	7.9
	(6.646 - 12.419)	(7.276 - 9.193)	(6.086 - 9.768)
Obesity	7.7	8.2	8.5
	(6.334 - 9.072)	(7.310 - 9.115)	(6.829 - 10.107)

Table B. 5: The intensity of nights for each BMI category in 2000-1 and 2009-10 relative to 1996-7

	2000-1 (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)
Overall	0.95	0.84*
	(0.794 - 1.140)	(0.689 - 1.016)
Underweight	1.99***	1.2
	(1.293 - 3.058)	(0.777 - 1.854)
Normal Weight	0.92	0.74**
	(0.688 - 1.225)	(0.546 - 0.999)
Overweight	0.86	0.83
	(0.622 - 1.200)	(0.571 - 1.211)
Obesity	1.07	1.1
	(0.868 - 1.311)	(0.840 - 1.439)

*** p<0.01, ** p<0.05, * p<0.1

Table B. 6: The propensity to visit a FP/GP by BMI category and year

	1996-7 (%, 95% CI)	***2000-1*** (%, 95% CI)	***2009-10*** (%, 95% CI)
Overall	77.9	78.9	78.5
	(77.1 - 78.6)	(78.5 - 79.4)	(78.0 - 78.9)
Underweight	83.5	80.7	74.6
	(78.7 - 88.3)	(78.3 - 83.1)	(70.8 - 78.5)
Normal weight	77.1	77.6	76.8
	(76.0 - 78.2)	(77.0 - 78.1)	(76.1 - 77.6)
Overweight	77.4	79.3	78.6
	(76.0 - 78.9)	(78.7 - 80.0)	(77.8 - 79.4)
Obesity	81.2	82.3	82.5
	(78.9 - 83.4)	(81.5 - 83.2)	(81.5 - 83.5)

Table B. 7: The propensity to visit a FP/GP for each BMI category in 2000-1 and 2009-10 relative to1996-7

	2000-1 (RR, 95% CI)	***2009-10*** (RR, 95% CI)
Overall	1.01**	1.01
	(1.003 - 1.025)	(0.996 - 1.019)
Underweight	0.97	0.89***
	(0.905 - 1.031)	(0.826 - 0.967)
Normal Weight	1.01	1
	(0.990 - 1.022)	(0.980 - 1.013)
Overweight	1.02**	1.02
	(1.004 - 1.045)	(0.994 - 1.037)
Obesity	1.01	1.02
	(0.985 - 1.044)	(0.985 - 1.049)

*** p<0.01, ** p<0.05, * p<0.1

Table B. 8: The intensity of visits to FP/GPs by BMI category and year

	1996-7 (mean, 95% CI)	***2000-1*** (mean, 95% CI)	***2009-10*** (mean, 95% CI)
Overall	4.4	4.4	3.6
	(4.245 - 4.567)	(4.281 - 4.419)	(3.524 - 3.637)
Underweight	5.3	4.6	4.5
	(4.498 - 6.126)	(4.277 - 4.961)	(3.887 - 5.055)
Normal weight	4.1	4.1	3.3
	(3.923 - 4.256)	(3.973 - 4.151)	(3.230 - 3.377)
Overweight	4.5	4.3	3.5
	(4.112 - 4.822)	(4.134 - 4.385)	(3.427 - 3.606)
Obesity	5.3	5.4	4.2
	(4.902 - 5.634)	(5.191 - 5.557)	(4.071 - 4.363)

Table B. 9: The intensity of visits to FP/GPs for each BMI category in 2000-1 and 2009-10 relative to 1996-7

	2000-1 (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)
Overall	0.99	0.80***
	(0.945 - 1.029)	(0.764 - 0.832)
Underweight	0.86	0.84*
	(0.727 - 1.029)	(0.680 - 1.026)
Normal Weight	0.99	0.79***
	(0.945 - 1.043)	(0.747 - 0.831)
Overweight	0.95	0.77***
	(0.869 - 1.041)	(0.706 - 0.841)
Obesity	1.02	0.79***
	(0.943 - 1.105)	(0.729 - 0.860)

*** p<0.01, ** p<0.05, * p<0.1

Table B. 10: Propensity to visit a specialist by BMI category and year

	1996 (%, 95% CI)	***2000*** (%, 95% CI)	***2009*** (%, 95% CI)
Overall	24.9	29.5	31.4
	(24.1 - 25.8)	(29.0 - 29.9)	(30.9 - 32.0)
Underweight	27.8	29.1	30.6
	(22.6 - 33.0)	(26.6 - 31.6)	(26.6 - 34.5)
Normal weight	25.3	28.9	29.7
	(24.1 - 26.6)	(28.4 - 29.5)	(28.9 - 30.5)
Overweight	23.3	29	31.1
	(22.1 - 24.6)	(28.2 - 29.7)	(30.3 - 32.0)
Obesity	27.4	32.4	36.3
	(25.0 - 29.8)	(31.3 - 33.5)	(35.0 - 37.7)

Table B. 11: Trends in the propensity to visit a specialist physician for each BMI category in 2000-1 and 2009-10 relative to 1996-7

	2000-1 (RR, 95% CI)	***2009-10*** (RR, 95% CI)
Overall	1.18***	1.26***
	(1.140 - 1.225)	(1.214 - 1.309)
Underweight	1.04	1.1
	(0.846 - 1.288)	(0.872 - 1.381)
Normal Weight	1.14***	1.17***
	(1.082 - 1.205)	(1.106 - 1.241)
Overweight	1.24***	1.33***
	(1.166 - 1.320)	(1.251 - 1.419)
Obesity	1.18***	1.33***
	(1.077 - 1.300)	(1.207 - 1.459)

*** p<0.01, ** p<0.05, * p<0.1

Table B. 12: The intensity of visits to specialists by BMI category and year

	1996-7 (mean, 95% CI)	***2000-1*** (mean, 95% CI)	***2009-10*** (mean, 95% CI)
Overall	3.2	3.3	3.3
	(3.035 - 3.435)	(3.190 - 3.456)	(3.132 - 3.397)
Underweight	3.9	4	3.5
	(2.836 - 5.005)	(3.007 - 5.088)	(2.983 - 3.923)
Normal weight	3.1	3.2	3.3
	(2.862 - 3.320)	(3.002 - 3.333)	(3.084 - 3.425)
Overweight	3.3	3.3	3.1
	(2.833 - 3.805)	(2.982 - 3.555)	(2.852 - 3.386)
Obesity	3.4	3.8	3.5
	(3.028 - 3.849)	(3.502 - 4.012)	(3.198 - 3.795)

Table B. 13: The intensity of visits to specialist physicians for each BMI category in 2000-1 and 2009-10 relative to 1996-7

	2000-1 (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)
Overall	1.03	1.01
	(0.948 - 1.123)	(0.927 - 1.103)
Underweight	1.04	0.87
	(0.689 - 1.555)	(0.605 - 1.244)
Normal Weight	1.03	1.06
	(0.922 - 1.150)	(0.955 - 1.183)
Overweight	0.98	0.93
	(0.807 - 1.196)	(0.761 - 1.135)
Obesity	1.1	1.02
	(0.941 - 1.297)	(0.861 - 1.207)

*** p<0.01, ** p<0.05, * p<0.1

8.3 Appendix C: Multivariable Tables

8.3.1 Hospital Utilization – Propensity

Table C. 1: The association between each BMI category and the risk of a hospital admission and pooled models in multivariable Poisson regression

	1996-7 (RR, 95% CI)	***2000-1*** (RR, 95% CI)	***2009-10*** (RR, 95% CI)	***Pooled*** (RR, 95% CI)	***Pooled with Interaction*** (RR, 95% CI)
Underweight	1.11 (0.809 - 1.512)	1.11 (0.949 - 1.287)	1.26* (0.988 - 1.608)	1.15** (1.006 - 1.314)	1.11 (0.814 - 1.517)
Overweight	0.93 (0.798 - 1.095)	1.03 (0.962 - 1.093)	1.04 (0.957 - 1.134)	1.00 (0.941 - 1.063)	0.95 (0.819 - 1.091)
Obesity	1.08 (0.889 - 1.311)	1.19*** (1.102 - 1.286)	1.27*** (1.154 - 1.392)	1.18*** (1.104 - 1.27)	1.10 (0.912 - 1.320)
2000-1				1.01 (0.948 - 1.085)	0.97 (0.874 - 1.078)
2009-10				1.02 (0.95 - 1.094)	0.97 (0.869 - 1.081)
2000-1×Obesity					1.10 (0.908 - 1.334)
2009-10×Obesity					1.12 (0.918 - 1.376)
2000-1×Overweight					1.09 (0.937 - 1.276)
2009-10×Overweight					1.08 (0.919 - 1.273)
2000-1×Underweight					0.99 (0.706 - 1.398)
2009-10×Underweight					1.14 (0.764 - 1.694)
Predisposing					
Age 25 to 34	1.06 (0.815 - 1.381)	1.12* (0.996 - 1.269)	1.02 (0.887 - 1.184)	1.08 (0.978 - 1.193)	1.08 (0.978 - 1.192)
Age 35 to 44	0.64*** (0.478 - 0.867)	0.70*** (0.615 - 0.803)	0.67*** (0.563 - 0.802)	0.68*** (0.604 - 0.759)	0.68*** (0.604 - 0.758)
Age 45 to 54	0.56*** (0.392 - 0.793)	0.64*** (0.560 - 0.737)	0.55*** (0.452 - 0.663)	0.59*** (0.514 - 0.672)	0.59*** (0.514 - 0.672)
Age 55 to 64	0.74* (0.530 - 1.028)	0.86** (0.746 - 0.989)	0.63*** (0.525 - 0.750)	0.73*** (0.648 - 0.833)	0.73*** (0.648 - 0.833)
Age 65 to 74	0.91 (0.668 - 1.239)	1.08 (0.940 - 1.242)	0.83** (0.701 - 0.990)	0.95 (0.838 - 1.067)	0.95 (0.838 - 1.067)
Age 75 to 84	1.31 (0.943 - 1.825)	1.43*** (1.236 - 1.660)	1.15 (0.959 - 1.368)	1.29*** (1.135 - 1.471)	1.29*** (1.135 - 1.471)
Age 85+	1.54 (0.870 - 2.712)	1.82*** (1.509 - 2.201)	1.44*** (1.152 - 1.796)	1.61*** (1.322 - 1.954)	1.60*** (1.320 - 1.949)
Male	0.77*** (0.655 - 0.908)	0.77*** (0.730 - 0.821)	0.80*** (0.750 - 0.862)	0.78*** (0.739 - 0.829)	0.78*** (0.739 - 0.830)
Divorced/widowed/ separated	1.68*** (1.300 - 2.170)	1.23*** (1.099 - 1.367)	1.43*** (1.264 - 1.626)	1.42*** (1.287 - 1.561)	1.42*** (1.288 - 1.563)
Married	1.74*** (1.409 - 2.152)	1.39*** (1.265 - 1.536)	1.54*** (1.379 - 1.713)	1.54*** (1.42 - 1.662)	1.54*** (1.421 - 1.663)
Immigrant < 10 years	0.92 (0.629 - 1.335)	0.69*** (0.569 - 0.830)	0.61*** (0.471 - 0.779)	0.72*** (0.613 - 0.842)	0.72*** (0.614 - 0.842)
Immigrant ≥ 10 years	0.97 (0.792 - 1.178)	0.86*** (0.776 - 0.954)	0.89* (0.782 - 1.002)	0.90** (0.83 - 0.979)	0.90** (0.830 - 0.979)
Bachelor's Degree	0.81* (0.652 - 1.012)	0.90* (0.799 - 1.015)	0.94 (0.827 - 1.073)	0.88*** (0.798 - 0.959)	0.88*** (0.799 - 0.960)
Diploma/Certificate	0.92 (0.751 - 1.131)	0.96 (0.891 - 1.040)	1.00 (0.900 - 1.108)	0.95 (0.887 - 1.025)	0.95 (0.886 - 1.025)

Secondary school	0.94	0.91**	0.99	0.94*	0.94*
	(0.801 - 1.099)	(0.840 - 0.979)	(0.895 - 1.105)	(0.876 - 1.005)	(0.875 - 1.004)
Former Smoker	1.43***	1.26***	1.30***	1.32***	1.32***
	(1.228 - 1.662)	(1.174 - 1.352)	(1.195 - 1.407)	(1.245 - 1.401)	(1.245 - 1.401)
Occasional Smoker	1.11	1.15*	1.43***	1.26***	1.26***
	(0.794 - 1.544)	(0.991 - 1.330)	(1.180 - 1.735)	(1.11 - 1.422)	(1.110 - 1.422)
Light Daily Smoker	1.45***	1.26***	1.45***	1.39**	1.39***
	(1.150 - 1.820)	(1.111 - 1.420)	(1.243 - 1.698)	(1.253 - 1.532)	(1.253 - 1.532)
Heavy Daily Smoker	1.43***	1.32***	1.36***	1.36***	1.36***
	(1.183 - 1.738)	(1.197 - 1.446)	(1.205 - 1.529)	(1.253 - 1.478)	(1.252 - 1.478)
Regular Drinker – Non Binge	0.66***	0.62***	0.67***	0.64***	0.64***
	(0.540 - 0.795)	(0.570 - 0.681)	(0.607 - 0.742)	(0.596 - 0.698)	(0.596 - 0.697)
Regular Drinker – Binge	0.47***	0.54***	0.55***	0.52***	0.52***
	(0.381 - 0.589)	(0.490 - 0.588)	(0.485 - 0.616)	(0.479 - 0.566)	(0.479 - 0.566)
Occasional Drinker	0.82**	0.81***	0.81***	0.81***	0.81***
	(0.689 - 0.981)	(0.742 - 0.874)	(0.736 - 0.894)	(0.754 - 0.877)	(0.753 - 0.877)
Enabling					
Rural	1.17*	1.04	0.94	1.05	1.05
	(0.990 - 1.391)	(0.979 - 1.113)	(0.872 - 1.021)	(0.983 - 1.116)	(0.982 - 1.116)
No Regular Medical Doctor	0.52***	0.53***	0.58***	0.55***	0.55***
	(0.373 - 0.736)	(0.471 - 0.588)	(0.508 - 0.669)	(0.492 - 0.611)	(0.492 - 0.611)
Income_Q5	0.92	0.76***	0.65***	0.77***	0.77***
	(0.726 - 1.179)	(0.679 - 0.862)	(0.557 - 0.757)	(0.696 - 0.862)	(0.696 - 0.862)
Income_Q4	0.85	0.73***	0.74***	0.78***	0.78***
	(0.693 - 1.036)	(0.663 - 0.813)	(0.658 - 0.843)	(0.712 - 0.849)	(0.711 - 0.848)
Income_Q3	0.94	0.80***	0.81***	0.85***	0.85***
	(0.805 - 1.104)	(0.733 - 0.868)	(0.719 - 0.904)	(0.79 - 0.912)	(0.790 - 0.912)
Income_Q2	0.89	0.90***	0.82***	0.87***	0.87***
	(0.754 - 1.052)	(0.832 - 0.967)	(0.741 - 0.898)	(0.814 - 0.932)	(0.814 - 0.932)
Homeowner	0.83**	0.84***	0.83***	0.83***	0.83***
	(0.715 - 0.961)	(0.784 - 0.891)	(0.761 - 0.910)	(0.781 - 0.881)	(0.782 - 0.881)
Organization/Resource					
Newfoundland	1.23	1.07	1.02	1.11*	1.10*
	(0.958 - 1.589)	(0.924 - 1.238)	(0.855 - 1.206)	(0.989 - 1.235)	(0.988 - 1.234)
Prince Edward Island	1.27	1.16**	1.29***	1.24***	1.24***
	(0.932 - 1.743)	(1.010 - 1.337)	(1.063 - 1.559)	(1.085 - 1.414)	(1.085 - 1.414)
Nova Scotia	1.08	0.95	1.08	1.04	1.04
	(0.807 - 1.455)	(0.838 - 1.083)	(0.932 - 1.261)	(0.921 - 1.168)	(0.922 - 1.170)
New Brunswick	1.32***	1.19***	1.20***	1.24***	1.24***
	(1.080 - 1.615)	(1.053 - 1.344)	(1.050 - 1.364)	(1.132 - 1.36)	(1.133 - 1.362)
Quebec	1.27**	1.24***	1.29***	1.26***	1.26***
	(1.040 - 1.545)	(1.141 - 1.339)	(1.166 - 1.418)	(1.17 - 1.365)	(1.170 - 1.366)
Manitoba	1.22***	1.06	1.08	1.12***	1.12***
	(1.057 - 1.398)	(0.950 - 1.180)	(0.919 - 1.277)	(1.029 - 1.213)	(1.029 - 1.213)
Saskatchewan	0.98	1.31***	1.18**	1.16***	1.16***
	(0.736 - 1.314)	(1.183 - 1.444)	(1.023 - 1.352)	(1.044 - 1.278)	(1.046 - 1.279)
Alberta	1.08	1.11**	1.28***	1.16***	1.16***
	(0.978 - 1.187)	(1.013 - 1.221)	(1.138 - 1.439)	(1.094 - 1.235)	(1.095 - 1.235)
British Columbia	1.13	1.03	1.17***	1.12***	1.12***
	(0.932 - 1.382)	(0.945 - 1.120)	(1.047 - 1.316)	(1.031 - 1.216)	(1.032 - 1.216)
Constant	0.10***	0.14***	0.13***	0.12***	0.13***
	(0.079 - 0.137)	(0.118 - 0.158)	(0.106 - 0.154)	(0.108 - 0.138)	(0.110 - 0.144)
Observations	**49962**	**98774**	**87452**	**236188**	**236188**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 2: The association between each BMI category and the risk of a hospital admission and pooled models in multivariable Poisson regression with control for number of chronic conditions

.	***1996-7*** (RR, 95% CI)	***2000-1*** (RR, 95% CI)	***2009-10*** (RR, 95% CI)	***Pooled*** (RR, 95% CI)	***Pooled with Interaction*** (RR, 95% CI)
Underweight	1.13	1.09	1.29**	1.16**	1.15
	(0.837 - 1.538)	(0.937 - 1.274)	(1.013 - 1.641)	(1.02 - 1.327)	(0.845 - 1.552)
Overweight	0.90	0.98	0.99	0.95	0.91
	(0.763 - 1.050)	(0.916 - 1.041)	(0.907 - 1.076)	(0.897 - 1.014)	(0.791 - 1.057)
Obesity	0.94	1.01	1.06	1.01	0.98
	(0.773 - 1.148)	(0.931 - 1.089)	(0.965 - 1.166)	(0.937 - 1.079)	(0.813 - 1.171)
2000-1				0.97	0.94
				(0.911 - 1.041)	(0.851 - 1.047)
2009-10				0.95	0.93
				(0.884 - 1.019)	(0.829 - 1.034)
2000-1×Obesity					1.05
					(0.872 - 1.273)
2009-10×Obesity					1.04
					(0.849 - 1.264)
2000-1×Overweight					1.08
					(0.925 - 1.260)
2009-10×Overweight					1.05
					(0.891 - 1.234)
2000-1×Underweight					0.96
					(0.684 - 1.338)
2009-10×Underweight					1.13
					(0.761 - 1.671)
Predisposing					
Age 25 to 34	1.04	1.09	1.01	1.06	1.06
	(0.802 - 1.353)	(0.970 - 1.234)	(0.876 - 1.168)	(0.959 - 1.168)	(0.958 - 1.167)
Age 35 to 44	0.62***	0.66***	0.62***	0.64***	0.64***
	(0.457 - 0.831)	(0.580 - 0.756)	(0.521 - 0.742)	(0.569 - 0.716)	(0.569 - 0.716)
Age 45 to 54	0.48***	0.56***	0.47***	0.51***	0.51***
	(0.337 - 0.688)	(0.487 - 0.640)	(0.386 - 0.565)	(0.445 - 0.584)	(0.445 - 0.583)
Age 55 to 64	0.58***	0.67***	0.47***	0.57***	0.57***
	(0.409 - 0.818)	(0.581 - 0.774)	(0.393 - 0.565)	(0.501 - 0.649)	(0.501 - 0.648)
Age 65 to 74	0.68**	0.77***	0.57***	0.68***	0.68***
	(0.491 - 0.932)	(0.668 - 0.894)	(0.480 - 0.686)	(0.599 - 0.771)	(0.599 - 0.771)
Age 75 to 84	0.89	0.95	0.71***	0.85**	0.85**
	(0.632 - 1.261)	(0.819 - 1.111)	(0.594 - 0.859)	(0.744 - 0.975)	(0.745 - 0.975)
Age 85+	0.95	1.19*	0.83	0.99	0.99
	(0.580 - 1.564)	(0.985 - 1.438)	(0.661 - 1.044)	(0.83 - 1.189)	(0.830 - 1.187)
Male	0.82**	0.82***	0.84***	0.83***	0.83***
	(0.697 - 0.965)	(0.775 - 0.872)	(0.784 - 0.901)	(0.779 - 0.875)	(0.780 - 0.875)
Divorced/widowed/ separated	1.60***	1.19***	1.42***	1.38***	1.39***
	(1.236 - 2.075)	(1.070 - 1.331)	(1.254 - 1.617)	(1.257 - 1.526)	(1.257 - 1.527)
Married	1.73***	1.39***	1.54***	1.53***	1.53***
	(1.405 - 2.143)	(1.258 - 1.527)	(1.377 - 1.712)	(1.418 - 1.657)	(1.418 - 1.658)
Immigrant < 10 years	1.00	0.77***	0.65***	0.79***	0.79***
	(0.694 - 1.452)	(0.640 - 0.934)	(0.511 - 0.835)	(0.676 - 0.924)	(0.676 - 0.924)
Immigrant ≥ 10 years	0.98	0.87***	0.89*	0.91**	0.91**
	(0.807 - 1.193)	(0.788 - 0.966)	(0.792 - 1.010)	(0.841 - 0.99)	(0.840 - 0.990)
Bachelor's Degree	0.82*	0.94	0.99	0.91**	0.91**
	(0.656 - 1.019)	(0.834 - 1.059)	(0.869 - 1.130)	(0.825 - 0.994)	(0.825 - 0.994)
Diploma/Certificate	0.90	0.99	1.03	0.96	0.96
	(0.737 - 1.108)	(0.913 - 1.064)	(0.926 - 1.137)	(0.896 - 1.035)	(0.896 - 1.035)
Secondary school	0.94	0.94*	1.04	0.96	0.96
	(0.801 - 1.092)	(0.869 - 1.012)	(0.939 - 1.159)	(0.895 - 1.026)	(0.894 - 1.025)
Former Smoker	1.37***	1.20***	1.24***	1.26***	1.26***
	(1.178 - 1.598)	(1.116 - 1.284)	(1.142 - 1.342)	(1.188 - 1.337)	(1.188 - 1.337)
Occasional Smoker	1.08	1.09	1.38***	1.21***	1.21***

	(0.772 - 1.517)	(0.944 - 1.263)	(1.137 - 1.666)	(1.07 - 1.372)	(1.069 - 1.372)
Light Daily Smoker	1.40***	1.21***	1.38***	1.33***	1.33***
	(1.115 - 1.763)	(1.067 - 1.364)	(1.178 - 1.608)	(1.201 - 1.468)	(1.201 - 1.469)
Heavy Daily Smoker	1.35***	1.21***	1.23***	1.25***	1.25***
	(1.117 - 1.642)	(1.099 - 1.330)	(1.090 - 1.385)	(1.155 - 1.362)	(1.155 - 1.362)
Regular Drinker – Non Binge	0.70***	0.66***	0.73***	0.69***	0.69***
	(0.571 - 0.847)	(0.608 - 0.728)	(0.661 - 0.808)	(0.638 - 0.747)	(0.637 - 0.746)
Regular Drinker – Binge	0.50***	0.57***	0.59***	0.56***	0.56***
	(0.401 - 0.628)	(0.519 - 0.626)	(0.525 - 0.666)	(0.512 - 0.606)	(0.512 - 0.606)
Occasional Drinker	0.86*	0.82***	0.84***	0.84***	0.84***
	(0.717 - 1.027)	(0.756 - 0.892)	(0.762 - 0.923)	(0.776 - 0.904)	(0.776 - 0.904)
Enabling					
Rural	1.17*	1.06*	0.95	1.05	1.05
	(0.989 - 1.382)	(0.992 - 1.125)	(0.875 - 1.022)	(0.986 - 1.118)	(0.986 - 1.118)
No Regular Medical Doctor	0.58***	0.57***	0.63***	0.59***	0.59***
	(0.410 - 0.806)	(0.509 - 0.636)	(0.545 - 0.717)	(0.533 - 0.661)	(0.533 - 0.661)
Income_Q5	1.00	0.84***	0.71***	0.84***	0.84***
	(0.789 - 1.266)	(0.744 - 0.945)	(0.611 - 0.832)	(0.759 - 0.939)	(0.759 - 0.939)
Income_Q4	0.90	0.80***	0.81***	0.84***	0.84***
	(0.740 - 1.104)	(0.723 - 0.886)	(0.719 - 0.920)	(0.771 - 0.918)	(0.771 - 0.918)
Income_Q3	1.01	0.86***	0.87**	0.91**	0.91**
	(0.859 - 1.182)	(0.788 - 0.934)	(0.780 - 0.978)	(0.851 - 0.983)	(0.851 - 0.983)
Income_Q2	0.95	0.95	0.87***	0.93**	0.93**
	(0.805 - 1.126)	(0.879 - 1.020)	(0.791 - 0.957)	(0.867 - 0.993)	(0.867 - 0.993)
Homeowner	0.86*	0.86***	0.87***	0.86***	0.86***
	(0.745 - 1.003)	(0.810 - 0.922)	(0.798 - 0.955)	(0.815 - 0.917)	(0.815 - 0.918)
Organization/Resource					
Newfoundland	1.31**	1.15*	1.04	1.16***	1.16***
	(1.019 - 1.680)	(0.999 - 1.325)	(0.874 - 1.230)	(1.039 - 1.297)	(1.038 - 1.297)
Prince Edward Island	1.30*	1.23***	1.32***	1.28***	1.28***
	(0.955 - 1.761)	(1.073 - 1.408)	(1.091 - 1.603)	(1.123 - 1.457)	(1.124 - 1.457)
Nova Scotia	1.09	0.95	1.07	1.04	1.04
	(0.814 - 1.468)	(0.843 - 1.082)	(0.920 - 1.248)	(0.921 - 1.168)	(0.921 - 1.168)
New Brunswick	1.38***	1.25***	1.21***	1.28***	1.28***
	(1.134 - 1.677)	(1.112 - 1.407)	(1.062 - 1.375)	(1.173 - 1.404)	(1.174 - 1.405)
Quebec	1.35***	1.34***	1.37***	1.35***	1.35***
	(1.109 - 1.645)	(1.236 - 1.450)	(1.242 - 1.507)	(1.251 - 1.46)	(1.252 - 1.460)
Manitoba	1.24***	1.08	1.08	1.13***	1.13***
	(1.080 - 1.419)	(0.968 - 1.206)	(0.922 - 1.272)	(1.044 - 1.227)	(1.044 - 1.226)
Saskatchewan	1.00	1.35***	1.20***	1.19***	1.19***
	(0.752 - 1.334)	(1.227 - 1.495)	(1.046 - 1.376)	(1.073 - 1.309)	(1.073 - 1.310)
Alberta	1.09*	1.12**	1.29***	1.17***	1.17***
	(0.989 - 1.197)	(1.022 - 1.228)	(1.147 - 1.449)	(1.103 - 1.244)	(1.103 - 1.244)
British Columbia	1.14	1.05	1.21***	1.14***	1.14***
	(0.940 - 1.387)	(0.962 - 1.140)	(1.083 - 1.358)	(1.052 - 1.239)	(1.052 - 1.239)
Need					
Number of Chronic Conditions	1.33***	1.32***	1.31***	1.31***	1.31***
	(1.272 - 1.390)	(1.299 - 1.351)	(1.275 - 1.338)	(1.292 - 1.336)	(1.292 - 1.336)
Constant	0.08***	0.10***	0.09***	0.10***	0.10***
	(0.061 - 0.106)	(0.088 - 0.118)	(0.078 - 0.115)	(0.085 - 0.108)	(0.085 - 0.112)
Observations	**49962**	**98774**	**87452**	**236188**	**236188**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 3: Trends in the risk of a hospital admission for each BMI category relative to the trend in individuals of normal weight in stratified pooled multivariable Poisson regression

	Age ≤ 64 (RR, 95% CI)	***Age ≥ 65*** (RR, 95% CI)	***M ale*** (RR, 95% CI)	***Female*** (RR, 95% CI)
Underweight	0.97	1.34	0.82	1.15
	(0.651 - 1.440)	(0.857 - 2.105)	(0.431 - 1.555)	(0.824 - 1.600)
Overweight	1.06	0.75**	0.86	1.07
	(0.885 - 1.260)	(0.596 - 0.936)	(0.670 - 1.095)	(0.890 - 1.277)
Obesity	1.10	1.13	0.92	1.24**
	(0.885 - 1.375)	(0.803 - 1.586)	(0.675 - 1.263)	(1.003 - 1.543)
2000-1	1.00	0.90	0.94	1.00
	(0.888 - 1.135)	(0.755 - 1.082)	(0.758 - 1.160)	(0.896 - 1.125)
2009-10	1.04	0.82**	0.94	1.00
	(0.913 - 1.178)	(0.678 - 0.993)	(0.756 - 1.163)	(0.893 - 1.121)
2000-1×Obesity	1.13	1.03	1.26	1.03
	(0.895 - 1.420)	(0.709 - 1.496)	(0.902 - 1.772)	(0.809 - 1.300)
2009-10×Obesity	1.15	1.07	1.30	1.04
	(0.899 - 1.460)	(0.740 - 1.539)	(0.919 - 1.837)	(0.824 - 1.305)
2000-1×Overweight	0.99	1.38**	1.16	1.03
	(0.822 - 1.199)	(1.074 - 1.773)	(0.890 - 1.520)	(0.844 - 1.248)
2009-10×Overweight	0.99	1.35**	1.12	1.03
	(0.808 - 1.215)	(1.046 - 1.750)	(0.843 - 1.483)	(0.838 - 1.255)
2000-1×Underweight	0.99	1.09	1.44	0.92
	(0.635 - 1.552)	(0.669 - 1.764)	(0.695 - 2.978)	(0.640 - 1.330)
2009-10×Underweight	1.28	1.01	1.94	1.01
	(0.760 - 2.148)	(0.601 - 1.712)	(0.777 - 4.835)	(0.673 - 1.516)
Predisposing				
Age 25 to 34	1.06		1.05	1.03
	(0.960 - 1.170)		(0.863 - 1.286)	(0.916 - 1.158)
Age 35 to 44	0.66***		1.24**	0.52***
	(0.588 - 0.741)		(1.036 - 1.485)	(0.446 - 0.600)
Age 45 to 54	0.57***		1.40***	0.37***
	(0.495 - 0.648)		(1.146 - 1.716)	(0.313 - 0.433)
Age 55 to 64	0.70***		1.92***	0.42***
	(0.613 - 0.792)		(1.588 - 2.326)	(0.361 - 0.492)
Age 65 to 74			2.56***	0.55***
			(2.091 - 3.137)	(0.468 - 0.638)
Age 75 to 84		1.37***	3.35***	0.80***
		(1.256 - 1.503)	(2.673 - 4.192)	(0.678 - 0.937)
Age 85+		1.70***	4.12***	1.00
		(1.451 - 1.991)	(2.881 - 5.880)	(0.820 - 1.221)
Male	0.67***	1.21***		
	(0.623 - 0.716)	(1.110 - 1.330)		
Divorced/widowed/ separated	1.59***	1.08	1.15*	1.73***
	(1.411 - 1.786)	(0.897 - 1.297)	(0.991 - 1.343)	(1.517 - 1.972)
Married	1.58***	1.11	0.92	1.97***
	(1.453 - 1.717)	(0.918 - 1.331)	(0.820 - 1.044)	(1.761 - 2.199)
Immigrant < 10 years	0.72***	0.58	0.55***	0.77***
	(0.609 - 0.853)	(0.285 - 1.181)	(0.412 - 0.741)	(0.632 - 0.932)
Immigrant ≥ 10 years	0.88**	0.91*	0.87**	0.91*
	(0.779 - 0.987)	(0.819 - 1.003)	(0.755 - 0.998)	(0.823 - 1.014)
Bachelor's Degree	0.82***	0.89	0.70***	0.99
	(0.731 - 0.916)	(0.769 - 1.035)	(0.600 - 0.814)	(0.882 - 1.119)
Diploma/Certificate	0.89**	0.99	0.84***	1.04
	(0.813 - 0.975)	(0.902 - 1.089)	(0.752 - 0.937)	(0.943 - 1.145)
Secondary school	0.87***	1.04	0.92	0.96
	(0.794 - 0.947)	(0.933 - 1.154)	(0.814 - 1.038)	(0.883 - 1.048)
Former Smoker	1.28***	1.22***	1.25***	1.26***
	(1.186 - 1.380)	(1.107 - 1.336)	(1.115 - 1.399)	(1.167 - 1.358)
Occasional Smoker	1.25***	1.12	1.26**	1.22**
	(1.090 - 1.437)	(0.821 - 1.520)	(1.047 - 1.519)	(1.036 - 1.425)

