CHANGES IN THE INFLUENCE OF SOCIO-ECONOMIC STATUS ON OBESITY AMONG AGING CANADIAN BABY BOOMERS

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ABSTRACT

A trend analysis was conducted on the influence of socio-economic (SES) status on obesity levels in Canadian baby boomers over time. Two, large scale national studies conducted 10 years apart were analyzed.

Riley's Social Change Model was used to frame how the influence of SES on obesity will converge over time due to social changes to food production and eating habits coupled with reliance on modern technology.

Partial support was found for convergence of SES and obesity associations over time, including interesting differences by sex. Findings from 1994 data indicate that measures of SES decreased the odds of obesity among males, while working status increased the odds of obesity for females.

In 2004, associations for males show that measures of income were positively associated with obesity, while post-secondary graduation showed an opposite association. In 2004, associations for females show an inverse association between measures of education and obesity.

Keywords: Obesity; Baby Boomers; Socioeconomic Status; Gender; Social Change; Social Determinants;

DEDICATION

I dedicate this thesis to the following people, without whom I' wouldn't be who I am nor would I have made it to this point in life. To my dearest Grama, Marjorie Glover, thank you for loving me like I was your own. Thank you for teaching me about being a strong woman and always believing in me. Thank you for encouraging me and for being my most steadfast support and guardian. I hope I have made you proud even though you're no longer here to celebrate this success with me.

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CHAPTER 1: INTRODUCTION

The focus of this thesis is to examine sex differences in the relationship between SES and obesity as an origin in the sequence of healthy lifestyles through social determinants and social change. This study conducts a trend analysis on the influence of SES (as measured via educational attainment, annual income and working status) on obesity levels in male and female Canadian baby boomer aged individuals. Baby boomers are the target population given that they are the next generation of older adults to reach retirement beginning in 2011 and represent the seniors of tomorrow.

The baby boomers are a generation comprised of 20 years of birth cohorts born post World War II, beginning in 1946 and ending in 1965 (Wister, 2001). Based on the 2001 Canadian census, the baby boom generation and its birth cohorts represent the largest birth cohorts in Canadian history, made up of over 9.4 million people or 31.3% of the total enumerated Canadian population (Wister, 2005). Those at the leading edge of the first cohort will reach their 65^{th} birthday in 2011 and by 2031 the entire baby boomer generation will be aged 65-85 years (Wister, 2005).

Social determinants of health are the number and quality of specific resources made available to members of a given society (Raphael, 2004). Health Canada has identified 12 specific determinants of health, most of which are social determinants and include income, education level, working status and

gender (Raphael, 2008). Each is associated with the extent to which a person possesses the capacity to achieve personal goals, meet needs and cope with their environment (Raphael, 2004). A social determinants approach to health promotion functions with the perspective that the health of an individual is derived from how a given society organizes and distributes economic and social resources (Raphael, 2004). It also helps direct attention towards improving economic and social policies for the improvement of overall social health (Raphael, 2004). The Ottawa Charter of Health Promotion speaks to the significance of social determinants of health to the practice of health promotion:

> "Health is a positive concept emphasizing social and personal resources, as well as physical capacities...[g]ood health is a major resource for social, economic and personal development and an important dimension of quality of life. Political, economic, social, cultural, environmental, behavioural and biological factors can all favour health or be harmful to it. Health promotion action aims at making these conditions favourable through advocacy for health." (Raphael, 2004, p. 1).

Socio-economic status (SES) is a major social determinant of health combining income and education (Raphael, 2008; 2004), as well as working status. SES factors may interact with gender – another social determinant of health, which affect the strength of available supportive environments and genetic predisposition for chronic illness and obesity to influence the overall health status of baby boomer aged Canadians. Mirowsky and Ross (1998) suggest that educational attainment assists in the acquisition and maintenance of a healthy lifestyle. Additionally, Wister (2005) suggests that SES, a factor made up of education, income and occupation, influences health behaviours, levels of physical activity and corresponding obesity levels. In other terms, all elements

of SES are social determinants of health that are associated individually and as a group, with overall health status in every individual. SES acts as both a barrier and enabler when it comes to lifestyle and health behaviours.

Baby boomers with more education and higher incomes may experience lower prevalence of obesity. Those baby boomers who earn more can materially afford to participate in more healthy behaviours such as working out at fitness centres and taking time off for relaxation, purchasing greater quantities of foods in general, as well as foods with better nutritional content (Wister, 2005). Income is a social determinant of health and as such, those with more income, more social status and material wealth should have better nutritional health, higher levels of physical activity, and lower body mass index (BMI) levels (Sobal & Stunkard, 1989).

Part of the education effect on health could be mediated through economic status, but educational attainment and income operate at different levels on health and thus must be examined independently. In other words, level of education attained is often influenced by income level (as a barrier or an enabler) whereby the cost of education and its affordability influences how much education an individual may or may not achieve. Income itself is also influenced by level of education achieved such that better job opportunities and working status become more available with more education. All of the above associations may be influenced by sex as well. A gap in the literature relates to the potential differential influence that income, education and working status have on obesity in males and females.

Obesity is a major and rapidly growing public health issue and it is likely that as baby boomers enter later adulthood their rates of obesity will contribute significantly to their health care resource use (Kaplan et al., 2003). Although the prevalence of obesity reaches its peak at the ages of 50-59 years and tends to decline in later years, overall rates of obesity among older adults are rising over time (Schieman et al., 2007). Baby boomers that fall into the obese category as they enter the age of retirement will see more health complications, lower quality of life and use more health care resources as they continue to age into their later years. We know that males and females have different rates of obesity in the general population and this bears out specifically among baby boomers as well (Wister, 2005).

In an effort to estimate prevalence, obesity is quantified by researchers and health care governing bodies. A common measure for obesity in research is body mass index (BMI) although there is disagreement and controversy with regard to validity and reliability of the measure (Wister, 2005). BMI is calculated as weight divided by height squared (BMI=kg/m2) and is considered inaccurate for individuals below the age of 20 years as well as for pregnant women (Wister, 2005).

The World Health Organization (WHO) criteria for body mass index, defining BMI > 25.0 as "overweight" and BMI>30.0 as "obese will be used in this study. A BMI of 30+ is closely linked to chronic illness in literature (Wister, 2005). A specific Canadian & U.S. BMI criteria, where BMI<20.0 is "underweight", BMI >25.0 is "some excess weight", and BMI>27.0 is "overweight" also exists in the

obesity literature (Gilmore, 1999), however, for the purposes of this study, obesity will be defined as BMI>=30. This measure is available in many national surveys.

Obesity is a measure of health status that may have more influence on morbidity than mortality (Chernoff, 2001), although a difference of approximately 2 BMI units translates into a 25% increase in mortality between a non-obese and an obese individual (Dosset, 2000). This link between obesity and mortality is controversial however. For many older adults, being slightly overweight is protective to health status (Orpana et al., 2009) but obesity, at BMI levels 30+, is not protective to health status at any age (Al Snih et al., 2007). A person with a BMI of 30+ is likely to also have one or more chronic illnesses and associated disability. Because of this established link, obesity in later adulthood is a major health status risk factor. Obesity is a major contributor to the increased risk for chronic illnesses such as cardiovascular disease, Type II diabetes, some endocrine and metabolic disturbances, several types of cancer and psychological disorders including depression (Monteiro et al., 2007; Kaplan, 2003).

There is no single theory addressing the association between SES and health status and how this changes over time. This thesis therefore synthesizes Riley's Social Change Model and the social determinants of health perspective. Combined, they provide theoretical rationale for the relative importance of SES on health and in particular, on obesity and how this may change over time. This combined approach helps to elucidate the dynamic interplay of structural change and individual life course changes.

Major social changes are affecting the health status of Canadian baby boomers and these social changes increase the spread of obesogenic environments and lifestyles. Popularity of fast food and eating away from home, combined with the increased society-wide use of technologies may make communication, food production and entertainment easier and more accessible, but do relatively little to promote healthy, obesity-reducing behaviours (Cutler, Glaeser & Shapiro, 2003).

Furthermore, increased technological mechanization of labour has significantly decreased physical activity involved in all types of daily work from paid labour to household chores and as a result, heavy physical labour is no longer prominent in lower SES (Popkin et al., 2005; Sobal & Stunkard, 1989). The overall picture in current social change is that the majority of people are eating larger portions, eating poorer quality food and moving their bodies less.

Gender is a social determinant of health that is associated with income, educational attainment and working status as well as lifestyle and health behaviours (Kaufert, 1996). Gender is different from sex. Sex is defined in biology and anatomy and where the difference is clearly biological one can identify a 'sex' difference - everything that is not explained by biology, is gender difference (Nobelius & Wainer, 2004). Gender is a word used to describe the social and cultural meaning of roles and expectations associated with sex. According to Health Canada (2000) gender is relational, such that gender roles and characteristics exist, not in isolation, but are defined in relation to one another and via relationships between adult and child males and females.

There are differences in the social determinant and cultural opportunities and resources available to women and men. Gender roles and inequitable gender relations interact with social and economic variables, resulting in different and sometimes unequal patterns of exposure to health risk, access to and use of health information and services. As such, these differences have clear impact on health outcomes (WHO, 2002). Sara Arber suggests that any analysis of women's health must account for the way in which "material circumstances intersect with their family (marital and parental roles) and their participation in paid employment" (Arber & Lahelma,1993, p.1065). When gender interacts with factors such as a low level of education or being a single parent, women are frequently doubly or triply disadvantaged falling to the very bottom of most SES gradients (Kaufert, 1996).

Together, Riley's Social Change Theory and the social determinants of health perspective suggest that an individual's health status is rooted in social structures and social change, within which gender, socioeconomic variables and social status are integral. People's lifestyles, the economic and social conditions under which they live and gender, have substantial influence on their health and longevity.

Purpose of this Study

The aims of this study are to examine: 1) the influence of SES, education, income and working status on the presence of obesity in Canadian baby boomers over a ten year span; 2) examine the differential effects of gender on any interactions in SES variables and obesity over time.

Comparative analyses will be conducted using the 1994 National Population Health Survey and the 2004 Canadian Community Health Survey, which are a decade apart. Riley's (1993) Social Change Model was employed as a framework for the analytic strategy and to understand how health behaviours and lifestyle choices are influenced by historical changes in society. Multivariate analyses were employed to examine the relative influence of income and education on obesity levels for the two time periods. Analyses were conducted separately for men and women to compare SES effects on obesity.

CHAPTER 2: LITERATURE REVIEW

Importance of this Study

There is an assumption in the social determinants of health literature that the influence of SES on health remains largely stable over time. However there are theoretical reasons and contradictory research-evidence to suggest that this assumption is questionable. This study addresses the dynamic nature of the influence of education, income and working status on obesity as the result of social change, with a specific focus on differences between males and females in the Canadian baby boomer population.

Income and education are two elements deemed by the Ottawa Charter of Health Promotion (1986) and the WHO to be prerequisites for equitable health. In studying the predictive quality of SES through income, education and working status we work towards creating a supportive environment in which better health choices can be made to improve equitable chances for good health by people at all SES strata.

Born between 1946 and 1965, the baby boomer generation's health is a critical social, economic and population health issue given that they comprise one third of the Canadian population (about 10 million) and are compressed into only twenty years of birth cohorts (Wister, 2005). Research has shown a doubling of the obesity rate in only 15 years for baby boomers who are now aged

43 to 62 (40-60 in 2005) and who represent the seniors of tomorrow (Wister, 2005). The health of Canadian baby boomers is of timely importance in health research and though there is much research available on the structural, economic, social and physical factors related to higher BMI in younger individuals, relatively little research is available on patterns of obesity within subgroups of the older adult population (Kaplan, et al., 2003).