Light Daily Smoker	1.39***	1.10	1.42***	1.31***
	(1.234 - 1.557)	(0.893 - 1.363)	(1.165 - 1.719)	(1.169 - 1.463)
Heavy Daily Smoker	1.36***	1.01	1.28***	1.34***
	(1.238 - 1.497)	(0.839 - 1.212)	(1.115 - 1.464)	(1.212 - 1.482)
Regular Drinker – Non Binge	0.61***	0.70***	0.76***	0.59***
	(0.549 - 0.674)	(0.631 - 0.771)	(0.666 - 0.875)	(0.539 - 0.642)
Regular Drinker –Binge	0.51***	0.62***	0.70***	0.43***
	(0.465 - 0.565)	(0.532 - 0.717)	(0.612 - 0.798)	(0.394 - 0.477)
Occasional Drinker	0.79***	0.84***	0.87*	0.77***
	(0.711 - 0.869)	(0.758 - 0.940)	(0.757 - 1.010)	(0.706 - 0.835)
Enabling				
Rural	1.03	1.09*	0.99	1.06
	(0.949 - 1.116)	(0.996 - 1.189)	(0.912 - 1.082)	(0.971 - 1.147)
No Regular Medical Doctor	0.55***	0.58***	0.55***	0.60***
	(0.486 - 0.614)	(0.432 - 0.767)	(0.472 - 0.644)	(0.522 - 0.686)
Income_Q5	0.75***	0.91	0.85*	0.72***
	(0.663 - 0.850)	(0.717 - 1.163)	(0.711 - 1.017)	(0.631 - 0.821)
Income_Q4	0.75***	0.89	0.76***	0.80***
	(0.675 - 0.823)	(0.757 - 1.047)	(0.662 - 0.869)	(0.716 - 0.892)
Income_Q3	0.78***	1.02	0.84***	0.85***
	(0.715 - 0.860)	(0.915 - 1.137)	(0.742 - 0.953)	(0.775 - 0.926)
Income_Q2	0.83***	0.95	0.90*	0.85***
	(0.764 - 0.907)	(0.859 - 1.041)	(0.795 - 1.008)	(0.785 - 0.925)
Homeowner	0.83***	0.85***	0.82***	0.83***
	(0.771 - 0.892)	(0.773 - 0.934)	(0.739 - 0.913)	(0.777 - 0.897)
Organization/Resource				
Newfoundland	1.08	1.13	1.20**	1.02
	(0.947 - 1.239)	(0.957 - 1.333)	(1.004 - 1.430)	(0.882 - 1.188)
Prince Edward Island	1.31***	1.07	1.12	1.31***
	(1.115 - 1.532)	(0.859 - 1.321)	(0.933 - 1.345)	(1.097 - 1.566)
Nova Scotia	1.07	0.94	1.23**	0.92
	(0.927 - 1.241)	(0.786 - 1.115)	(1.025 - 1.470)	(0.798 - 1.068)
New Brunswick	1.21***	1.34***	1.30***	1.20***
	(1.081 - 1.346)	(1.134 - 1.576)	(1.105 - 1.520)	(1.047 - 1.365)
Quebec	1.37***	1.04	1.32***	1.20***
	(1.246 - 1.497)	(0.919 - 1.172)	(1.162 - 1.502)	(1.094 - 1.323)
Manitoba	1.09*	1.15**	1.20***	1.06
	(0.985 - 1.216)	(1.024 - 1.303)	(1.056 - 1.366)	(0.960 - 1.169)
Saskatchewan	1.14**	1.18**	1.15	1.17***
	(1.003 - 1.295)	(1.025 - 1.351)	(0.973 - 1.371)	(1.040 - 1.308)
Alberta	1.20***	1.05	1.11**	1.18***
	(1.113 - 1.288)	(0.943 - 1.180)	(1.002 - 1.225)	(1.088 - 1.279)
British Columbia	1.10*	1.16**	1.10	1.11*
	(0.989 - 1.214)	(1.009 - 1.338)	(0.966 - 1.256)	(0.998 - 1.242)
Constant	0.14***	0.14***	0.08***	0.14***
	(0.123 - 0.166)	(0.114 - 0.173)	(0.058 - 0.098)	(0.121 - 0.163)
Observations	**185144**	**51044**	**111642**	**124546**

*** p<0.01, ** p<0.05, * p<0.1

8.3.2 Hospital Utilization – Intensity

Table C. 4: The association between each BMI category and the intensity of nights spent in the hospital and pooled models in multivariable Zero Truncated Poisson regression

	1996-7 (IRR, 95% CI)	***2000-1*** (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)	***Pooled*** (IRR, 95% CI)	***Pooled with Interaction*** (IRR, 95% CI)
Underweight	0.75	1.62***	1.32	1.24*	0.73
	(0.471 - 1.191)	(1.221 - 2.148)	(0.944 - 1.853)	(0.995 - 1.539)	(0.482 - 1.100)
Overweight	0.94	0.86*	1.02	0.93	0.95
	(0.684 - 1.300)	(0.734 - 1.010)	(0.761 - 1.372)	(0.784 - 1.098)	(0.659 - 1.368)
Obesity	0.67**	0.86**	1.08	0.87*	0.72**
	(0.474 - 0.951)	(0.737 - 0.998)	(0.823 - 1.414)	(0.757 - 1.006)	(0.528 - 0.975)
2000-1				0.95	0.92
				(0.814 - 1.104)	(0.720 - 1.185)
2009-10				0.86	0.78*
				(0.724 - 1.032)	(0.594 - 1.012)
2000-1×Obesity					1.18
					(0.846 - 1.647)
2009-10×Obesity					1.45*
					(0.982 - 2.153)
2000-1×Overweight					0.90
					(0.602 - 1.359)
2009-10×Overweight					1.05
					(0.673 - 1.651)
2000-1×Underweight					2.21***
					(1.354 - 3.596)
2009-10×Underweight					1.83**
					(1.085 - 3.084)
Predisposing					
Age 25 to 34	0.96	1.25	1.12	1.12	1.12
	(0.556 - 1.649)	(0.888 - 1.758)	(0.798 - 1.560)	(0.877 - 1.419)	(0.877 - 1.420)
Age 35 to 44	0.99	1.48**	1.36	1.28*	1.27*
	(0.560 - 1.748)	(1.066 - 2.055)	(0.942 - 1.956)	(0.998 - 1.631)	(0.996 - 1.628)
Age 45 to 54	2.13**	1.67***	1.90***	1.88***	1.89***
	(1.120 - 4.041)	(1.181 - 2.366)	(1.305 - 2.767)	(1.431 - 2.478)	(1.443 - 2.488)
Age 55 to 64	1.42	1.97***	1.93***	1.77***	1.77***
	(0.793 - 2.533)	(1.418 - 2.741)	(1.292 - 2.871)	(1.372 - 2.282)	(1.373 - 2.288)
Age 65 to 74	2.81***	2.65***	2.90***	2.71***	2.73***
	(1.385 - 5.699)	(1.870 - 3.766)	(1.978 - 4.237)	(2.004 - 3.657)	(2.027 - 3.684)
Age 75 to 84	2.41***	3.29***	3.20***	2.93***	2.94***
	(1.391 - 4.159)	(2.262 - 4.783)	(2.138 - 4.778)	(2.253 - 3.82)	(2.255 - 3.821)
Age 85+	4.49***	2.99***	5.96***	4.53***	4.55***
	(1.892 - 10.658)	(1.998 - 4.465)	(3.035 - 11.708)	(2.873 - 7.133)	(2.902 - 7.130)
Male	1.02	1.30***	1.16	1.19**	1.18**
	(0.759 - 1.369)	(1.115 - 1.527)	(0.971 - 1.388)	(1.038 - 1.358)	(1.030 - 1.348)
Divorced/widowed/ separated	0.64**	0.76**	0.92	0.77***	0.77***
	(0.444 - 0.909)	(0.580 - 0.986)	(0.724 - 1.167)	(0.654 - 0.914)	(0.653 - 0.909)
Married	0.78*	0.66***	0.66***	0.72***	0.72***
	(0.600 - 1.006)	(0.523 - 0.827)	(0.520 - 0.836)	(0.63 - 0.827)	(0.626 - 0.819)
Immigrant < 10 years	0.73	0.78	1.16	0.87	0.88
	(0.454 - 1.189)	(0.429 - 1.420)	(0.462 - 2.900)	(0.56 - 1.349)	(0.565 - 1.359)
Immigrant ≥ 10 years	0.78	0.80**	0.88	0.85	0.86
	(0.488 - 1.255)	(0.673 - 0.948)	(0.650 - 1.195)	(0.675 - 1.077)	(0.681 - 1.083)
Bachelor's Degree	0.90	0.96	0.86	0.88	0.88
	(0.528 - 1.548)	(0.752 - 1.214)	(0.603 - 1.218)	(0.708 - 1.09)	(0.712 - 1.097)
Diploma/Certificate	1.19	0.99	1.03	1.06	1.05
	(0.872 - 1.620)	(0.837 - 1.174)	(0.788 - 1.337)	(0.916 - 1.224)	(0.911 - 1.221)
Secondary school	1.29	1.05	0.82	1.09	1.09
	(0.916 - 1.809)	(0.886 - 1.254)	(0.631 - 1.057)	(0.911 - 1.306)	(0.907 - 1.301)

Former Smoker	1.62**	1.05	0.95	1.19**	1.19**
	(1.116 - 2.356)	(0.882 - 1.241)	(0.752 - 1.203)	(1.005 - 1.402)	(1.009 - 1.407)
Occasional Smoker	2.12*	0.99	1.09	1.29	1.29
	(0.988 - 4.563)	(0.674 - 1.442)	(0.759 - 1.577)	(0.944 - 1.769)	(0.945 - 1.772)
Light Daily Smoker	0.99	1.15	1.14	1.11	1.11
	(0.633 - 1.542)	(0.911 - 1.452)	(0.855 - 1.507)	(0.938 - 1.316)	(0.934 - 1.312)
Heavy Daily Smoker	1.08	1.11	1.23	1.13	1.13
	(0.776 - 1.513)	(0.878 - 1.392)	(0.913 - 1.653)	(0.958 - 1.323)	(0.958 - 1.324)
Regular Drinker – Non Binge	0.50***	0.62***	0.73**	0.61***	0.61***
	(0.347 - 0.733)	(0.524 - 0.730)	(0.562 - 0.943)	(0.503 - 0.734)	(0.506 - 0.736)
Regular Drinker – Binge	0.64**	0.62***	0.55***	0.57***	0.58***
	(0.430 - 0.943)	(0.519 - 0.734)	(0.425 - 0.703)	(0.467 - 0.687)	(0.476 - 0.696)
Occasional Drinker	0.50***	0.82**	0.77**	0.68***	0.68***
	(0.376 - 0.665)	(0.708 - 0.959)	(0.608 - 0.983)	(0.583 - 0.782)	(0.587 - 0.783)
Enabling					
Rural	0.91	0.94	0.90	0.92	0.93
	(0.692 - 1.196)	(0.821 - 1.081)	(0.748 - 1.080)	(0.821 - 1.035)	(0.828 - 1.041)
No Regular Medical Doctor	0.60	0.76**	0.74**	0.7***	0.70***
	(0.294 - 1.229)	(0.607 - 0.941)	(0.579 - 0.952)	(0.559 - 0.881)	(0.559 - 0.882)
Income_Q5	1.40	0.80*	1.06	1.11	1.10
	(0.835 - 2.351)	(0.618 - 1.043)	(0.686 - 1.646)	(0.821 - 1.512)	(0.818 - 1.492)
Income_Q4	1.03	0.81*	1.00	0.94	0.94
	(0.688 - 1.549)	(0.635 - 1.040)	(0.567 - 1.762)	(0.724 - 1.213)	(0.724 - 1.216)
Income_Q3	0.83	0.76***	0.91	0.81***	0.81***
	(0.593 - 1.161)	(0.632 - 0.924)	(0.693 - 1.186)	(0.697 - 0.938)	(0.693 - 0.936)
Income_Q2	1.16	0.88	0.85	0.94	0.94
	(0.815 - 1.650)	(0.721 - 1.067)	(0.668 - 1.071)	(0.796 - 1.1)	(0.798 - 1.102)
Homeowner	0.95	0.94	0.94	0.9	0.90
	(0.715 - 1.274)	(0.806 - 1.098)	(0.742 - 1.184)	(0.779 - 1.046)	(0.780 - 1.045)
Organization/Resource					
Newfoundland	1.28	0.99	1.34*	1.13	1.15
	(0.869 - 1.873)	(0.756 - 1.289)	(0.995 - 1.798)	(0.935 - 1.371)	(0.949 - 1.390)
Prince Edward Island	1.34	0.89	1.25	1.15	1.15
	(0.750 - 2.394)	(0.695 - 1.153)	(0.857 - 1.833)	(0.873 - 1.503)	(0.876 - 1.511)
Nova Scotia	0.93	0.90	0.99	0.94	0.95
	(0.629 - 1.361)	(0.717 - 1.139)	(0.743 - 1.325)	(0.785 - 1.122)	(0.792 - 1.134)
New Brunswick	0.99	1.11	0.91	1.00	1.00
	(0.704 - 1.393)	(0.874 - 1.401)	(0.710 - 1.154)	(0.834 - 1.197)	(0.834 - 1.192)
Quebec	1.35	0.98	1.11	1.13	1.14
	(0.926 - 1.972)	(0.810 - 1.190)	(0.794 - 1.543)	(0.92 - 1.392)	(0.930 - 1.405)
Manitoba	1.18	0.97	1.13	1.07	1.08
	(0.856 - 1.614)	(0.766 - 1.220)	(0.686 - 1.873)	(0.863 - 1.318)	(0.873 - 1.337)
Saskatchewan	1.05	0.95	0.95	0.97	0.98
	(0.728 - 1.508)	(0.685 - 1.325)	(0.720 - 1.250)	(0.792 - 1.179)	(0.803 - 1.195)
Alberta	1.08	1.01	0.95	1.01	1.02
	(0.844 - 1.383)	(0.777 - 1.315)	(0.679 - 1.318)	(0.852 - 1.191)	(0.860 - 1.200)
British Columbia	1.08	1.02	0.87	0.99	1.00
	(0.638 - 1.829)	(0.834 - 1.247)	(0.693 - 1.097)	(0.79 - 1.249)	(0.791 - 1.254)
Constant	7.38***	9.43***	7.17***	8.7	8.98***
	(3.733 - 14.594)	(6.618 - 13.432)	(4.358 - 11.796)	(6.353 - 11.907)	(6.260 - 12.892)
Observations	**4624**	**9792**	**8570**	**22986**	**22986**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 5: The association between each BMI category and the intensity of utilization of hospital nights and pooled models in multivariable Zero Truncated Poisson regression with control for the number of chronic conditions

	1996-7 (IRR, 95% CI)	***2000-1*** (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)	***Pooled*** (IRR, 95% CI)	***Pooled with Interaction*** (IRR, 95% CI)
Underweight	0.78	1.62***	1.36*	1.26**	0.75
	(0.500 - 1.221)	(1.224 - 2.142)	(0.959 - 1.929)	(1.021 - 1.566)	(0.505 - 1.127)
Overweight	0.93	0.84**	0.98	0.90	0.94
	(0.672 - 1.287)	(0.717 - 0.986)	(0.734 - 1.314)	(0.763 - 1.071)	(0.651 - 1.360)
Obesity	0.61***	0.78***	0.93	0.78***	0.65***
	(0.425 - 0.868)	(0.668 - 0.911)	(0.703 - 1.232)	(0.669 - 0.901)	(0.481 - 0.890)
2000-1				0.93	0.92
				(0.8 - 1.078)	(0.717 - 1.169)
2009-10				0.82**	0.75**
				(0.69 - 0.977)	(0.578 - 0.975)
2000-1×Obesity					1.15
					(0.830 - 1.598)
2009-10×Obesity					1.39*
					(0.947 - 2.042)
2000-1×Overweight					0.88
					(0.587 - 1.328)
2009-10×Overweight					1.02
					(0.653 - 1.601)
2000-1×Underweight					2.16***
					(1.324 - 3.509)
2009-10× Underweight					1.79**
					(1.060 - 3.031)
Predisposing					
Age 25 to 34	0.95	1.24	1.13	1.11	1.11
	(0.564 - 1.615)	(0.883 - 1.749)	(0.808 - 1.576)	(0.878 - 1.415)	(0.876 - 1.415)
Age 35 to 44	0.93	1.42**	1.26	1.21	1.21
	(0.538 - 1.621)	(1.028 - 1.963)	(0.873 - 1.829)	(0.948 - 1.543)	(0.946 - 1.540)
Age 45 to 54	1.86*	1.51**	1.63***	1.66***	1.67***
	(0.996 - 3.472)	(1.068 - 2.143)	(1.137 - 2.350)	(1.261 - 2.195)	(1.272 - 2.202)
Age 55 to 64	1.17	1.70***	1.53*	1.46***	1.47***
	(0.675 - 2.040)	(1.219 - 2.360)	(0.999 - 2.331)	(1.134 - 1.89)	(1.136 - 1.897)
Age 65 to 74	2.26**	2.22***	2.24***	2.18***	2.21***
	(1.156 - 4.423)	(1.558 - 3.167)	(1.503 - 3.326)	(1.625 - 2.934)	(1.645 - 2.961)
Age 75 to 84	1.78**	2.70***	2.37***	2.25***	2.25***
	(1.017 - 3.130)	(1.865 - 3.922)	(1.550 - 3.625)	(1.722 - 2.938)	(1.725 - 2.944)
Age 85+	2.96***	2.38***	4.07***	3.24***	3.26***
	(1.406 - 6.213)	(1.592 - 3.564)	(1.989 - 8.340)	(2.112 - 4.967)	(2.129 - 4.988)
Male	1.08	1.34***	1.19**	1.23***	1.22***
	(0.822 - 1.419)	(1.147 - 1.568)	(1.004 - 1.416)	(1.079 - 1.398)	(1.071 - 1.388)
Divorced/widowed/ separated	0.64**	0.74**	0.90	0.76***	0.76***
	(0.451 - 0.901)	(0.570 - 0.967)	(0.711 - 1.142)	(0.642 - 0.898)	(0.641 - 0.894)
Married	0.78*	0.65***	0.65***	0.71***	0.71***
	(0.607 - 1.005)	(0.517 - 0.818)	(0.515 - 0.814)	(0.623 - 0.813)	(0.618 - 0.805)
Immigrant < 10 years	0.75	0.84	1.23	0.92	0.93
	(0.462 - 1.226)	(0.462 - 1.531)	(0.478 - 3.153)	(0.589 - 1.423)	(0.596 - 1.437)
Immigrant ≥ 10 years	0.84	0.79***	0.87	0.86	0.87
	(0.528 - 1.339)	(0.663 - 0.940)	(0.646 - 1.172)	(0.677 - 1.096)	(0.683 - 1.102)
Bachelor's Degree	0.92	0.98	0.86	0.89	0.89
	(0.536 - 1.565)	(0.769 - 1.242)	(0.608 - 1.208)	(0.717 - 1.102)	(0.720 - 1.108)
Diploma/Certificate	1.18	1.00	1.03	1.06	1.05
	(0.866 - 1.594)	(0.844 - 1.184)	(0.790 - 1.333)	(0.915 - 1.221)	(0.911 - 1.219)
Secondary school	1.29	1.07	0.83	1.09	1.09
	(0.922 - 1.798)	(0.898 - 1.271)	(0.642 - 1.063)	(0.917 - 1.304)	(0.913 - 1.301)

Former Smoker	1.51**	1.02	0.91	1.14	1.14
	(1.071 - 2.138)	(0.854 - 1.209)	(0.722 - 1.148)	(0.964 - 1.339)	(0.969 - 1.345)
Occasional Smoker	2.08*	0.95	1.04	1.24	1.25
	(0.982 - 4.396)	(0.660 - 1.365)	(0.720 - 1.498)	(0.914 - 1.694)	(0.918 - 1.700)
Light Daily Smoker	0.92	1.13	1.08	1.06	1.06
	(0.587 - 1.441)	(0.895 - 1.420)	(0.818 - 1.431)	(0.899 - 1.26)	(0.898 - 1.257)
Heavy Daily Smoker	1.03	1.05	1.14	1.06	1.06
	(0.751 - 1.417)	(0.834 - 1.317)	(0.872 - 1.493)	(0.906 - 1.233)	(0.908 - 1.236)
Regular Drinker – Non Binge	0.52***	0.64***	0.78*	0.63***	0.63***
	(0.358 - 0.745)	(0.539 - 0.748)	(0.604 - 1.016)	(0.521 - 0.761)	(0.525 - 0.763)
Regular Drinker – Binge	0.65**	0.63***	0.59***	0.59***	0.60***
	(0.439 - 0.971)	(0.530 - 0.747)	(0.461 - 0.758)	(0.484 - 0.718)	(0.493 - 0.727)
Occasional Drinker	0.50***	0.82**	0.81*	0.68***	0.69***
	(0.377 - 0.667)	(0.704 - 0.956)	(0.639 - 1.028)	(0.59 - 0.791)	(0.594 - 0.792)
Enabling					
Rural	0.93	0.94	0.89	0.93	0.93
	(0.713 - 1.215)	(0.824 - 1.079)	(0.741 - 1.078)	(0.825 - 1.039)	(0.832 - 1.047)
No Regular Medical Doctor	0.64	0.78**	0.77**	0.73***	0.73***
	(0.316 - 1.298)	(0.623 - 0.973)	(0.606 - 0.988)	(0.585 - 0.921)	(0.584 - 0.921)
Income_Q5	1.43	0.85	1.17	1.18	1.17
	(0.864 - 2.367)	(0.654 - 1.109)	(0.755 - 1.819)	(0.879 - 1.576)	(0.875 - 1.558)
Income_Q4	1.06	0.87	1.08	0.99	1.00
	(0.712 - 1.571)	(0.683 - 1.116)	(0.620 - 1.895)	(0.771 - 1.284)	(0.772 - 1.287)
Income_Q3	0.86	0.80**	0.99	0.86**	0.86**
	(0.615 - 1.198)	(0.664 - 0.974)	(0.763 - 1.294)	(0.74 - 0.995)	(0.737 - 0.993)
Income_Q2	1.19	0.92	0.89	0.98	0.98
	(0.835 - 1.704)	(0.752 - 1.118)	(0.705 - 1.123)	(0.834 - 1.157)	(0.836 - 1.159)
Homeowner	1.02	0.95	0.96	0.94	0.94
	(0.770 - 1.363)	(0.816 - 1.113)	(0.759 - 1.210)	(0.815 - 1.076)	(0.816 - 1.077)
Organization/Resource					
Newfoundland	1.36	1.04	1.36**	1.19*	1.20*
	(0.917 - 2.016)	(0.800 - 1.350)	(1.021 - 1.824)	(0.981 - 1.432)	(0.994 - 1.454)
Prince Edward Island	1.34	0.89	1.32	1.16	1.17
	(0.756 - 2.378)	(0.692 - 1.148)	(0.900 - 1.946)	(0.892 - 1.522)	(0.896 - 1.533)
Nova Scotia	0.94	0.90	1.04	0.95	0.96
	(0.633 - 1.392)	(0.710 - 1.130)	(0.781 - 1.388)	(0.799 - 1.141)	(0.805 - 1.154)
New Brunswick	1.05	1.13	0.92	1.03	1.03
	(0.751 - 1.469)	(0.893 - 1.418)	(0.725 - 1.173)	(0.861 - 1.228)	(0.861 - 1.223)
Quebec	1.45*	1.02	1.18	1.2*	1.21*
	(0.993 - 2.104)	(0.847 - 1.240)	(0.851 - 1.646)	(0.978 - 1.462)	(0.987 - 1.478)
Manitoba	1.18	0.97	1.15	1.07	1.09
	(0.861 - 1.630)	(0.768 - 1.224)	(0.704 - 1.884)	(0.869 - 1.327)	(0.879 - 1.348)
Saskatchewan	1.08	0.97	0.96	0.99	1.00
	(0.744 - 1.577)	(0.701 - 1.350)	(0.737 - 1.256)	(0.811 - 1.206)	(0.822 - 1.222)
Alberta	1.08	1.02	0.97	1.02	1.02
	(0.843 - 1.377)	(0.784 - 1.322)	(0.698 - 1.339)	(0.863 - 1.199)	(0.869 - 1.207)
British Columbia	1.09	1.03	0.90	1.01	1.01
	(0.656 - 1.827)	(0.845 - 1.263)	(0.720 - 1.115)	(0.809 - 1.266)	(0.808 - 1.269)
Need					
Number of Chronic Conditions	1.17***	1.14***	1.17***	1.16***	1.16***
	(1.053 - 1.291)	(1.092 - 1.185)	(1.103 - 1.248)	(1.111 - 1.214)	(1.111 - 1.212)
Constant	6.15***	8.10***	5.82***	7.46***	7.63***
	(3.049 - 12.416)	(5.667 - 11.566)	(3.570 - 9.501)	(5.487 - 10.154)	(5.353 - 10.880)
Observations	**4624**	**9792**	**8570**	**22986**	**22986**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 6: Trends in the intensity of utilization of hospital nights for each BMI category relative to the trend in individuals of normal weight in stratified pooled multivariable Zero Truncated Poisson regression

	Age ≤ 64 (IRR, 95% CI)	***Age ≥ 65*** (IRR, 95% CI)	***M ale*** (IRR, 95% CI)	***Female*** (IRR, 95% CI)
Underweight	0.84	0.68	1.32	0.60*
	(0.526 - 1.346)	(0.366 - 1.261)	(0.811 - 2.142)	(0.360 - 1.009)
Overweight	1.16	0.77	1.03	0.87
	(0.744 - 1.795)	(0.453 - 1.295)	(0.641 - 1.658)	(0.578 - 1.311)
Obesity	0.78	0.66	0.70*	0.72
	(0.571 - 1.066)	(0.371 - 1.165)	(0.467 - 1.046)	(0.452 - 1.142)
2000-1	1.01	0.86	1.01	0.87
	(0.789 - 1.300)	(0.563 - 1.312)	(0.721 - 1.421)	(0.637 - 1.195)
2009-10	0.80*	0.77	0.88	0.71*
	(0.626 - 1.024)	(0.492 - 1.217)	(0.619 - 1.256)	(0.498 - 1.004)
2000-1×Obesity	1.10	1.19	1.05	1.31
	(0.771 - 1.576)	(0.651 - 2.167)	(0.653 - 1.672)	(0.822 - 2.102)
2009-10×Obesity	1.36	1.52	1.15	1.80**
	(0.915 - 2.008)	(0.764 - 3.008)	(0.672 - 1.953)	(1.049 - 3.091)
2000-1×Overweight	0.77	1.03	0.80	1.01
	(0.465 - 1.267)	(0.584 - 1.829)	(0.459 - 1.389)	(0.649 - 1.569)
2009-10×Overweight	0.82	1.35	0.83	1.35
	(0.504 - 1.322)	(0.665 - 2.755)	(0.476 - 1.433)	(0.739 - 2.467)
2000-1×Underweight	1.83**	2.50**	1.55	2.46***
	(1.042 - 3.214)	(1.215 - 5.132)	(0.687 - 3.495)	(1.381 - 4.380)
2009-10×Underweight	1.83*	1.71	0.96	2.25**
	(0.948 - 3.528)	(0.795 - 3.675)	(0.478 - 1.926)	(1.173 - 4.324)
Predisposing				
Age 25 to 34	1.18		1.16	1.10
	(0.931 - 1.509)		(0.701 - 1.924)	(0.857 - 1.423)
Age 35 to 44	1.33**		1.02	1.43***
	(1.031 - 1.722)		(0.619 - 1.684)	(1.099 - 1.859)
Age 45 to 54	1.98***		1.60*	2.05***
	(1.529 - 2.557)		(0.980 - 2.605)	(1.505 - 2.790)
Age 55 to 64	1.83***		1.38	2.10***
	(1.386 - 2.415)		(0.844 - 2.246)	(1.586 - 2.783)
Age 65 to 74			2.07***	3.21***
			(1.277 - 3.340)	(2.139 - 4.825)
Age 75 to 84		1.06	2.66***	2.94***
		(0.846 - 1.318)	(1.564 - 4.523)	(2.240 - 3.867)
Age 85+		1.54**	3.40***	4.99***
		(1.069 - 2.226)	(1.700 - 6.789)	(3.032 - 8.219)
Male	1.20**	1.08		
	(1.034 - 1.389)	(0.830 - 1.411)		
Divorced/widowed/ separated	0.81**	0.92	0.76**	0.84
	(0.669 - 0.970)	(0.632 - 1.348)	(0.589 - 0.969)	(0.667 - 1.048)
Married	0.67***	0.94	0.75***	0.73***
	(0.583 - 0.781)	(0.630 - 1.412)	(0.601 - 0.929)	(0.603 - 0.881)
Immigrant < 10 years	0.78	1.85	1.11	0.77
	(0.550 - 1.119)	(0.255 - 13.481)	(0.560 - 2.202)	(0.429 - 1.396)
Immigrant ≥ 10 years	0.91	0.84	0.98	0.76***
	(0.613 - 1.354)	(0.676 - 1.046)	(0.689 - 1.400)	(0.621 - 0.935)
Bachelor's Degree	0.92	0.83	0.78	1.04
	(0.713 - 1.175)	(0.556 - 1.253)	(0.574 - 1.050)	(0.767 - 1.414)
Diploma/Certificate	1.01	1.09	0.98	1.12
	(0.847 - 1.210)	(0.889 - 1.344)	(0.827 - 1.169)	(0.898 - 1.404)
Secondary school	1.07	1.04	1.08	1.08
	(0.847 - 1.345)	(0.794 - 1.373)	(0.844 - 1.393)	(0.848 - 1.362)
Former Smoker	1.21*	1.17	1.27**	1.11
	(0.985 - 1.481)	(0.916 - 1.502)	(1.001 - 1.598)	(0.899 - 1.382)
Occasional Smoker	1.41*	1.02	1.62*	1.05
	(0.965 - 2.058)	(0.621 - 1.664)	(0.956 - 2.750)	(0.774 - 1.416)

Light Daily Smoker	1.21*	0.87	1.15	1.08
	(0.990 - 1.468)	(0.635 - 1.184)	(0.869 - 1.534)	(0.873 - 1.328)
Heavy Daily Smoker	1.20*	0.80	1.13	1.15
	(0.994 - 1.459)	(0.585 - 1.096)	(0.886 - 1.453)	(0.923 - 1.431)
Regular Drinker – Non Binge	0.62***	0.58***	0.67***	0.55***
	(0.493 - 0.775)	(0.452 - 0.739)	(0.523 - 0.857)	(0.432 - 0.697)
Regular Drinker – Binge	0.60***	0.55***	0.52***	0.69***
	(0.476 - 0.760)	(0.394 - 0.761)	(0.397 - 0.688)	(0.559 - 0.863)
Occasional Drinker	0.75***	0.59***	0.65***	0.70***
	(0.628 - 0.896)	(0.475 - 0.735)	(0.524 - 0.818)	(0.583 - 0.832)
Enabling				
Rural	0.91	0.96	0.95	0.93
	(0.816 - 1.019)	(0.783 - 1.177)	(0.813 - 1.113)	(0.777 - 1.125)
No Regular Medical Doctor	0.74**	0.65**	0.74*	0.65***
	(0.563 - 0.962)	(0.459 - 0.916)	(0.530 - 1.037)	(0.524 - 0.803)
Income_Q5	0.86	1.64**	1.27	0.88
	(0.617 - 1.203)	(1.049 - 2.579)	(0.835 - 1.931)	(0.665 - 1.160)
Income_Q4	0.73***	1.43	0.87	0.99
	(0.579 - 0.913)	(0.846 - 2.417)	(0.642 - 1.180)	(0.660 - 1.489)
Income_Q3	0.73***	0.89	0.82*	0.79**
	(0.615 - 0.862)	(0.673 - 1.189)	(0.652 - 1.021)	(0.629 - 0.987)
Income_Q2	0.82***	1.09	0.88	0.98
	(0.702 - 0.952)	(0.848 - 1.407)	(0.712 - 1.085)	(0.786 - 1.217)
Homeowner	0.93	0.95	0.79**	1.02
	(0.808 - 1.069)	(0.748 - 1.202)	(0.634 - 0.983)	(0.867 - 1.189)
Organization/Resource				
Newfoundland	1.11	1.18	1.10	1.14
	(0.876 - 1.412)	(0.879 - 1.585)	(0.832 - 1.450)	(0.899 - 1.450)
Prince Edward Island	1.32	0.88	1.41	0.98
	(0.942 - 1.855)	(0.600 - 1.303)	(0.860 - 2.322)	(0.768 - 1.253)
Nova Scotia	1.02	0.83	0.99	0.91
	(0.809 - 1.284)	(0.634 - 1.086)	(0.755 - 1.292)	(0.725 - 1.153)
New Brunswick	1.18	0.82	1.03	0.94
	(0.921 - 1.523)	(0.637 - 1.067)	(0.798 - 1.341)	(0.728 - 1.202)
Quebec	1.01	1.38**	1.14	1.12
	(0.790 - 1.299)	(1.003 - 1.892)	(0.840 - 1.543)	(0.891 - 1.409)
Manitoba	1.06	1.17	0.91	1.23
	(0.846 - 1.339)	(0.840 - 1.630)	(0.706 - 1.171)	(0.906 - 1.674)
Saskatchewan	1.01	0.97	0.95	0.98
	(0.815 - 1.242)	(0.712 - 1.327)	(0.673 - 1.328)	(0.783 - 1.235)
Alberta	0.95	1.13	1.03	1.00
	(0.793 - 1.144)	(0.825 - 1.539)	(0.781 - 1.361)	(0.822 - 1.211)
British Columbia	0.94	1.06	0.89	1.11
	(0.772 - 1.146)	(0.718 - 1.564)	(0.693 - 1.153)	(0.802 - 1.527)
Constant	8.97***	19.03***	12.65***	7.75***
	(5.842 - 13.785)	(10.394 - 34.857)	(6.955 - 22.992)	(5.426 - 11.076)
Observations	**15197**	**7789**	**8929**	**14057**

*** p<0.01, ** p<0.05, * p<0.1

8.3.3 Family Physician/General Practitioner Visits – Propensity

Table C. 7: The Association between each BMI category and the propensity to visit a FP/GP visit and pooled models in multivariable Poisson regression

	1996-7 (RR, 95% CI)	***2000-1*** (RR, 95% CI)	***2009-10*** (RR, 95% CI)	***Pooled*** (RR, 95% CI)	***Pooled with Interaction*** (RR, 95% CI)
Underweight	1.03	1.02	0.98	1.01	1.04
	(0.978 - 1.088)	(0.988 - 1.051)	(0.928 - 1.026)	(0.984 - 1.033)	(0.988 - 1.096)
Overweight	1.01	1.02***	1.01**	1.02***	1.01
	(0.988 - 1.033)	(1.011 - 1.032)	(1.001 - 1.029)	(1.006 - 1.025)	(0.983 - 1.028)
Obesity	1.04**	1.04***	1.05***	1.04***	1.04**
	(1.006 - 1.067)	(1.028 - 1.052)	(1.039 - 1.071)	(1.034 - 1.055)	(1.006 - 1.066)
2000-1				1.02***	1.01*
				(1.007 - 1.029)	(0.998 - 1.029)
2009-10				1.00	0.99
				(0.989 - 1.012)	(0.978 - 1.010)
2000-1×Obesity					1.00
					(0.971 - 1.032)
2009-10×Obesity					1.02
					(0.987 - 1.055)
2000-1×Overweight					1.01
					(0.990 - 1.040)
2009-10×Overweight					1.01
					(0.989 - 1.041)
2000-1×Underweight					0.98
					(0.921 - 1.039)
2009-10×Underweight					0.93**
					(0.862 - 1.000)
Predisposing					
Age 25 to 34	0.97	1.00	1.01	0.99	0.99
	(0.931 - 1.021)	(0.976 - 1.021)	(0.978 - 1.040)	(0.974 - 1.013)	(0.974 - 1.013)
Age 35 to 44	0.96	0.98*	1.00	0.98*	0.98*
	(0.917 - 1.015)	(0.960 - 1.002)	(0.968 - 1.029)	(0.96 - 1.001)	(0.960 - 1.001)
Age 45 to 54	1.00	1.01	1.04**	1.01	1.01
	(0.951 - 1.047)	(0.985 - 1.031)	(1.007 - 1.071)	(0.994 - 1.034)	(0.994 - 1.034)
Age 55 to 64	1.04	1.06***	1.08***	1.06***	1.06***
	(0.986 - 1.095)	(1.035 - 1.086)	(1.050 - 1.116)	(1.04 - 1.085)	(1.040 - 1.084)
Age 65 to 74	1.07**	1.09***	1.14***	1.10***	1.10***
	(1.013 - 1.130)	(1.059 - 1.113)	(1.105 - 1.176)	(1.077 - 1.125)	(1.077 - 1.125)
Age 75 to 84	1.13***	1.13***	1.17***	1.14***	1.14***
	(1.073 - 1.187)	(1.097 - 1.154)	(1.136 - 1.211)	(1.119 - 1.167)	(1.119 - 1.166)
Age 85+	1.14***	1.14***	1.17***	1.15***	1.15***
	(1.061 - 1.229)	(1.104 - 1.171)	(1.119 - 1.221)	(1.117 - 1.18)	(1.116 - 1.179)
Male	0.86***	0.89***	0.89***	0.88***	0.88***
	(0.846 - 0.879)	(0.879 - 0.898)	(0.882 - 0.905)	(0.875 - 0.889)	(0.875 - 0.889)
Divorced/widowed/ separated	1.03	1.01	1.01	1.01*	1.01*
	(0.992 - 1.065)	(0.990 - 1.024)	(0.986 - 1.031)	(0.999 - 1.029)	(0.999 - 1.029)
Married	1.04**	1.02**	1.02**	1.03***	1.03***
	(1.006 - 1.078)	(1.002 - 1.033)	(1.003 - 1.040)	(1.013 - 1.041)	(1.013 - 1.041)
Immigrant < 10 years	0.98	0.98	0.97	0.98**	0.98**
	(0.926 - 1.031)	(0.947 - 1.010)	(0.940 - 1.010)	(0.955 - 0.999)	(0.955 - 0.999)
Immigrant ≥ 10 years	1.00	0.99	1.01	1.00	1.00
	(0.972 - 1.030)	(0.976 - 1.005)	(0.991 - 1.030)	(0.988 - 1.013)	(0.988 - 1.013)
Bachelor's Degree	0.98	1.03***	1.06***	1.03***	1.03***
	(0.935 - 1.020)	(1.012 - 1.050)	(1.034 - 1.077)	(1.012 - 1.045)	(1.012 - 1.045)
Diploma/Certificate	0.99	1.01	1.01	1.01	1.01
	(0.954 - 1.024)	(0.998 - 1.024)	(0.996 - 1.032)	(0.996 - 1.021)	(0.995 - 1.020)
Secondary school	1.02	1.00	0.99	1.01	1.01
	(0.988 - 1.046)	(0.990 - 1.018)	(0.971 - 1.012)	(0.995 - 1.021)	(0.994 - 1.021)

Former Smoker	1.04***	1.03***	1.05***	1.04***	1.04***
	(1.016 - 1.066)	(1.016 - 1.040)	(1.033 - 1.060)	(1.03 - 1.051)	(1.030 - 1.050)
Occasional Smoker	1.03	1.01	0.99	1.01	1.01
	(0.974 - 1.083)	(0.989 - 1.040)	(0.957 - 1.022)	(0.987 - 1.029)	(0.987 - 1.029)
Light Daily Smoker	1.03	1.00	1.00	1.01	1.01
	(0.992 - 1.071)	(0.976 - 1.018)	(0.977 - 1.031)	(0.993 - 1.028)	(0.993 - 1.028)
Heavy Daily Smoker	0.98	0.98**	1.01	0.99	0.99
	(0.946 - 1.010)	(0.962 - 0.997)	(0.990 - 1.039)	(0.975 - 1.005)	(0.974 - 1.005)
Regular Drinker – Non Binge	0.98	1.01*	1.01	1.00	1.00
	(0.956 - 1.013)	(1.000 - 1.027)	(0.995 - 1.028)	(0.991 - 1.015)	(0.991 - 1.015)
Regular Drinker – Binge	0.99	1.01	1.01	1.00	1.00
	(0.962 - 1.029)	(0.990 - 1.023)	(0.986 - 1.026)	(0.989 - 1.016)	(0.989 - 1.016)
Occasional Drinker	1.01	1.01	1.01	1.01	1.01
	(0.984 - 1.034)	(0.996 - 1.025)	(0.987 - 1.028)	(0.997 - 1.021)	(0.996 - 1.021)
Enabling					
Rural	0.95***	0.97***	0.97***	0.97***	0.97***
	(0.926 - 0.981)	(0.963 - 0.984)	(0.957 - 0.984)	(0.957 - 0.977)	(0.957 - 0.977)
No Regular Medical Doctor	0.62***	0.65***	0.57***	0.61***	0.61***
	(0.580 - 0.664)	(0.631 - 0.663)	(0.552 - 0.591)	(0.598 - 0.626)	(0.599 - 0.626)
Income_Q5	1.00	1.01	1.02**	1.01	1.01
	(0.961 - 1.044)	(0.987 - 1.025)	(1.000 - 1.044)	(0.993 - 1.026)	(0.993 - 1.026)
Income_Q4	1.00	1.00	1.02**	1.01	1.01
	(0.954 - 1.041)	(0.982 - 1.014)	(1.001 - 1.042)	(0.991 - 1.022)	(0.991 - 1.022)
Income_Q3	0.99	1.00	1.00	1.00	1.00
	(0.952 - 1.027)	(0.985 - 1.017)	(0.983 - 1.023)	(0.985 - 1.012)	(0.985 - 1.012)
Income_Q2	0.96**	0.99*	0.99	0.98***	0.98***
	(0.930 - 0.995)	(0.974 - 1.002)	(0.967 - 1.005)	(0.966 - 0.993)	(0.966 - 0.993)
Homeowner	0.98	0.98***	0.97***	0.98***	0.98***
	(0.961 - 1.007)	(0.965 - 0.990)	(0.958 - 0.990)	(0.968 - 0.989)	(0.969 - 0.989)
Organization/Resource					
Newfoundland	1.01	1.08***	1.02	1.04***	1.04***
	(0.957 - 1.060)	(1.057 - 1.102)	(0.993 - 1.044)	(1.017 - 1.059)	(1.017 - 1.059)
Prince Edward Island	0.98	1.00	1.03	1.00	1.00
	(0.939 - 1.030)	(0.970 - 1.021)	(0.993 - 1.060)	(0.983 - 1.024)	(0.983 - 1.024)
Nova Scotia	0.98	1.00	1.00	1.00	1.00
	(0.930 - 1.027)	(0.981 - 1.017)	(0.981 - 1.029)	(0.977 - 1.015)	(0.977 - 1.015)
New Brunswick	0.95**	1.02**	0.98	0.99	0.99
	(0.914 - 0.992)	(1.003 - 1.042)	(0.961 - 1.008)	(0.97 - 1.003)	(0.970 - 1.004)
Quebec	0.94***	0.95***	0.96***	0.95***	0.95***
	(0.906 - 0.969)	(0.941 - 0.968)	(0.947 - 0.981)	(0.942 - 0.966)	(0.941 - 0.966)
Manitoba	1.02*	0.99	1.01	1.01	1.01
	(1.000 - 1.042)	(0.971 - 1.010)	(0.979 - 1.031)	(0.994 - 1.019)	(0.994 - 1.019)
Saskatchewan	0.99	1.04***	1.04***	1.02**	1.02**
	(0.944 - 1.036)	(1.020 - 1.056)	(1.013 - 1.058)	(1.003 - 1.04)	(1.003 - 1.040)
Alberta	1.01	1.03***	1.01	1.02***	1.02***
	(0.993 - 1.023)	(1.016 - 1.048)	(0.991 - 1.031)	(1.007 - 1.028)	(1.007 - 1.028)
British Columbia	1.02	1.02***	1.03***	1.02***	1.02***
	(0.986 - 1.046)	(1.008 - 1.033)	(1.009 - 1.044)	(1.009 - 1.035)	(1.010 - 1.035)
Constant	0.88***	0.85***	0.80***	0.83***	0.84***
	(0.836 - 0.919)	(0.828 - 0.870)	(0.776 - 0.834)	(0.816 - 0.852)	(0.818 - 0.858)
Observations	**49962**	**98774**	**87452**	**236188**	**236188**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 8: The association between each BMI category and the propensity to visit a FP/GP and pooled models in multivariable Poisson regression with control for the number of chronic conditions

	1996-7 (RR, 95% CI)	***2000-1*** (RR, 95% CI)	***2009-10*** (RR, 95% CI)	***Pooled*** (RR, 95% CI)	***Pooled with Interaction*** (RR, 95% CI)
Underweight	1.04	1.02	0.98	1.01	1.05*
	(0.984 - 1.093)	(0.988 - 1.050)	(0.932 - 1.029)	(0.987 - 1.035)	(0.995 - 1.102)
Overweight	1.00	1.01**	1.00	1.01	1.00
	(0.979 - 1.024)	(1.002 - 1.023)	(0.991 - 1.019)	(0.996 - 1.015)	(0.976 - 1.021)
Obesity	1.01	1.01	1.02***	1.01**	1.01
	(0.980 - 1.039)	(0.998 - 1.021)	(1.006 - 1.038)	(1.003 - 1.024)	(0.986 - 1.043)
2000-1				1.01**	1.01
				(1 - 1.022)	(0.993 - 1.024)
2009-10				0.99*	0.99
				(0.979 - 1.001)	(0.972 - 1.004)
2000-1×Obesity					0.99
					(0.964 - 1.023)
2009-10×Obesity					1.00
					(0.973 - 1.038)
2000-1×Overweight					1.01
					(0.987 - 1.037)
2009-10×Overweight					1.01
					(0.983 - 1.035)
2000-1×Underweight					0.97
					(0.916 - 1.031)
2009-10×Underweight					0.93**
					(0.860 - 0.996)
Predisposing					
Age 25 to 34	0.97	0.99	1.01	0.99	0.99
	(0.927 - 1.017)	(0.972 - 1.016)	(0.977 - 1.038)	(0.97 - 1.009)	(0.970 - 1.009)
Age 35 to 44	0.96*	0.97***	0.99	0.97***	0.97***
	(0.909 - 1.005)	(0.950 - 0.992)	(0.958 - 1.017)	(0.95 - 0.991)	(0.950 - 0.991)
Age 45 to 54	0.97	0.98	1.01	0.99	0.99
	(0.925 - 1.018)	(0.962 - 1.007)	(0.984 - 1.046)	(0.97 - 1.009)	(0.970 - 1.009)
Age 55 to 64	0.99	1.01	1.04**	1.02	1.02
	(0.939 - 1.042)	(0.990 - 1.039)	(1.005 - 1.068)	(0.994 - 1.037)	(0.994 - 1.036)
Age 65 to 74	1.00	1.02	1.07***	1.03***	1.03***
	(0.949 - 1.059)	(0.994 - 1.045)	(1.038 - 1.103)	(1.01 - 1.056)	(1.010 - 1.056)
Age 75 to 84	1.04	1.04***	1.08***	1.05***	1.05***
	(0.988 - 1.094)	(1.014 - 1.067)	(1.046 - 1.114)	(1.031 - 1.075)	(1.031 - 1.075)
Age 85+	1.03	1.04***	1.06***	1.04***	1.04***
	(0.962 - 1.107)	(1.014 - 1.076)	(1.014 - 1.107)	(1.016 - 1.072)	(1.015 - 1.072)
Male	0.87***	0.90***	0.90***	0.89***	0.89***
	(0.857 - 0.890)	(0.889 - 0.908)	(0.890 - 0.912)	(0.884 - 0.898)	(0.884 - 0.898)
Divorced/widowed/ separated	1.02	1.00	1.01	1.01	1.01
	(0.983 - 1.056)	(0.986 - 1.019)	(0.985 - 1.030)	(0.995 - 1.024)	(0.995 - 1.024)
Married	1.04**	1.02**	1.02**	1.03***	1.03***
	(1.007 - 1.078)	(1.001 - 1.033)	(1.003 - 1.040)	(1.013 - 1.04)	(1.013 - 1.040)
Immigrant < 10 years	0.99	1.00	0.99	0.99	0.99
	(0.944 - 1.049)	(0.966 - 1.030)	(0.951 - 1.021)	(0.971 - 1.014)	(0.971 - 1.015)
Immigrant ≥ 10 years	1.00	0.99	1.01	1.00	1.00
	(0.975 - 1.033)	(0.980 - 1.008)	(0.994 - 1.033)	(0.991 - 1.016)	(0.991 - 1.016)
Bachelor's Degree	0.98	1.04***	1.07***	1.04***	1.04***
	(0.938 - 1.023)	(1.021 - 1.059)	(1.044 - 1.087)	(1.019 - 1.052)	(1.019 - 1.052)
Diploma/Certificate	0.99	1.02**	1.02**	1.01	1.01
	(0.952 - 1.021)	(1.002 - 1.029)	(1.002 - 1.037)	(0.998 - 1.023)	(0.998 - 1.023)
Secondary school	1.02	1.01	1.00	1.01*	1.01*
	(0.989 - 1.047)	(0.998 - 1.025)	(0.980 - 1.021)	(0.999 - 1.026)	(0.999 - 1.026)
Former Smoker	1.03***	1.02***	1.04***	1.03***	1.03***
	(1.008 - 1.057)	(1.008 - 1.032)	(1.026 - 1.053)	(1.023 - 1.043)	(1.023 - 1.043)

Occasional Smoker	1.03	1.01	0.98	1.00	1.00
	(0.974 - 1.081)	(0.981 - 1.031)	(0.952 - 1.017)	(0.982 - 1.024)	(0.982 - 1.024)
Light Daily Smoker	1.03	0.99	1.00	1.00	1.00
	(0.988 - 1.066)	(0.970 - 1.011)	(0.969 - 1.023)	(0.987 - 1.021)	(0.987 - 1.021)
Heavy Daily Smoker	0.97**	0.97***	1.00	0.98***	0.98***
	(0.937 - 0.999)	(0.949 - 0.983)	(0.976 - 1.023)	(0.962 - 0.992)	(0.962 - 0.992)
Regular Drinker – Non Binge	0.99	1.02***	1.02***	1.01**	1.01**
	(0.966 - 1.025)	(1.010 - 1.038)	(1.006 - 1.040)	(1.002 - 1.026)	(1.002 - 1.026)
Regular Drinker – Binge	1.01	1.02*	1.02*	1.01*	1.01*
	(0.973 - 1.040)	(1.000 - 1.032)	(0.998 - 1.038)	(1 - 1.027)	(1.000 - 1.027)
Occasional Drinker	1.02	1.01*	1.01	1.01**	1.01**
	(0.991 - 1.041)	(0.999 - 1.028)	(0.990 - 1.032)	(1.001 - 1.025)	(1.000 - 1.025)
Enabling					
Rural	0.95***	0.98***	0.97***	0.97***	0.97***
	(0.927 - 0.981)	(0.965 - 0.986)	(0.958 - 0.984)	(0.958 - 0.978)	(0.958 - 0.978)
No Regular Medical Doctor	0.63***	0.66***	0.58***	0.62***	0.62***
	(0.591 - 0.676)	(0.640 - 0.672)	(0.559 - 0.598)	(0.607 - 0.635)	(0.607 - 0.635)
Income_Q5	1.02	1.02**	1.04***	1.03***	1.03***
	(0.976 - 1.059)	(1.003 - 1.041)	(1.016 - 1.061)	(1.009 - 1.042)	(1.009 - 1.042)
Income_Q4	1.01	1.01	1.04***	1.02***	1.02***
	(0.966 - 1.053)	(0.996 - 1.028)	(1.016 - 1.059)	(1.005 - 1.037)	(1.005 - 1.037)
Income_Q3	1.00	1.01	1.02	1.01	1.01
	(0.964 - 1.038)	(0.997 - 1.030)	(0.997 - 1.038)	(0.998 - 1.025)	(0.998 - 1.025)
Income_Q2	0.97	1.00	1.00	0.99	0.99
	(0.941 - 1.006)	(0.983 - 1.011)	(0.977 - 1.015)	(0.977 - 1.003)	(0.977 - 1.003)
Homeowner	0.99	0.98***	0.98**	0.98***	0.99***
	(0.969 - 1.015)	(0.970 - 0.996)	(0.964 - 0.997)	(0.975 - 0.995)	(0.975 - 0.995)
Organization/Resource					
Newfoundland	1.02	1.09***	1.02	1.05***	1.05***
	(0.966 - 1.070)	(1.069 - 1.114)	(0.995 - 1.046)	(1.025 - 1.067)	(1.025 - 1.067)
Prince Edward Island	0.99	1.00	1.03*	1.01	1.01
	(0.944 - 1.034)	(0.978 - 1.030)	(0.998 - 1.064)	(0.989 - 1.03)	(0.989 - 1.030)
Nova Scotia	0.97	1.00	1.00	0.99	0.99
	(0.929 - 1.022)	(0.981 - 1.017)	(0.977 - 1.024)	(0.975 - 1.013)	(0.975 - 1.013)
New Brunswick	0.96**	1.03***	0.99	0.99	0.99
	(0.921 - 0.997)	(1.010 - 1.050)	(0.964 - 1.011)	(0.976 - 1.009)	(0.976 - 1.009)
Quebec	0.95***	0.97***	0.97***	0.96***	0.96***
	(0.916 - 0.979)	(0.952 - 0.980)	(0.956 - 0.990)	(0.951 - 0.976)	(0.951 - 0.976)
Manitoba	1.02**	0.99	1.01	1.01	1.01
	(1.001 - 1.043)	(0.975 - 1.014)	(0.980 - 1.033)	(0.996 - 1.021)	(0.996 - 1.021)
Saskatchewan	0.99	1.04***	1.04***	1.02***	1.02***
	(0.947 - 1.036)	(1.026 - 1.060)	(1.015 - 1.059)	(1.007 - 1.043)	(1.007 - 1.043)
Alberta	1.01	1.03***	1.01	1.02***	1.02***
	(0.994 - 1.024)	(1.016 - 1.047)	(0.992 - 1.032)	(1.007 - 1.028)	(1.007 - 1.028)
British Columbia	1.02	1.02***	1.03***	1.02***	1.02***
	(0.988 - 1.047)	(1.010 - 1.035)	(1.014 - 1.049)	(1.012 - 1.037)	(1.013 - 1.037)
Need					
Number of Chronic Conditions	1.07***	1.06***	1.05***	1.06***	1.06***
	(1.065 - 1.080)	(1.058 - 1.066)	(1.050 - 1.059)	(1.059 - 1.064)	(1.059 - 1.064)
Constant	1.04	1.02	0.98	0.80***	1.05*
	(0.984 - 1.093)	(0.988 - 1.050)	(0.932 - 1.029)	(0.779 - 0.814)	(0.995 - 1.102)
Observations	**49962**	**98774**	**87452**	**236188**	**236188**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 9: Trends in the propensity to visit a FP/GP for each BMI category relative to the trend in normal weight individuals in stratified pooled multivariable Poisson regression

	Age ≤ 64 (RR, 95% CI)	***Age ≥ 65*** (RR, 95% CI)	***M ale*** (RR, 95% CI)	***Female*** (RR, 95% CI)
Underweight	1.06*	0.99	1.05	1.02
	(0.997 - 1.123)	(0.910 - 1.076)	(0.913 - 1.207)	(0.967 - 1.074)
Overweight	1.00	1.02	1.00	1.02*
	(0.978 - 1.031)	(0.989 - 1.052)	(0.966 - 1.045)	(0.999 - 1.049)
Obesity	1.04**	1.04*	1.03	1.05***
	(1.005 - 1.074)	(0.996 - 1.077)	(0.979 - 1.087)	(1.017 - 1.080)
2000-1	1.01	1.01	1.03	1.01
	(0.996 - 1.032)	(0.987 - 1.035)	(0.995 - 1.057)	(0.992 - 1.025)
2009-10	0.99	1.01	1.00	0.99
	(0.971 - 1.009)	(0.988 - 1.035)	(0.970 - 1.034)	(0.975 - 1.013)
2000-1×Obesity	1.00	0.99	1.01	0.99
	(0.969 - 1.039)	(0.944 - 1.031)	(0.955 - 1.067)	(0.959 - 1.024)
2009-10×Obesity	1.02	1.00	1.05	0.99
	(0.986 - 1.065)	(0.957 - 1.044)	(0.986 - 1.109)	(0.954 - 1.028)
2000-1×Overweight	1.02	0.98	1.02	0.99
	(0.993 - 1.052)	(0.947 - 1.019)	(0.980 - 1.067)	(0.965 - 1.019)
2009-10×Overweight	1.02	1.00	1.01	1.00
	(0.987 - 1.048)	(0.965 - 1.035)	(0.970 - 1.062)	(0.969 - 1.027)
2000-1×Underweight	0.96	1.03	1.04	0.97
	(0.896 - 1.032)	(0.934 - 1.128)	(0.884 - 1.214)	(0.914 - 1.032)
2009-10×Underweight	0.92*	0.97	0.92	0.94
	(0.839 - 1.001)	(0.874 - 1.076)	(0.757 - 1.119)	(0.871 - 1.012)
Predisposing				
Age 25 to 34	0.99		1.01	0.99
	(0.975 - 1.015)		(0.973 - 1.044)	(0.972 - 1.012)
Age 35 to 44	0.98		1.03	0.95***
	(0.963 - 1.005)		(0.989 - 1.064)	(0.934 - 0.975)
Age 45 to 54	1.02*		1.08***	0.97***
	(0.998 - 1.038)		(1.044 - 1.118)	(0.946 - 0.990)
Age 55 to 64	1.07***		1.16***	0.99
	(1.046 - 1.091)		(1.115 - 1.199)	(0.968 - 1.015)
Age 65 to 74			1.22***	1.01
			(1.174 - 1.264)	(0.989 - 1.037)
Age 75 to 84		1.04***	1.29***	1.03***
		(1.026 - 1.052)	(1.240 - 1.336)	(1.010 - 1.060)
Age 85+		1.05***	1.31***	1.03**
		(1.030 - 1.069)	(1.255 - 1.371)	(1.002 - 1.069)
Male	0.86***	0.99**		
	(0.854 - 0.870)	(0.973 - 0.998)		
Divorced/widowed/ separated	1.02***	1.04**	1.02	1.02**
	(1.007 - 1.043)	(1.006 - 1.081)	(0.995 - 1.049)	(1.001 - 1.035)
Married	1.02***	1.05***	1.04***	1.00
	(1.008 - 1.037)	(1.016 - 1.092)	(1.017 - 1.063)	(0.987 - 1.016)
Immigrant < 10 years	0.98*	0.90*	1.00	0.95***
	(0.958 - 1.003)	(0.789 - 1.015)	(0.964 - 1.042)	(0.924 - 0.979)
Immigrant ≥ 10 years	1.00	1.01	1.00	1.00
	(0.982 - 1.013)	(0.997 - 1.025)	(0.983 - 1.020)	(0.980 - 1.011)
Bachelor's Degree	1.03***	1.03***	1.03**	1.01
	(1.008 - 1.046)	(1.009 - 1.049)	(1.005 - 1.054)	(0.990 - 1.026)
Diploma/Certificate	1.01	1.00	1.02	0.99
	(0.993 - 1.025)	(0.989 - 1.021)	(0.996 - 1.037)	(0.978 - 1.007)
Secondary school	1.01	1.01	1.02*	0.99
	(0.992 - 1.025)	(0.993 - 1.025)	(0.998 - 1.040)	(0.980 - 1.010)
Former Smoker	1.04***	1.02**	1.05***	1.01***
	(1.026 - 1.050)	(1.003 - 1.031)	(1.028 - 1.064)	(1.005 - 1.025)