Middle-aged British Columbians represent some of the healthier individuals of their generation in Canada with an obesity prevalence rate of 13.3% compared to 17.1% in Ontario, 19.3% in the Prairies and 22.5% in Maritime Canada. B.C. shows lower rates of sedentary or infrequent exercisers at 33.1% compared to 41.6% in Ontario, 43.9% in Maritime Canada, 47.8% in Quebec in 2000/01 (Wister, 2005). Despite the fact that baby boomers are working out more often than any generation before them and given that obesity levels are rising over time, the baby boomer generation is significantly at risk for chronic illnesses and corresponding disabilities via obesity.

According to Najman and colleagues there are few studies that look at changes in SES in relation to BMI over time (2006). By better understanding the dynamic relationship between SES and obesity over time among Canadian boomers, future public health policy can be refined to more effectively guide obesity management and prevention policies (Reas et al., 2007).

SES as a Social Determinant of Health

There are many pathways through which SES influences health outcomes (Adler & Ostrove, 1999). In order to set the stage for understanding how social determinants affect obesity levels in Canadian boomers, we begin by examining how, at a general level, socio-economic status and income are structural factors that influence health status. A relationship between SES and health has been found in nearly every industrialized nation in which it has been studied, though the strength of that association has not been uniform (Adler & Ostrove, 1999).

Theories exist in the literature that point to both the direct and the mediating effects of SES on health status (Kawachi, 2000 as cited in Auger et al., 2004). What is of particular interest in this thesis is the structural relationship of education and income to obesity and thus, health status.

Income is a social determinant of health in its own right, but it is also a determinant of quality of life, of educational attainment, of employment, food security, quality housing and a determinant of premature mortality when considering deficits across the lifespan (Raphael, 2004). Income inequality may come about through underinvestment in human capital, generated through cuts to spending in public infrastructure sectors such as education and health services. A variant on this theory is the "neo-materialist" hypothesis which states that income inequality is a manifestation of underlying historical, political, cultural and economic processes (Lynch et al. 2000 as cited in Auger et al., 2004., p. 50). These structural and cultural processes are strong influences that cut across income strata and age gradients to influence health status in a population.

Raphael (2004) states that "[s]ocioeconomic or income status are powerful predictors of health as they serve as indicators of material advantage or disadvantage that accumulate over the lifespan" (Pp. 12-13).

Furthermore, Marmot (2004) contends that health follows a social gradient he calls "the status syndrome" (p.1). He suggests that though living in a modern, developed country such as Canada, where one likely enjoys a home with a roof, food to eat, potable water, employment and health resources, there are inevitably individuals sitting both above and below any given point in the social order. Life at different levels in the social gradient is better for some than for others. These locations on the social gradient lead to individual differences in health status and among all of these people on a society's hierarchy, those higher up the social ladder have better health and longevity (2004).

For Marmot (2004), the answer to why marginal differences in income and education lead to significant health status differences is that people in different social groups are exposed to different social and economic conditions. These translate into unique opportunities that interact with individual determinants of health and autonomous choices made through lifestyle. Socioeconomic disadvantage is associated with a host of health risk behaviours such as smoking and physical inactivity, heavy alcohol consumption and obesity (Kivimaki et al, 2007). Najman and colleagues (2006) contend that these behaviours comprise the major component of socioeconomic inequalities in health status but it is important to remember that some individuals with high incomes and more education also smoke and exercise infrequently and vice versa.

Research consistently provides evidence that those with more income and higher education live longer, healthier lives because income and education are correlated (Marmot, 2004). Those with higher education, earn more. However, it is difficult to know whether it is income or education that confers the greater benefits to health status and longevity (2004).

As a corollary, it is important to note that income and education have been studied and conceptualized differently. Previously, theorists such as Weber conceptualized income as reflective of social groups and human capital (education), whereas Karl Marx considered income to be reflective of financial capital. Each shines a different light on the influence of income on lifestyle and health behaviour.

Locke & Wister (1992) suggest that social class directly affects individual differences in health. They contend that the economic location of a person influences his or her opportunity to create and maintain a healthy life. The Weberian perspective suggests that those with higher education belong to social groups with more opportunity to engage in healthy behaviours afforded them through better paying jobs (Locke & Wister, 1992). The Marxian perspective contends that those with more money are healthier because they have more of better foods and can afford exercise. Kaplan (1999) posits that "it is not rank *per se* but instead the interaction of rank and the differential distribution of demands and resources by rank that allow individual differences in reactivity to social stress to be expressed physiologically" (p.118).

A person's state of health varies in relation to patterns of social stratification and is closely related to Weber's idea of status (Weberian perspective). According to Weber:

> With some over-simplification, one might say that 'classes' are stratified according to their relations to the production and acquisition of goods: whereas 'status groups' are stratified according to the principles of their consumption of goods as represented by special styles of life (Weber, 1946, p.192).

It is important to investigate the influence of education, income and working status on obesity. With the above theoretical background in mind, income is understood to relate more to material or financial capital and the resource advantages that it affords individuals with higher financial status. Education on the other hand, relates more closely to lifestyle and health behaviour choices. Working status relates directly to income and thus to material and financial resource advantages. By examining income, education and working status separately, we shine light on the opportunities that income and working status afford as well as the behaviours and lifestyle choices that education confers. Combined, these associations act as the SES effect on obesity in Canadian boomers.

SES and Obesity

The basic mechanism of obesity is the result of consuming more calories than are needed to function. But such a simple obesity origin mechanism is not easily reversed (LePetit & Berthelot, 2005). As Schlosser (2002) explains, over thousands of years of food scarcity, the human animal evolved efficient

physiological mechanisms to store energy as fat. Until very recently, most societies did not have the benefit of an overabundance of food (Schlosser, 2002) and as such, the human phenotype, or the physical representation of successfully passed down genes (genotype) is more efficient at gaining weight, than at losing it, purely as a survival mechanism. Thus, it is hardwired to do so.

However, what influences that greater caloric intake and the manner in which SES acts as a moderator on the modern health behaviours that create and maintain obesogenic propensities is less clear (Sobal & Stunkard, 1989). Increased obesity has been observed in families who report being food insecure, ran out of food or were unsure if they could obtain sufficient food (Olsen, 1999 as cited in Dossett, 2000). This begs the question: how do those who experience food insecurity and have less food or less stable food resources experience an increase in obesity if the basic mechanism is greater caloric intake than expenditure? (Dossett, 2000). A possible answer may lie in the quality and nutritional density of the food that is available.

Population health research shows a long-established link between obesity and low income. Especially among women, there exists a strong inverse relationship between BMI and SES (Monteiro et al., 2007; Dossett, 2000). Women who earn more and have higher education show low levels of being overweight and obese (Kuhle & Veugelers, 2008).

A common assumption regarding the inverse relationship between SES and obesity is that a lower level of education is linked to less knowledge about healthy nutrition, exercise and healthy lifestyle behaviours (Dossett, 2000).

Seemingly, those with less education may seek health knowledge and try to change health behaviour less often. Jeffrey & French (1996) considered this question and found that lower income women had a higher percentage of fat intake and a higher mean energy intake, although they could not speak to whether poverty and less education preceded obesity.

Marmot (2004) found that High Density Lipoprotein (HDL) cholesterol level is linked to obesity and both are connected to location in the socioeconomic rank of a society. In healthy individuals, about 30% of blood cholesterol is carried by HDL and cholesterol contained in HDL particles is considered beneficial for cardiovascular health as opposed to "bad" cholesterol or Low-Density Lilpoprotein (LDL). Marmot (2004) found that study participants higher up the SES ladder had lower HDL cholesterol levels and thereby lower risk for cardiovascular disease. He contends that eating a poor diet combined with the psychological stress associated with lower SES rank plays a major part in the development of obesity and risks for cardiovascular disease (2004).

The inverse relationship between rising obesity levels and lower SES exists when comparing developed nations such as Canada to developing nations such as Brazil (Monteiro, 2007). In a seminal review of cross-sectional data studying SES and obesity published prior to 1989, Sobal & Stunkard concluded that obesity was in essence a health concern of the socio-economically advantaged countries (fat nations). In developing countries the opposite was true, those who were poor experienced lower obesity (1989), however, more

recently a number of developing countries are showing signs of converging with developed ones in terms of obesity rate.

In Wister's study on baby boomer health dynamics, Canadian baby boomers in lower income levels experienced a slower rise in obesity (BMI) rate between 1985 and 2000/01 compared to those in the higher income group, but the difference was only 10% between groups (2005). This finding was supported by Kuhle & Veugelers in 2008 when they examined the social gradient in obesity.

Thus, there is evidence that unhealthy body weight is tied to an individual's economic resources. However, there may be indication of convergence of obesity rates across SES strata as well as globally (Monteiro, 2007; Sclhosser, 2002).

Gender, SES & Obesity

There is strong evidence that gender interacts with social determinants of health (Matthews, Manor & Power, 1999). One of the tenets of public health in developed countries such as Canada is that individuals in lower SES categories tend to experience poorer health (Kuhle & Veugelers, 2008). We know that males and females experience differing life expectancies around the world. In Canada the majority of seniors are women, and this is especially so in older age groups. In 2005 women accounted for almost 75% of persons aged 90 or older, while they accounted for 52% of persons aged 65 to 69. Longer life expectancy among women explains their over-representation in older age groups (Stat Can: A Portrait of Seniors in Canada, 2006. Accessed March 19, 2009).

The social gradient in health is less consistent when considering differential rates of obesity between males and females (Kuhle & Veugelers, 2008; Borders, Rohrer & Cardarelli, 2006; Wister, 2005; Wardle, Waller & Jarvis, 2002; Sobal & Stunkard, 1989). Kuhle & Veugelers (2008) note that studies comparing Canadian national longitudinal data show the prevalence in obesity to be rising faster in the highest SES groups than in the lowest SES groups and that most recently, this trend varies with gender. Specifically, Kuhle & Veugelers' (2008) study showed no association between household income and obesity among women but a positive association among men. They also found a negative association between education and obesity among women, but not among men.

Borders, Rohrer & Cardarelli (2006) found that higher household income protects females from obesity but that the inverse association is true for males. They suggest that women of higher SES are more likely to engage in preventive health behaviour than are their male counterparts in the same SES category (2006). These findings were similar for Zhang & Wang (2004) who found that among men, the burden of obesity appears to be equally distributed across all SES groups. They also found that men in high SES were significantly more likely to be overweight than men in low SES and women of high SES were significantly less likely to be overweight than their counterparts in low SES (2004). However, in a longitudinal analysis of the NPHS from 1992/3 – 2002/3, LePetit & Berthelot (2005) found the opposite, that for both men and women, higher income translated into protection against obesity.

Thus far, research has discussed the gender difference in the social gradient in obesity health, but cannot speak to causation. Wardle, Waller & Jarvis (2002) state that the three variables commonly used to equate SES: education, income and occupation, all operate in subtly different manners and note that the relationship between gender, SES and obesity may vary with the SES index being used. There is very little research that considers gender disparity in obesity and the specific relationship with all three SES variables: income, education and occupation (Zhang & Wang, 2004; Wardle, Waller & Jarvis, 2002). This type of comparative research is important at the population level for public health promotion and health policy as well as tailoring health information to better match need at the individual level.