Occasional Smoker	1.01	1.00	1.00	1.00
	(0.983 - 1.029)	(0.962 - 1.036)	(0.971 - 1.040)	(0.975 - 1.024)
Light Daily Smoker	1.01	0.99	1.03*	0.98*
	(0.989 - 1.027)	(0.959 - 1.027)	(0.997 - 1.059)	(0.964 - 1.003)
Heavy Daily Smoker	0.99	0.97*	0.99	0.98*
	(0.972 - 1.005)	(0.949 - 1.001)	(0.963 - 1.012)	(0.967 - 1.001)
Regular Drinker - Non Binge	1.00	0.99	0.98*	1.02**
	(0.987 - 1.019)	(0.980 - 1.009)	(0.960 - 1.002)	(1.004 - 1.030)
Regular Drinker – Binge	1.01	0.98	0.99	1.02***
	(0.990 - 1.023)	(0.963 - 1.005)	(0.966 - 1.005)	(1.006 - 1.040)
Occasional Drinker	1.01	1.00	1.01	1.01
	(0.994 - 1.025)	(0.983 - 1.015)	(0.991 - 1.035)	(0.991 - 1.020)
Enabling				
Rural	0.96***	0.99	0.95***	0.98***
	(0.949 - 0.973)	(0.980 - 1.005)	(0.936 - 0.971)	(0.968 - 0.990)
No Regular Medical Doctor	0.62***	0.52***	0.59***	0.66***
	(0.607 - 0.636)	(0.476 - 0.574)	(0.572 - 0.609)	(0.639 - 0.678)
Income_Q5	1.01	0.99	1.02	1.01
	(0.994 - 1.031)	(0.968 - 1.019)	(0.992 - 1.049)	(0.994 - 1.026)
Income_Q4	1.01	1.01	1.01	1.01
	(0.989 - 1.027)	(0.992 - 1.029)	(0.985 - 1.040)	(0.996 - 1.026)
Income_Q3	1.00	0.99	1.01	0.99
	(0.985 - 1.018)	(0.966 - 1.008)	(0.985 - 1.034)	(0.979 - 1.009)
Income_Q2	0.97***	1.00	0.98*	0.98**
	(0.958 - 0.992)	(0.984 - 1.011)	(0.955 - 1.003)	(0.971 - 0.997)
Homeowner	0.98***	1.00	0.98**	0.98***
	(0.964 - 0.988)	(0.981 - 1.010)	(0.962 - 0.995)	(0.969 - 0.994)
Organization/Resource				
Newfoundland	1.03***	1.06***	1.03	1.04***
	(1.009 - 1.060)	(1.033 - 1.077)	(0.994 - 1.065)	(1.023 - 1.065)
Prince Edward Island	1.00	1.03**	1.00	1.01
	(0.973 - 1.023)	(1.005 - 1.051)	(0.964 - 1.033)	(0.985 - 1.030)
Nova Scotia	0.99	1.00	0.98	1.01
	(0.973 - 1.016)	(0.972 - 1.033)	(0.947 - 1.010)	(0.990 - 1.031)
New Brunswick	0.98**	1.03***	0.96***	1.01
	(0.957 - 0.997)	(1.012 - 1.050)	(0.931 - 0.988)	(0.992 - 1.027)
Quebec	0.94***	1.00	0.94***	0.96***
	(0.929 - 0.959)	(0.983 - 1.016)	(0.922 - 0.963)	(0.949 - 0.976)
Manitoba	1.00	1.02***	1.02*	0.99
	(0.988 - 1.018)	(1.009 - 1.038)	(0.999 - 1.045)	(0.977 - 1.006)
Saskatchewan	1.03**	1.01	1.04**	1.01
	(1.004 - 1.047)	(0.983 - 1.033)	(1.007 - 1.068)	(0.988 - 1.028)
Alberta	1.02***	1.00	1.01	1.02***
	(1.005 - 1.029)	(0.990 - 1.019)	(0.994 - 1.029)	(1.008 - 1.032)
British Columbia	1.02***	1.02*	1.02	1.03***
	(1.008 - 1.038)	(0.999 - 1.037)	(0.995 - 1.039)	(1.011 - 1.039)
Constant	0.85***	0.85***	0.69***	0.89***
	(0.825 - 0.871)	(0.814 - 0.880)	(0.662 - 0.724)	(0.867 - 0.916)
Observations	**185144**	**51044**	**111642**	**124546**

*** p<0.01, ** p<0.05, * p<0.1

8.3.4 Family Physician/General Practitioner Visits – Intensity

Table C. 10: The association between each BMI category and the intensity of visits to FP/GPs and pooled models in multivariable Zero Truncated Poisson regression

	1996-7 (IRR, 95% CI)	***2000-1*** (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)	***Pooled*** (IRR, 95% CI)	***Pooled with Interaction*** (IRR, 95% CI)
Underweight	1.16*	1.04	1.26***	1.14***	1.18*
	(0.976 - 1.382)	(0.962 - 1.128)	(1.093 - 1.459)	(1.051 - 1.228)	(0.994 - 1.395)
Overweight	1.11**	1.06***	1.10***	1.09***	1.12**
	(1.005 - 1.224)	(1.014 - 1.097)	(1.057 - 1.143)	(1.045 - 1.129)	(1.017 - 1.232)
Obesity	1.21***	1.26***	1.29***	1.26***	1.23***
	(1.107 - 1.334)	(1.203 - 1.316)	(1.234 - 1.355)	(1.217 - 1.303)	(1.126 - 1.343)
2000-1				0.99	1.01
				(0.95 - 1.031)	(0.960 - 1.058)
2009-10				0.81***	0.82***
				(0.781 - 0.85)	(0.775 - 0.862)
2000-1×Obesity					1.03
					(0.936 - 1.133)
2009-10×Obesity					1.03
					(0.935 - 1.145)
2000-1×Overweight					0.95
					(0.856 - 1.048)
2009-10×Overweight					0.97
					(0.873 - 1.072)
2000-1×Underweight					0.88
					(0.733 - 1.059)
2009-10×Underweight					1.07
					(0.861 - 1.327)
Predisposing					
Age 25 to 34	1.09	1.03	1.00	1.04	1.04
	(0.954 - 1.244)	(0.947 - 1.122)	(0.921 - 1.096)	(0.982 - 1.109)	(0.980 - 1.107)
Age 35 to 44	0.98	0.98	0.96	0.98	0.97
	(0.859 - 1.111)	(0.908 - 1.066)	(0.878 - 1.054)	(0.92 - 1.034)	(0.919 - 1.033)
Age 45 to 54	1.09	0.99	0.94	1.01	1.01
	(0.954 - 1.256)	(0.912 - 1.080)	(0.858 - 1.031)	(0.948 - 1.075)	(0.947 - 1.074)
Age 55 to 64	1.24**	1.07	0.96	1.09**	1.08**
	(1.027 - 1.491)	(0.978 - 1.169)	(0.874 - 1.047)	(1.009 - 1.168)	(1.008 - 1.167)
Age 65 to 74	1.17**	1.05	0.96	1.07*	1.07*
	(1.000 - 1.372)	(0.954 - 1.149)	(0.879 - 1.053)	(0.996 - 1.142)	(0.995 - 1.141)
Age 75 to 84	1.24**	1.19***	1.11**	1.19***	1.18***
	(1.039 - 1.478)	(1.083 - 1.315)	(1.004 - 1.217)	(1.102 - 1.275)	(1.101 - 1.274)
Age 85+	1.33**	1.17***	1.21***	1.23***	1.23***
	(1.061 - 1.661)	(1.046 - 1.314)	(1.087 - 1.348)	(1.129 - 1.347)	(1.129 - 1.346)
Male	0.89***	0.86***	0.87***	0.87***	0.87***
	(0.816 - 0.962)	(0.834 - 0.897)	(0.835 - 0.898)	(0.844 - 0.898)	(0.844 - 0.898)
Divorced/widowed/ separated	1.09	1.06*	1.08**	1.08**	1.08**
	(0.936 - 1.263)	(0.998 - 1.135)	(1.009 - 1.151)	(1.015 - 1.147)	(1.015 - 1.147)
Married	0.99	1.03	1.04	1.02	1.02
	(0.900 - 1.090)	(0.975 - 1.086)	(0.981 - 1.106)	(0.978 - 1.064)	(0.978 - 1.064)
Immigrant < 10 years	1.10	0.82***	0.87***	0.92	0.92
	(0.840 - 1.452)	(0.765 - 0.889)	(0.782 - 0.962)	(0.829 - 1.018)	(0.829 - 1.018)
Immigrant ≥ 10 years	1.01	1.05	1.03	1.03**	1.03*
	(0.930 - 1.088)	(0.991 - 1.108)	(0.983 - 1.088)	(0.995 - 1.07)	(0.995 - 1.070)
Bachelor's Degree	0.87**	0.82***	0.91***	0.85***	0.85***
	(0.764 - 0.990)	(0.768 - 0.886)	(0.853 - 0.963)	(0.808 - 0.898)	(0.808 - 0.898)
Diploma/Certificate	0.94	0.90***	0.98	0.92***	0.92***
	(0.833 - 1.056)	(0.851 - 0.946)	(0.928 - 1.030)	(0.878 - 0.961)	(0.878 - 0.960)
Secondary school	0.87***	0.89***	0.99	0.89***	0.89***

	(0.780 - 0.961)	(0.840 - 0.935)	(0.933 - 1.044)	(0.85 - 0.936)	(0.850 - 0.936)
Former Smoker	1.12***	1.10***	1.09***	1.10***	1.10***
	(1.040 - 1.208)	(1.057 - 1.138)	(1.050 - 1.140)	(1.068 - 1.135)	(1.068 - 1.135)
Occasional Smoker	1.12	1.11***	1.15***	1.13***	1.13***
	(0.966 - 1.295)	(1.041 - 1.188)	(1.055 - 1.244)	(1.065 - 1.195)	(1.065 - 1.195)
Light Daily Smoker	1.44**	1.19***	1.18***	1.27***	1.27***
	(1.051 - 1.974)	(1.057 - 1.349)	(1.099 - 1.265)	(1.116 - 1.438)	(1.116 - 1.438)
Heavy Daily Smoker	1.27***	1.25***	1.29***	1.26***	1.26***
	(1.164 - 1.396)	(1.181 - 1.321)	(1.204 - 1.372)	(1.207 - 1.314)	(1.207 - 1.314)
Regular Drinker – Non Binge	0.70***	0.79***	0.80***	0.76***	0.76***
	(0.619 - 0.782)	(0.749 - 0.835)	(0.757 - 0.845)	(0.721 - 0.795)	(0.721 - 0.795)
Regular Drinker – Binge	0.69***	0.77***	0.74***	0.73***	0.73***
	(0.606 - 0.779)	(0.734 - 0.810)	(0.697 - 0.779)	(0.695 - 0.766)	(0.695 - 0.766)
Occasional Drinker	0.81***	0.92***	0.90***	0.87***	0.87***
	(0.717 - 0.924)	(0.876 - 0.961)	(0.862 - 0.950)	(0.831 - 0.921)	(0.831 - 0.920)
Enabling					
Rural	1.01	0.98	0.96**	0.98	0.98
	(0.945 - 1.080)	(0.945 - 1.022)	(0.919 - 0.993)	(0.952 - 1.01)	(0.952 - 1.010)
No Regular Medical Doctor	0.63***	0.69***	0.78***	0.70***	0.70***
	(0.542 - 0.733)	(0.652 - 0.729)	(0.724 - 0.838)	(0.663 - 0.738)	(0.663 - 0.738)
Income_Q5	0.81***	0.70***	0.72***	0.75***	0.75***
	(0.706 - 0.922)	(0.660 - 0.747)	(0.677 - 0.775)	(0.707 - 0.789)	(0.707 - 0.788)
Income_Q4	0.81***	0.74***	0.77***	0.78***	0.78***
	(0.723 - 0.905)	(0.698 - 0.785)	(0.725 - 0.816)	(0.739 - 0.815)	(0.739 - 0.815)
Income_Q3	0.90**	0.79***	0.81***	0.83***	0.83***
	(0.806 - 0.999)	(0.746 - 0.828)	(0.766 - 0.855)	(0.796 - 0.87)	(0.796 - 0.869)
Income_Q2	1.00	0.86***	0.84***	0.9	0.90***
	(0.841 - 1.189)	(0.812 - 0.904)	(0.797 - 0.886)	(0.842 - 0.964)	(0.842 - 0.963)
Homeowner	0.84***	0.89***	0.89***	0.87***	0.87***
	(0.766 - 0.920)	(0.850 - 0.926)	(0.851 - 0.933)	(0.838 - 0.904)	(0.838 - 0.904)
Organization/Resource					
Newfoundland	0.98	0.98	1.29***	1.06**	1.06**
	(0.881 - 1.090)	(0.916 - 1.039)	(1.172 - 1.414)	(1.002 - 1.112)	(1.002 - 1.112)
Prince Edward Island	0.98	0.89**	0.80***	0.9***	0.90***
	(0.843 - 1.135)	(0.815 - 0.973)	(0.738 - 0.875)	(0.835 - 0.967)	(0.835 - 0.967)
Nova Scotia	1.10	1.01	1.14***	1.07**	1.08**
	(0.952 - 1.275)	(0.952 - 1.075)	(1.043 - 1.238)	(1.012 - 1.142)	(1.012 - 1.142)
New Brunswick	0.98	0.85***	0.95*	0.92***	0.92***
	(0.846 - 1.128)	(0.795 - 0.911)	(0.894 - 1.009)	(0.87 - 0.981)	(0.870 - 0.981)
Quebec	0.75***	0.75***	0.67***	0.72***	0.72***
	(0.643 - 0.865)	(0.705 - 0.791)	(0.634 - 0.701)	(0.682 - 0.768)	(0.682 - 0.767)
Manitoba	0.91***	0.97	1.00	0.96*	0.96*
	(0.848 - 0.969)	(0.906 - 1.049)	(0.910 - 1.107)	(0.918 - 1.005)	(0.918 - 1.005)
Saskatchewan	1.03	1.02	1.10***	1.05	1.05
	(0.901 - 1.180)	(0.967 - 1.087)	(1.025 - 1.174)	(0.991 - 1.103)	(0.991 - 1.104)
Alberta	1.10**	1.09***	1.11***	1.10***	1.10***
	(1.021 - 1.178)	(1.041 - 1.149)	(1.047 - 1.179)	(1.064 - 1.138)	(1.063 - 1.138)
British Columbia	1.21***	1.13***	1.27***	1.20***	1.20***
	(1.071 - 1.375)	(1.087 - 1.177)	(1.203 - 1.345)	(1.144 - 1.256)	(1.145 - 1.257)
Constant	6.20***	6.78***	5.13***	6.55***	6.51***
	(5.429 - 7.080)	(6.257 - 7.351)	(4.663 - 5.641)	(6.137 - 6.994)	(6.095 - 6.944)
Observations	**40087**	**78983**	**70478**	**189548**	**189548**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 11: The association between each BMI category and the intensity of visits to FP/GPs and pooled models in multivariable Zero Truncated Poisson regression with control for chronic conditions

	1996-7 (IRR, 95% CI)	***2000-1*** (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)	***Pooled*** (IRR, 95% CI)	***Pooled with Interaction*** (IRR, 95% CI)
Underweight	1.17*	1.03	1.27***	1.14***	1.20**
	(0.997 - 1.375)	(0.947 - 1.112)	(1.107 - 1.466)	(1.056 - 1.225)	(1.023 - 1.399)
Overweight	1.07	1.01	1.05**	1.04*	1.09*
	(0.965 - 1.179)	(0.970 - 1.048)	(1.007 - 1.089)	(0.999 - 1.082)	(0.985 - 1.195)
Obesity	1.06	1.08***	1.11***	1.09***	1.10**
	(0.969 - 1.169)	(1.037 - 1.132)	(1.061 - 1.168)	(1.052 - 1.127)	(1.011 - 1.203)
2000-1				0.96**	0.98
				(0.919 - 0.996)	(0.938 - 1.032)
2009-10				0.77***	0.79***
				(0.734 - 0.797)	(0.748 - 0.831)
2000-1×Obesity					1.00
					(0.906 - 1.095)
2009-10×Obesity					0.96
					(0.870 - 1.065)
2000-1×Overweight					0.94
					(0.846 - 1.035)
2009-10×Overweight					0.94
					(0.845 - 1.039)
2000-1×Underweight					0.86*
					(0.721 - 1.017)
2009-10×Underweight					1.06
					(0.864 - 1.302)
Predisposing					
Age 25 to 34	1.07	1.00	1.00	1.02	1.02
	(0.936 - 1.214)	(0.920 - 1.087)	(0.914 - 1.083)	(0.962 - 1.085)	(0.960 - 1.083)
Age 35 to 44	0.92	0.92**	0.90**	0.92***	0.91***
	(0.809 - 1.046)	(0.850 - 0.997)	(0.822 - 0.981)	(0.864 - 0.969)	(0.863 - 0.968)
Age 45 to 54	0.94	0.86***	0.82***	0.88***	0.87***
	(0.820 - 1.072)	(0.787 - 0.936)	(0.745 - 0.892)	(0.823 - 0.931)	(0.821 - 0.930)
Age 55 to 64	0.97	0.84***	0.75***	0.86***	0.86***
	(0.797 - 1.190)	(0.764 - 0.919)	(0.688 - 0.825)	(0.792 - 0.926)	(0.792 - 0.925)
Age 65 to 74	0.86*	0.76***	0.71***	0.79***	0.79***
	(0.738 - 1.006)	(0.690 - 0.842)	(0.645 - 0.775)	(0.734 - 0.842)	(0.733 - 0.841)
Age 75 to 84	0.87*	0.82***	0.76***	0.82***	0.82***
	(0.735 - 1.023)	(0.734 - 0.908)	(0.684 - 0.834)	(0.764 - 0.88)	(0.763 - 0.879)
Age 85+	0.87	0.79***	0.78***	0.81***	0.81***
	(0.701 - 1.071)	(0.706 - 0.894)	(0.694 - 0.869)	(0.746 - 0.885)	(0.745 - 0.884)
Male	0.94	0.91***	0.90***	0.91***	0.91***
	(0.863 - 1.018)	(0.874 - 0.940)	(0.868 - 0.931)	(0.883 - 0.94)	(0.883 - 0.940)
Divorced/widowed/ separated	1.05	1.04	1.07**	1.06*	1.06*
	(0.898 - 1.217)	(0.978 - 1.110)	(1.005 - 1.141)	(0.994 - 1.123)	(0.994 - 1.123)
Married	0.99	1.03	1.05	1.02	1.02
	(0.904 - 1.095)	(0.974 - 1.083)	(0.987 - 1.109)	(0.98 - 1.065)	(0.980 - 1.065)
Immigrant < 10 years	1.21	0.93*	0.93	1.01	1.01
	(0.927 - 1.592)	(0.862 - 1.003)	(0.837 - 1.026)	(0.912 - 1.118)	(0.912 - 1.119)
Immigrant ≥ 10 years	1.02	1.07**	1.05**	1.05***	1.05***
	(0.944 - 1.106)	(1.013 - 1.132)	(1.001 - 1.109)	(1.013 - 1.09)	(1.013 - 1.090)
Bachelor's Degree	0.89*	0.86***	0.95*	0.88***	0.88***
	(0.778 - 1.007)	(0.803 - 0.926)	(0.892 - 1.004)	(0.837 - 0.93)	(0.837 - 0.930)
Diploma/Certificate	0.92	0.92***	1.01	0.93***	0.93***
	(0.821 - 1.034)	(0.873 - 0.970)	(0.955 - 1.058)	(0.888 - 0.972)	(0.889 - 0.972)
Secondary school	0.87***	0.92***	1.03	0.91***	0.91***
	(0.779 - 0.965)	(0.870 - 0.968)	(0.976 - 1.089)	(0.868 - 0.958)	(0.869 - 0.959)
Former Smoker	1.07*	1.05***	1.06***	1.06***	1.06***
	(0.991 - 1.147)	(1.013 - 1.088)	(1.015 - 1.103)	(1.025 - 1.088)	(1.025 - 1.088)
Occasional Smoker	1.09	1.06*	1.11***	1.09***	1.09***

	(0.948 - 1.262)	(0.998 - 1.130)	(1.030 - 1.206)	(1.034 - 1.157)	(1.034 - 1.157)
Light Daily Smoker	1.40**	1.14**	1.14***	1.22***	1.22***
	(1.012 - 1.946)	(1.015 - 1.288)	(1.061 - 1.216)	(1.072 - 1.392)	(1.073 - 1.392)
Heavy Daily Smoker	1.20***	1.14***	1.17***	1.16***	1.16***
	(1.097 - 1.313)	(1.083 - 1.205)	(1.098 - 1.252)	(1.115 - 1.211)	(1.115 - 1.212)
Regular Drinker – Non Binge	0.74***	0.84***	0.85***	0.81***	0.81***
	(0.658 - 0.841)	(0.797 - 0.886)	(0.808 - 0.902)	(0.766 - 0.848)	(0.766 - 0.848)
Regular Drinker –Binge	0.73***	0.82***	0.78***	0.78***	0.78***
	(0.643 - 0.835)	(0.778 - 0.856)	(0.741 - 0.829)	(0.738 - 0.816)	(0.738 - 0.817)
Occasional Drinker	0.85**	0.93***	0.93***	0.90***	0.90***
	(0.746 - 0.968)	(0.892 - 0.977)	(0.885 - 0.974)	(0.853 - 0.946)	(0.853 - 0.947)
Enabling					
Rural	1.00	0.99	0.95***	0.98	0.98
	(0.934 - 1.069)	(0.951 - 1.026)	(0.916 - 0.986)	(0.949 - 1.006)	(0.949 - 1.006)
No Regular Medical Doctor	0.67***	0.73***	0.81***	0.74***	0.74***
	(0.573 - 0.779)	(0.688 - 0.768)	(0.755 - 0.871)	(0.697 - 0.776)	(0.697 - 0.776)
Income_Q5	0.88*	0.77***	0.79***	0.81***	0.81***
	(0.769 - 1.005)	(0.723 - 0.818)	(0.740 - 0.844)	(0.771 - 0.86)	(0.771 - 0.860)
Income_Q4	0.86***	0.80***	0.83***	0.84***	0.84***
	(0.771 - 0.959)	(0.759 - 0.852)	(0.789 - 0.882)	(0.798 - 0.878)	(0.798 - 0.878)
Income_Q3	0.95	0.84***	0.87***	0.89***	0.89***
	(0.857 - 1.060)	(0.802 - 0.889)	(0.822 - 0.914)	(0.852 - 0.931)	(0.852 - 0.930)
Income_Q2	1.07	0.90***	0.89***	0.95	0.95
	(0.894 - 1.274)	(0.856 - 0.950)	(0.845 - 0.935)	(0.892 - 1.022)	(0.891 - 1.021)
Homeowner	0.87***	0.92***	0.93***	0.90***	0.90***
	(0.793 - 0.959)	(0.878 - 0.957)	(0.888 - 0.972)	(0.87 - 0.94)	(0.869 - 0.939)
Organization/Resource					
Newfoundland	1.05	1.05	1.32***	1.12***	1.12***
	(0.940 - 1.166)	(0.989 - 1.116)	(1.200 - 1.446)	(1.06 - 1.173)	(1.061 - 1.173)
Prince Edward Island	0.99	0.94	0.83***	0.93**	0.93**
	(0.866 - 1.129)	(0.863 - 1.023)	(0.764 - 0.906)	(0.87 - 0.996)	(0.869 - 0.996)
Nova Scotia	1.10	1.02	1.13***	1.07**	1.07**
	(0.954 - 1.259)	(0.960 - 1.077)	(1.039 - 1.231)	(1.014 - 1.139)	(1.014 - 1.138)
New Brunswick	1.02	0.89***	0.96	0.95	0.95
	(0.887 - 1.163)	(0.835 - 0.952)	(0.908 - 1.021)	(0.901 - 1.011)	(0.901 - 1.011)
Quebec	0.79***	0.80***	0.71***	0.77***	0.77***
	(0.684 - 0.920)	(0.757 - 0.849)	(0.673 - 0.743)	(0.727 - 0.818)	(0.727 - 0.818)
Manitoba	0.93**	1.00	1.01	0.98	0.98
	(0.874 - 0.990)	(0.931 - 1.076)	(0.922 - 1.112)	(0.939 - 1.023)	(0.939 - 1.023)
Saskatchewan	1.05	1.06**	1.12***	1.07***	1.07**
	(0.914 - 1.207)	(1.006 - 1.125)	(1.049 - 1.199)	(1.018 - 1.135)	(1.017 - 1.134)
Alberta	1.11***	1.10***	1.12***	1.11***	1.11***
	(1.032 - 1.187)	(1.046 - 1.158)	(1.061 - 1.189)	(1.074 - 1.148)	(1.073 - 1.148)
British Columbia	1.22***	1.15***	1.31***	1.22***	1.22***
	(1.083 - 1.383)	(1.110 - 1.199)	(1.243 - 1.387)	(1.168 - 1.28)	(1.168 - 1.280)
Need					
Number of Chronic Conditions	1.30***	1.29***	1.24***	1.27***	1.27***
	(1.267 - 1.336)	(1.271 - 1.303)	(1.226 - 1.256)	(1.259 - 1.285)	(1.260 - 1.286)
Constant	4.82***	5.13***	3.95***	5.21***	5.11***
	(4.219 - 5.516)	(4.741 - 5.558)	(3.604 - 4.320)	(4.87 - 5.57)	(4.786 - 5.459)
Observations	**40087**	**78983**	**70478**	**189548**	**189548**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 12: Trends in the intensity of visits to FP/GPs for each BMI category relative to the trend in normal weight individuals in stratified pooled multivariable Zero Truncated Poisson regression

	Age ≤ 64 (IRR, 95% CI)	***Age ≥ 65*** (IRR, 95% CI)	***M ale*** (IRR, 95% CI)	***Female*** (IRR, 95% CI)
Underweight	1.26**	0.92	1.71**	1.05
	(1.026 - 1.554)	(0.708 - 1.197)	(1.050 - 2.773)	(0.915 - 1.215)
Overweight	1.18***	0.95	0.96	1.28***
	(1.041 - 1.336)	(0.854 - 1.065)	(0.845 - 1.087)	(1.108 - 1.481)
Obesity	1.33***	0.94	1.23**	1.23***
	(1.193 - 1.476)	(0.827 - 1.065)	(1.042 - 1.452)	(1.113 - 1.350)
2000-1	1.05	0.87***	0.94	1.05*
	(0.989 - 1.110)	(0.802 - 0.955)	(0.846 - 1.038)	(0.994 - 1.113)
2009-10	0.86***	0.69***	0.76***	0.85***
	(0.805 - 0.917)	(0.630 - 0.752)	(0.689 - 0.849)	(0.799 - 0.905)
2000-1×Obesity	0.97	1.32***	1.04	1.05
	(0.865 - 1.086)	(1.135 - 1.524)	(0.864 - 1.241)	(0.938 - 1.167)
2009-10×Obesity	0.99	1.24***	1.04	1.05
	(0.875 - 1.117)	(1.081 - 1.417)	(0.866 - 1.258)	(0.934 - 1.172)
2000-1×Overweight	0.91	1.08	1.12	0.83**
	(0.800 - 1.038)	(0.962 - 1.220)	(0.964 - 1.291)	(0.716 - 0.972)
2009-10×Overweight	0.93	1.11*	1.10	0.88
	(0.810 - 1.062)	(0.985 - 1.257)	(0.956 - 1.258)	(0.751 - 1.031)
2000-1×Underweight	0.75**	1.43**	0.68	0.94
	(0.600 - 0.947)	(1.068 - 1.918)	(0.410 - 1.132)	(0.792 - 1.117)
2009-10×Underweight	1.02	1.26	0.79	1.18
	(0.788 - 1.333)	(0.926 - 1.715)	(0.434 - 1.457)	(0.958 - 1.444)
Predisposing				
Age 25 to 34	1.04		1.28***	0.95
	(0.977 - 1.107)		(1.150 - 1.426)	(0.880 - 1.024)
Age 35 to 44	0.97		1.34***	0.83***
	(0.915 - 1.032)		(1.231 - 1.460)	(0.773 - 0.900)
Age 45 to 54	1.00		1.37***	0.87***
	(0.935 - 1.066)		(1.255 - 1.504)	(0.798 - 0.941)
Age 55 to 64	1.07*		1.57***	0.89**
	(0.993 - 1.147)		(1.429 - 1.726)	(0.801 - 0.989)
Age 65 to 74			1.64***	0.83***
			(1.491 - 1.813)	(0.751 - 0.916)
Age 75 to 84		1.12***	1.83***	0.92
		(1.071 - 1.171)	(1.644 - 2.031)	(0.827 - 1.020)
Age 85+		1.17***	1.95***	0.95
		(1.086 - 1.254)	(1.692 - 2.259)	(0.843 - 1.073)
Male		1.06**		
	(0.788 - 0.853)	(1.011 - 1.108)		
Divorced/widowed/ separated	1.14***	1.03	1.08*	1.13***
	(1.051 - 1.233)	(0.932 - 1.132)	(0.999 - 1.171)	(1.041 - 1.223)
Married	1.02	1.00	0.93*	1.06**
	(0.973 - 1.066)	(0.909 - 1.099)	(0.859 - 1.007)	(1.007 - 1.111)
Immigrant < 10 years	0.91*	1.07	0.92	0.91*
	(0.815 - 1.017)	(0.908 - 1.250)	(0.750 - 1.135)	(0.825 - 1.009)
Immigrant ≥ 10 years	1.02	1.05**	1.06*	1.00
	(0.966 - 1.070)	(1.007 - 1.102)	(0.996 - 1.130)	(0.958 - 1.046)
Bachelor's Degree	0.83***	0.89***	0.84***	0.83***
	(0.773 - 0.884)	(0.821 - 0.957)	(0.779 - 0.912)	(0.780 - 0.893)
Diploma/Certificate	0.89***	0.97	0.94**	0.90***
	(0.834 - 0.940)	(0.918 - 1.021)	(0.879 - 0.999)	(0.843 - 0.955)
Secondary school	0.87***	0.92***	0.93**	0.87***
	(0.811 - 0.923)	(0.868 - 0.970)	(0.865 - 0.991)	(0.813 - 0.926)
Former Smoker	1.08***	1.08***	1.04*	1.10***
	(1.041 - 1.123)	(1.032 - 1.131)	(0.996 - 1.096)	(1.055 - 1.138)
Occasional Smoker	1.13***	1.05	1.08*	1.13***
	(1.063 - 1.198)	(0.905 - 1.225)	(0.993 - 1.182)	(1.044 - 1.216)

Light Daily Smoker	1.29***	1.02	1.26***	1.23**
	(1.116 - 1.481)	(0.922 - 1.136)	(1.076 - 1.476)	(1.024 - 1.478)
Heavy Daily Smoker	1.26***	1.11**	1.16***	1.30***
	(1.196 - 1.317)	(1.009 - 1.230)	(1.083 - 1.245)	(1.226 - 1.369)
Regular Drinker – Non Binge	0.73***	0.79***	0.81***	0.72***
	(0.685 - 0.786)	(0.753 - 0.834)	(0.761 - 0.872)	(0.667 - 0.767)
Regular Drinker – Binge	0.72***	0.75***	0.77***	0.72***
	(0.680 - 0.770)	(0.696 - 0.815)	(0.721 - 0.817)	(0.673 - 0.778)
Occasional Drinker	0.86***	0.89***	0.97	0.82***
	(0.803 - 0.924)	(0.848 - 0.940)	(0.898 - 1.056)	(0.767 - 0.880)
Enabling				
Rural	0.98	0.98	0.92***	1.02
	(0.947 - 1.014)	(0.941 - 1.030)	(0.891 - 0.961)	(0.981 - 1.062)
No Regular Medical Doctor	0.70***	0.66***	0.69***	0.72***
	(0.665 - 0.745)	(0.562 - 0.767)	(0.634 - 0.756)	(0.679 - 0.773)
Income_Q5	0.74***	0.82***	0.71***	0.79***
	(0.690 - 0.796)	(0.752 - 0.889)	(0.655 - 0.763)	(0.727 - 0.857)
Income_Q4	0.76***	0.85***	0.73***	0.82***
	(0.717 - 0.814)	(0.780 - 0.916)	(0.683 - 0.785)	(0.764 - 0.876)
Income_Q3	0.81***	0.89***	0.80***	0.86***
	(0.767 - 0.861)	(0.836 - 0.940)	(0.747 - 0.857)	(0.810 - 0.904)
Income_Q2	0.89**	0.93***	0.88***	0.92*
	(0.807 - 0.972)	(0.887 - 0.983)	(0.804 - 0.957)	(0.839 - 1.008)
Homeowner	0.87***	0.89***	0.87***	0.88***
	(0.828 - 0.913)	(0.845 - 0.933)	(0.813 - 0.925)	(0.835 - 0.917)
Organization/Resource				
Newfoundland	1.07**	1.01	1.09*	1.03
	(1.003 - 1.134)	(0.937 - 1.088)	(0.992 - 1.189)	(0.966 - 1.101)
Prince Edward Island	0.89***	0.91	0.91	0.90**
	(0.817 - 0.970)	(0.804 - 1.020)	(0.808 - 1.027)	(0.822 - 0.977)
Nova Scotia	1.09**	1.03	1.07	1.07
	(1.013 - 1.175)	(0.940 - 1.120)	(0.985 - 1.156)	(0.985 - 1.171)
New Brunswick	0.93*	0.89***	0.92*	0.92**
	(0.867 - 1.003)	(0.810 - 0.969)	(0.835 - 1.013)	(0.857 - 0.997)
Quebec	0.75***	0.64***	0.71***	0.73***
	(0.700 - 0.810)	(0.604 - 0.688)	(0.662 - 0.762)	(0.670 - 0.793)
Manitoba	0.99	0.87***	0.96	0.96
	(0.937 - 1.047)	(0.822 - 0.914)	(0.902 - 1.012)	(0.896 - 1.026)
Saskatchewan	1.08**	0.95	1.09*	1.02
	(1.015 - 1.149)	(0.879 - 1.025)	(0.999 - 1.189)	(0.956 - 1.080)
Alberta	1.12***	1.02	1.07**	1.12***
	(1.077 - 1.166)	(0.954 - 1.086)	(1.011 - 1.128)	(1.068 - 1.165)
British Columbia	1.23***	1.09***	1.21***	1.19***
	(1.162 - 1.299)	(1.025 - 1.168)	(1.101 - 1.321)	(1.133 - 1.243)
Constant	6.66***	7.54***	4.80***	7.18***
	(6.153 - 7.211)	(6.655 - 8.547)	(4.288 - 5.382)	(6.570 - 7.841)
Observations	**143859**	**45689**	**82430**	**107118**

*** p<0.01, ** p<0.05, * p<0.1

8.3.5 Specialist Physician Visits – Propensity

Table C. 13: The association between each BMI category and the propensity to visit a specialist physician and pooled models in multivariable Poisson regression

	1996-7 (RR, 95% CI)	***2000-1*** (RR, 95% CI)	***2009-10*** (RR, 95% CI)	***Pooled*** (RR, 95% CI)	***Pooled with Interaction*** (RR, 95% CI)
Underweight	0.97 (0.812 - 1.167)	0.96 (0.888 - 1.049)	1.04 (0.911 - 1.184)	0.99 (0.925 - 1.067)	1.01 (0.836 - 1.208)
Overweight	0.98 (0.909 - 1.059)	1.02 (0.988 - 1.054)	1.06*** (1.017 - 1.098)	1.02 (0.995 - 1.049)	0.95 (0.886 - 1.026)
Obesity	1.11* (0.994 - 1.240)	1.11*** (1.070 - 1.160)	1.22*** (1.167 - 1.276)	1.16*** (1.119 - 1.195)	1.09 (0.980 - 1.207)
2000-1				1.17*** (1.126 - 1.206)	1.13*** (1.078 - 1.195)
2009-10				1.21*** (1.163 - 1.251)	1.13*** (1.072 - 1.199)
2000-1×Obesity					1.03 (0.923 - 1.152)
2009-10×Obesity					1.13** (1.012 - 1.265)
2000-1×Overweight					1.07* (0.990 - 1.164)
2009-10×Overweight					1.12*** (1.035 - 1.222)
2000-1×Underweight					0.96 (0.784 - 1.177)
2009-10×Underweight					1.02 (0.808 - 1.276)
Predisposing					
Age 25 to 34	1.12 (0.957 - 1.303)	1.02 (0.948 - 1.087)	1.07 (0.984 - 1.161)	1.06* (0.998 - 1.121)	1.06* (0.999 - 1.122)
Age 35 to 44	1.01 (0.860 - 1.190)	0.98 (0.910 - 1.051)	1.09** (1.008 - 1.188)	1.02 (0.962 - 1.086)	1.02 (0.962 - 1.086)
Age 45 to 54	1.12 (0.947 - 1.318)	1.06* (0.989 - 1.138)	1.20*** (1.102 - 1.301)	1.12*** (1.054 - 1.186)	1.12*** (1.055 - 1.186)
Age 55 to 64	1.30*** (1.082 - 1.570)	1.26*** (1.165 - 1.352)	1.30*** (1.199 - 1.405)	1.27*** (1.194 - 1.354)	1.27*** (1.193 - 1.353)
Age 65 to 74	1.30*** (1.102 - 1.538)	1.33*** (1.229 - 1.431)	1.48*** (1.365 - 1.604)	1.37*** (1.287 - 1.455)	1.37*** (1.287 - 1.454)
Age 75 to 84	1.39*** (1.129 - 1.703)	1.42*** (1.304 - 1.537)	1.57*** (1.440 - 1.721)	1.45*** (1.357 - 1.56)	1.45*** (1.356 - 1.559)
Age 85+	1.37* (0.949 - 1.990)	1.15** (1.015 - 1.311)	1.46*** (1.288 - 1.655)	1.31*** (1.169 - 1.479)	1.31*** (1.166 - 1.474)
Male	0.64*** (0.593 - 0.694)	0.71*** (0.685 - 0.726)	0.75*** (0.725 - 0.779)	0.71*** (0.687 - 0.726)	0.71*** (0.687 - 0.726)
Divorced/widowed/ separated	1.04 (0.920 - 1.167)	0.98 (0.927 - 1.031)	1.03 (0.971 - 1.090)	1.01 (0.97 - 1.057)	1.01 (0.971 - 1.058)
Married	1.03 (0.930 - 1.130)	1.04* (0.996 - 1.090)	1.05* (0.999 - 1.106)	1.04** (1.006 - 1.079)	1.04** (1.007 - 1.080)
Immigrant < 10 years	0.95 (0.767 - 1.167)	0.81*** (0.730 - 0.889)	0.82*** (0.742 - 0.916)	0.84*** (0.782 - 0.906)	0.84*** (0.781 - 0.906)
Immigrant ≥ 10 years	1.06 (0.953 - 1.184)	0.98 (0.940 - 1.030)	0.98 (0.927 - 1.034)	1.00 (0.965 - 1.037)	1.00 (0.965 - 1.038)
Bachelor's Degree	1.31*** (1.151 - 1.494)	1.23*** (1.167 - 1.293)	1.34*** (1.261 - 1.416)	1.29*** (1.23 - 1.345)	1.29*** (1.230 - 1.345)
Diploma/Certificate	1.18*** (1.060 - 1.317)	1.14*** (1.091 - 1.187)	1.22*** (1.159 - 1.281)	1.18*** (1.138 - 1.221)	1.18*** (1.136 - 1.218)
Secondary school	1.14*** (1.033 - 1.250)	1.08*** (1.034 - 1.129)	1.13*** (1.064 - 1.193)	1.11*** (1.072 - 1.155)	1.11*** (1.070 - 1.153)

Former Smoker	1.18***	1.21***	1.16***	1.18***	1.18***
	(1.079 - 1.297)	(1.166 - 1.256)	(1.112 - 1.207)	(1.144 - 1.221)	(1.143 - 1.221)
Occasional Smoker	1.18*	1.18***	1.14***	1.16***	1.16***
	(0.977 - 1.419)	(1.091 - 1.276)	(1.046 - 1.233)	(1.086 - 1.235)	(1.086 - 1.235)
Light Daily Smoker	1.13	1.10***	1.08*	1.10***	1.10***
	(0.971 - 1.304)	(1.028 - 1.177)	(0.999 - 1.161)	(1.04 - 1.16)	(1.039 - 1.159)
Heavy Daily Smoker	1.05	1.09***	1.06*	1.07***	1.07***
	(0.951 - 1.166)	(1.039 - 1.143)	(1.000 - 1.130)	(1.028 - 1.115)	(1.027 - 1.114)
Regular Drinker – Non Binge	1.00	0.97	1.02	1.00	0.99
	(0.894 - 1.120)	(0.927 - 1.012)	(0.966 - 1.077)	(0.957 - 1.036)	(0.956 - 1.036)
Regular Drinker – Binge	0.97	0.89***	0.96	0.93***	0.93***
	(0.863 - 1.097)	(0.850 - 0.937)	(0.900 - 1.015)	(0.892 - 0.975)	(0.892 - 0.974)
Occasional Drinker	1.05	1.01	1.07**	1.05**	1.05**
	(0.959 - 1.154)	(0.968 - 1.058)	(1.015 - 1.137)	(1.007 - 1.087)	(1.006 - 1.086)
Enabling					
Rural	0.95	0.90***	0.87***	0.91***	0.91***
	(0.869 - 1.048)	(0.874 - 0.936)	(0.840 - 0.907)	(0.88 - 0.934)	(0.879 - 0.933)
No Regular Medical Doctor	0.62***	0.65***	0.67***	0.65***	0.65***
	(0.523 - 0.740)	(0.613 - 0.681)	(0.626 - 0.716)	(0.614 - 0.683)	(0.614 - 0.683)
Income_Q5	1.02	1.08***	1.05	1.05*	1.05**
	(0.903 - 1.148)	(1.023 - 1.131)	(0.982 - 1.113)	(1.004 - 1.098)	(1.004 - 1.097)
Income_Q4	0.95	1.04	1.02	1.01	1.01
	(0.852 - 1.065)	(0.986 - 1.090)	(0.962 - 1.078)	(0.967 - 1.051)	(0.967 - 1.050)
Income_Q3	1.00	0.99	0.97	0.99	0.99
	(0.899 - 1.112)	(0.945 - 1.034)	(0.921 - 1.029)	(0.949 - 1.027)	(0.949 - 1.027)
Income_Q2	0.88**	0.99	0.97	0.95**	0.95**
	(0.790 - 0.977)	(0.946 - 1.035)	(0.921 - 1.030)	(0.92 - 0.99)	(0.920 - 0.990)
Homeowner	0.91**	0.95***	0.97	0.95***	0.95***
	(0.842 - 0.994)	(0.914 - 0.980)	(0.927 - 1.014)	(0.917 - 0.976)	(0.918 - 0.977)
Organization/Resource					
Newfoundland	0.95	0.95	0.96	0.95*	0.95*
	(0.813 - 1.120)	(0.885 - 1.029)	(0.893 - 1.038)	(0.902 - 1.007)	(0.902 - 1.006)
Prince Edward Island	0.92	0.91**	1.02	0.95	0.95
	(0.760 - 1.112)	(0.827 - 0.992)	(0.920 - 1.129)	(0.882 - 1.017)	(0.882 - 1.018)
Nova Scotia	0.93	0.96	1.02	0.97	0.97
	(0.792 - 1.088)	(0.902 - 1.029)	(0.943 - 1.094)	(0.917 - 1.021)	(0.917 - 1.022)
New Brunswick	1.01	1.02	0.99	1.00	1.00
	(0.866 - 1.176)	(0.951 - 1.087)	(0.918 - 1.060)	(0.941 - 1.053)	(0.942 - 1.054)
Quebec	1.42***	1.27***	1.14***	1.25***	1.25***
	(1.318 - 1.538)	(1.219 - 1.320)	(1.090 - 1.187)	(1.216 - 1.294)	(1.216 - 1.294)
Manitoba	0.95	0.93**	0.94	0.94***	0.94***
	(0.868 - 1.035)	(0.869 - 0.988)	(0.866 - 1.030)	(0.895 - 0.982)	(0.894 - 0.982)
Saskatchewan	1.10	0.91***	0.80***	0.92***	0.92***
	(0.948 - 1.281)	(0.857 - 0.970)	(0.742 - 0.868)	(0.865 - 0.973)	(0.867 - 0.975)
Alberta	0.87***	0.85***	0.83***	0.84***	0.85***
	(0.820 - 0.923)	(0.799 - 0.895)	(0.778 - 0.888)	(0.815 - 0.876)	(0.815 - 0.876)
British Columbia	0.94	0.86***	0.90***	0.90***	0.90***
	(0.839 - 1.062)	(0.827 - 0.905)	(0.848 - 0.948)	(0.857 - 0.936)	(0.857 - 0.937)
Constant	0.22***	0.28***	0.23***	0.22***	0.23***
	(0.189 - 0.265)	(0.255 - 0.302)	(0.213 - 0.259)	(0.205 - 0.237)	(0.210 - 0.247)
Observations	**49962**	**98774**	**87452**	**236188**	**236188**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 14: The association between each BMI category and the propensity to visit a specialist physician and pooled models in multivariable Poisson regression with control for the number of chronic conditions

	1996-7 (RR, 95% CI)	***2000-1*** (RR, 95% CI)	***2009-10*** (RR, 95% CI)	***Pooled*** (RR, 95% CI)	***Pooled with Interaction*** (RR, 95% CI)
Underweight	0.99 (0.831 - 1.190)	0.96 (0.886 - 1.047)	1.05 (0.928 - 1.191)	1.00 (0.936 - 1.075)	1.03 (0.860 - 1.236)
Overweight	0.95 (0.879 - 1.025)	0.98 (0.949 - 1.013)	1.01 (0.975 - 1.053)	0.98 (0.956 - 1.008)	0.93* (0.866 - 1.003)
Obesity	0.99 (0.885 - 1.100)	0.98 (0.939 - 1.021)	1.07*** (1.022 - 1.121)	1.01 (0.981 - 1.05)	1.00 (0.899 - 1.103)
2000-1				1.13*** (1.096 - 1.171)	1.12*** (1.061 - 1.174)
2009-10				1.15*** (1.111 - 1.193)	1.11*** (1.047 - 1.169)
2000-1×Obesity					0.99 (0.889 - 1.105)
2009-10×Obesity					1.06 (0.948 - 1.179)
2000-1×Overweight					1.06 (0.974 - 1.145)
2009-10×Overweight					1.09** (1.004 - 1.187)
2000-1×Underweight					0.94 (0.766 - 1.144)
2009-10×Underweight					1.00 (0.802 - 1.250)
Predisposing					
Age 25 to 34	1.10 (0.946 - 1.284)	1.00 (0.930 - 1.066)	1.06 (0.981 - 1.155)	1.04 (0.985 - 1.107)	1.04 (0.985 - 1.107)
Age 35 to 44	0.98 (0.835 - 1.145)	0.94* (0.875 - 1.010)	1.05 (0.965 - 1.136)	0.98 (0.924 - 1.042)	0.98 (0.924 - 1.042)
Age 45 to 54	0.99 (0.844 - 1.164)	0.96 (0.897 - 1.033)	1.09* (0.999 - 1.180)	1.01 (0.953 - 1.072)	1.01 (0.953 - 1.072)
Age 55 to 64	1.06 (0.879 - 1.268)	1.05 (0.973 - 1.129)	1.08* (1.000 - 1.177)	1.05* (0.99 - 1.124)	1.05 (0.990 - 1.124)
Age 65 to 74	0.99 (0.836 - 1.175)	1.03 (0.950 - 1.109)	1.15*** (1.058 - 1.246)	1.06* (0.991 - 1.124)	1.06* (0.992 - 1.124)
Age 75 to 84	0.98 (0.799 - 1.214)	1.03 (0.951 - 1.124)	1.13*** (1.032 - 1.237)	1.05 (0.974 - 1.121)	1.05 (0.974 - 1.122)
Age 85+	0.88 (0.632 - 1.235)	0.82*** (0.727 - 0.932)	0.99 (0.870 - 1.123)	0.89** (0.799 - 0.994)	0.89** (0.799 - 0.993)
Male	0.68*** (0.631 - 0.731)	0.74*** (0.719 - 0.762)	0.78*** (0.749 - 0.805)	0.74*** (0.718 - 0.757)	0.74*** (0.718 - 0.757)
Divorced/widowed/ separated	0.99 (0.885 - 1.113)	0.96 (0.909 - 1.011)	1.02 (0.965 - 1.080)	0.99 (0.954 - 1.037)	1.00 (0.954 - 1.037)
Married	1.02 (0.935 - 1.121)	1.04 (0.993 - 1.086)	1.05* (0.997 - 1.101)	1.04** (1.005 - 1.075)	1.04** (1.005 - 1.075)
Immigrant < 10 years	1.03 (0.834 - 1.262)	0.87*** (0.792 - 0.963)	0.87*** (0.780 - 0.962)	0.90*** (0.837 - 0.969)	0.90*** (0.837 - 0.968)
Immigrant ≥ 10 years	1.08 (0.965 - 1.197)	1.00 (0.953 - 1.042)	0.99 (0.937 - 1.046)	1.01 (0.975 - 1.048)	1.01 (0.976 - 1.049)
Bachelor's Degree	1.32*** (1.162 - 1.511)	1.27*** (1.209 - 1.338)	1.39*** (1.314 - 1.476)	1.33*** (1.268 - 1.386)	1.33*** (1.268 - 1.385)
Diploma/Certificate	1.15*** (1.036 - 1.287)	1.16*** (1.114 - 1.210)	1.25*** (1.188 - 1.315)	1.19*** (1.149 - 1.233)	1.19*** (1.148 - 1.231)
Secondary school	1.14*** (1.032 - 1.249)	1.11*** (1.065 - 1.162)	1.17*** (1.104 - 1.239)	1.14*** (1.094 - 1.179)	1.13*** (1.092 - 1.178)
Former Smoker	1.15*** (1.047 - 1.256)	1.17*** (1.126 - 1.212)	1.13*** (1.082 - 1.174)	1.15*** (1.109 - 1.184)	1.15*** (1.109 - 1.184)

Occasional Smoker	1.17*	1.14***	1.11**	1.13***	1.13***
	(0.972 - 1.412)	(1.057 - 1.232)	(1.022 - 1.205)	(1.062 - 1.207)	(1.063 - 1.207)
Light Daily Smoker	1.11	1.07**	1.04	1.07**	1.07**
	(0.962 - 1.276)	(1.004 - 1.146)	(0.967 - 1.122)	(1.014 - 1.128)	(1.013 - 1.127)
Heavy Daily Smoker	1.01	1.03	1.00	1.01	1.01
	(0.910 - 1.116)	(0.980 - 1.076)	(0.938 - 1.061)	(0.971 - 1.052)	(0.970 - 1.052)
Regular Drinker – Non Binge	1.05	1.02	1.08***	1.05**	1.05**
	(0.939 - 1.177)	(0.973 - 1.061)	(1.020 - 1.137)	(1.006 - 1.089)	(1.005 - 1.088)
Regular Drinker –Binge	1.02	0.93***	1.01	0.98	0.98
	(0.911 - 1.153)	(0.888 - 0.979)	(0.950 - 1.072)	(0.94 - 1.026)	(0.939 - 1.025)
Occasional Drinker	1.09*	1.03	1.10***	1.07***	1.07***
	(0.993 - 1.198)	(0.981 - 1.073)	(1.035 - 1.158)	(1.027 - 1.109)	(1.026 - 1.108)
Enabling					
Rural	0.96	0.91***	0.88***	0.91***	0.91***
	(0.872 - 1.051)	(0.882 - 0.943)	(0.844 - 0.910)	(0.884 - 0.937)	(0.883 - 0.937)
No Regular Medical Doctor	0.68***	0.68***	0.70***	0.69***	0.69***
	(0.569 - 0.803)	(0.649 - 0.721)	(0.659 - 0.753)	(0.652 - 0.725)	(0.652 - 0.725)
Income_Q5	1.09	1.15***	1.12***	1.13***	1.12***
	(0.970 - 1.224)	(1.096 - 1.214)	(1.052 - 1.193)	(1.076 - 1.176)	(1.076 - 1.176)
Income_Q4	1.01	1.11***	1.09***	1.08***	1.08***
	(0.903 - 1.131)	(1.056 - 1.166)	(1.030 - 1.153)	(1.034 - 1.123)	(1.034 - 1.123)
Income_Q3	1.06	1.05**	1.04	1.05**	1.05**
	(0.948 - 1.180)	(1.001 - 1.095)	(0.981 - 1.092)	(1.008 - 1.091)	(1.008 - 1.091)
Income_Q2	0.93	1.03	1.02	1.00	1.00
	(0.840 - 1.041)	(0.987 - 1.078)	(0.965 - 1.079)	(0.966 - 1.04)	(0.966 - 1.040)
Homeowner	0.95	0.97*	1.00	0.97**	0.97
	(0.872 - 1.031)	(0.935 - 1.001)	(0.956 - 1.045)	(0.945 - 1.005)	(0.945 - 1.005)
Organization/Resource					
Newfoundland	1.00	1.00	0.97	0.98	0.98
	(0.858 - 1.165)	(0.933 - 1.081)	(0.903 - 1.049)	(0.934 - 1.038)	(0.933 - 1.038)
Prince Edward Island	0.94	0.94	1.04	0.97	0.97
	(0.782 - 1.124)	(0.861 - 1.025)	(0.942 - 1.154)	(0.908 - 1.045)	(0.908 - 1.045)
Nova Scotia	0.92	0.96	1.00	0.96	0.96
	(0.791 - 1.074)	(0.905 - 1.026)	(0.928 - 1.075)	(0.911 - 1.011)	(0.911 - 1.012)
New Brunswick	1.04	1.05	1.00	1.02	1.02
	(0.892 - 1.212)	(0.984 - 1.119)	(0.929 - 1.074)	(0.964 - 1.078)	(0.964 - 1.078)
Quebec	1.49***	1.33***	1.18***	1.31***	1.31***
	(1.386 - 1.610)	(1.284 - 1.387)	(1.135 - 1.235)	(1.274 - 1.353)	(1.274 - 1.353)
Manitoba	0.95	0.94*	0.95	0.95**	0.95**
	(0.876 - 1.040)	(0.883 - 1.002)	(0.869 - 1.037)	(0.903 - 0.991)	(0.902 - 0.990)
Saskatchewan	1.11	0.93**	0.81***	0.93**	0.93**
	(0.960 - 1.284)	(0.876 - 0.989)	(0.751 - 0.875)	(0.88 - 0.986)	(0.881 - 0.987)
Alberta	0.88***	0.85***	0.83***	0.85***	0.85***
	(0.827 - 0.928)	(0.799 - 0.895)	(0.782 - 0.892)	(0.818 - 0.879)	(0.818 - 0.879)
British Columbia	0.95	0.87***	0.91***	0.91***	0.91***
	(0.844 - 1.062)	(0.835 - 0.913)	(0.865 - 0.965)	(0.868 - 0.946)	(0.868 - 0.947)
Need					
Number of Chronic Conditions	1.31***	1.26***	1.22***	1.25***	1.25***
	(1.281 - 1.342)	(1.243 - 1.268)	(1.209 - 1.238)	(1.244 - 1.264)	(1.244 - 1.264)
Constant	0.17***	0.22***	0.19***	0.18***	0.18***
	(0.146 - 0.208)	(0.202 - 0.238)	(0.169 - 0.206)	(0.166 - 0.193)	(0.168 - 0.199)
Observations	**49962**	**98774**	**87452**	**236188**	**236188**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 15: Trends in the propensity to use a specialist visit for each BMI category relative to the trend in normal weight individuals in stratified pooled multivariable Poisson regression

	Age ≤ 64 (RR, 95% CI)	***Age ≥ 65*** (RR, 95% CI)	***M ale*** (RR, 95% CI)	***Female*** (RR, 95% CI)
Underweight	1.01	0.99	0.90	0.97
	(0.815 - 1.255)	(0.674 - 1.440)	(0.522 - 1.558)	(0.790 - 1.195)
Overweight	0.99	0.89	0.98	1.00
	(0.907 - 1.074)	(0.762 - 1.045)	(0.863 - 1.113)	(0.912 - 1.086)
Obesity	1.11*	1.03	1.12	1.11*
	(0.994 - 1.246)	(0.824 - 1.297)	(0.928 - 1.363)	(0.990 - 1.240)
2000-1	1.14***	1.14**	1.21***	1.11***
	(1.079 - 1.206)	(1.020 - 1.280)	(1.091 - 1.339)	(1.050 - 1.171)
2009-10	1.13***	1.20***	1.23***	1.10***
	(1.063 - 1.201)	(1.071 - 1.339)	(1.110 - 1.373)	(1.033 - 1.162)
2000-1×Obesity	1.01	1.15	0.99	1.04
	(0.892 - 1.135)	(0.902 - 1.470)	(0.808 - 1.209)	(0.919 - 1.179)
2009-10×Obesity	1.14**	1.11	1.13	1.09
	(1.005 - 1.283)	(0.873 - 1.400)	(0.920 - 1.387)	(0.968 - 1.227)
2000-1×Overweight	1.05	1.13	1.07	1.03
	(0.957 - 1.156)	(0.954 - 1.342)	(0.928 - 1.225)	(0.936 - 1.139)
2009-10×Overweight	1.11**	1.15	1.10	1.08
	(1.006 - 1.218)	(0.972 - 1.353)	(0.950 - 1.270)	(0.978 - 1.192)
2000-1×Underweight	0.93	1.06	1.27	0.93
	(0.740 - 1.178)	(0.693 - 1.608)	(0.698 - 2.320)	(0.738 - 1.164)
2009-10×Underweight	1.03	0.94	1.20	1.02
	(0.788 - 1.345)	(0.604 - 1.467)	(0.638 - 2.248)	(0.797 - 1.310)
Predisposing				
Age 25 to 34	1.06**		1.09*	1.06*
	(1.004 - 1.128)		(0.986 - 1.206)	(0.993 - 1.135)
Age 35 to 44	1.03		1.17***	0.97
	(0.967 - 1.091)		(1.059 - 1.288)	(0.909 - 1.045)
Age 45 to 54	1.12***		1.37***	1.01
	(1.056 - 1.187)		(1.245 - 1.505)	(0.945 - 1.087)
Age 55 to 64	1.26***		1.68***	1.08*
	(1.187 - 1.346)		(1.527 - 1.855)	(0.999 - 1.160)
Age 65 to 74			2.04***	1.05
			(1.843 - 2.258)	(0.975 - 1.125)
Age 75 to 84		1.07***	2.25***	1.08*
		(1.017 - 1.122)	(2.021 - 2.503)	(0.991 - 1.180)
Age 85+		0.98	2.16***	0.96
		(0.892 - 1.086)	(1.760 - 2.653)	(0.850 - 1.092)
Male	0.64***	1.06**		
	(0.619 - 0.660)	(1.009 - 1.113)		
Divorced/widowed/ separated	1.09***	0.95	1.01	1.07***
	(1.035 - 1.142)	(0.864 - 1.049)	(0.934 - 1.088)	(1.022 - 1.130)
Married	1.04*	1.01	1.00	1.04
	(0.998 - 1.075)	(0.914 - 1.111)	(0.941 - 1.059)	(0.989 - 1.084)
Immigrant < 10 years	0.84***	0.93	0.75***	0.91**
	(0.774 - 0.903)	(0.688 - 1.254)	(0.645 - 0.867)	(0.831 - 0.989)
Immigrant ≥ 10 years	0.98	1.03	0.92***	1.06**
	(0.935 - 1.024)	(0.973 - 1.084)	(0.873 - 0.972)	(1.004 - 1.113)
Bachelor's Degree	1.23***	1.29***	1.22***	1.30***
	(1.162 - 1.293)	(1.200 - 1.396)	(1.141 - 1.302)	(1.223 - 1.375)
Diploma/Certificate	1.13***	1.18***	1.11***	1.21***
	(1.076 - 1.179)	(1.118 - 1.240)	(1.053 - 1.177)	(1.155 - 1.270)
Secondary school	1.06**	1.16***	1.09***	1.13***
	(1.011 - 1.110)	(1.096 - 1.238)	(1.023 - 1.154)	(1.075 - 1.188)
Former Smoker	1.16***	1.12***	1.17***	1.13***
	(1.114 - 1.202)	(1.063 - 1.171)	(1.106 - 1.238)	(1.086 - 1.170)

Occasional Smoker	1.17***	0.88	1.12**	1.15***
	(1.092 - 1.250)	(0.726 - 1.073)	(1.011 - 1.243)	(1.064 - 1.242)
Light Daily Smoker	1.07**	1.09	1.09*	1.06*
	(1.009 - 1.137)	(0.961 - 1.245)	(0.994 - 1.204)	(0.997 - 1.135)
Heavy Daily Smoker	1.05**	0.91*	1.05	1.06**
	(1.006 - 1.103)	(0.820 - 1.015)	(0.976 - 1.120)	(1.005 - 1.112)
Regular Drinker – Non Binge	0.97	1.01	0.98	1.00
	(0.926 - 1.021)	(0.955 - 1.068)	(0.919 - 1.048)	(0.953 - 1.048)
Regular Drinker – Binge	0.94**	0.93*	0.93**	0.96
	(0.889 - 0.984)	(0.854 - 1.005)	(0.865 - 0.991)	(0.913 - 1.014)
Occasional Drinker	1.03	1.06*	1.07**	1.03
	(0.982 - 1.083)	(0.992 - 1.137)	(1.000 - 1.154)	(0.986 - 1.070)
Enabling				
Rural	0.90***	0.91***	0.89***	0.91***
	(0.873 - 0.934)	(0.865 - 0.958)	(0.854 - 0.934)	(0.876 - 0.949)
No Regular Medical Doctor	0.66***	0.56***	0.55***	0.79***
	(0.620 - 0.695)	(0.477 - 0.663)	(0.507 - 0.597)	(0.746 - 0.842)
Income_Q5	1.01	1.28***	1.07**	1.04
	(0.960 - 1.059)	(1.165 - 1.410)	(1.000 - 1.150)	(0.989 - 1.101)
Income_Q4	0.96	1.18***	1.00	1.03
	(0.922 - 1.010)	(1.086 - 1.282)	(0.931 - 1.064)	(0.981 - 1.082)
Income_Q3	0.94***	1.13***	0.97	1.00
	(0.896 - 0.980)	(1.060 - 1.206)	(0.908 - 1.034)	(0.952 - 1.049)
Income_Q2	0.91***	1.09***	0.96	0.95**
	(0.865 - 0.947)	(1.021 - 1.154)	(0.904 - 1.026)	(0.911 - 0.996)
Homeowner	0.96**	0.91***	0.93**	0.96**
	(0.922 - 0.990)	(0.854 - 0.967)	(0.885 - 0.984)	(0.924 - 0.992)
Organization/Resource				
Newfoundland	0.96	0.92	0.90***	0.99
	(0.899 - 1.023)	(0.833 - 1.017)	(0.826 - 0.972)	(0.922 - 1.067)
Prince Edward Island	0.98	0.83***	0.92	0.96
	(0.902 - 1.064)	(0.723 - 0.943)	(0.830 - 1.018)	(0.876 - 1.062)
Nova Scotia	1.00	0.84***	0.95	0.98
	(0.939 - 1.066)	(0.762 - 0.918)	(0.874 - 1.033)	(0.909 - 1.056)
New Brunswick	1.00	0.99	0.98	1.00
	(0.934 - 1.067)	(0.896 - 1.084)	(0.901 - 1.075)	(0.933 - 1.078)
Quebec	1.33***	0.98	1.12***	1.35***
	(1.285 - 1.377)	(0.915 - 1.049)	(1.060 - 1.181)	(1.301 - 1.401)
Manitoba	0.95*	0.88***	0.88***	0.98
	(0.898 - 1.006)	(0.820 - 0.950)	(0.822 - 0.942)	(0.925 - 1.036)
Saskatchewan	0.94*	0.85***	0.92*	0.92**
	(0.875 - 1.008)	(0.773 - 0.934)	(0.829 - 1.012)	(0.856 - 0.990)
Alberta	0.86***	0.81***	0.86***	0.83***
	(0.821 - 0.893)	(0.759 - 0.860)	(0.809 - 0.911)	(0.797 - 0.870)
British Columbia	0.91***	0.85***	0.91***	0.88***
	(0.861 - 0.954)	(0.790 - 0.913)	(0.855 - 0.976)	(0.827 - 0.931)
Constant	0.25***	0.28***	0.14***	0.24***
	(0.229 - 0.274)	(0.243 - 0.326)	(0.124 - 0.168)	(0.220 - 0.262)
Observations	**185144**	**51044**	**111642**	**124546**