Riley's Social Change Model

As people age, they change socially, psychologically and biologically (Riley, 1993). The process of aging is not static over time, but changes across as well as within cohorts as society changes (Riley, 1993) and this is integral to the concept of age-stratification. It is understood that older adults in the future will not behave the "same" as older adults in a current given cohort because they are born into different periods and experience different cohort-level historical effects. All generations are aging at the same rate, yet, the way in which obesity levels are affected by SES in the baby boomer population may differ from how it is influenced in the following generation.

Specifically, Riley's Social Change Model (1993) connects macro-level social changes to micro-level individual health and health behaviour opportunities and behaviours (Wister, 2005). This has been lacking in much of the body of research currently available in the influence of SES on obesity (Popkin, Duffey & Gordon-Larsen, 2005). The roots of Riley's (1993) model are the combined universal concepts of aging (age stratification), cohort succession and the life course approach. A generation, such as the baby boomers, needs to be studied in terms of age, period and cohort effects, as well as by their interaction (Wister, 2005). An **age effect** is an index for information about the life course (Riley, 1993), but speaks specifically to the effect of chronological age on the outcome of interest. An age effect on obesity levels would be demonstrated by an increase in obesity relative to an increase in age. A **cohort effect** constitutes information on the changing age stratification of a population (Riley, 1993) such that people born in the same birth cohort experience similar patterns in an outcome due to its size. A cohort effect on obesity levels would be demonstrated by observing age cohorts, or an entire generation with respect to rising obesity levels (such as found in the baby boomers). A **period effect,** also known as a historical effect, arises out of shared historical and period events and experiences (Wister, 2005). Such shared influences for the purposes of this thesis, would be the introduction of fast food, communications and transportation technologies.

There are four major theoretical components to Riley's Social Change Model (1993). First, the cohort approach provides the opportunity to identify

changeable factors affecting health by comparing cohorts of individuals who age under different historical circumstances. Second, age relevant or irrelevant life course trends can be identified when historical period effects (such as the introduction of internet and fast food production technologies) can be observed as influencing an entire population or only specific age groups. The life course approach follows over time, the lives of individuals within a single cohort in order to study health and its antecedents and consequences in relation to the aging process (Riley, 1993). The life course approach requires longitudinal data in order to find patterns and identify their time-based source and make health forecasts for the future (Riley, 1993).

Third, the cohort approach can help clarify what health characteristics of a population may look like in the future by identifying health patterns in successive cohorts. Fourth, the health of a population is best understood as a mix of successive birth cohorts with unique health and illness patterns connected to their cohort size, composition, life experiences and exposure to structural norms and historical events (Riley, 1993).

Social change is a central component in this thesis. In Riley's model (1993), "social change means not only that new cohorts are continually entering the population while others are leaving, but also that the members of all existing cohorts are simultaneously ageing (sic) and thus moving from younger to older strata...cohort succession is the vehicle producing population changes, including changes in health and disease" (1993, p.45). For Riley then, social change is

influencing the health status of each aging cohort differently, although concurrently.

In this thesis it is argued that the most important social change is the introduction and adoption of technologies that enable convenient food production and consumption, communications, entertainment, transportation. Cutler, Glaeser & Shapiro (2003) are economists who theorize that technological innovations made since the late 1960's in the U.S. have allowed food manufacturers to cook inexpensive, mass produced food centrally and ship it for wide distribution and consumption. They suggest that rising obesity levels across countries since the late 1960's is correlated directly with increased access across all SES strata to new food manufacturing technologies and to a growing variety of processed foods. With regard to the questions in this thesis, applying Riley's model suggests that obesity is rising in the population as a whole, but differentially and over time as social change influences each age-sex-cohort and SES strata in Canadian society.

Social and Cultural Shifts

As discussed, research by Wister (2005) and Statistics Canada (1995) suggests that rates of obesity and sedentary activity levels are cutting across all income and education gradients over time and may be converging. For instance, Wister (2005) considered the education effect on obesity among Canadian baby boomers and found that midlife Canadians with post-secondary

education have been quickly catching up to the obesity levels of less-educated individuals in their cohort, leaving only a 20% difference to separate them.

Furthermore, in a study assessing changes in BMI trends over ten years in a cohort of Norwegian men and women, Reas and colleagues (2007) found that weight gain occurred across all education and income strata with no differential associations between SES strata and changes in BMI for either gender or region.

Increases in BMI were also found to occur in individuals with greater levels of education in two generations of Norwegian adults aged 40-42 in data from 1984-1986 and 1995-1997 (Meyer & Tverdal, 2005). This weight increase was not restricted to only middle-aged Norwegians but occurred in all adult age groups in the greater population, suggesting rising BMI and obesity levels is not primarily a cohort effect, but a general trend affecting all strata in society. The reason for the weight gain in the Norwegian population has not yet been identified but researchers suggest that a likely mechanism is a combination of decreasing daily physical activity over time combined with access to technological improvements without a concomitant decrease in energy consumption or food intake (Meyer & Tverdal, 2005).

The general trend in weight increase found by Meyer & Tverdal (2005) underscores that in industrialized nations, the inverse relationship between BMI and low SES has long been recognized as a public health concern. It has been argued that an increasingly pervasive, blanket exposure to an obesogenic environment may eventually work to narrow social gaps in BMI distribution (Zhang & Wang, 2004). Obesity has become a serious public health problem in

many industrialized countries and more recently has become an emerging issue in developing countries undergoing a rapid economic transition (Popkin & Doak,1998). Monteiro and colleagues (2007) contend that the current picture of the relationship between obesity and SES in both developed and developing nations is much more complex than previously assumed, and suggest that a gross national product of $2,500 per capita is the tipping point at which obesity begins to be more common among the poor than among the rich.

A growing number of studies in developing nations are suggesting that socioeconomic status (SES) is linked to the risk for obesity and indicate a positive association of obesity risk with urbanization, education and other indicators of higher SES in developing nations such as China (Xie et al. 2007). In developing countries such as China, dramatic social and economic changes, such as modernization and industrialization, are deemed to contribute to behavioural and nutritional transitions leading to significantly increased BMI and greater risk of obesity (Xie et al. 2007). This position is supported by Monteiro and colleagues (2007) who suggest that rising obesity levels in Brazil are based in "marked increases in urbanization and integration of the economy to global markets, coupled with increased penetration of the so-called Western culture" (p.1811).

Cutler, Glaeser & Shapiro (2003) note that lower prices on any good or commodity, especially food, improves quality of life for individuals in all SES strata. However, when people have trouble controlling how much they eat, then lowering costs of processed foods may exacerbate overeating and obesity levels

over time. They suggest technological innovation that allows mass preparation of foods affects consumption in two ways: 1) a decline in the price of food which increases its availability across all SES strata; and 2) reducing any time delay before consumption because processed foods are readily available and require no time preparation.

In a seminal work, Fast Food Nation (2002) Eric Schlosser speaks to the introduction and popularization of convenience and fast foods as the major social change that has taken place since the end of World War II (Schlosser, 2002). The popularity of North American fast food is a cultural "meme", or a cultural equivalent of a gene (Dawkins, 1989) that is being most literally consumed around the world by developing nations which are watching their own fast food industries take hold (2002). Indeed, rising obesity levels are correlated with cultural transfer (2002). Since that time, there have been no reports of decreasing trends of obesity levels from any country and no countries have been able to show the ability to even slow the rising obesity rate (Pietanen et al., 1996 as cited in Monteiro et al., 2007). In a follow-up to his 2005 research, Wister found a slowdown in rates of obesity in 2005 which may be attributable to the attention obesity is receiving at population health levels (Wister, 2009 April, Keynote Address).

What has changed, to speed the spread of obesity across genders, income and education strata, generations and countries, is not genetics or genetic predisposition to obesity, but rather, the way in which people live and eat (Schlosser, 2002). Availability and affordability of fast, convenient, low-quality

food and technologies, such as mass food production, video games, computers, television, cellular communications and reliance on using the automobile instead of walking, has created a complex social change. This social change has created a cultural shift in eating habits and health behaviour that we are seeing translated into a rapidly growing obesity epidemic across developed and developing nations (2002). This social change has occurred for all socioeconomic strata, despite income and education. This change may be an epi-genetic change, where genes and environment interact over time.

While obesogenic social change is occurring over time, obesity levels are associated with a constellation of other health and lifestyle variables that may be additive and interactive. The presence of chronic illness such as diabetes, high blood pressure (hypertension), arthritis, asthma or breathing disorders, stomach problems, are common associations for obesity (Cairny & Wade, 1998; Gilmore, 1999 as cited in Wister, 2005). Regular smoking and regular drinking are also commonly associated with obesity though obesity is more prevalent among former smokers and drinkers (Cairny & Wade, 1998; Gilmore, 1999 as cited in Wister, 2005). Higher personal stress levels relate to working status and income as well as hypertension and heart disease (Dallman et al., 2003). Of course a sedentary physical activity level contributes to obesity alone and in combinations with any or all of the above.

Summary

Research suggests that the underlying determinants of shifting BMI distributions (to the right over time) are undeniably complex but are indicative of

unfavourable societal and environmental conditions. These conditions contribute to immoderate caloric intake and malnutrition through eating fast and convenient foods. Socio-economic factors continue to be major determinants of health as well as of lifestyle, but that may be differentially changing over time for males and females.

Riley's Social Change Model, which combines life course theory, cohort analysis, and age stratification theory, would suggest that the influence of SES on obesity in previous generations of males and females may be weakening over time because of convergence of rates.

Widely available food processing technologies enable consumption of higher quantities of less expensive foods and make those foods available at all SES. Poor lifestyle choices made at the individual level may have negative effects at all socioeconomic levels of the Canadian baby boomer population, over-riding the health-protective influence of higher education and income and moving towards converging obesity rates over time.

Research Questions

Based on the literature review and Riley's Social Change Model, a series of research questions were built to consider obesity rate change over time, SES effects and associated changes over time, sex differences within those effects and lifestyle effects.

We know that obesity rates have steadily increased since the 1980's and that lower socio-economic strata have seen faster obesity rate increases until recent history. Thus we consider:

I. What is the rate of obesity among baby boomers across SES strata over time?

- To what extent does the rate of obesity increase or decrease?
- What is the degree of difference between the SES strata in terms of obesity change?

We know that socioeconomic status influences obesity rates in several studies in Canada and worldwide, but the individual contributions of income, education and working status are less well understood. It is also not clear if income and education continue to provide protection against poor health and obesity. Thus we consider:

II. What are the predictive effects of income, education and working status on obesity in baby boomer aged individuals (35-54 yrs) in 1994 and in 2004?

- Does the strength of the predictive effect of income, education or working status converge over time?

The social gradient in health is less consistent when considering differential rates of obesity between males and females; thus we consider:

III. Are there differential effects for income, education and working status on the obesity rates of male versus female baby boomers?

IV. Does the effect of income, education or working status on obesity change when examining the role of other predictors such as physical activity?