*** p<0.01, ** p<0.05, * p<0.1

8.3.6 Specialist Physician Visits – Intensity

Table C. 16: The association between each BMI category and the intensity of visits to specialist physicians and pooled models in multivariable Zero Truncated Poisson regression

	1996-7 (IRR, 95% CI)	***2000-1*** (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)	***Pooled*** (IRR, 95% CI)	***Pooled with Interaction*** (IRR, 95% CI)
Underweight	1.15	1.27*	0.99	1.15*	1.19
	(0.833 - 1.601)	(0.957 - 1.674)	(0.835 - 1.182)	(0.986 - 1.353)	(0.870 - 1.639)
Overweight	1.09	1.04	0.99	1.03	1.10
	(0.891 - 1.336)	(0.923 - 1.166)	(0.883 - 1.099)	(0.95 - 1.123)	(0.900 - 1.344)
Obesity	1.09	1.15**	1.08	1.11***	1.11
	(0.932 - 1.281)	(1.030 - 1.277)	(0.944 - 1.232)	(1.025 - 1.193)	(0.949 - 1.294)
2000-1				1.05	1.06
				(0.969 - 1.14)	(0.951 - 1.180)
2009-10				1.05	1.11**
				(0.972 - 1.144)	(1.003 - 1.239)
2000-1×Obesity					1.04
					(0.861 - 1.253)
2009-10×Obesity					0.96
					(0.786 - 1.162)
2000-1×Overweight					0.95
					(0.757 - 1.194)
2009-10×Overweight					0.89
					(0.705 - 1.115)
2000-1×Underweight					1.06
					(0.694 - 1.619)
2009-10×Underweight					0.83
					(0.574 - 1.206)
Predisposing					
Age 25 to 34	1.62***	1.35***	1.31***	1.42***	1.42***
	(1.216 - 2.155)	(1.154 - 1.591)	(1.096 - 1.556)	(1.264 - 1.606)	(1.263 - 1.606)
Age 35 to 44	1.12	1.20**	1.08	1.14**	1.14**
	(0.857 - 1.470)	(1.013 - 1.411)	(0.886 - 1.314)	(1.012 - 1.289)	(1.013 - 1.290)
Age 45 to 54	1.19	1.25**	0.84*	1.06	1.06
	(0.873 - 1.633)	(1.030 - 1.517)	(0.691 - 1.014)	(0.923 - 1.208)	(0.924 - 1.209)
Age 55 to 64	1.01	1.25	0.93	1.07	1.07
	(0.761 - 1.337)	(0.945 - 1.664)	(0.724 - 1.190)	(0.908 - 1.253)	(0.910 - 1.255)
Age 65 to 74	0.98	1.19	0.73***	0.95	0.95
	(0.734 - 1.312)	(0.955 - 1.473)	(0.595 - 0.893)	(0.829 - 1.091)	(0.830 - 1.093)
Age 75 to 84	0.83	1.09	0.77**	0.89	0.90
	(0.571 - 1.214)	(0.847 - 1.405)	(0.599 - 0.995)	(0.756 - 1.058)	(0.756 - 1.059)
Age 85+	0.54**	0.73**	0.64***	0.66***	0.66***
	(0.328 - 0.901)	(0.571 - 0.929)	(0.492 - 0.825)	(0.548 - 0.793)	(0.548 - 0.794)
Male	0.96	1.00	1.05	1.01	1.01
	(0.829 - 1.119)	(0.905 - 1.096)	(0.946 - 1.165)	(0.948 - 1.083)	(0.948 - 1.083)
Divorced/widowed/ separated	1.29	0.85**	1.03	1.04	1.04
	(0.948 - 1.761)	(0.721 - 0.998)	(0.883 - 1.211)	(0.911 - 1.188)	(0.911 - 1.187)
Married	0.95	0.87**	1.00	0.94	0.94
	(0.788 - 1.151)	(0.771 - 0.973)	(0.882 - 1.138)	(0.867 - 1.021)	(0.866 - 1.020)
Immigrant < 10 years	0.99	0.69***	0.71***	0.78**	0.78**
	(0.562 - 1.748)	(0.539 - 0.888)	(0.573 - 0.881)	(0.634 - 0.958)	(0.635 - 0.959)
Immigrant ≥ 10 years	0.85*	0.80***	1.01	0.9**	0.90**
	(0.724 - 1.007)	(0.687 - 0.928)	(0.859 - 1.196)	(0.818 - 0.995)	(0.819 - 0.995)
Bachelor's Degree	0.96	1.23***	1.15*	1.12**	1.13**
	(0.780 - 1.187)	(1.078 - 1.401)	(0.994 - 1.325)	(1.022 - 1.236)	(1.024 - 1.237)

Diploma/Certificate	1.05	1.10	1.05	1.05	1.05
	(0.841 - 1.304)	(0.979 - 1.229)	(0.927 - 1.179)	(0.973 - 1.141)	(0.974 - 1.143)
Secondary school	1.07	1.18**	1.06	1.11**	1.11**
	(0.888 - 1.296)	(1.025 - 1.367)	(0.878 - 1.289)	(0.998 - 1.232)	(1.000 - 1.234)
Former Smoker	0.99	1.01	1.03	1.02	1.02
	(0.860 - 1.140)	(0.888 - 1.151)	(0.923 - 1.157)	(0.945 - 1.095)	(0.945 - 1.094)
Occasional Smoker	1.09	1.01	1.12	1.07	1.07
	(0.816 - 1.468)	(0.824 - 1.245)	(0.918 - 1.376)	(0.937 - 1.226)	(0.938 - 1.229)
Light Daily Smoker	1.03	1.17*	1.15	1.12*	1.12*
	(0.794 - 1.342)	(0.986 - 1.389)	(0.920 - 1.433)	(0.988 - 1.273)	(0.988 - 1.273)
Heavy Daily Smoker	1.14	1.21***	1.16**	1.18***	1.18***
	(0.923 - 1.410)	(1.065 - 1.384)	(1.013 - 1.328)	(1.066 - 1.311)	(1.066 - 1.310)
Regular Drinker – Non Binge	0.79***	0.71***	0.78***	0.75***	0.75***
	(0.661 - 0.934)	(0.605 - 0.829)	(0.662 - 0.916)	(0.681 - 0.834)	(0.682 - 0.835)
Regular Drinker – Binge	0.69***	0.59***	0.62***	0.63***	0.63***
	(0.538 - 0.879)	(0.519 - 0.681)	(0.544 - 0.717)	(0.57 - 0.696)	(0.570 - 0.696)
Occasional Drinker	0.95	0.78***	0.87*	0.86***	0.86***
	(0.779 - 1.149)	(0.684 - 0.898)	(0.753 - 1.007)	(0.778 - 0.941)	(0.778 - 0.941)
Rural	0.85*	0.82***	0.87***	0.84***	0.84***
	(0.712 - 1.015)	(0.744 - 0.909)	(0.794 - 0.944)	(0.782 - 0.901)	(0.782 - 0.901)
No Regular Medical Doctor	0.61***	0.88*	0.78***	0.78***	0.78***
	(0.443 - 0.827)	(0.776 - 1.004)	(0.696 - 0.881)	(0.713 - 0.85)	(0.714 - 0.851)
Income_Q5	0.94	0.83**	0.75***	0.83***	0.83***
	(0.716 - 1.235)	(0.717 - 0.957)	(0.609 - 0.923)	(0.735 - 0.941)	(0.734 - 0.939)
Income_Q4	0.97	0.82***	0.83*	0.87**	0.87**
	(0.753 - 1.252)	(0.720 - 0.940)	(0.667 - 1.033)	(0.768 - 0.981)	(0.767 - 0.981)
Income_Q3	0.87	0.90	0.75***	0.84***	0.84***
	(0.703 - 1.082)	(0.763 - 1.067)	(0.634 - 0.894)	(0.748 - 0.937)	(0.747 - 0.936)
Income_Q2	1.02	0.89*	0.83**	0.9**	0.90**
	(0.819 - 1.278)	(0.787 - 1.008)	(0.696 - 0.982)	(0.807 - 0.996)	(0.806 - 0.995)
Homeowner	0.88	0.95	0.93	0.93	0.93
	(0.711 - 1.100)	(0.877 - 1.035)	(0.830 - 1.046)	(0.852 - 1.014)	(0.852 - 1.014)
Organization/ Resource					
Newfoundland	0.56***	0.66***	0.77***	0.67***	0.67***
	(0.435 - 0.711)	(0.558 - 0.783)	(0.653 - 0.915)	(0.601 - 0.749)	(0.602 - 0.750)
Prince Edward Island	0.99	0.99	0.91	0.97	0.97
	(0.752 - 1.307)	(0.718 - 1.357)	(0.749 - 1.116)	(0.83 - 1.133)	(0.829 - 1.132)
Nova Scotia	1.25	0.76***	0.82*	0.93	0.93
	(0.609 - 2.573)	(0.636 - 0.905)	(0.674 - 1.003)	(0.681 - 1.257)	(0.682 - 1.255)
New Brunswick	0.71***	0.65***	0.76***	0.71***	0.71***
	(0.557 - 0.904)	(0.561 - 0.750)	(0.635 - 0.917)	(0.633 - 0.79)	(0.633 - 0.791)
Quebec	0.63***	0.74***	0.72***	0.70***	0.70***
	(0.499 - 0.785)	(0.659 - 0.826)	(0.641 - 0.810)	(0.643 - 0.76)	(0.643 - 0.761)
Manitoba	0.81**	0.95	0.85**	0.87**	0.87**
	(0.680 - 0.957)	(0.775 - 1.157)	(0.729 - 0.990)	(0.776 - 0.968)	(0.777 - 0.968)
Saskatchewan	0.67**	0.83	0.68***	0.73***	0.73***
	(0.457 - 0.980)	(0.662 - 1.052)	(0.597 - 0.775)	(0.627 - 0.849)	(0.627 - 0.848)
Alberta	0.92	0.89	0.94	0.92*	0.92*
	(0.801 - 1.067)	(0.759 - 1.040)	(0.806 - 1.105)	(0.839 - 1.003)	(0.839 - 1.002)
British Columbia	0.90	0.87**	0.94	0.91**	0.91**
	(0.718 - 1.134)	(0.780 - 0.974)	(0.810 - 1.085)	(0.827 - 0.998)	(0.827 - 0.997)
Constant	4.10***	4.68***	5.40***	4.54***	4.43***
	(2.956 - 5.684)	(3.835 - 5.716)	(4.328 - 6.734)	(3.945 - 5.219)	(3.796 - 5.173)
Observations	**11358**	**28170**	**28291**	**67819**	**67819**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 17: The association between each BMI category and the intensity of visits to specialist physicians and pooled models in multivariable Zero Truncated Poisson regression with control for the number of chronic conditions

	1996-7 (IRR, 95% CI)	***2000-1*** (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)	***Pooled*** (IRR, 95% CI)	***Pooled with Interaction*** (IRR, 95% CI)
Underweight	1.15	1.25	0.99	1.15*	1.20
	(0.835 - 1.587)	(0.946 - 1.661)	(0.833 - 1.182)	(0.984 - 1.351)	(0.885 - 1.639)
Overweight	1.06	1.01	0.96	1.01	1.08
	(0.869 - 1.292)	(0.900 - 1.139)	(0.859 - 1.076)	(0.927 - 1.095)	(0.885 - 1.317)
Obesity	1.00	1.06	1.00	1.02	1.05
	(0.855 - 1.177)	(0.951 - 1.190)	(0.872 - 1.137)	(0.945 - 1.102)	(0.897 - 1.220)
2000-1				1.04	1.05
				(0.958 - 1.126)	(0.946 - 1.172)
2009-10				1.03	1.10*
				(0.952 - 1.12)	(0.993 - 1.225)
2000-1×Obesity					1.02
					(0.843 - 1.224)
2009-10×Obesity					0.92
					(0.760 - 1.119)
2000-1×Overweight					0.94
					(0.753 - 1.185)
2009-10×Overweight					0.88
					(0.697 - 1.101)
2000-1×Underweight					1.04
					(0.687 - 1.580)
2009-10×Underweight					0.82
					(0.573 - 1.187)
Predisposing					
Age 25 to 34	1.62***	1.36***	1.29***	1.42***	1.42***
	(1.216 - 2.147)	(1.157 - 1.590)	(1.084 - 1.540)	(1.257 - 1.596)	(1.256 - 1.596)
Age 35 to 44	1.07	1.17*	1.03	1.10	1.10
	(0.821 - 1.404)	(0.991 - 1.380)	(0.844 - 1.253)	(0.975 - 1.242)	(0.975 - 1.242)
Age 45 to 54	1.06	1.18*	0.77***	0.97	0.97
	(0.776 - 1.438)	(0.971 - 1.428)	(0.632 - 0.928)	(0.849 - 1.109)	(0.849 - 1.110)
Age 55 to 64	0.85	1.13	0.80*	0.93	0.93
	(0.639 - 1.135)	(0.852 - 1.498)	(0.620 - 1.036)	(0.79 - 1.095)	(0.791 - 1.096)
Age 65 to 74	0.79	1.03	0.61***	0.80***	0.80***
	(0.582 - 1.061)	(0.826 - 1.273)	(0.496 - 0.750)	(0.694 - 0.917)	(0.694 - 0.917)
Age 75 to 84	0.64**	0.92	0.62***	0.72***	0.72***
	(0.438 - 0.925)	(0.711 - 1.202)	(0.479 - 0.791)	(0.611 - 0.855)	(0.611 - 0.856)
Age 85+	0.41***	0.60***	0.49***	0.52***	0.52***
	(0.240 - 0.698)	(0.470 - 0.769)	(0.374 - 0.640)	(0.427 - 0.623)	(0.427 - 0.624)
Male	1.00	1.02	1.07	1.04	1.04
	(0.859 - 1.155)	(0.925 - 1.121)	(0.962 - 1.185)	(0.97 - 1.108)	(0.970 - 1.108)
Divorced/widowed/ separated	1.26	0.83**	1.03	1.03	1.03
	(0.929 - 1.705)	(0.708 - 0.981)	(0.877 - 1.206)	(0.899 - 1.171)	(0.898 - 1.170)
Married	0.96	0.85***	1.00	0.94	0.94
	(0.792 - 1.156)	(0.760 - 0.961)	(0.881 - 1.140)	(0.863 - 1.019)	(0.863 - 1.018)
Immigrant < 10 years	1.05	0.73**	0.74***	0.82*	0.82*
	(0.594 - 1.839)	(0.570 - 0.941)	(0.595 - 0.913)	(0.667 - 1.006)	(0.667 - 1.007)
Immigrant ≥ 10 years	0.87*	0.80***	1.02	0.91*	0.91*
	(0.731 - 1.024)	(0.692 - 0.935)	(0.867 - 1.206)	(0.826 - 1.006)	(0.826 - 1.006)
Bachelor's Degree	0.97	1.26***	1.18**	1.15***	1.15***
	(0.789 - 1.193)	(1.105 - 1.443)	(1.022 - 1.364)	(1.046 - 1.266)	(1.048 - 1.268)
Diploma/Certificate	1.02	1.11*	1.06	1.06	1.06
	(0.828 - 1.265)	(0.994 - 1.250)	(0.941 - 1.197)	(0.98 - 1.148)	(0.982 - 1.151)
Secondary school	1.07	1.21**	1.09	1.12**	1.13**
	(0.887 - 1.294)	(1.043 - 1.396)	(0.898 - 1.317)	(1.012 - 1.249)	(1.015 - 1.252)
Former Smoker	0.98	0.99	1.01	1.00	1.00

	(0.848 - 1.124)	(0.872 - 1.131)	(0.904 - 1.134)	(0.928 - 1.076)	(0.928 - 1.076)
Occasional Smoker	1.09	0.99	1.10	1.05	1.06
	(0.812 - 1.451)	(0.808 - 1.216)	(0.902 - 1.346)	(0.922 - 1.205)	(0.923 - 1.207)
Light Daily Smoker	1.02	1.15	1.12	1.10	1.10
	(0.783 - 1.319)	(0.972 - 1.365)	(0.897 - 1.401)	(0.969 - 1.247)	(0.970 - 1.249)
Heavy Daily Smoker	1.11	1.16**	1.10	1.13**	1.13**
	(0.895 - 1.366)	(1.017 - 1.324)	(0.962 - 1.258)	(1.02 - 1.252)	(1.020 - 1.252)
Regular Drinker – Non Binge	0.82**	0.73***	0.81**	0.78***	0.78***
	(0.686 - 0.986)	(0.627 - 0.861)	(0.689 - 0.956)	(0.707 - 0.868)	(0.708 - 0.869)
Regular Drinker – Binge	0.72**	0.61***	0.65***	0.66***	0.66***
	(0.562 - 0.927)	(0.536 - 0.704)	(0.567 - 0.751)	(0.593 - 0.727)	(0.593 - 0.727)
Occasional Drinker	0.98	0.80***	0.89	0.87***	0.87***
	(0.807 - 1.199)	(0.693 - 0.912)	(0.767 - 1.026)	(0.794 - 0.961)	(0.794 - 0.962)
Enabling					
Rural	0.85*	0.82***	0.86***	0.84***	0.84***
	(0.718 - 1.017)	(0.744 - 0.909)	(0.790 - 0.940)	(0.781 - 0.9)	(0.781 - 0.900)
No Regular Medical Doctor	0.63***	0.91	0.80***	0.8***	0.80***
	(0.461 - 0.853)	(0.799 - 1.034)	(0.709 - 0.897)	(0.732 - 0.872)	(0.733 - 0.873)
Income_Q5	1.01	0.87*	0.80**	0.88**	0.88**
	(0.770 - 1.314)	(0.751 - 1.004)	(0.645 - 0.986)	(0.778 - 0.996)	(0.777 - 0.995)
Income_Q4	1.01	0.86**	0.87	0.91	0.91
	(0.785 - 1.297)	(0.756 - 0.987)	(0.699 - 1.093)	(0.805 - 1.031)	(0.805 - 1.030)
Income_Q3	0.91	0.94	0.79***	0.88**	0.88**
	(0.740 - 1.129)	(0.795 - 1.112)	(0.665 - 0.945)	(0.784 - 0.982)	(0.784 - 0.982)
Income_Q2	1.08	0.91	0.86*	0.93	0.93
	(0.863 - 1.341)	(0.807 - 1.036)	(0.723 - 1.028)	(0.839 - 1.036)	(0.838 - 1.035)
Homeowner	0.90	0.97	0.95	0.95	0.95
	(0.725 - 1.119)	(0.891 - 1.050)	(0.848 - 1.073)	(0.869 - 1.036)	(0.870 - 1.035)
Organization/ Resource					
Newfoundland	0.59***	0.69***	0.78***	0.69***	0.69***
	(0.461 - 0.744)	(0.580 - 0.814)	(0.660 - 0.925)	(0.62 - 0.772)	(0.620 - 0.773)
Prince Edward Island	0.97	1.00	0.92	0.98	0.98
	(0.737 - 1.280)	(0.726 - 1.382)	(0.756 - 1.130)	(0.835 - 1.143)	(0.834 - 1.142)
Nova Scotia	1.25	0.75***	0.81**	0.92	0.92
	(0.615 - 2.525)	(0.633 - 0.898)	(0.664 - 0.990)	(0.678 - 1.241)	(0.678 - 1.238)
New Brunswick	0.71***	0.66***	0.77***	0.72***	0.72***
	(0.558 - 0.914)	(0.570 - 0.762)	(0.643 - 0.933)	(0.641 - 0.802)	(0.642 - 0.803)
Quebec	0.66***	0.77***	0.75***	0.73***	0.73***
	(0.528 - 0.826)	(0.683 - 0.858)	(0.662 - 0.839)	(0.669 - 0.791)	(0.669 - 0.792)
Manitoba	0.82**	0.95	0.86**	0.87**	0.88**
	(0.694 - 0.976)	(0.779 - 1.165)	(0.738 - 0.995)	(0.784 - 0.977)	(0.784 - 0.977)
Saskatchewan	0.68**	0.84	0.69***	0.74***	0.74***
	(0.462 - 0.994)	(0.670 - 1.064)	(0.601 - 0.784)	(0.635 - 0.859)	(0.634 - 0.858)
Alberta	0.93	0.89	0.94	0.92*	0.92*
	(0.809 - 1.075)	(0.763 - 1.045)	(0.806 - 1.101)	(0.842 - 1.006)	(0.842 - 1.005)
British Columbia	0.91	0.88**	0.94	0.92*	0.91*
	(0.727 - 1.145)	(0.786 - 0.981)	(0.814 - 1.091)	(0.833 - 1.006)	(0.833 - 1.004)
Need					
Number of Chronic Conditions	1.18***	1.13***	1.13***	1.14***	1.14***
	(1.127 - 1.236)	(1.094 - 1.161)	(1.099 - 1.157)	(1.118 - 1.16)	(1.119 - 1.160)
Constant	3.36***	3.98***	4.59***	3.87***	3.75***
	(2.354 - 4.788)	(3.244 - 4.887)	(3.627 - 5.798)	(3.334 - 4.493)	(3.189 - 4.420)
Observations	**11358**	**28170**	**28291**	**67819**	**67819**

*** p<0.01, ** p<0.05, * p<0.1

Table C. 18: Trends in the intensity of visits to specialist physicians for each BMI category relative to the trend in normal weight individuals in stratified multivariable Zero Truncated Poisson regression

	Age ≤ 64 (IRR, 95% CI)	***Age ≥ 65*** (IRR, 95% CI)	***M ale*** (IRR, 95% CI)	***Female*** (IRR, 95% CI)
Underweight	1.17	1.34	1.88*	1.03
	(0.815 - 1.691)	(0.605 - 2.984)	(0.952 - 3.696)	(0.688 - 1.531)
Overweight	1.09	1.24	0.98	1.27*
	(0.861 - 1.373)	(0.885 - 1.734)	(0.789 - 1.222)	(0.960 - 1.690)
Obesity	1.13	1.04	1.14	1.12
	(0.951 - 1.348)	(0.735 - 1.464)	(0.864 - 1.495)	(0.924 - 1.354)
2000-1	1.04	1.22*	1.14	1.03
	(0.920 - 1.165)	(0.973 - 1.532)	(0.950 - 1.358)	(0.909 - 1.175)
2009-10	1.11*	1.14	1.10	1.13*
	(0.990 - 1.250)	(0.915 - 1.430)	(0.923 - 1.306)	(0.987 - 1.288)
2000-1×Obesity	1.04	1.01	0.89	1.14
	(0.844 - 1.288)	(0.667 - 1.535)	(0.645 - 1.235)	(0.904 - 1.441)
2009-10×Obesity	0.97	0.89	0.96	0.96
	(0.776 - 1.206)	(0.612 - 1.300)	(0.671 - 1.381)	(0.767 - 1.200)
2000-1×Overweight	1.00	0.71*	0.95	0.91
	(0.775 - 1.298)	(0.483 - 1.055)	(0.724 - 1.247)	(0.661 - 1.247)
2009-10 Overweight*	0.94	0.67**	1.01	0.77*
	(0.714 - 1.226)	(0.471 - 0.966)	(0.748 - 1.376)	(0.570 - 1.047)
2000-1 Underweight*	0.95	1.36	0.96	1.08
	(0.617 - 1.472)	(0.456 - 4.085)	(0.344 - 2.676)	(0.695 - 1.667)
2009-10 Underweight*	0.81	0.90	0.62	0.94
	(0.526 - 1.252)	(0.391 - 2.087)	(0.281 - 1.383)	(0.598 - 1.487)
Predisposing				
Age 25 to 34	1.43***		1.44***	1.42***
	(1.264 - 1.608)		(1.165 - 1.769)	(1.224 - 1.643)
Age 35 to 44	1.14**		1.29***	1.10
	(1.007 - 1.288)		(1.066 - 1.555)	(0.951 - 1.279)
Age 45 to 54	1.05		1.32**	0.96
	(0.912 - 1.205)		(1.054 - 1.652)	(0.815 - 1.122)
Age 55 to 64	1.06		1.39**	0.94
	(0.899 - 1.253)		(1.073 - 1.811)	(0.764 - 1.150)
Age 65 to 74			1.28**	0.80***
			(1.003 - 1.629)	(0.681 - 0.932)
Age 75 to 84		0.94	1.21	0.72***
		(0.823 - 1.069)	(0.931 - 1.583)	(0.598 - 0.867)
Age 85+		0.70***	0.81	0.59***
		(0.582 - 0.835)	(0.585 - 1.131)	(0.485 - 0.720)
Male	0.95	1.31***		
	(0.879 - 1.027)	(1.142 - 1.496)		
Divorced/widowed/ separated	1.10	0.93	0.97	1.13
	(0.942 - 1.275)	(0.665 - 1.305)	(0.819 - 1.158)	(0.953 - 1.331)
Married	0.93	0.90	0.83***	0.98
	(0.856 - 1.020)	(0.646 - 1.264)	(0.729 - 0.949)	(0.881 - 1.092)
Immigrant < 10 years	0.78**	0.91	0.70***	0.81
	(0.627 - 0.965)	(0.444 - 1.866)	(0.532 - 0.916)	(0.624 - 1.062)
Immigrant ≥ 10 years	0.89*	0.97	1.06	0.79***
	(0.782 - 1.003)	(0.849 - 1.115)	(0.890 - 1.251)	(0.709 - 0.880)
Bachelor's Degree	1.12**	1.12	1.10	1.11
	(1.000 - 1.255)	(0.925 - 1.358)	(0.943 - 1.284)	(0.979 - 1.247)
Diploma/Certificate	1.04	1.10	0.99	1.09

	(0.946 - 1.153)	(0.918 - 1.309)	(0.862 - 1.138)	(0.982 - 1.201)
Secondary school	1.13*	0.98	1.08	1.13*
	(0.997 - 1.284)	(0.836 - 1.137)	(0.908 - 1.278)	(0.990 - 1.299)
Former Smoker	1.00	1.01	0.97	0.99
	(0.916 - 1.084)	(0.880 - 1.169)	(0.830 - 1.133)	(0.913 - 1.083)
Occasional Smoker	1.06	1.11	1.03	1.06
	(0.923 - 1.228)	(0.743 - 1.660)	(0.820 - 1.290)	(0.884 - 1.274)
Light Daily Smoker	1.14*	0.83*	1.07	1.10
	(0.996 - 1.312)	(0.672 - 1.015)	(0.841 - 1.356)	(0.947 - 1.284)
Heavy Daily Smoker	1.19***	0.98	1.11	1.19**
	(1.067 - 1.324)	(0.796 - 1.205)	(0.955 - 1.297)	(1.036 - 1.361)
Regular Drinker – Non Binge	0.74***	0.80***	0.78***	0.73***
	(0.652 - 0.829)	(0.694 - 0.930)	(0.658 - 0.923)	(0.650 - 0.829)
Regular Drinker – Binge	0.62***	0.70***	0.63***	0.66***
	(0.559 - 0.697)	(0.573 - 0.849)	(0.544 - 0.726)	(0.572 - 0.763)
Occasional Drinker	0.85***	0.86*	0.84*	0.85***
	(0.757 - 0.944)	(0.724 - 1.025)	(0.710 - 1.000)	(0.760 - 0.955)
Enabling				
Rural	0.82***	0.90	0.79***	0.87***
	(0.762 - 0.892)	(0.775 - 1.056)	(0.726 - 0.867)	(0.786 - 0.953)
No Regular Medical Doctor	0.77***	1.10	0.84**	0.76***
	(0.706 - 0.848)	(0.827 - 1.456)	(0.731 - 0.975)	(0.676 - 0.846)
Income_Q5	0.83**	0.83*	0.69***	0.98
	(0.724 - 0.958)	(0.669 - 1.025)	(0.566 - 0.842)	(0.847 - 1.130)
Income_Q4	0.86**	0.92	0.73***	0.99
	(0.747 - 0.988)	(0.750 - 1.130)	(0.602 - 0.896)	(0.859 - 1.134)
Income_Q3	0.81***	1.00	0.74***	0.92
	(0.709 - 0.920)	(0.820 - 1.218)	(0.618 - 0.887)	(0.803 - 1.052)
Income_Q2	0.89*	0.93	0.82**	0.96
	(0.785 - 1.008)	(0.784 - 1.097)	(0.679 - 0.994)	(0.854 - 1.074)
Homeowner	0.95	0.84***	0.93	0.92
	(0.859 - 1.045)	(0.746 - 0.952)	(0.826 - 1.052)	(0.825 - 1.030)
Organization/ Resource				
Newfoundland	0.63***	0.92	0.68***	0.66***
	(0.562 - 0.706)	(0.717 - 1.191)	(0.556 - 0.842)	(0.587 - 0.747)
Prince Edward Island	1.01	0.76**	0.81**	1.05
	(0.846 - 1.195)	(0.610 - 0.947)	(0.664 - 0.990)	(0.862 - 1.286)
Nova Scotia	0.90	1.09	0.95	0.92
	(0.626 - 1.296)	(0.746 - 1.601)	(0.760 - 1.174)	(0.585 - 1.439)
New Brunswick	0.71***	0.68***	0.77**	0.67***
	(0.628 - 0.809)	(0.561 - 0.829)	(0.616 - 0.960)	(0.597 - 0.759)
Quebec	0.68***	0.81***	0.74***	0.67***
	(0.618 - 0.748)	(0.694 - 0.945)	(0.651 - 0.837)	(0.602 - 0.754)
Manitoba	0.87**	0.83***	0.91	0.84**
	(0.768 - 0.993)	(0.734 - 0.937)	(0.761 - 1.080)	(0.728 - 0.962)
Saskatchewan	0.71***	0.83	0.84	0.66***
	(0.602 - 0.835)	(0.551 - 1.245)	(0.620 - 1.142)	(0.587 - 0.743)
Alberta	0.86***	1.26*	0.98	0.87***
	(0.783 - 0.937)	(0.967 - 1.641)	(0.833 - 1.151)	(0.787 - 0.961)
British Columbia	0.90**	0.99	0.97	0.87**
	(0.805 - 0.996)	(0.821 - 1.198)	(0.831 - 1.126)	(0.777 - 0.983)
Constant	4.67***	3.56***	4.61***	4.28***
	(3.933 - 5.553)	(2.446 - 5.188)	(3.609 - 5.893)	(3.440 - 5.315)
Observations	**50313**	**17506**	**26682**	**41137**

*** p<0.01, ** p<0.05, * p<0.1

8.4 Appendix D: Missing Income

Table D. 1: The association between each BMI category and the risk of a hospital admission and pooled models in multivariable Poisson regression including individuals with missing responses on income

	1996-7 (RR, 95% CI)	***2000-1*** (RR, 95% CI)	***2009-10*** (RR, 95% CI)	***Pooled*** (RR, 95% CI)	***Pooled with Interaction*** (RR, 95% CI)
Underweight	1.09 (0.827 - 1.435)	1.07 (0.935 - 1.231)	1.25* (0.999 - 1.560)	1.13** (1.003 - 1.281)	1.09 (0.831 - 1.437)
Overweight	0.95 (0.832 - 1.090)	1.03 (0.965 - 1.097)	1.06 (0.980 - 1.146)	1.01 (0.958 - 1.071)	0.97 (0.851 - 1.100)
Obesity	1.13 (0.954 - 1.336)	1.19*** (1.101 - 1.277)	1.29*** (1.175 - 1.412)	1.20*** (1.126 - 1.288)	1.15* (0.981 - 1.359)
2000-1				1.01 (0.954 - 1.079)	0.99 (0.899 - 1.081)
2009-10				1.02 (0.959 - 1.088)	0.98 (0.891 - 1.080)
2000-1×Obesity					1.04 (0.874 - 1.246)
2009-10×Obesity					1.08 (0.897 - 1.299)
2000-1×Overweight					1.07 (0.931 - 1.233)
2009-10×Overweight					1.07 (0.923 - 1.240)
2000-1 Underweight*					0.98 (0.724 - 1.333)
2009-10 Underweight*					1.15 (0.809 - 1.631)
Predisposing					
Age 25 to 34	1.05 (0.820 - 1.348)	1.09 (0.965 - 1.224)	1.07 (0.923 - 1.250)	1.08* (0.986 - 1.187)	1.08 (0.977 - 1.196)
Age 35 to 44	0.64*** (0.485 - 0.858)	0.70*** (0.608 - 0.795)	0.70*** (0.591 - 0.836)	0.69*** (0.615 - 0.764)	0.68*** (0.610 - 0.769)
Age 45 to 54	0.55*** (0.410 - 0.741)	0.62*** (0.541 - 0.716)	0.56*** (0.465 - 0.669)	0.58*** (0.516 - 0.659)	0.58*** (0.518 - 0.657)
Age 55 to 64	0.74** (0.549 - 0.989)	0.83** (0.725 - 0.957)	0.64*** (0.544 - 0.758)	0.73*** (0.653 - 0.823)	0.73*** (0.652 - 0.823)
Age 65 to 74	0.94 (0.698 - 1.254)	1.07 (0.928 - 1.230)	0.86* (0.721 - 1.015)	0.96 (0.856 - 1.071)	0.96 (0.850 - 1.078)
Age 75 to 84	1.34* (0.987 - 1.832)	1.43*** (1.237 - 1.652)	1.23** (1.029 - 1.459)	1.33*** (1.183 - 1.498)	1.33*** (1.176 - 1.506)
Age 85+	1.60* (0.951 - 2.691)	1.74*** (1.447 - 2.088)	1.55*** (1.261 - 1.916)	1.64*** (1.376 - 1.95)	1.64*** (1.362 - 1.962)
Male	0.78*** (0.687 - 0.890)	0.78*** (0.739 - 0.831)	0.81*** (0.758 - 0.873)	0.79*** (0.752 - 0.837)	0.79*** (0.754 - 0.835)
Divorced/widowed/ separated	1.70*** (1.316 - 2.192)	1.25*** (1.117 - 1.393)	1.39*** (1.218 - 1.587)	1.41*** (1.292 - 1.547)	1.41*** (1.283 - 1.561)
Married	1.80*** (1.463 - 2.224)	1.40*** (1.275 - 1.536)	1.48*** (1.323 - 1.649)	1.53*** (1.42 - 1.65)	1.53*** (1.415 - 1.658)
Immigrant < 10 years	0.93 (0.656 - 1.306)	0.71*** (0.587 - 0.854)	0.67*** (0.531 - 0.836)	0.76*** (0.66 - 0.864)	0.76*** (0.651 - 0.876)
Immigrant ≥ 10 years	0.95 (0.790 - 1.147)	0.86*** (0.783 - 0.939)	0.87** (0.780 - 0.970)	0.89*** (0.827 - 0.96)	0.89*** (0.826 - 0.962)
Bachelor's Degree	0.81** (0.654 - 0.994)	0.89** (0.799 - 0.999)	0.95 (0.839 - 1.080)	0.87*** (0.802 - 0.952)	0.87*** (0.802 - 0.953)
Diploma/Certificate	0.92 (0.765 - 1.111)	0.94 (0.876 - 1.016)	1.00 (0.911 - 1.102)	0.95* (0.887 - 1.01)	0.95 (0.885 - 1.012)

Secondary school	0.94	0.90***	1.00	0.93**	0.93*
	(0.803 - 1.092)	(0.830 - 0.967)	(0.903 - 1.100)	(0.878 - 0.993)	(0.871 - 1.000)
Former Smoker	1.40***	1.28***	1.34***	1.33***	1.33***
	(1.217 - 1.612)	(1.192 - 1.365)	(1.238 - 1.461)	(1.265 - 1.408)	(1.259 - 1.414)
Occasional Smoker	1.12	1.19**	1.44***	1.27***	1.27***
	(0.833 - 1.508)	(1.038 - 1.371)	(1.189 - 1.739)	(1.134 - 1.43)	(1.129 - 1.436)
Light Daily Smoker	1.42***	1.25***	1.49***	1.39***	1.39***
	(1.150 - 1.744)	(1.111 - 1.408)	(1.288 - 1.724)	(1.262 - 1.522)	(1.262 - 1.522)
Heavy Daily Smoker	1.40***	1.32***	1.46***	1.38***	1.38***
	(1.181 - 1.665)	(1.209 - 1.439)	(1.289 - 1.651)	(1.275 - 1.489)	(1.272 - 1.491)
Regular Drinker – Non Binge	0.66***	0.62***	0.67***	0.64***	0.64***
	(0.556 - 0.780)	(0.569 - 0.665)	(0.608 - 0.734)	(0.599 - 0.69)	(0.601 - 0.688)
Regular Drinker – Binge	0.50***	0.54***	0.55***	0.53***	0.53***
	(0.413 - 0.602)	(0.492 - 0.585)	(0.493 - 0.610)	(0.49 - 0.572)	(0.492 - 0.571)
Occasional Drinker	0.87*	0.80***	0.81***	0.83***	0.83***
	(0.747 - 1.014)	(0.741 - 0.863)	(0.737 - 0.886)	(0.772 - 0.884)	(0.773 - 0.882)
Enabling					
Rural	1.20***	1.05	0.99	1.07**	1.07***
	(1.058 - 1.370)	(0.988 - 1.114)	(0.916 - 1.068)	(1.012 - 1.139)	(1.017 - 1.133)
No Regular Medical Doctor	0.53***	0.53***	0.60***	0.56***	0.56***
	(0.402 - 0.706)	(0.472 - 0.586)	(0.523 - 0.677)	(0.503 - 0.615)	(0.505 - 0.613)
Income_Q5	0.93	0.78***	0.66***	0.78***	0.78***
	(0.728 - 1.187)	(0.695 - 0.868)	(0.565 - 0.762)	(0.726 - 0.839)	(0.703 - 0.867)
Income_Q4	0.85	0.74***	0.75***	0.78***	0.78***
	(0.694 - 1.039)	(0.674 - 0.822)	(0.667 - 0.844)	(0.703 - 0.867)	(0.719 - 0.850)
Income_Q3	0.94	0.81***	0.81***	0.78***	0.85***
	(0.790 - 1.121)	(0.740 - 0.880)	(0.728 - 0.907)	(0.718 - 0.853)	(0.792 - 0.919)
Income_Q2	0.89	0.90***	0.82***	0.85***	0.87***
	(0.748 - 1.055)	(0.837 - 0.974)	(0.746 - 0.903)	(0.795 - 0.916)	(0.817 - 0.934)
Income Missing	0.82**	0.76***	0.76***	0.87***	0.78***
	(0.698 - 0.969)	(0.688 - 0.846)	(0.675 - 0.854)	(0.816 - 0.935)	(0.723 - 0.840)
Homeowner	0.83***	0.82***	0.83***	0.83***	0.83***
	(0.719 - 0.954)	(0.772 - 0.879)	(0.766 - 0.906)	(0.782 - 0.873)	(0.780 - 0.876)
Organization/ Resource					
Newfoundland	1.27*	1.06	0.98	1.10*	1.10*
	(0.997 - 1.610)	(0.927 - 1.214)	(0.836 - 1.152)	(0.983 - 1.231)	(0.985 - 1.227)
Prince Edward Island	1.39**	1.14*	1.20*	1.24***	1.24***
	(1.044 - 1.843)	(0.986 - 1.310)	(0.988 - 1.460)	(1.09 - 1.41)	(1.089 - 1.413)
Nova Scotia	1.10	0.98	1.04	1.04	1.04
	(0.850 - 1.429)	(0.870 - 1.104)	(0.891 - 1.211)	(0.93 - 1.163)	(0.932 - 1.162)
New Brunswick	1.31**	1.20***	1.17**	1.23***	1.23***
	(1.052 - 1.630)	(1.074 - 1.335)	(1.032 - 1.331)	(1.124 - 1.344)	(1.118 - 1.352)
Quebec	1.27***	1.22***	1.27***	1.26***	1.26***
	(1.064 - 1.516)	(1.128 - 1.321)	(1.156 - 1.398)	(1.168 - 1.349)	(1.169 - 1.349)
Manitoba	1.20***	1.08	1.09	1.13***	1.13***
	(1.062 - 1.365)	(0.967 - 1.212)	(0.944 - 1.270)	(1.047 - 1.216)	(1.047 - 1.216)
Saskatchewan	1.01	1.28***	1.21***	1.17***	1.17***
	(0.794 - 1.277)	(1.163 - 1.410)	(1.069 - 1.371)	(1.061 - 1.283)	(1.069 - 1.275)
Alberta	1.12**	1.13**	1.29***	1.19***	1.19***
	(1.026 - 1.217)	(1.028 - 1.241)	(1.150 - 1.457)	(1.122 - 1.253)	(1.116 - 1.260)
British Columbia	1.12	1.02	1.20***	1.12***	1.12***
	(0.921 - 1.353)	(0.938 - 1.106)	(1.073 - 1.332)	(1.034 - 1.207)	(1.034 - 1.208)
Constant	0.10***	0.14***	0.12***	0.12***	0.12***
	(0.075 - 0.126)	(0.120 - 0.162)	(0.100 - 0.142)	(0.106 - 0.132)	(0.106 - 0.137)
Observations	**61720**	**108788**	**100891**	**271399**	**271399**

*** p<0.01, ** p<0.05, * p<0.1

Table D. 2: The association between each BMI category and the intensity of nights and pooled models in multivariable Zero Truncated Poisson regression including individuals with missing responses on income

	1996-7 (IRR, 95% CI)	***2000-1*** (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)	***Pooled*** (IRR, 95% CI)	***Pooled with Interaction*** (IRR, 95% CI)
Underweight	0.78	1.58***	1.21	1.19*	0.76
	(0.534 - 1.139)	(1.226 - 2.040)	(0.891 - 1.657)	(0.979 - 1.457)	(0.543 - 1.069)
Overweight	0.91	0.89	0.99	0.93	0.94
	(0.697 - 1.200)	(0.764 - 1.032)	(0.737 - 1.322)	(0.795 - 1.08)	(0.680 - 1.287)
Obesity	0.69**	0.87**	1.03	0.87**	0.74**
	(0.499 - 0.959)	(0.753 - 0.998)	(0.809 - 1.311)	(0.763 - 0.991)	(0.556 - 0.987)
2000-1				0.97	0.93
				(0.839 - 1.111)	(0.744 - 1.171)
2009-10				0.86*	0.78**
				(0.729 - 1.004)	(0.620 - 0.994)
2000-1×Obesity					1.15
					(0.841 - 1.578)
2009-10×Obesity					1.35*
					(0.961 - 1.909)
2000-1×Overweight					0.94
					(0.663 - 1.347)
2009-10×Overweight					1.04
					(0.691 - 1.567)
2000-1 Underweight*					2.05***
					(1.353 - 3.117)
2009-10 Underweight*					1.60**
					(1.013 - 2.529)
Predisposing					
Age 25 to 34	0.98	1.26	1.06	1.10	1.10
	(0.616 - 1.571)	(0.916 - 1.743)	(0.787 - 1.437)	(0.883 - 1.371)	(0.875 - 1.387)
Age 35 to 44	1.09	1.56***	1.28	1.32***	1.32**
	(0.653 - 1.809)	(1.161 - 2.110)	(0.937 - 1.752)	(1.054 - 1.646)	(1.039 - 1.666)
Age 45 to 54	2.14***	1.68***	1.77***	1.84***	1.85***
	(1.257 - 3.643)	(1.241 - 2.280)	(1.261 - 2.471)	(1.435 - 2.352)	(1.440 - 2.371)
Age 55 to 64	1.53*	2.09***	1.84***	1.82***	1.82***
	(0.923 - 2.545)	(1.547 - 2.836)	(1.321 - 2.551)	(1.436 - 2.298)	(1.428 - 2.319)
Age 65 to 74	2.77***	2.66***	2.70***	2.64***	2.66***
	(1.477 - 5.196)	(1.961 - 3.607)	(1.960 - 3.721)	(2.028 - 3.427)	(2.016 - 3.507)
Age 75 to 84	2.34***	3.36***	3.06***	2.88***	2.89***
	(1.429 - 3.817)	(2.392 - 4.730)	(2.158 - 4.348)	(2.274 - 3.658)	(2.237 - 3.721)
Age 85+	4.33***	2.96***	5.27***	4.22***	4.23***
	(2.283 - 8.212)	(2.067 - 4.248)	(2.877 - 9.647)	(2.804 - 6.352)	(2.814 - 6.368)
Male	1.06	1.34***	1.19*	1.22***	1.21***
	(0.822 - 1.372)	(1.157 - 1.555)	(1.000 - 1.413)	(1.075 - 1.374)	(1.067 - 1.371)
Divorced/widowed/ separated	0.70**	0.77**	0.89	0.79***	0.79***
	(0.521 - 0.948)	(0.594 - 0.992)	(0.714 - 1.103)	(0.679 - 0.923)	(0.672 - 0.930)
Married	0.80*	0.68***	0.67***	0.73***	0.73***
	(0.636 - 1.006)	(0.544 - 0.843)	(0.539 - 0.831)	(0.648 - 0.827)	(0.641 - 0.829)
Immigrant < 10 years	0.73*	0.74	1.12	0.84	0.85
	(0.506 - 1.051)	(0.431 - 1.268)	(0.488 - 2.553)	(0.577 - 1.23)	(0.571 - 1.259)
Immigrant ≥ 10 years	0.79	0.79***	0.87	0.84	0.85
	(0.525 - 1.180)	(0.669 - 0.940)	(0.666 - 1.140)	(0.684 - 1.043)	(0.687 - 1.053)
Bachelor's Degree	0.90	0.99	0.90	0.90	0.90
	(0.597 - 1.353)	(0.781 - 1.249)	(0.639 - 1.259)	(0.743 - 1.093)	(0.743 - 1.099)
Diploma/Certificate	1.15	1.06	1.06	1.08	1.08
	(0.878 - 1.512)	(0.894 - 1.264)	(0.818 - 1.369)	(0.949 - 1.234)	(0.939 - 1.236)

Secondary school	1.23	1.07	0.89	1.09	1.09
	(0.916 - 1.652)	(0.917 - 1.257)	(0.698 - 1.147)	(0.931 - 1.286)	(0.921 - 1.284)
Former Smoker	1.51***	1.03	0.98	1.16*	1.16*
	(1.123 - 2.025)	(0.878 - 1.209)	(0.767 - 1.252)	(0.993 - 1.347)	(0.997 - 1.351)
Occasional Smoker	1.88*	1.05	1.07	1.26	1.26
	(0.979 - 3.631)	(0.739 - 1.484)	(0.748 - 1.524)	(0.949 - 1.676)	(0.943 - 1.694)
Light Daily Smoker	0.95	1.26*	1.10	1.13	1.13
	(0.669 - 1.342)	(0.958 - 1.655)	(0.845 - 1.444)	(0.948 - 1.343)	(0.945 - 1.342)
Heavy Daily Smoker	1.06	1.12	1.22	1.12	1.12
	(0.802 - 1.393)	(0.903 - 1.380)	(0.932 - 1.608)	(0.965 - 1.298)	(0.965 - 1.298)
Regular Drinker – Non Binge	0.50***	0.61***	0.74**	0.61***	0.61***
	(0.368 - 0.690)	(0.520 - 0.715)	(0.569 - 0.950)	(0.514 - 0.725)	(0.511 - 0.732)
Regular Drinker – Binge	0.62***	0.59***	0.56***	0.56***	0.57***
	(0.440 - 0.879)	(0.496 - 0.712)	(0.444 - 0.698)	(0.471 - 0.678)	(0.478 - 0.682)
Occasional Drinker	0.51***	0.80***	0.75**	0.67***	0.67***
	(0.403 - 0.640)	(0.688 - 0.941)	(0.606 - 0.940)	(0.585 - 0.765)	(0.584 - 0.767)
Enabling					
Rural	0.94	0.95	0.89	0.93	0.94
	(0.728 - 1.212)	(0.836 - 1.075)	(0.742 - 1.058)	(0.839 - 1.03)	(0.836 - 1.046)
No Regular Medical Doctor	0.65	0.79**	0.66***	0.7***	0.70***
	(0.352 - 1.207)	(0.640 - 0.987)	(0.504 - 0.858)	(0.569 - 0.856)	(0.564 - 0.868)
Income_Q5	1.43*	0.81*	1.01	0.84***	1.09
	(0.961 - 2.142)	(0.624 - 1.041)	(0.683 - 1.484)	(0.741 - 0.959)	(0.811 - 1.478)
Income_Q4	1.04	0.82*	0.96	1.1	0.93
	(0.692 - 1.564)	(0.647 - 1.027)	(0.512 - 1.814)	(0.811 - 1.493)	(0.702 - 1.235)
Income_Q3	0.84	0.77***	0.87	0.93	0.80***
	(0.598 - 1.179)	(0.633 - 0.926)	(0.667 - 1.133)	(0.723 - 1.192)	(0.690 - 0.932)
Income_Q2	1.16	0.88	0.83	0.8***	0.94
	(0.820 - 1.649)	(0.729 - 1.067)	(0.653 - 1.046)	(0.698 - 0.927)	(0.802 - 1.095)
Income Missing	0.96	0.94	0.74***	0.94	0.85**
	(0.735 - 1.250)	(0.731 - 1.211)	(0.604 - 0.918)	(0.795 - 1.1)	(0.737 - 0.978)
Homeowner	0.96	0.88	0.94	0.89	0.89
	(0.755 - 1.223)	(0.759 - 1.030)	(0.746 - 1.178)	(0.78 - 1.023)	(0.776 - 1.026)
Organization/ Resource					
Newfoundland	1.28	0.97	1.37**	1.15	1.16*
	(0.923 - 1.780)	(0.757 - 1.251)	(1.017 - 1.843)	(0.957 - 1.376)	(0.973 - 1.387)
Prince Edward Island	1.28	0.94	1.23	1.13	1.13
	(0.748 - 2.189)	(0.726 - 1.212)	(0.881 - 1.706)	(0.878 - 1.446)	(0.879 - 1.456)
Nova Scotia	0.94	0.92	0.99	0.95	0.95
	(0.666 - 1.332)	(0.734 - 1.143)	(0.755 - 1.286)	(0.801 - 1.117)	(0.809 - 1.122)
New Brunswick	0.98	1.04	0.90	0.97	0.97
	(0.698 - 1.383)	(0.839 - 1.285)	(0.717 - 1.130)	(0.823 - 1.155)	(0.825 - 1.150)
Quebec	1.32*	0.96	1.10	1.11	1.12
	(0.977 - 1.782)	(0.804 - 1.137)	(0.800 - 1.511)	(0.92 - 1.349)	(0.924 - 1.360)
Manitoba	1.12	0.94	1.12	1.03	1.04
	(0.849 - 1.475)	(0.754 - 1.164)	(0.693 - 1.796)	(0.849 - 1.255)	(0.859 - 1.263)
Saskatchewan	1.06	0.96	1.11	1.03	1.04
	(0.767 - 1.474)	(0.725 - 1.281)	(0.841 - 1.462)	(0.858 - 1.237)	(0.873 - 1.237)
Alberta	1.11	0.95	0.98	1.01	1.01
	(0.891 - 1.387)	(0.756 - 1.206)	(0.739 - 1.302)	(0.87 - 1.166)	(0.880 - 1.167)
British Columbia	1.10	0.98	0.85	0.98	0.98
	(0.692 - 1.751)	(0.808 - 1.194)	(0.697 - 1.042)	(0.791 - 1.206)	(0.795 - 1.207)
Constant	7.28***	9.18***	7.64***	8.77***	9.05***
	(3.913 - 13.562)	(6.628 - 12.723)	(4.813 - 12.114)	(6.614 - 11.633)	(6.542 - 12.506)
Observations	**5603**	**10752**	**9844**	**26199**	**26199**

*** p<0.01, ** p<0.05, * p<0.1

Table D. 3: The association between each BMI category and the propensity to visit a FP/GP and pooled models in multivariable Poisson regression including individuals with missing responses on income

	1996-7 (RR, 95% CI)	***2000-1*** (RR, 95% CI)	***2009-10*** (RR, 95% CI)	***Pooled*** (RR, 95% CI)	***Pooled with Interaction*** (RR, 95% CI)
Underweight	1.02	1.02	1.00	1.01	1.03
	(0.978 - 1.065)	(0.991 - 1.051)	(0.951 - 1.043)	(0.99 - 1.034)	(0.988 - 1.073)
Overweight	1.02	1.02***	1.02**	1.02***	1.01
	(0.996 - 1.039)	(1.010 - 1.031)	(1.003 - 1.030)	(1.009 - 1.026)	(0.990 - 1.032)
Obesity	1.04***	1.04***	1.05***	1.04***	1.04***
	(1.012 - 1.069)	(1.026 - 1.051)	(1.038 - 1.069)	(1.035 - 1.055)	(1.010 - 1.065)
2000-1				1.02***	1.01*
				(1.006 - 1.026)	(0.999 - 1.029)
2009-10				1.00	0.99
				(0.987 - 1.007)	(0.975 - 1.007)
2000-1×Obesity					1.00
					(0.969 - 1.028)
2009-10×Obesity					1.02
					(0.990 - 1.051)
2000-1×Overweight					1.01
					(0.985 - 1.031)
2009-10×Overweight					1.01
					(0.987 - 1.036)
2000-1×Underweight					0.99
					(0.942 - 1.042)
2009-10×Underweight					0.96
					(0.900 - 1.017)
Predisposing					
Age 25 to 34	0.98	0.99	1.02	0.99	1.00
	(0.935 - 1.018)	(0.969 - 1.013)	(0.990 - 1.048)	(0.977 - 1.013)	(0.977 - 1.014)
Age 35 to 44	0.96*	0.97**	1.01	0.98*	0.98*
	(0.921 - 1.006)	(0.953 - 0.995)	(0.982 - 1.041)	(0.964 - 1.001)	(0.964 - 1.001)
Age 45 to 54	0.99	1.00	1.05***	1.01	1.01
	(0.942 - 1.034)	(0.979 - 1.023)	(1.022 - 1.083)	(0.996 - 1.032)	(0.995 - 1.033)
Age 55 to 64	1.03	1.05***	1.10***	1.06***	1.06***
	(0.986 - 1.083)	(1.028 - 1.076)	(1.070 - 1.133)	(1.044 - 1.085)	(1.044 - 1.085)
Age 65 to 74	1.07***	1.08***	1.15***	1.1***	1.10***
	(1.024 - 1.123)	(1.052 - 1.103)	(1.121 - 1.186)	(1.081 - 1.125)	(1.082 - 1.124)
Age 75 to 84	1.12***	1.12***	1.19***	1.15***	1.14***
	(1.069 - 1.175)	(1.093 - 1.145)	(1.157 - 1.227)	(1.124 - 1.167)	(1.123 - 1.167)
Age 85+	1.15***	1.13***	1.18***	1.15***	1.15***
	(1.076 - 1.219)	(1.095 - 1.157)	(1.133 - 1.222)	(1.119 - 1.176)	(1.118 - 1.175)
Male	0.86***	0.89***	0.89***	0.88***	0.88***
	(0.847 - 0.881)	(0.880 - 0.897)	(0.879 - 0.900)	(0.874 - 0.887)	(0.874 - 0.888)
Divorced/widowed/ separated	1.03	1.01	1.00	1.01*	1.01*
	(0.994 - 1.064)	(0.994 - 1.028)	(0.981 - 1.025)	(1 - 1.027)	(0.999 - 1.028)
Married	1.04**	1.02***	1.02**	1.03***	1.03***
	(1.009 - 1.072)	(1.008 - 1.039)	(1.003 - 1.039)	(1.016 - 1.041)	(1.016 - 1.041)
Immigrant < 10 years	0.97	0.99	0.98	0.98**	0.98**
	(0.921 - 1.024)	(0.960 - 1.016)	(0.941 - 1.011)	(0.957 - 0.998)	(0.955 - 0.999)
Immigrant ≥ 10 years	1.00	0.99	1.01	1.00	1.00
	(0.980 - 1.031)	(0.981 - 1.009)	(0.996 - 1.031)	(0.993 - 1.015)	(0.994 - 1.015)
Bachelor's Degree	0.99	1.03***	1.05***	1.03***	1.03***
	(0.958 - 1.024)	(1.014 - 1.048)	(1.033 - 1.077)	(1.017 - 1.047)	(1.018 - 1.046)
Diploma/Certificate	0.99	1.01*	1.01	1.01	1.01
	(0.964 - 1.023)	(1.000 - 1.026)	(0.996 - 1.031)	(0.998 - 1.021)	(0.998 - 1.020)
Secondary school	1.02	1.01	1.00	1.01*	1.01*
	(0.993 - 1.040)	(0.994 - 1.020)	(0.981 - 1.018)	(0.998 - 1.022)	(0.999 - 1.021)
Former Smoker	1.04***	1.03***	1.04***	1.04***	1.04***
	(1.018 - 1.062)	(1.017 - 1.039)	(1.029 - 1.056)	(1.03 - 1.048)	(1.029 - 1.048)

Occasional Smoker	1.02	1.02	0.99	1.01	1.01
	(0.975 - 1.068)	(0.994 - 1.041)	(0.953 - 1.019)	(0.987 - 1.025)	(0.986 - 1.026)
Light Daily Smoker	1.03*	1.00	0.99	1.01	1.01
	(0.996 - 1.068)	(0.974 - 1.017)	(0.969 - 1.020)	(0.991 - 1.024)	(0.991 - 1.024)
Heavy Daily Smoker	0.98	0.98***	1.00	0.99	0.99*
	(0.951 - 1.011)	(0.964 - 0.994)	(0.979 - 1.029)	(0.974 - 1.003)	(0.974 - 1.002)
Regular Drinker – Non Binge	0.98	1.01**	1.01	1.00	1.00
	(0.960 - 1.009)	(1.000 - 1.027)	(0.997 - 1.031)	(0.993 - 1.015)	(0.993 - 1.015)
Regular Drinker – Binge	1.00	1.01	1.01	1.00	1.00
	(0.969 - 1.024)	(0.991 - 1.022)	(0.994 - 1.031)	(0.993 - 1.017)	(0.993 - 1.017)
Occasional Drinker	1.01	1.01	1.01	1.01*	1.01*
	(0.982 - 1.031)	(0.996 - 1.025)	(0.993 - 1.034)	(0.999 - 1.021)	(0.998 - 1.021)
Enabling					
Rural	0.96***	0.98***	0.97***	0.97***	0.97***
	(0.933 - 0.982)	(0.966 - 0.985)	(0.957 - 0.982)	(0.959 - 0.977)	(0.959 - 0.978)
No Regular Medical Doctor	0.62***	0.64***	0.57***	0.61***	0.61***
	(0.587 - 0.658)	(0.627 - 0.656)	(0.552 - 0.590)	(0.597 - 0.623)	(0.597 - 0.623)
Income_Q5	1.00	1.01	1.02	0.98***	1.01
	(0.965 - 1.034)	(0.989 - 1.024)	(0.996 - 1.042)	(0.968 - 0.993)	(0.993 - 1.023)
Income_Q4	1.00	1.00	1.02*	1.01	1.00
	(0.962 - 1.030)	(0.982 - 1.014)	(0.997 - 1.041)	(0.992 - 1.024)	(0.991 - 1.019)
Income_Q3	0.99	1.00	1.00	1.00	1.00
	(0.956 - 1.020)	(0.986 - 1.016)	(0.980 - 1.022)	(0.99 - 1.02)	(0.984 - 1.011)
Income_Q2	0.96**	0.99*	0.98	1.00	0.98***
	(0.932 - 0.991)	(0.974 - 1.002)	(0.965 - 1.004)	(0.984 - 1.011)	(0.966 - 0.991)
Income Missing	0.98	0.98**	0.98	0.98***	0.98***
	(0.952 - 1.006)	(0.965 - 0.999)	(0.961 - 1.004)	(0.966 - 0.992)	(0.968 - 0.994)
Homeowner	0.99	0.98***	0.97***	0.98***	0.98***
	(0.964 - 1.008)	(0.966 - 0.989)	(0.959 - 0.989)	(0.97 - 0.988)	(0.970 - 0.988)
Organization/ Resource					
Newfoundland	1.01	1.08***	1.00	1.03***	1.03***
	(0.969 - 1.056)	(1.057 - 1.097)	(0.980 - 1.031)	(1.013 - 1.054)	(1.015 - 1.051)
Prince Edward Island	0.98	1.00	1.03	1.00	1.00
	(0.941 - 1.027)	(0.976 - 1.027)	(0.993 - 1.060)	(0.986 - 1.023)	(0.985 - 1.024)
Nova Scotia	0.99	1.00	1.01	1.00	1.00
	(0.949 - 1.029)	(0.982 - 1.019)	(0.982 - 1.030)	(0.982 - 1.017)	(0.983 - 1.016)
New Brunswick	0.95**	1.02**	0.98	0.98*	0.99*
	(0.912 - 0.990)	(1.005 - 1.041)	(0.958 - 1.006)	(0.969 - 1.001)	(0.969 - 1.002)
Quebec	0.95***	0.96***	0.96***	0.96***	0.96***
	(0.917 - 0.977)	(0.944 - 0.970)	(0.944 - 0.977)	(0.944 - 0.968)	(0.944 - 0.968)
Manitoba	1.01	0.99	1.01	1.00	1.00
	(0.990 - 1.031)	(0.973 - 1.011)	(0.979 - 1.032)	(0.992 - 1.016)	(0.991 - 1.017)
Saskatchewan	0.97	1.04***	1.04***	1.02*	1.02**
	(0.932 - 1.016)	(1.025 - 1.057)	(1.015 - 1.060)	(1 - 1.035)	(1.001 - 1.035)
Alberta	1.01	1.03***	1.02*	1.02***	1.02***
	(0.997 - 1.025)	(1.018 - 1.048)	(0.999 - 1.039)	(1.011 - 1.031)	(1.011 - 1.031)
British Columbia	1.01	1.02***	1.02***	1.02***	1.02***
	(0.980 - 1.042)	(1.006 - 1.030)	(1.006 - 1.041)	(1.006 - 1.03)	(1.006 - 1.030)
Constant	0.87***	0.85***	0.80***	0.83***	0.83***
	(0.833 - 0.912)	(0.829 - 0.870)	(0.772 - 0.823)	(0.816 - 0.848)	(0.816 - 0.854)
Observations	**61720**	**108788**	**100891**	**271399**	**271399**

*** p<0.01, ** p<0.05, * p<0.1

Table D. 4: The association between each BMI category and the intensity of visits to FP/GPs and pooled models in multivariable Zero Truncated Poisson regression including individuals with missing responses on income