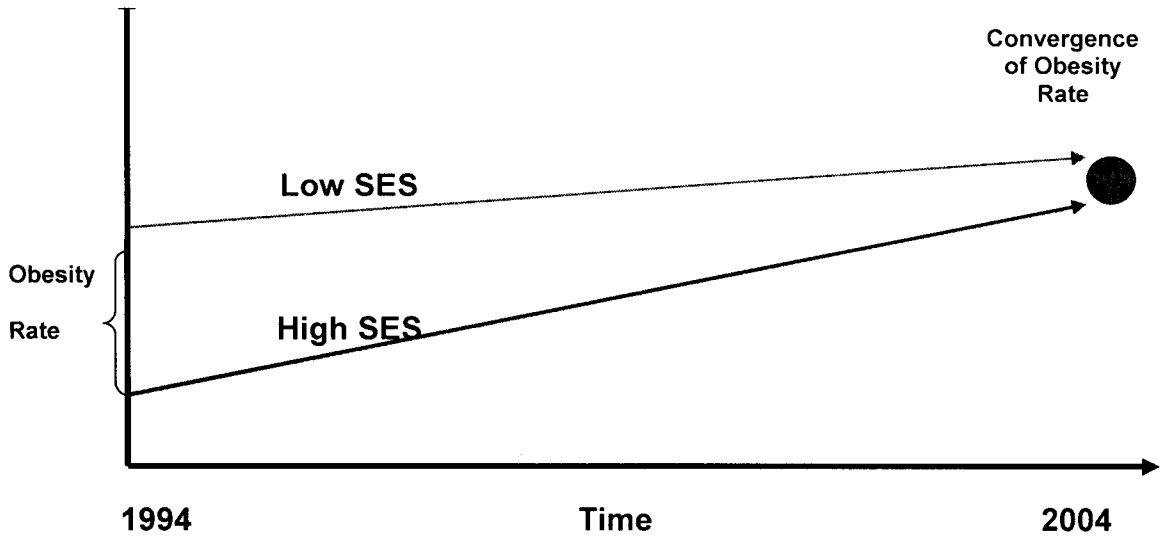
Hypotheses

Table 1 Summary of Hypotheses

	Hypotheses
Ho 1	Prevalence rates of obesity increase at a faster rate among higher SES strata than in lower SES strata and move towards convergence of obesity rates.
Ho 2	The independent effects of income, education and working status on obesity will decrease over the ten year period of study.
Ho 3	An interaction effect between sex and SES will show a decreased SES effect for females and an increased SES effect for males.

The three hypotheses were built by distilling the research questions into efficient, observeable and testable inferences. Above is a table of hypotheses tested through the analytic hierarchical regression model in both the '94 NPHS and the '04 CCHS. All hypotheses were tested with sex splitting the analyses in order to find any differential effects for males and females in the baby boomer sample populations. Though we are not testing Riley's Social Change Model directly, it is used to build the analytical model, suggest changes over time and to interpret the results of the hypotheses being tested.

Figure 1 Model of Convergence of Obesity Rates in High & Low SES Levels



In the convergence model above, the obesity rate for high socioeconomic (SES) strata (high education, high income, working status) in 1994 is lower than that of the obesity rate for low socioeconomic strata. This is the result of the protective effects of education and income on health status. This thesis hypothesizes that in the ten years between data sets (1994-2004) the obesity rate of higher SES will come close to or converge upon the obesity rate of lower SES, due to social change.

CHAPTER 3: METHODS

Data from adult respondents aged 35-54 drawn from the 1994 National Population Health Survey – Health Microdata File and the 2004 Canadian Community Health Survey (cycle 2.2) were used. A series of frequencies, crosstabular analyses and multivariate analyses regressing income adequacy, educational attainment and working status as well as other determinants of obesity (BMI 30+) were performed separately by sex.

Data Sets

Comparative analyses were conducted using the 1994 National Population Health Survey (NPHS) – Health Component Public Use Microdata File and the Canadian Community Health Survey (CCHS) 2004 Cycle 2.2 Public Use Microdata File, which are approximately a decade apart.

The **1994 National Population Health Survey** – public use Health microdata were collected beginning in four stages from1994 through 1995. Data collection was spread over four quarters (June, August and November 1994, and March 1995) and interviews were conducted by Statistics Canada Labour Force Survey (LFS) interviewers, part-time employees trained specifically to carry out the LFS, using the computer-assisted interviewing (CAI) method.

The data collected are cross-sectional with supplemental panel data bi-annually. The target population of the NPHS is related to the health of the

general Canadian population and thus targets residents in all provinces with the specific exclusion of citizens residing on Indian Reserves, Canadian Armed Forces Bases and some remote rural areas of Quebec and Ontario. Separate surveys were conducted to specifically target long-term residents of hospitals and care institutions as well as residents of the Yukon and Northwest Territories (NPHS User Guide, 1995). The sample design considered for the household component of the NPHS was a stratified two-stage design. In the first stage homogeneous strata are formed and independent samples of clusters are drawn from each stratum. In the second stage dwelling lists are prepared for each cluster households that are selected (Statistics Canada, NPHS User Guide, 1995).

The NPHS questions were designed for CAI and all respondents were first contacted in person except for a small sample in British Columbia that was conducted by telephone. Many interviews which were begun in person were finished on the telephone either because the selected respondent was not available at the time of the initial visit or because the long interview time prevented the completion of the interview in one contact. The total interview took an average of one hour in each household. In all dwellings, information about all household members is obtained from a knowledgeable household member - usually the person at home at the time of the interviewer visit ('proxy' reporting). All data were self-reported, including anthropomorphic data such as height and weight.

The **2004 Canadian Community Health Survey (cycle 2.2)** public use microdata file is a cross-sectional survey that collects information related to demographics, health, health care utilization, social environment, physical activity, nutrition and anthropomorphic measures (height and weight) for the Canadian population. (Statistics Canada, CCHS 2.2 User Guide, 2004).

The CCHS operates on a two-year collection cycle. The first year of the survey cycle ".1" is a large sample, general population health survey, designed to provide reliable estimates at the health region level. The second year of the survey cycle ".2" is a smaller survey designed to provide provincial level results on specific focused health topics. Data on anthropomorphic measures such as height and weight were collected by surveyors in person (Statistics Canada, CCHS 2.2 User Guide, 2004).

This Microdata File contains data collected in the fourth year of collection for the CCHS (Cycle 2.2). Information was collected starting in January 2004 and through to January 2005 in the ten provinces. The CCHS (Cycle 2.2) collected responses from persons of all ages, living in private occupied dwellings. Excluded from the sampling frame were individuals living in the three Territories, on Indian Reserves and on Crown Lands, institutional residents, full-time members of the Canadian Forces, and residents of certain remote regions (Statistics Canada, CCHS 2.2 User Guide, 2004).

Samples

The NPHS sample of N=17,626 people aged 12 years to 80+ years was filtered to exclude all individuals not falling into the baby boomer aged cohort age span of interest: 35-54. Given that the focus of this thesis was on factors leading to obesity, the sample was then further filtered to exclude underweight individuals with a BMI falling below 18.5, thereby filtering out respondents who fell below normal weight, which is typical in these types of analyses.

The age and BMI filtered sample was then weighted and re-scaled for representativeness by applying the NPHS weight (WT6) n = 9,654,278 and dividing the filtered sample size (n=6,777) by the NPHS weighted sample size (n = 9,654,278) to arrive at a value of 0.0007020. The new weight for the NPHS age and BMI filtered sample was then computed into a weight variable (NEWWT) and applied to the sample. The sample was therefore re-scaled with a resulting n=6,777.

The CCHS sample of 145,787 people aged 12 years to 80+ years was filtered to exclude all individuals not falling into the baby boomer aged cohort age span of interest: 35-54. This allowed for comparison of the age span of interest across 10 years of data and thus controlling for all age-related interactions in the analyses. As with the NPHS data set, the sample was then further filtered to exclude individuals with a BMI falling below 18.5, thereby filtering out respondents who fell below normal weight (see Dependent Variable).

The age and BMI filtered sample was then weighted and re-scaled for representativeness by applying the CCHS weight (WTSC_M) n=11,719,192 and dividing the filtered sample size (n=61,588) by the NPHS weighted sample size (n = 11,719,192) to arrive at a value of 0.0054899. The new weight for the CCHS age and BMI filtered sample was then computed into a weight variable (NEWWT) and applied to the sample. The sample was therefore re-scaled for representativeness with a resulting n=61,588.

Trend Analysis Design

This study employed secondary data analysis using cross-sectional data from two surveys collected 10 years apart (1994 and 2004) to identify whether the associations of education, income and working status with obesity changed over time.

The focus of the analyses was on Canadians between the ages of 35-54 in 1994 and in 2004 using the 5 year age groupings available in the public use microdata sets. These age groups were chosen in order to isolate as closely as possible, the baby boomers' age cohort during the survey years of 1994 and 2004. In Wister's (2005) analyses, the baby boomer aged individuals would have been between ages 36-55 in 2001. In choosing the 5 year age group of 35-54, this analysis captured the bulk of baby boomer aged individuals in both data sets, though not perfectly and allows for comparison with Wister's (2005) data to these results.

By examining these identical age groups, one in each data set, any age effects that are present due to chronological age were statistically controlled. This helps to isolate SES effects on obesity while identifying the period effects of social change on both sample populations. Although we could also examine cohort or age effects over time, it was determined that trend analysis (period effects) are the most important to examine for the present study.

Measures

Measures of major correlates of obesity were drawn from the Social Determinants of Health model and the work of Kaplan and colleagues (2003). Early on in the development of this research the Kaplan et al. (2003) study on overweight and obesity among adults aged 65+ became a key building block. In that study, Kaplan and colleagues looked at predictors and correlates of overweight and obesity in older adults using logistic regression, stratified by gender and used predictor variables including: Age, education, marital status, place of birth, region, smoking status, alcohol use, chronic conditions, physical activity, functional limitations, self-rated health, social support and psychological distress.

Kaplan et al. (2003) uniquely created a "comorbidity" variable made up of a constellation of correlated chronic illnesses that are very often present in obese individuals: asthma, arthritis, rheumatism, back problems, high blood pressure, chronic bronchitis or emphysema, diabetes, heart disease, effects of a stroke, bowel disorder, Alzheimer's disease, cataracts or glaucoma. Out of that list, key chronic condition variables that matched closely to Kaplan et al.'s (2003) list were

chosen, but did not include all of them as this research focused on individuals below the age of 65 i.e.) no eye conditions etc.

Chronic conditions can be both correlates and outcomes of obesity. One cannot always point to causation, such that obesity causes a chronic condition or a chronic condition causes obesity. For the purposes of this research, chronic conditions are used as correlates based upon Kaplan et al.'s (2003) model and to give an objective measure of health instead of using a variable for number of chronic conditions.

Demographic variables in the model included: age, sex, province, marital status and foreign born status. Mental and physical health variables included: self-rated stress, high blood pressure, heart disease, diabetes, arthritis, respiratory and stomach problems (Kaplan et al., 2003; Cairney & Wadet, 1998). Lifestyle variables included: smoking, consumption of alcohol and frequency of physical activity (Kaplan et al., 2003).

Education is cited as being a more reliable measure of SES than either income or occupation (Liberatos, Link & Kelsey, 1988 as cited in (Xie et al. 2007). Both education and income are ordinal variables. Income is typically separated into quintiles and in this thesis education was separated into quartiles. This treatment may be crude but afforded the opportunity to capture subtle between group differences that might otherwise be missed with fewer groups.

Dependent Variable

The regression model (both data sets) used BMI split into obese or non-obese as the dependent variable. This recoded DV was based on original

derived BMI score variables in both data sets. In both the NPHS and the CCHS, anthropomorphic measurements were taken, though the NPHS collected self-reported height (in metres) and weight (in kilograms) while the CCHS collected in-person data for height and weight. Although self-reported weight might be considered to be biased due to reporting lower weights, this bias is not considered to be large based on the dichotomization of obesity into >=30 and <=29. Also, obesity rates showed increase over time, which would be magnified if the bias was eliminated.

In the NPHS, the derived variable DVBMI94 gave a numerical BMI score to all persons aged between 20-64 years inclusive (excluding pregnant women) based on the calculation: BMI=weight (KG) / Squared height (Metres). In the CCHS, the BMI derived variable HWTCGBMI variable measured the respondent's weight relative to their height calculated by dividing weight in kilograms by their height, measured in meters, squared. BMI = WEIGHT (KG) / HEIGHT (METERS) SQUARED. This is the standard BMI calculation used in both data sets on same age groups.

In both the NPHS and the CCHS, the derived BMI score variables were recoded by splitting the variable into BMI<=29 and BMI>=30. Anything falling at or above a BMI of 30 fell into the "obese" category and anything falling at or below a BMI of 29 fell into the "non-obese" category. This recoded dichotomous BMI variable (BMI2CAT) is identical in both data sets because it is based on the derived BMI score variable and not the weight category variables. This allowed ease of comparison of the dependent variable across data sets.

Independent Variables

Block 1 –Socioeconomic Variables

In both data sets the income adequacy variable classifies the total household income (DVINC594 and INCADIA5) into 5 categories based on total household income and the number of people living in the household. An advantage of using large, Statistics Canada datasets is that in both the NPHS and the CCHS income adequacy (income level) was measured using equivalent cut-offs. The lowest income level is set at less than $10,000 if the household contains 1 to 4 people or less than $15,000 if the household contains 5 or more people. Lower middle income is set at $10,000 - $14,999 if the household contains 1 or 2 people; $10,000 - $19,999 if the household contains 3 or 4 people or $15,000 - $29,999 if the household contains 5 or more people. Middle Income is set at $15,000 - $29,999 if the household contains 1 or 2 people; $20,000 - $39,999 if the household contains 3 or 4 people and $30,000 - $59,999 if the household contains 5 or more people. Upper Middle Income is set at $30,000 - $59,999 if the household contains 1 or 2 people; $40,000 - $79,999 if the household contains 3 or 4 people and $60,000 - $79,999 if the household contains 5 or more people. The highest income level is set at greater than or equal to $60,000 if the household contains 1 or 2 people and greater than or equal to $80,000 if the household contains 3 or more people.

Education variables were not identical in both data sets and as such, the NPHS education variable DVEDC294 which originally had 12 categories was recoded to match the education variable in the CCHS which had only four categories. The original NPHS education variable was split into: no schooling, elementary, some secondary, secondary graduation, other beyond high school, some trade school, some community college, some university, trade school diploma/certificate, community college diploma/certificate, bachelor degree including LLB, MA/PhD/MD. In order to match the CCHS education variable, the above were categorized into: less than secondary, secondary graduate, other post secondary and post secondary graduate with all others as system missing.

The original intention had been to have a working status variable split into full-time, part-time, unemployed and other. Unfortunately there were no equivalent variables in both data sets. As such, the NPHS variable for working status in the past year (DVWK94) which was originally coded as currently working, not currently working and did not work in past 12 months was recoded into: currently working and all others with remaining data as system missing (RECODE_DVWK94). In the CCHS a variable closely resembling DVWK94 was chosen to make comparison possible, and the original variable LBFCGJST (job status over last year) originally coded as job all past year, without / looking (or not) and had job (looking) was recoded into currently working and all others with remaining data as system missing.

Block 2 – Demographic Variables

Sex was identically coded in both data sets. Age was coded within standard 5 year groups in both data sets. Marital status was coded slightly differently in each data set. NPHS coded marital status (MARSTATG) as married / common law, single and other while the CCHS (DHHCGMS) coded marital status as married, common law, widow/separated/divorced, single. This variable was not recoded to match as it was deemed easy to analyze across data sets despite slight differences. Immigrant status was coded identically in both data sets as either yes or no to the "are you an immigrant" question.

Province of residence was coded identically from east to west as Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia in both data sets, with the exception that the CCHS included Yellowknife/Northwest Territories/Nunavut as the final category after British Columbia. For actual variable names from both data sets are listed in hierarchical order of input into the regressions, please see Appendix A.

Block 3 – Physical & Psychological Health

The physical and psychological health variables chosen were based on the determinants of health and known correlates of obesity. In the NPHS all chronic illness items were coded as yes, no or no answer. In the CCHS all chronic illness items were coded as yes, no but with additional options for no answer, don't know, refusal and not stated (NS). These variables were all easily comparable across data sets with the slight difference that NPHS combined

bronchitis with emphysema in one variable (CHRQI_H) and also combined stomach illness with intestinal illness (CHRQI_N). The personal stress variables in each data set were not identical. The NPHS measured personal stress as a derived variable (DVCSI494) based on five questions (Q1, Q2, Q3, Q12, Q18) in the chronic stress section (C-STRESS) of the questionnaire, giving a minimum score of 0 and a maximum score of 5 where higher values indicated more stress.

In the CCHS self-perceived stress was an ordinal variable coded as not at all, not very, a bit, quite a bit, extremely and not applicable, don't know, refusal and NS for missing data. Comparison of the personal stress variables across data sets is not as clear as with the chronic illness variables, but one can look to significance level and odds ratios to determine whether stress has impact on obesity in each data set without having direct variable matching.

Block 4 – Lifestyle Variables

The lifestyle variables chosen are known correlates of obesity. The type of smoker variable in the NPHS (DVSMT94) was more sensitive than the CCHS type of smoker variable (SMKC_202) and was coded as daily smoker, occasional smoker (former daily), always occasional smoker, former daily smoker, former occasional smoker, never smoked and NS. The CCHS coded type of smoker more simply as daily, occasionally, not at all, not applicable, don't know, refusal and NS. The NPHS type of smoker variable was not recoded to match the CCHS variable, as it was not immediately intuitive how to recode appropriately. In order not to lose sensitivity both type of smoker variables were left as-is. As with the comparison of the personal stress variables across data sets,

comparison of the type of smoker variables is not ideal but one can look to significance level and odds ratios to determine impact on obesity in each data set without having direct variable matching.

The type of drinker variables in both the NPHS (DVALT94) and the CCHS (ALCCDTYP) are virtually identical and coded in each data set as daily, occasionally, not at all. The only difference being that NPHS includes NS for missing data and the CCHS includes not applicable, don't know, refusal and NS. The NPHS physical activity index variable was derived in the following manner. Energy expenditure values used to categorize individuals were the same as those used in the Ontario Health Survey and in the Campbell's Survey Well-Being. Active described those who averaged 3.0+ kcal/kg/day of energy expenditure. This is approximately the amount of exercise that is required for cardiovascular health benefit. Moderate described those who averaged 1.5 - 2.9 kcal/kg/day. They might experience some health benefits but little cardiovascular benefit. Inactive described those with energy expenditure below 1.5 kcal/kg/day.

In the CCHS the physical activity index was derived from another variable (PACDEE) that calculated the total daily Energy Expenditure values (kcal/kg/day) per physical activity using the following calculation: EE (Energy Expenditure for each activity) = (N X D X METvalue) / 365 Where: N = the number of times a respondent engaged in an activity over a 12 month period; D = the average duration in hours of the activity; MET value = the energy cost of the activity expressed as kilocalories expended per kilogram of body weight per hour of activity (kcal/kg per hour)/365 (to convert yearly data into daily data). The

physical activity index then categorizes respondents as being "active", "moderate", or "inactive" based on the total daily Energy Expenditure values (kcal/kg/day) calculated for PACCDEE. The CCHS Physical Activity Index also follows the same criteria used to categorize individuals in the Ontario Health Survey (OHS) and in the Campbell's Survey on Well Being.

The physical activity index variables in both the NPHS (DVPAID94) and the CCHS (PACCDPAI) were coded the same as active, moderate, inactive. The only difference being that NPHS includes NS for missing data and the CCHS includes not applicable, don't know, refusal and NS.

Analysis

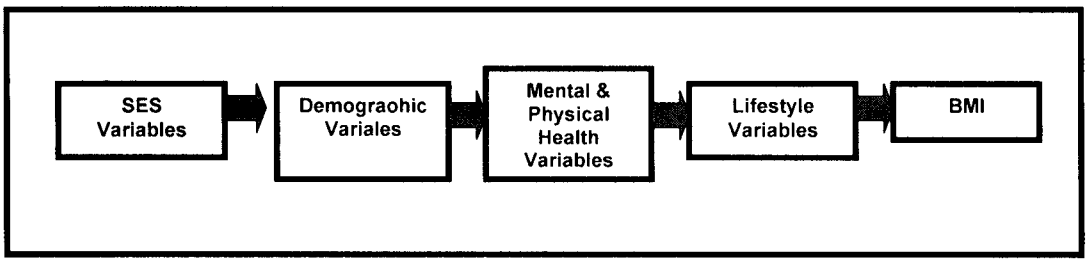
Statistical analysis was carried out using SPSS version 15.0. Hierarchical logistic regression was run with obesity, measured as BMI >= 30 as the dependent variable and with income, education and working status in past 12 months as key SES independent variables. No missing data were imputed in either data set, as sample sizes were deemed large enough to absorb any loss.

Analytic Strategy

Income, education and working status were added into the first block of the model, in order to determine the unique effect each has on BMI. The remaining independent variables were entered sequentially in order of predicted influence. The variables included SES variables: income adequacy, education level, working status; demographic variables: age group, marital status, immigration status, province; mental and physical health variables: arthritis, high

blood pressure, asthma, emphysema, diabetes, stomach / intestinal ulcers, personal stress index; and lifestyle variables: type of smoker, type of drinker, physical activity index.

Figure 2 Hierarchical Logistic Regression Analytic Model



The analytic model reflects how variables were entered into the logistic regression in order of importance and influence on obesity. The key elements of socioeconomic status: income, education level and working status combined with socio-demographic variables to influence mental and physical health, lifestyle and ultimately, determine obesity levels. The entire analysis in both data sets was split by sex in order to determine the differential influence of sex on the hypotheses and to find any sex / SES interactions.

CHAPTER 4: RESULTS

This section will describe results of hypothesis testing through descriptive statistics, bivariate statistics and regression analyses in both data sets. First, frequency tables for all variables in each data set will be presented, followed by bivariate analyses for the whole sample in each data set. The logistic regression results for both data sets will then be presented, with special attention paid to the SES variables and all other significant variables in the final block of analyses (block 4).

Descriptive Frequencies

The following table describes frequencies for the dependent and independent variables used in the analytic regression model in the NPHS '94.

Table 2 **Table of Frequencies: NPHS '94 Males & Females**

NPHS '94 Variables	Category	Frequency Males	Valid % M	Frequency Females	Valid % F
BMI (2 categories)	Non-Obese	2925	84.5	2757	83.2
DEPENDENT Variable					
	Obese	537	15.5	558	16.8
NPHS '94 Independent Variables					
Income Adequacy	Lowest (REF)	159	4.8	171	5.4
	Lower Middle	256	7.8	295	9.4
	Middle	804	24.4	842	26.7
	Upper	1334	40.5	1230	39.0
	Highest	742	22.5	617	19.6
Education Level	< Secondary (REF)	763	22.1	748	226.