	1996-7 (IRR, 95% CI)	***2000-1*** (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)	***Pooled*** (IRR, 95% CI)	***Pooled with Interaction*** (IRR, 95% CI)
Underweight	1.18**	1.02	1.21***	1.12***	1.20**
	(1.021 - 1.375)	(0.945 - 1.100)	(1.056 - 1.378)	(1.045 - 1.208)	(1.034 - 1.383)
Overweight	1.10*	1.05**	1.11***	1.08***	1.11**
	(0.999 - 1.205)	(1.007 - 1.090)	(1.065 - 1.148)	(1.043 - 1.12)	(1.014 - 1.214)
Obesity	1.21***	1.25***	1.30***	1.26***	1.24***
	(1.115 - 1.322)	(1.195 - 1.308)	(1.237 - 1.366)	(1.216 - 1.297)	(1.138 - 1.341)
2000-1				1.00	1.03
				(0.967 - 1.043)	(0.978 - 1.077)
2009-10				0.83***	0.83***
				(0.797 - 0.86)	(0.790 - 0.871)
2000-1×Obesity					1.02
					(0.927 - 1.113)
2009-10×Obesity					1.03
					(0.938 - 1.134)
2000-1×Overweight					0.95
					(0.860 - 1.043)
2009-10×Overweight					0.98
					(0.889 - 1.077)
2000-1×Underweight					0.85*
					(0.724 - 1.001)
2009-10×Underweight					1.00
					(0.827 - 1.220)
Predisposing					
Age 25 to 34	1.07	1.05	1.02	1.04	1.04
	(0.948 - 1.206)	(0.963 - 1.140)	(0.936 - 1.110)	(0.988 - 1.105)	(0.985 - 1.106)
Age 35 to 44	0.97	1.00	0.98	0.98	0.98
	(0.861 - 1.083)	(0.930 - 1.086)	(0.893 - 1.073)	(0.93 - 1.036)	(0.928 - 1.037)
Age 45 to 54	1.07	1.02	0.95	1.01	1.01
	(0.945 - 1.206)	(0.936 - 1.101)	(0.861 - 1.040)	(0.954 - 1.071)	(0.953 - 1.070)
Age 55 to 64	1.20**	1.11**	0.97	1.09***	1.09**
	(1.008 - 1.420)	(1.012 - 1.218)	(0.886 - 1.070)	(1.023 - 1.168)	(1.018 - 1.171)
Age 65 to 74	1.16**	1.10**	0.98	1.09***	1.09**
	(1.012 - 1.337)	(1.005 - 1.208)	(0.888 - 1.076)	(1.021 - 1.158)	(1.018 - 1.159)
Age 75 to 84	1.24***	1.25***	1.11**	1.21***	1.21***
	(1.062 - 1.449)	(1.142 - 1.378)	(1.006 - 1.225)	(1.127 - 1.292)	(1.125 - 1.291)
Age 85+	1.31**	1.22***	1.21***	1.24***	1.24***
	(1.066 - 1.612)	(1.095 - 1.349)	(1.084 - 1.349)	(1.146 - 1.346)	(1.140 - 1.352)
Male	0.88***	0.87***	0.86***	0.87***	0.87***
	(0.814 - 0.950)	(0.834 - 0.900)	(0.829 - 0.892)	(0.843 - 0.893)	(0.841 - 0.894)
Divorced/widowed/ separated	1.11	1.03	1.07*	1.07**	1.07**
	(0.969 - 1.269)	(0.967 - 1.105)	(1.000 - 1.136)	(1.011 - 1.131)	(1.009 - 1.133)
Married	1.01	1.02	1.04	1.02	1.02
	(0.920 - 1.099)	(0.959 - 1.076)	(0.977 - 1.099)	(0.978 - 1.057)	(0.977 - 1.059)
Immigrant < 10 years	1.07	0.87***	0.85***	0.93	0.93
	(0.849 - 1.359)	(0.783 - 0.960)	(0.774 - 0.944)	(0.847 - 1.014)	(0.843 - 1.019)
Immigrant ≥ 10 years	1.02	1.04	1.05*	1.04*	1.04**
	(0.953 - 1.100)	(0.981 - 1.101)	(0.992 - 1.108)	(1.004 - 1.075)	(1.003 - 1.077)
Bachelor's Degree	0.84***	0.82***	0.90***	0.84***	0.84***
	(0.752 - 0.936)	(0.765 - 0.878)	(0.845 - 0.953)	(0.801 - 0.88)	(0.800 - 0.880)
Diploma/Certificate	0.92*	0.90***	0.96	0.91***	0.91***
	(0.831 - 1.016)	(0.853 - 0.942)	(0.914 - 1.010)	(0.872 - 0.944)	(0.871 - 0.945)
Secondary school	0.85***	0.91***	0.97	0.89***	0.89***
	(0.774 - 0.925)	(0.859 - 0.955)	(0.915 - 1.019)	(0.852 - 0.926)	(0.850 - 0.928)
Former Smoker	1.13***	1.11***	1.10***	1.11***	1.11***

	(1.056 - 1.205)	(1.068 - 1.145)	(1.055 - 1.147)	(1.077 - 1.139)	(1.077 - 1.138)
Occasional Smoker	1.12*	1.12***	1.14***	1.13***	1.13***
	(0.991 - 1.268)	(1.054 - 1.198)	(1.051 - 1.240)	(1.075 - 1.19)	(1.074 - 1.191)
Light Daily Smoker	1.40**	1.24***	1.21***	1.28***	1.28***
	(1.035 - 1.884)	(1.093 - 1.398)	(1.127 - 1.298)	(1.14 - 1.431)	(1.133 - 1.440)
Heavy Daily Smoker	1.24***	1.26***	1.29***	1.25***	1.25***
	(1.145 - 1.349)	(1.193 - 1.327)	(1.210 - 1.372)	(1.203 - 1.302)	(1.202 - 1.302)
Regular Drinker – Non Binge	0.70***	0.78***	0.79***	0.75***	0.75***
	(0.630 - 0.775)	(0.735 - 0.820)	(0.752 - 0.830)	(0.719 - 0.784)	(0.718 - 0.785)
Regular Drinker – Binge	0.70***	0.76***	0.74***	0.73***	0.73***
	(0.622 - 0.779)	(0.723 - 0.797)	(0.698 - 0.778)	(0.697 - 0.762)	(0.696 - 0.763)
Occasional Drinker	0.83***	0.90***	0.89***	0.87***	0.87***
	(0.741 - 0.927)	(0.856 - 0.936)	(0.852 - 0.939)	(0.831 - 0.91)	(0.830 - 0.911)
Enabling					
Rural	1.03	0.98	0.98	0.99	0.99
	(0.971 - 1.101)	(0.943 - 1.010)	(0.939 - 1.015)	(0.965 - 1.021)	(0.966 - 1.020)
No Regular Medical Doctor	0.64***	0.69***	0.77***	0.70***	0.70***
	(0.561 - 0.737)	(0.649 - 0.724)	(0.721 - 0.828)	(0.666 - 0.736)	(0.667 - 0.736)
Income_Q5	0.82***	0.71***	0.73***	0.83***	0.76***
	(0.718 - 0.932)	(0.671 - 0.761)	(0.675 - 0.783)	(0.799 - 0.872)	(0.715 - 0.800)
Income_Q4	0.82***	0.75***	0.77***	0.76***	0.78***
	(0.731 - 0.912)	(0.708 - 0.796)	(0.728 - 0.817)	(0.718 - 0.796)	(0.747 - 0.822)
Income_Q3	0.90**	0.79***	0.81***	0.78***	0.84***
	(0.815 - 0.998)	(0.754 - 0.838)	(0.769 - 0.857)	(0.749 - 0.822)	(0.802 - 0.875)
Income_Q2	1.00	0.86***	0.84***	0.84***	0.90***
	(0.842 - 1.187)	(0.816 - 0.910)	(0.800 - 0.887)	(0.803 - 0.875)	(0.845 - 0.966)
Income Missing	0.82***	0.85***	0.84***	0.90***	0.83***
	(0.747 - 0.902)	(0.783 - 0.915)	(0.795 - 0.894)	(0.847 - 0.965)	(0.798 - 0.872)
Homeowner	0.84***	0.87***	0.89***	0.86***	0.86***
	(0.768 - 0.912)	(0.830 - 0.906)	(0.852 - 0.927)	(0.831 - 0.892)	(0.831 - 0.892)
Organization/Resource					
Newfoundland	0.98	0.97	1.27***	1.05**	1.05*
	(0.879 - 1.098)	(0.909 - 1.027)	(1.147 - 1.403)	(1.004 - 1.107)	(0.999 - 1.113)
Prince Edward Island	0.97	0.87***	0.82***	0.89***	0.89***
	(0.853 - 1.109)	(0.801 - 0.936)	(0.753 - 0.887)	(0.835 - 0.956)	(0.840 - 0.951)
Nova Scotia	1.11	1.02	1.13***	1.08***	1.08***
	(0.961 - 1.287)	(0.957 - 1.079)	(1.047 - 1.211)	(1.02 - 1.149)	(1.019 - 1.150)
New Brunswick	0.96	0.85***	0.94**	0.92***	0.92***
	(0.845 - 1.095)	(0.797 - 0.906)	(0.883 - 0.995)	(0.869 - 0.971)	(0.869 - 0.971)
Quebec	0.74***	0.74***	0.66***	0.72***	0.72***
	(0.643 - 0.850)	(0.696 - 0.786)	(0.619 - 0.705)	(0.68 - 0.761)	(0.678 - 0.763)
Manitoba	0.89***	0.97	0.99	0.95**	0.95**
	(0.840 - 0.947)	(0.899 - 1.038)	(0.904 - 1.084)	(0.912 - 0.99)	(0.910 - 0.992)
Saskatchewan	1.00	1.02	1.07**	1.03	1.03
	(0.894 - 1.122)	(0.967 - 1.073)	(1.011 - 1.143)	(0.981 - 1.087)	(0.986 - 1.081)
Alberta	1.08***	1.10***	1.11***	1.10***	1.10***
	(1.018 - 1.140)	(1.042 - 1.156)	(1.051 - 1.174)	(1.063 - 1.13)	(1.062 - 1.131)
British Columbia	1.20***	1.12***	1.29***	1.20***	1.20***
	(1.063 - 1.346)	(1.075 - 1.164)	(1.224 - 1.355)	(1.152 - 1.253)	(1.149 - 1.256)
Constant	6.34***	6.80***	5.16***	6.54***	6.49***
	(5.598 - 7.176)	(6.291 - 7.349)	(4.677 - 5.686)	(6.163 - 6.942)	(6.072 - 6.944)
Observations	**49512**	**86997**	**81115**	**217624**	**217624**

*** p<0.01, ** p<0.05, * p<0.1

Table D. 5: The association between each BMI category and the propensity to visit a specialist and pooled models in multivariable Poisson regression with individuals with missing responses on income included

	1996-7 (RR, 95% CI)	***2000-1*** (RR, 95% CI)	***2009-10*** (RR, 95% CI)	***Pooled*** (RR, 95% CI)	***Pooled with Interaction*** (RR, 95% CI)
Underweight	1.01	0.97	1.06	1.02	1.04
	(0.857 - 1.192)	(0.895 - 1.063)	(0.948 - 1.189)	(0.949 - 1.085)	(0.879 - 1.227)
Overweight	0.99	1.02	1.05**	1.02	0.97
	(0.925 - 1.066)	(0.991 - 1.055)	(1.006 - 1.086)	(0.996 - 1.046)	(0.903 - 1.036)
Obesity	1.13**	1.12***	1.22***	1.16***	1.11**
	(1.028 - 1.237)	(1.078 - 1.162)	(1.171 - 1.279)	(1.129 - 1.201)	(1.013 - 1.214)
2000-1				1.18***	1.16***
				(1.144 - 1.221)	(1.108 - 1.218)
2009-10				1.22***	1.16***
				(1.178 - 1.26)	(1.102 - 1.218)
2000-1×Obesity					1.01
					(0.916 - 1.112)
2009-10×Obesity					1.11**
					(1.009 - 1.231)
2000-1×Overweight					1.06
					(0.980 - 1.138)
2009-10×Overweight					1.10**
					(1.014 - 1.186)
2000-1×Underweight					0.94
					(0.780 - 1.134)
2009-10×Underweight					1.00
					(0.821 - 1.226)
Predisposing					
Age 25 to 34	1.10	1.03	1.08*	1.06**	1.06**
	(0.960 - 1.252)	(0.960 - 1.097)	(0.996 - 1.165)	(1.006 - 1.119)	(1.006 - 1.119)
Age 35 to 44	1.00	0.99	1.10**	1.03	1.03
	(0.866 - 1.145)	(0.927 - 1.056)	(1.016 - 1.196)	(0.971 - 1.084)	(0.971 - 1.083)
Age 45 to 54	1.09	1.08**	1.21***	1.12***	1.12***
	(0.945 - 1.266)	(1.011 - 1.155)	(1.110 - 1.310)	(1.064 - 1.186)	(1.063 - 1.187)
Age 55 to 64	1.27***	1.29***	1.32***	1.29***	1.29***
	(1.094 - 1.477)	(1.204 - 1.382)	(1.221 - 1.436)	(1.216 - 1.364)	(1.217 - 1.361)
Age 65 to 74	1.33***	1.34***	1.48***	1.39***	1.38***
	(1.141 - 1.553)	(1.250 - 1.442)	(1.366 - 1.610)	(1.31 - 1.466)	(1.307 - 1.467)
Age 75 to 84	1.39***	1.44***	1.58***	1.47***	1.47***
	(1.163 - 1.658)	(1.331 - 1.554)	(1.443 - 1.721)	(1.378 - 1.565)	(1.376 - 1.562)
Age 85+	1.25	1.14**	1.42***	1.27***	1.27***
	(0.885 - 1.774)	(1.008 - 1.292)	(1.263 - 1.594)	(1.143 - 1.411)	(1.138 - 1.410)
Male	0.64***	0.71***	0.75***	0.7***	0.70***
	(0.597 - 0.687)	(0.685 - 0.727)	(0.722 - 0.776)	(0.687 - 0.723)	(0.687 - 0.723)
Divorced/widowed/ separated	1.04	0.96	1.03	1.01	1.01
	(0.925 - 1.166)	(0.916 - 1.017)	(0.966 - 1.090)	(0.968 - 1.051)	(0.966 - 1.054)
Married	1.03	1.02	1.06**	1.04**	1.04**
	(0.943 - 1.135)	(0.980 - 1.072)	(1.007 - 1.110)	(1.008 - 1.075)	(1.005 - 1.078)
Immigrant < 10 years	0.90	0.83***	0.77***	0.82***	0.82***
	(0.747 - 1.093)	(0.749 - 0.912)	(0.684 - 0.857)	(0.761 - 0.875)	(0.757 - 0.879)
Immigrant ≥ 10 years	1.05	0.99	0.99	1.01	1.01
	(0.960 - 1.154)	(0.947 - 1.031)	(0.945 - 1.045)	(0.974 - 1.04)	(0.973 - 1.043)
Bachelor's Degree	1.29***	1.24***	1.32***	1.28***	1.28***
	(1.155 - 1.437)	(1.183 - 1.308)	(1.246 - 1.405)	(1.229 - 1.337)	(1.229 - 1.336)
Diploma/Certificate	1.17***	1.15***	1.21***	1.18***	1.17***
	(1.059 - 1.296)	(1.105 - 1.195)	(1.148 - 1.271)	(1.139 - 1.216)	(1.134 - 1.216)

Secondary school	1.11**	1.09***	1.12***	1.11***	1.11***
	(1.017 - 1.213)	(1.048 - 1.138)	(1.059 - 1.181)	(1.07 - 1.147)	(1.066 - 1.147)
Former Smoker	1.18***	1.21***	1.16***	1.18***	1.18***
	(1.095 - 1.267)	(1.166 - 1.246)	(1.114 - 1.206)	(1.144 - 1.215)	(1.147 - 1.211)
Occasional Smoker	1.17*	1.16***	1.13***	1.15***	1.15***
	(0.992 - 1.390)	(1.079 - 1.249)	(1.035 - 1.231)	(1.082 - 1.218)	(1.081 - 1.219)
Light Daily Smoker	1.09	1.11***	1.06	1.08***	1.08***
	(0.959 - 1.235)	(1.037 - 1.183)	(0.981 - 1.138)	(1.031 - 1.14)	(1.029 - 1.140)
Heavy Daily Smoker	1.05	1.09***	1.07**	1.07***	1.07***
	(0.950 - 1.153)	(1.044 - 1.144)	(1.002 - 1.141)	(1.032 - 1.114)	(1.028 - 1.116)
Regular Drinker – Non Binge	0.99	0.99	1.01	1.00	1.00
	(0.907 - 1.085)	(0.946 - 1.026)	(0.966 - 1.065)	(0.962 - 1.034)	(0.963 - 1.031)
Regular Drinker – Binge	0.97	0.92***	0.95**	0.94***	0.94***
	(0.872 - 1.068)	(0.876 - 0.959)	(0.898 - 1.000)	(0.898 - 0.976)	(0.901 - 0.972)
Occasional Drinker	1.07	1.01	1.07**	1.05***	1.05***
	(0.975 - 1.165)	(0.972 - 1.058)	(1.013 - 1.130)	(1.012 - 1.088)	(1.012 - 1.087)
Enabling					
Rural	0.94	0.90***	0.87***	0.90***	0.90***
	(0.869 - 1.021)	(0.874 - 0.931)	(0.841 - 0.908)	(0.878 - 0.928)	(0.877 - 0.928)
No Regular Medical Doctor	0.62***	0.64***	0.68***	0.65***	0.65***
	(0.537 - 0.710)	(0.612 - 0.679)	(0.634 - 0.723)	(0.618 - 0.682)	(0.620 - 0.680)
Income_Q5	1.03	1.06**	1.04	0.89***	1.05**
	(0.918 - 1.153)	(1.006 - 1.117)	(0.978 - 1.114)	(0.855 - 0.931)	(1.003 - 1.096)
Income_Q4	0.96	1.03	1.02	1.05**	1.01
	(0.858 - 1.071)	(0.977 - 1.077)	(0.959 - 1.079)	(1.005 - 1.095)	(0.966 - 1.049)
Income_Q3	1.00	0.98	0.97	1.01	0.99
	(0.901 - 1.116)	(0.937 - 1.027)	(0.919 - 1.028)	(0.967 - 1.048)	(0.947 - 1.026)
Income_Q2	0.88**	0.99	0.97	0.99	0.95**
	(0.788 - 0.975)	(0.944 - 1.029)	(0.923 - 1.028)	(0.948 - 1.025)	(0.918 - 0.990)
Income Missing	0.83***	0.96	0.91***	0.95***	0.89***
	(0.748 - 0.915)	(0.903 - 1.015)	(0.859 - 0.972)	(0.919 - 0.989)	(0.856 - 0.931)
Homeowner	0.92**	0.96***	0.96*	0.95***	0.95***
	(0.851 - 0.990)	(0.923 - 0.988)	(0.922 - 1.006)	(0.92 - 0.974)	(0.920 - 0.976)
Organization/ Resource					
Newfoundland	0.94	0.95	0.95	0.95**	0.95*
	(0.803 - 1.112)	(0.884 - 1.023)	(0.877 - 1.027)	(0.898 - 0.999)	(0.893 - 1.004)
Prince Edward Island	1.01	0.88***	1.02	0.97	0.97
	(0.849 - 1.206)	(0.806 - 0.953)	(0.923 - 1.137)	(0.908 - 1.035)	(0.904 - 1.040)
Nova Scotia	0.96	0.97	1.01	0.98	0.98
	(0.820 - 1.127)	(0.915 - 1.034)	(0.937 - 1.086)	(0.934 - 1.033)	(0.930 - 1.039)
New Brunswick	1.01	1.01	0.98	0.99	0.99
	(0.872 - 1.159)	(0.949 - 1.069)	(0.911 - 1.050)	(0.943 - 1.046)	(0.944 - 1.047)
Quebec	1.42***	1.26***	1.13***	1.25***	1.25***
	(1.303 - 1.542)	(1.217 - 1.309)	(1.084 - 1.183)	(1.215 - 1.287)	(1.211 - 1.291)
Manitoba	0.96	0.93**	0.93*	0.94***	0.94***
	(0.889 - 1.046)	(0.871 - 0.985)	(0.859 - 1.008)	(0.896 - 0.98)	(0.897 - 0.978)
Saskatchewan	1.07	0.90***	0.81***	0.91***	0.91***
	(0.925 - 1.230)	(0.849 - 0.952)	(0.752 - 0.871)	(0.86 - 0.96)	(0.861 - 0.961)
Alberta	0.87***	0.85***	0.85***	0.85***	0.85***
	(0.825 - 0.916)	(0.809 - 0.897)	(0.794 - 0.902)	(0.825 - 0.884)	(0.825 - 0.885)
British Columbia	0.93	0.85***	0.89***	0.89***	0.89***
	(0.830 - 1.051)	(0.817 - 0.888)	(0.841 - 0.937)	(0.853 - 0.927)	(0.854 - 0.927)
Constant	0.23***	0.27***	0.24***	0.22***	0.22***
	(0.196 - 0.267)	(0.252 - 0.293)	(0.217 - 0.261)	(0.204 - 0.234)	(0.209 - 0.240)
Observations	**61720**	**108788**	**100891**	**271399**	**271399**

*** p<0.01, ** p<0.05, * p<0.1

Table D. 6: The association between each BMI category and the intensity of visits to specialist physicians and pooled models in multivariable Zero Truncated Poisson regression with individuals with missing responses on income included

	1996-7 (IRR, 95% CI)	***2000-1*** (IRR, 95% CI)	***2009-10*** (IRR, 95% CI)	***Pooled*** (IRR, 95% CI)	***Pooled with Interaction*** (IRR, 95% CI)
Underweight	1.05	1.26*	0.98	1.11	1.09
	(0.763 - 1.447)	(0.959 - 1.665)	(0.833 - 1.148)	(0.96 - 1.295)	(0.810 - 1.470)
Overweight	1.02	1.04	0.99	1.01	1.02
	(0.845 - 1.228)	(0.929 - 1.155)	(0.891 - 1.096)	(0.938 - 1.097)	(0.846 - 1.226)
Obesity	1.05	1.16***	1.08	1.1***	1.06
	(0.900 - 1.234)	(1.049 - 1.276)	(0.947 - 1.236)	(1.022 - 1.183)	(0.900 - 1.244)
2000-1				1.02	0.99
				(0.945 - 1.106)	(0.885 - 1.111)
2009-10				1.02	1.03
				(0.939 - 1.102)	(0.918 - 1.164)
2000-1×Obesity					1.10
					(0.916 - 1.320)
2009-10×Obesity					1.01
					(0.827 - 1.231)
2000-1×Overweight					1.03
					(0.833 - 1.272)
2009-10×Overweight					0.96
					(0.774 - 1.198)
2000-1×Underweight					1.16
					(0.776 - 1.740)
2009-10×Underweight					0.89
					(0.639 - 1.247)
Predisposing					
Age 25 to 34	1.86***	1.27***	1.35***	1.46***	1.46***
	(1.297 - 2.668)	(1.089 - 1.482)	(1.140 - 1.588)	(1.286 - 1.665)	(1.274 - 1.682)
Age 35 to 44	1.29*	1.14*	1.09	1.17***	1.17**
	(0.958 - 1.733)	(0.977 - 1.339)	(0.901 - 1.324)	(1.038 - 1.315)	(1.032 - 1.326)
Age 45 to 54	1.34*	1.18*	0.85*	1.07	1.07
	(0.968 - 1.845)	(0.985 - 1.412)	(0.701 - 1.020)	(0.943 - 1.215)	(0.938 - 1.224)
Age 55 to 64	1.16	1.20	0.94	1.09	1.09
	(0.860 - 1.566)	(0.924 - 1.553)	(0.733 - 1.200)	(0.936 - 1.268)	(0.932 - 1.278)
Age 65 to 74	1.10	1.13	0.74***	0.96	0.96
	(0.806 - 1.497)	(0.912 - 1.393)	(0.604 - 0.902)	(0.844 - 1.095)	(0.837 - 1.109)
Age 75 to 84	0.96	1.02	0.80*	0.92	0.92
	(0.679 - 1.369)	(0.810 - 1.294)	(0.632 - 1.001)	(0.786 - 1.067)	(0.784 - 1.072)
Age 85+	0.70	0.78*	0.63***	0.7***	0.70***
	(0.440 - 1.121)	(0.606 - 1.001)	(0.493 - 0.802)	(0.589 - 0.839)	(0.590 - 0.838)
Male	0.95	1.01	1.02	1.00	1.00
	(0.822 - 1.094)	(0.922 - 1.109)	(0.916 - 1.144)	(0.943 - 1.068)	(0.939 - 1.074)
Divorced/widowed/ separated	1.10	0.87*	1.05	1.01	1.01
	(0.784 - 1.542)	(0.749 - 1.001)	(0.905 - 1.223)	(0.886 - 1.152)	(0.884 - 1.153)
Married	0.82	0.88**	1.01	0.91**	0.91*
	(0.625 - 1.073)	(0.786 - 0.983)	(0.893 - 1.141)	(0.83 - 1)	(0.829 - 1.002)
Immigrant < 10 years	1.13	0.68***	0.69***	0.8**	0.80**
	(0.726 - 1.752)	(0.537 - 0.861)	(0.567 - 0.841)	(0.669 - 0.963)	(0.666 - 0.971)
Immigrant ≥ 10 years	0.87*	0.79***	0.97	0.89***	0.89**
	(0.742 - 1.022)	(0.690 - 0.909)	(0.822 - 1.155)	(0.812 - 0.971)	(0.805 - 0.981)
Bachelor's Degree	0.98	1.22***	1.11	1.11**	1.11**
	(0.799 - 1.195)	(1.074 - 1.389)	(0.970 - 1.277)	(1.017 - 1.216)	(1.016 - 1.217)
Diploma/Certificate	1.04	1.11*	1.02	1.05	1.05
	(0.855 - 1.265)	(0.995 - 1.233)	(0.910 - 1.150)	(0.976 - 1.132)	(0.974 - 1.136)
Secondary school	1.11	1.17**	1.04	1.11**	1.11**
	(0.922 - 1.324)	(1.029 - 1.342)	(0.869 - 1.252)	(1.007 - 1.22)	(1.005 - 1.224)
Former Smoker	1.08	1.02	1.02	1.04	1.04

	(0.888 - 1.304)	(0.904 - 1.157)	(0.900 - 1.155)	(0.961 - 1.121)	(0.955 - 1.127)
Occasional Smoker	1.12	1.02	1.11	1.08	1.08
	(0.864 - 1.463)	(0.841 - 1.241)	(0.914 - 1.357)	(0.952 - 1.222)	(0.953 - 1.223)
Light Daily Smoker	1.06	1.17*	1.10	1.11*	1.11*
	(0.834 - 1.355)	(0.983 - 1.390)	(0.871 - 1.401)	(0.989 - 1.252)	(0.980 - 1.264)
Heavy Daily Smoker	1.18	1.21***	1.15*	1.18***	1.18***
	(0.962 - 1.440)	(1.068 - 1.368)	(0.991 - 1.335)	(1.074 - 1.3)	(1.069 - 1.306)
Regular Drinker – Non Binge	0.81**	0.70***	0.78***	0.76***	0.76***
	(0.690 - 0.954)	(0.611 - 0.812)	(0.668 - 0.903)	(0.693 - 0.833)	(0.696 - 0.831)
Regular Drinker – Binge	0.71***	0.60***	0.63***	0.64***	0.64***
	(0.566 - 0.885)	(0.528 - 0.686)	(0.550 - 0.732)	(0.585 - 0.708)	(0.584 - 0.709)
Occasional Drinker	1.01	0.78***	0.84**	0.87***	0.87***
	(0.837 - 1.227)	(0.690 - 0.893)	(0.730 - 0.972)	(0.792 - 0.952)	(0.791 - 0.954)
Enabling					
Rural	0.81**	0.82***	0.88***	0.84***	0.84***
	(0.683 - 0.956)	(0.751 - 0.902)	(0.809 - 0.955)	(0.782 - 0.892)	(0.781 - 0.893)
No Regular Medical Doctor	0.61***	0.89*	0.80***	0.79***	0.79***
	(0.466 - 0.794)	(0.784 - 1.002)	(0.713 - 0.902)	(0.724 - 0.853)	(0.722 - 0.857)
Income_Q5	0.91	0.83***	0.75**	0.87**	0.83***
	(0.690 - 1.207)	(0.727 - 0.957)	(0.591 - 0.945)	(0.769 - 0.991)	(0.724 - 0.948)
Income_Q4	0.95	0.83***	0.83	0.83***	0.86**
	(0.733 - 1.225)	(0.729 - 0.940)	(0.653 - 1.043)	(0.735 - 0.935)	(0.761 - 0.982)
Income_Q3	0.86	0.91	0.75***	0.87**	0.83***
	(0.692 - 1.063)	(0.770 - 1.068)	(0.621 - 0.904)	(0.767 - 0.977)	(0.743 - 0.938)
Income_Q2	1.02	0.89*	0.82**	0.84***	0.90**
	(0.810 - 1.283)	(0.794 - 1.006)	(0.680 - 0.997)	(0.747 - 0.934)	(0.803 - 1.000)
Income Missing	1.09	0.83**	0.74***	0.90**	0.87*
	(0.832 - 1.439)	(0.720 - 0.960)	(0.595 - 0.913)	(0.808 - 0.996)	(0.761 - 1.001)
Homeowner	0.94	0.93	0.94	0.94	0.94
	(0.758 - 1.170)	(0.860 - 1.014)	(0.841 - 1.060)	(0.866 - 1.023)	(0.865 - 1.025)
Organization/ Resource					
Newfoundland	0.56***	0.65***	0.80***	0.68***	0.68***
	(0.441 - 0.705)	(0.554 - 0.774)	(0.688 - 0.938)	(0.61 - 0.755)	(0.613 - 0.754)
Prince Edward Island	0.97	0.97	0.91	0.96	0.96
	(0.762 - 1.244)	(0.715 - 1.325)	(0.757 - 1.086)	(0.827 - 1.107)	(0.829 - 1.103)
Nova Scotia	1.20	0.79***	0.83**	0.92	0.92
	(0.626 - 2.282)	(0.665 - 0.937)	(0.699 - 0.997)	(0.69 - 1.223)	(0.688 - 1.228)
New Brunswick	0.69***	0.64***	0.81**	0.71***	0.71***
	(0.545 - 0.886)	(0.559 - 0.737)	(0.686 - 0.964)	(0.642 - 0.795)	(0.643 - 0.795)
Quebec	0.63***	0.74***	0.74***	0.71***	0.71***
	(0.510 - 0.785)	(0.665 - 0.828)	(0.647 - 0.846)	(0.653 - 0.764)	(0.646 - 0.773)
Manitoba	0.75***	0.93	0.87**	0.85***	0.85***
	(0.637 - 0.888)	(0.775 - 1.115)	(0.758 - 0.988)	(0.765 - 0.942)	(0.771 - 0.936)
Saskatchewan	0.67**	0.83	0.76***	0.75***	0.75***
	(0.472 - 0.962)	(0.655 - 1.040)	(0.636 - 0.900)	(0.647 - 0.861)	(0.644 - 0.866)
Alberta	0.88*	0.88	1.01	0.93*	0.93*
	(0.759 - 1.010)	(0.757 - 1.029)	(0.869 - 1.168)	(0.852 - 1.008)	(0.848 - 1.013)
British Columbia	0.87	0.89**	0.96	0.91**	0.91**
	(0.695 - 1.083)	(0.798 - 0.995)	(0.832 - 1.109)	(0.827 - 0.994)	(0.826 - 0.996)
Constant	3.85***	4.83***	5.40***	4.62***	4.63***
	(2.824 - 5.242)	(3.950 - 5.899)	(4.311 - 6.762)	(4.05 - 5.269)	(3.974 - 5.406)
Observations	**13642**	**30810**	**32147**	**76599**	**76599**

*** p<0.01, ** p<0.05, * p<0.1

Curriculum Vitae

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