NPHS '94 Variables	Category	Frequency Males	Valid % M	Frequency Females	Valid % F
	Secondary Graduate	488	14.1	623	18.8
	Other Post Secondary	808	23.4	799	24.1
	Post-Secondary Graduate	1394	40.4	1141	34.5
Working Status	Job all past year (REF)	2879	83.7	2177	66.0
	Without job for part of year & looking/not looking	562	16.3	1122	34.0
Age Groups	35-39 years (REF)	935	27.0	872	26.3
	40-44 years	815	23.5	779	23.5
	45-49 years	724	20.9	659	19.9
	50-54 years	562	16.2	519	15.7
	55-59 years	427	12.3	486	14.7
Marital Status	Married / Common Law (REF)	2850	82.3	2540	76.7
	Single	298	8.6	244	7.4
	Other	314	9.1	529	16.0
Immigration Status	Immigrant (REF)	765	22.1	731	22.1
	Non-Immigrant	2697	77.9	2584	77.9
Province	Newfoundland (REF)	68	2.0	67	2.0

NPHS '94 Variables	Category	Frequency Males	Valid % M	Frequency Females	Valid % F
	PEI	15	.4	15	.4
	Nova Scotia	99	2.9	97	2.9
	New Brunswick	92	2.7	89	2.7
	Quebec	919	26.5	842	25.4
	Ontario	1265	36.5	1279	38.6
	Manitoba	126	3.6	117	3.5
	Saskatchewan	102	2.9	102	3.1
	Alberta	322	9.3	298	9.0
	British Columbia	455	13.1	411	12.4
Arthritis	Yes (REF)	320	9.2	488	14.7
	No	3137	90.8	2826	85.3
High BP (Y/N)	Yes (REF)	277	8.0	289	8.7
	No	3180	92.0	3025	91.3
Emphysema	Yes (REF)	62	1.8	120	3.6
	No	3395	98.2	3194	96.4
Diabetes	Yes (REF)	97	2.8	83	2.5

NPHS '94 Variables	Category	Frequency Males	Valid % M	Frequency Females	Valid % F
	No	3359	97.2	3231	97.5
Stomach	Yes (REF)	121	3.5	144	4.3
	No	3335	96.5	3170	95.7
Personal Stress Index	0 (REF)	1281	39.9	1026	31.9
	1	913	28.5	847	26.3
	2	538	16.8	678	21.1
	3	343	10.7	448	13.9
	4	110	3.4	169	5.2
	5	21	.7	53	1.6
Type of Smoker	Daily (REF)	1055	30.5	812	24.5
	Occasional	131	3.8	71	2.1
	Always Occasional	47	1.4	44	1.3
	Former Daily	1043	30.2	755	22.8
	Former Occasional	207	6.0	230	6.9
	Never Smoked	973	28.2	1401	42.3
Type of Drinker	Regular Drinker (REF)	2577	74.6	1715	51.7

NPHS '94 Variables	Category	Frequency Males	Valid % M	Frequency Females	Valid % F
	Occ. Drinker	393	11.4	863	26.0
	Former Drinker	292	8.5	426	12.9
	Never Drank	189	5.5	310	9.4
Physical Activity Index	Active (REF)	518	16.0	475	14.7
	Moderate	730	22.6	690	21.3
	Inactive	1980	61.4	2070	64.0

The NPHS sample (n=6777) represented nearly a perfect split between males (51%) and females (49%) with just over one quarter of males falling into the 35-39 year age group (27%) followed by the 40-44 year age group (23.5%) and the same for females (26.3%; 23.5% respectively). The majority of males and females were non-immigrants (77.9% each). Married or common-law status describes the bulk of males (82.3%) and females (76.7%).

The majority of males fell into the upper middle income quintile (40.5%) ($30,000-$59,999 1 or 2 people; $40,000-$79,000 3-4 people; $60,000-$79,999 5+ people) followed by middle income quintile (24.4%) ($15,000-$29,999 1-2 people; $20,000-$39,000 3-4 people; $30,000-$59,000 5+ people) and for females it was the same (39%; 26.8% respectively).

Commensurate with income bracket, the majority of NPHS males (40.4%) and females (34.5%) were post-secondary graduates, followed by male (23.4%) and female (24.1%) with "other" post-secondary education. The majority of NPHS males (83.7%) and females (66%) had work in the 12 months prior to the completion of the questionnaire.

The provincial spread of the sample translated into the majority of males residing in Ontario (36.5%), followed by Quebec (26.5%) and British Columbia (13.1%). This pattern was also reflected in females with the majority residing in Ontario (38.6%), followed by Quebec (25.4%) and British Columbia (12.4%).

The following table describes frequencies for the dependent and independent variables used in the analytic regression model in the CCHS '04.

Table 3 Table of Frequencies: CCHS '04 Males & Females

Frequencies: CCHS '04 Males & Females					
CCHS '04 Variables	**Category**	**Frequency Males**	**Valid % M**	**Frequency Females**	**Valid % F**
BMI (2 categories)	Non-Obese	25867	81.6	25043	83.7
INDEPENDENT Variable	Obese	5818	18.4	4859	16.3
CCHS '04 DEPENDENT Variables	**Category**	**Frequency Males**	**Valid % M**	**Frequency Females**	**Valid % F**
Income Adequacy	Lowest (REF)	627	2.2	685	2.6
	Lower Middle	1045	3.7	1364	5.2
	Middle	3938	13.8	4185	16.0
	Upper	9554	33.5	9319	35.6
	Highest	13376	46.9	10629	40.6
Education Level	< Secondary (REF)	4498	14.6	4039	13.8
	Secondary Graduate	5779	18.7	6467	22.0
	Other Post Secondary	1748	5.7	1808	6.2
	Post-Secondary Graduate	18835	61.0	17016	58.0
Working Status	Job all past year (REF)	22354	73.5	17028	59.2
	Without job for part of year & looking/not looking	8074	26.5	11745	40.8

Frequencies: CCHS '04 Males & Females					
CCHS '04 Variables	**Category**	**Frequency Males**	**Valid % M**	**Frequency Females**	**Valid % F**
Age Groups	35-39 years (REF)	6873	21.7	6113	20.4
	40-44 years	7597	24.0	7066	23.6
	45-49 years	6290	19.8	6116	20.5
	50-54 years	5872	18.5	5769	19.3
	55-59 years	5055	16.0	4839	16.2
Marital Status	Married (REF)	21982	69.5	19957	66.9
	Common Law	3080	9.7	2851	9.6
	Widow / Separated / Divorced	2752	8.7	4350	14.6
	Single	3810	12.0	2676	9.0
Immigration Status	Immigrant (REF)	7075	23.1	6433	22.2
	Non-Immigrant	23569	76.9	22577	77.8
Province	Newfoundland (REF)	563	1.8	533	1.8
	PEI	138	.4	133	.4
	Nova Scotia	948	3.0	860	2.9
	New Brunswick	763	2.4	731	2.4
	Quebec	7658	24.2	7243	24.2
	Ontario	12212	38.5	11685	39.1
	Manitoba	1031	3.3	989	3.3
	Saskatchewan	893	2.8	815	2.7

Frequencies: CCHS '04 Males & Females					
CCHS '04 Variables	**Category**	**Frequency Males**	**Valid % M**	**Frequency Females**	**Valid % F**
	Alberta	3158	10.0	2728	9.1
	British Columbia	4232	13.4	4105	13.7
	Yukon / NWT / Nunavut	88	.3	81	.3
Arthritis	Yes (REF)	3857	12.2	6030	20.2
	No	27780	87.8	23823	79.8
High BP	Yes (REF)	4410	14.0	3777	12.6
	No	27191	86.0	26088	87.4
Emphysema	Yes (REF)	220	.7	163	.5
	No	31435	99.3	29712	99.5
Asthma	Yes (REF)	1738	5.5	2502	8.4
	No	29913	94.5	27375	91.6
Diabetes	Yes (REF)	1416	4.5	1136	3.8
	No	30244	95.5	28737	96.2
Stomach / Intestinal Ulcers (Y/N)	Yes (REF)	919	2.9	1038	3.5
	No	30720	97.1	28816	96.5
Self-Perceived Stress	Not at all (REF)	2739	8.7	2048	6.9
	Not Very	6102	19.3	6078	20.4
	A Bit	13569	43.0	12946	43.4

Frequencies: CCHS '04 Males & Females					
CCHS '04 Variables	**Category**	**Frequency Males**	**Valid % M**	**Frequency Females**	**Valid % F**
	Quite a Bit	7621	24.1	7296	24.4
	Extremely	1557	4.9	1479	5.0
Type of Smoker	Daily (REF)	7359	23.3	5913	19.8
	Occasionally	1552	4.9	1226	4.1
	Not at All	22654	71.8	22666	76.0
Type of Drinker	Regular Drinker (REF)	23063	74.6	17360	59.3
	Occ. Drinker	6342	11.8	6217	21.3
	Former Drinker	3084	10.0	3706	12.7
	Never Drank	1122	3.6	1971	6.7
Physical Activity Index	Active (REF)	7393	23.8	6474	21.8
	Moderate	7820	25.2	7806	26.3
	Inactive	15835	51.0	15419	51.9

The provincial spread of the sample translated into the majority of males residing in Ontario (38.5%), followed by Quebec (24.2%) and British Columbia (13.4%). This pattern was also reflected in females with the majority residing in Ontario (39.1%), followed by Quebec (24.2%) and British Columbia (13.7%).

The majority of males fell into the highest income quintile (46.9%) (>=$60,000 1-2 people; >=$80,000 3+ people) followed by upper middle income quintile (33.5%) ($30,000-$59,999 1 or 2 people; $40,000-$79,000 3-4 people; $60,000-$79,999 5+ people). Females showed the same pattern where the majority fell into the highest income quintile (40.6%) followed by upper middle income quintile (40.6%).

Commensurate with income bracket, the majority of males (61%) and females (58%) were post-secondary graduates, followed by male (18.7%) and female (22%) with post-secondary education. Married or common-law status describes the bulk of males (79.2%) and females (76.5%).

The majority of CCHS males (73.5%) and females (59.2%) had work in the 12 months prior to the completion of the questionnaire, though as in the NPHS there is a nearly 20% difference between males and females. This is possibly explained in both the NPHS and CCHS by stay-at-home mothers who are not looking for paid work outside the home during their child-rearing years.

Bivariate Results

Bivariate associations were first generated for the three socioeconomic variables: income level, education level and working status, and the dependent variable: BMI (Obese, Not-Obese) using the whole sample of males and females combined, in each data set. Kendall's Tau-c coefficient describes the degree of correspondence between rankings of two variables. Kendall's Tau-c coefficient lies between 0 and 1.0 where a positive coefficient indicates a positive association and a negative one indicates an inverse association.

Table 4 Total Sample Crosstab: Obesity by Income Adequacy Across Data Sets

Income Level	Lowest	Lower Middle	Middle	Upper Middle	Highest	Kendall's Tau-C	Statistical Significance
% Obese							
NPHS'94	20.7	15.1	16.3	15.4	15.2	-0.015	.141
CCHS'04	19.1	22	18.7	18.4	15.8	0.033	.000

In the crosstab analysis of the total sample examining the relationship between income level and obesity, the association between income level and obesity in the '94 NPHS was very low (-.015, NS). Approximately 10 years later in the '04 CCHS, the same association was weak but statistically significant (.033, p<=.001). For the whole sample in 1994, income adequacy and obesity were negatively related but by 2004 that same relationship changed direction and became positively related.

Table 5 Crosstab: Obesity by Income Adequacy Across Data Sets - Males

Income Level	Lowest	Lower Middle	Middle	Upper Middle	Highest	Kendall's Tau-C	Statistical Significance
% Obese Males							
NPHS'94	19	13.2	13.9	15.1	16.7	0.15	.294
CCHS'04	16.9	20	17.8	19.1	18.1	-.004	.378

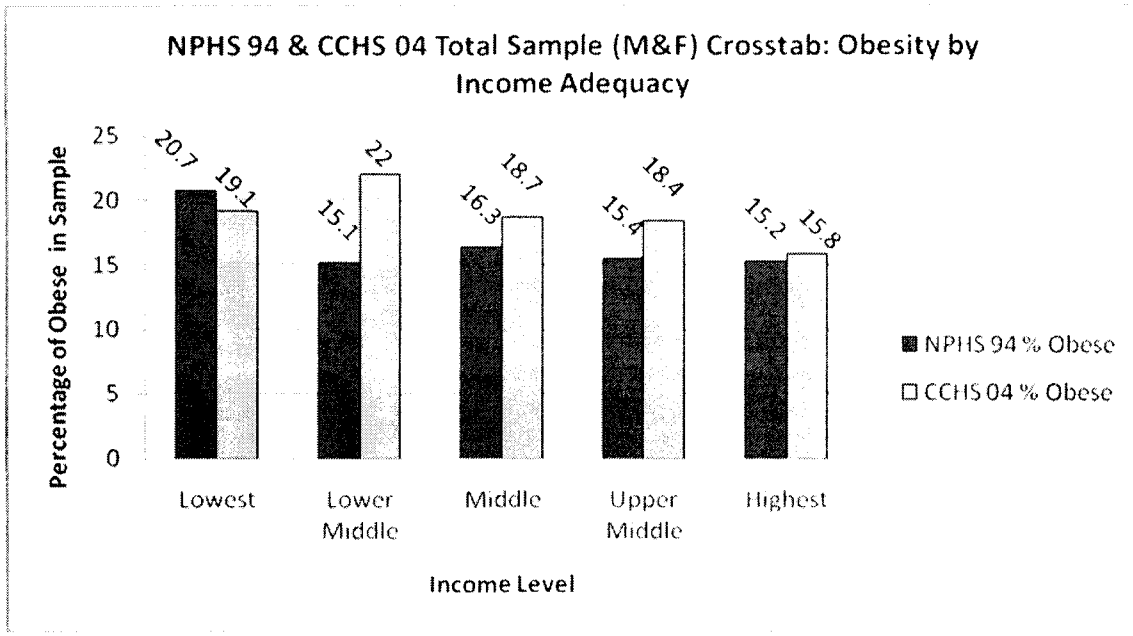
In the crosstab analysis of the total sample examining the relationship between income level and obesity, but split by gender, the association between income level and obesity in the '94 NPHS for males was weak (0.15, NS) and statistically insignificant. Approximately 10 years later in the '04 CCHS, the same association was very weak and remained statistically insignificant (-.004, p<=.001).

Table 6 Crosstab: Obesity by Income Adequacy Across Data Sets - Females

Income Level	Lowest	Lower Middle	Middle	Upper Middle	Highest	Kendall's Tau-C	Statistical Significance
% Obese Females							
NPHS'94	22.2	16.9	18.6	15.8	16.5	-.045	.002
CCHS'04	21.2	23.5	19.5	17.7	13.0	-.068	.000

The association between income level and obesity in the '94 NPHS for females was weak (-.045, p<=.01) and statistically significant. Approximately 10 years later in the '04 CCHS, the same association was weak and remained statistically significant (-.068, p<=.001).

Figure 3 Total Sample Crosstab: Obesity by Income Adequacy



The above graph pictorially illustrates the association in the crosstab analyses, in percentages, examining the relationship between income level and obesity in each data set for the total sample where the percentage of obese increased at all levels of income between the two data sets with the exception of lowest income level.

Table 7 Total Sample Crosstab: Obesity by Education Level Across Data Sets

Education Level	Less than Secondary	Secondary Grad	Other Post Secondary	Post Secondary Grad	Kendall's Tau-C	Statistical Significance
% Obese						
NPHS '94	19	14.7	18.9	13.1	-0.045	.000
CCHS '04	24.3	17.8	19.8	15.3	-0.057	.000

In the crosstab analysis examining the relationship between education level and obesity, the association between education level and obesity in the '94 NPHS was weak and statistically significant (-.045, $p<.001$). Approximately 10

years later in the '04 CCHS, the same association maintained the same direction, increased slightly in magnitude and was still statistically significant (-.057, p<=.001). For the whole sample, educational level and obesity are negatively related.

Table 8 Crosstab: Obesity by Education Level Across Data Sets - Males

Education Level	Less than Secondary	Secondary Grad	Other Post Secondary	Post Secondary Grad	Kendall's Tau-C	Statistical Significance
% Obese Males						
NPHS '94	19.3	15	17.2	12.3	-.056	.000
CCHS '04	23.5	20	20.1	16.6	-.050	.000

In the crosstab analysis examining the relationship between education level and obesity, but split by sex, the association between education level and obesity for males in the '94 NPHS was weak and statistically significant (-.056 p<.001). Approximately 10 years later in the '04 CCHS, the same association maintained the same direction, decreased slightly in magnitude and was still statistically significant (-.050, p<=.001).

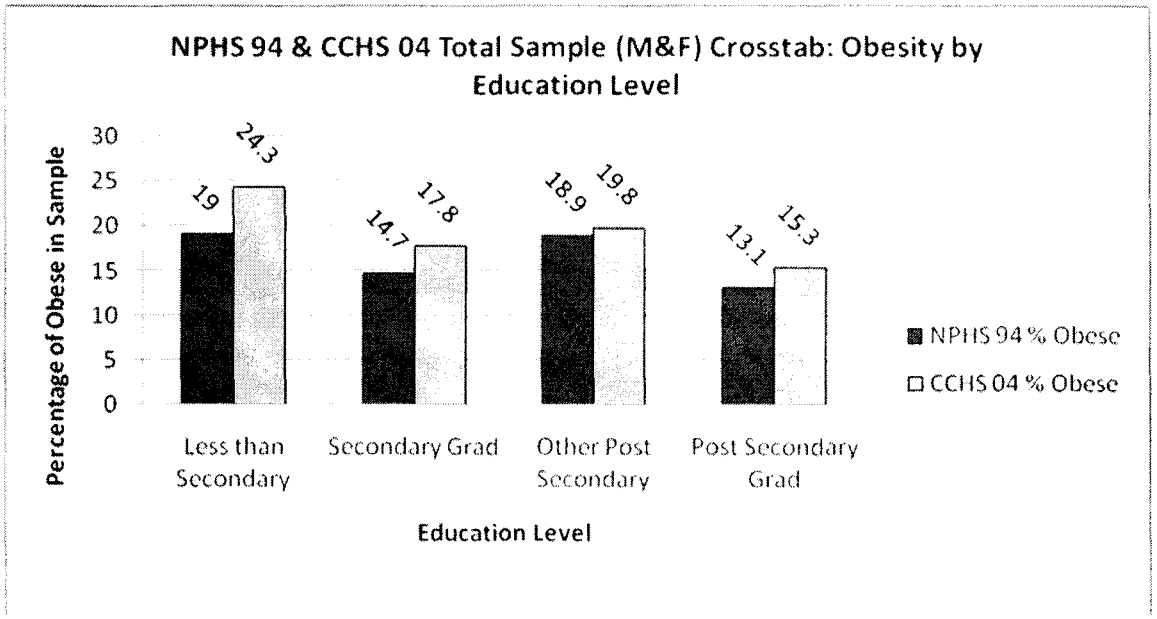
Table 9 Crosstab: Obesity by Education Level Across Data Sets - Females

Education Level	Less than Secondary	Secondary Grad	Other Post Secondary	Post Secondary Grad	Kendall's Tau-C	Statistical Significance
% Obese Females						
NPHS '94	18.7	14.4	20.7	14	-.030	.038
CCHS '04	25.3	15.9	19.5	13.9	-.066	.000

For females, the association between education level and obesity in the '94 NPHS was weak and statistically significant (-.030, p<.05). Approximately 10

years later in the '04 CCHS, the same association maintained the same direction, increased in magnitude and in statistical significance (-.066, p<=.001).

Figure 4 Total Sample Crosstab: Obesity by Education Level



The above graph pictorially illustrates the association in percentages, in the crosstab analyses, examining the relationship between education level and obesity in each data set for the total sample. Over ten years, the relationship between education and obesity increased at all levels of education.

Table 10 Total Sample Crosstab: Obesity Levels by Working Status

Working Status	Working All Past Year	Without job for part of year	Kendall's Tau-C	Statistical Significance
% Obese				
NPHS 94	15	19.4	0.033	.000
CCHS 04	16.7	18.7	0.018	.000

In the crosstab analysis examining the relationship between working status and obesity, the whole sample association between working status and obesity in the '94 NPHS was positive, weak and statistically significant (.033, p<.001). Approximately 10 years later in the '04 CCHS, the same association maintained the same direction, decreased in magnitude and was still statistically significant (.018, p<=.001). For the whole sample, the relationship between working status and obesity was positive in direction in both data sets.

Table 11 Crosstab: Obesity Levels by Working Status - Males

Working Status	Working All Past Year	Without job for part of year	Kendall's Tau-C	Statistical Significance
% Obese Males				
NPHS 94	15.3	16.4	.006	.536
CCHS 04	18	19.6	.013	.002

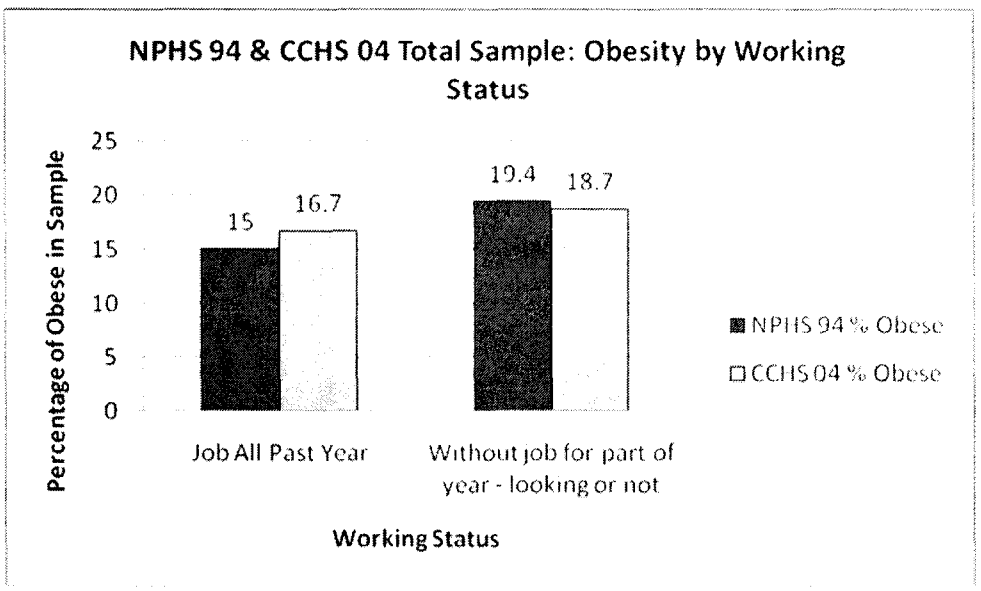
In the crosstab analysis examining the relationship between working status and obesity, the association between working status and obesity in the '94 NPHS for males was positive, very weak and statistically insignificant (.006, NS). Approximately 10 years later in the '04 CCHS, the same association maintained the same direction, increased in magnitude and reached statistical significance (.013, p<=.01).

Table 12 Crosstab: Obesity Levels by Working Status - Females

Working Status	Working All Past Year	Without job for part of year	Kendall's Tau-C	Statistical Significance
% Obese Females				
NPHS 94	14.6	21	.058	.000
CCHS 04	15.1	18.1	.029	.000

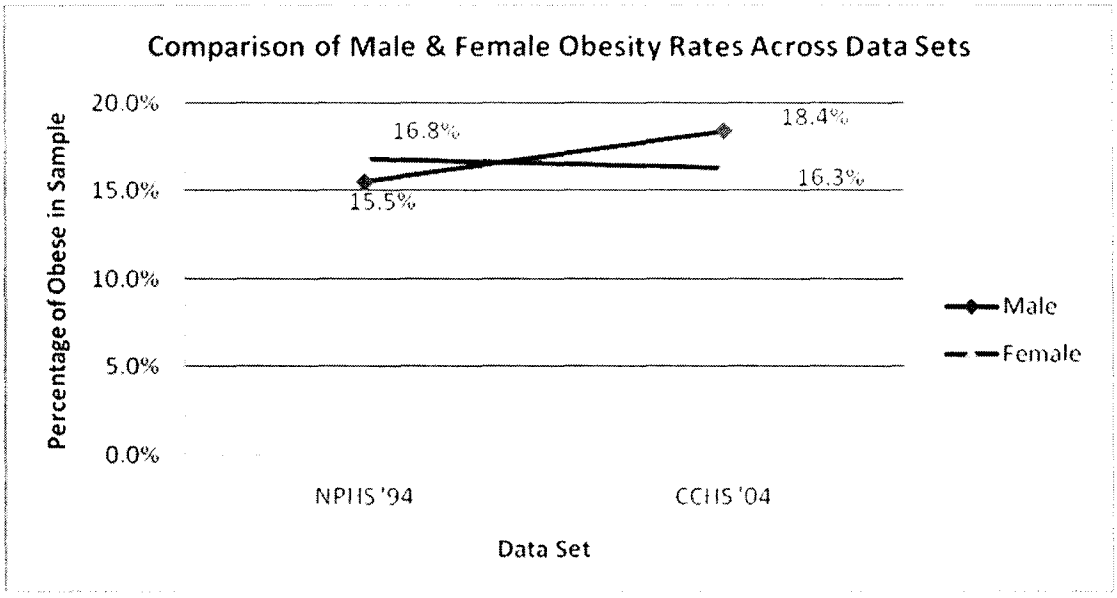
For females, the relationship between working status and obesity, association between working status and obesity in the '94 NPHS was positive, moderate and statistically significant (.058, p<.001). Approximately 10 years later in the '04 CCHS, the same association maintained the same direction, decreased in magnitude and was still statistically significant (.029, p<=.001).

Figure 5 Total Sample Crosstab: Obesity by Working Status



The above graph pictorially illustrates the association in percentages, in the crosstab analyses, examining the relationship between working status and obesity in each data set for the total sample.

Figure 6 Graph Comparison of Obesity Rate Across Data Sets



The above graph demonstrates the crosstab interaction of time, gender and obesity. In the '94 NPHS obese individuals accounted for 15.5% of males and 16.8% of females. However, in the '04 CCHS, obese individuals accounted for 18.4% of males and 16.3% of females. Within 10 years the obesity rate for males rose 2.9% while the obesity rate for females dropped slightly by only .5%.

For males, this indicates a 2.9% absolute change and a 19% proportional change in obesity over the approximate ten year time span between data sets. For females, this represents a -0.5% absolute change and a 0.03% proportional change in obesity over the approximate ten year time span between data sets.

Multivariate Results

The multivariate results represent statistically significant findings from the analytic regression model used in both the '94 NPHS and the '04 CCHS. Variables used in the regressions are the same for each data set. The full set of results, including insignificant variables and their coefficients, are presented in Appendix B.

The tables presented below are separated by gender and data set. Summary tables of coefficients, their associated odds ratios, 95% confidence intervals and significance levels compared across data sets complete this section.

Table 13 NPHS '94 MALES Significant Odds Ratios in Final Block of Regression Analysis

NPHS 1994 MALES Block 4 - Final	Coefficient	Odds Ratio	Confidence Interval (95%)
Variable	**(β)**	**Exp(β)**	**C.I. (lower – upper)**
Middle Income (lowest REF)	-.587*	.556	.336 - .921
Post-secondary graduate (< Secondary REF)	-.443**	.642	.482 - .856
Age Group 45-49 (35-39 REF)	.372*	1.451	1.064 – 1.980
Non-Immigrant (Immigrant REF)	.402**	1.495	1.125 - 1.986
Chronic Illness - High Blood Pressure (Yes REF)	-.926***	.396	.291 - .540
Chronic Illness – Diabetes (Yes REF)	-.664*	.515	.308 - .862
Stress Index 3 (0 REF)	.374*	1.454	1.046 – 2.022
Alcohol Consumption – Occasional (Regular REF)	.384**	1.469	1.147 – 2.203

NPHS 1994 MALES Block 4 - Final	Coefficient	Odds Ratio	Confidence Interval (95%)
Physical Activity Index Inactive (Active REF)	.464**	1.590	1.147 – 2.203

Significance: p<=.05*; p<=.01**; p<=.001***

The above table shows variables of statistical significance in predicting the odds of obesity among males in the final block of the hierarchical logistic regression of the '94 NPHS.

Several statistically significant associations were found between socioeconomic variables and obesity. Of the few statistically significant variables in this block of the regression, the significant socioeconomic variables were: middle income (β=-.587*, OR=.556) which decreased the odds of obesity compared to those in the reference group (lowest income); and post-secondary graduation (β=-.443**, OR=.642) which decreased the likelihood of obesity compared to those in the reference group (< Secondary) with all other variables controlled.

Of the demographic variables, a statistically significant association was found between falling into the age group 45-49 years and obesity (β=.372*, OR=1.451) which increased the odds of obesity compared to the reference group (35-39). A positive association was also found between being a non-immigrant and obesity (β=.402**, OR=1.495), increasing the odds of obesity, compared to the reference group (immigrant).

Several statistically significant associations were also found between health and lifestyle variables and obesity. Not having high blood pressure (β=-

.926***, OR=.396) decreased the odds of obesity compared to the reference group (has high blood pressure). Not having diabetes (β=-.664*, OR=.515) decreased the odds of obesity compared to the reference group (has diabetes) as well. An association was found between self-reported stress level (β=.374*, OR=1.454) and obesity where rating stress as 3 increased the odds of obesity compared to the reference group (rating 0 stress). A positive association was found between occasionally consuming alcohol (β=.384**, OR=1.469) and obesity, which increased the odds of obesity compared to the reference group (regular drinker). A positive association was found between inactivity (β=.464**, OR=1.590) and obesity, which increased the odds of obesity compared to the reference group (active).

Table 14 NPHS '94 MALE Final Block & Model Significance

NPHS 1994 Male	Chi-Square	df	Sig.
Block	19.132	10	*
Model	151.558	44	***

The final block of the hierarchical regression for males in the '94 NPHS was statistically significant at the p<=.05 level while the entire analytic model was statistically significant at the p=<=.001 level.

Following are the significant odds ratios tables for males and females in the '04 CCHS data set.

Table 15 CCHS '04 MALES Significant Odds Ratios Final Block of Regression Analysis

CCHS 2004 MALES Block 4 - Final	Coefficient	Odds Ratio	Confidence Interval (95%)
Variable	**(β)**	**Exp(β)**	**Lowest - Highest**
Upper Middle Income (lowest REF)	.242*	1.273	.999 – 1.622
Post Secondary graduate(<Secondary REF)	-.325***	.722	.657 - .794
Age Group 40-44 (35-39 REF)	-.119*	.888	.806 - .978
Age Group 45-49	-.131**	.877	.793 - .970
Age Group 55-59	-.127*	.881	.788 - .985
Marital Status - Common Law (Married REF)	-.132*	.877	.780 - .985
Marital Status – Single (Married REF)	-.125*	.882	.791 - .984
Non-Immigrant (Immigrant REF)	.627***	1.872	1.708 – 2.050
Province – Nova Scotia (Newfoundland REF)	.315*	1.370	1.039 – 1.808
Province - British Columbia (Newfoundland REF)	-.279*	.57	.592 - .967
Chronic Illness – Arthritis (Yes REF)	-.352***	.704	.642 - .771
Chronic Illness - High Blood Pressure (Yes REF)	-.819***	.441	.406 - .479
Chronic Illness – Emphysema (Yes REF)	.563**	1.755	1.162 – 2.652
Chronic Illness – Asthma (Yes REF)	-.339***	.712	.627 - .810
Chronic Illness – Diabetes (Yes REF)	-1.102***	.332	.292 - .378
Personal Stress - Not Very (Not at all REF)	.188**	1.207	1.055 – 1..382
Personal Stress - Quite a Bit / Very (Not at all REF)	.179**	1.196	1.046 – 1.366
Personal Stress – Extremely (Not at all REF)	.296**	1.345	1.117 – 1.618
Smoker – Occasional (Daily REF)	.249**	1.283	1.091 – 1.508
Smoker - Never	.326***	1.385	1.275 – 1.505
Alcohol Consumption – Occasional (Regular	.226***	1.253	1.136 – 1.383

CCHS 2004 MALES Block 4 - Final	Coefficient	Odds Ratio	Confidence Interval (95%)
REF)			
Alcohol Consumption - Former	.175***	1.191	1.070 – 1.326
Alcohol Consumption - Never	-.228**	.796	.651 - .974
Physical Activity – Moderate (Active REF)	.130**	1.139	1.036 – 1.252
Physical Activity - Inactive	.326***	1.386	1.274 – 1.507

Significance: p<=.05*; p<=.01**; p<=.001***

Over the 10 year span of time between the '94 NPHS and the '04 CCHS the number of statistically significant associations which increased odds of obesity in males increased from 5 to 13, while the number of statistically significant associations which increased odds of obesity in females increased from 6 to 7.

Among socioeconomic variables, an association between income and obesity was found, where upper middle income (β=.242*, OR=1.273) increased the probability of obesity compared to the reference group (lowest income). An association between education and obesity was found, and post-secondary graduation (β=-.325***, OR=.722) decreased the probability of obesity compared to the reference group (< Secondary).

A number of associations were found between demographic variables and obesity. Being in the age group 45-49 years was inversely related to obesity (β=-.119*, OR=.888), which changed direction over ten years. Being in the age groups 40-44 years (β=-.131**, OR=.877) and 55-59 years (β=-.127*, OR=.881) as compared to the reference group (35-39), both decreased the probability of

obesity in males. Marital status associations with obesity included common-law (β=-.132*, OR=.877) and single (β=-.125*, OR=.882) which both decreased the probability of obesity compared to the reference group (married). Being a non-immigrant showed an increasing association with obesity (β=.627***, OR=1.872) compared to the reference group (immigrant), in the ten years from the '94 NPHS. Living in Nova Scotia showed an association that increased the probability of obesity (β=.315*, OR=1.370) compared to the reference group (Newfoundland) while living in British Columbia (β=-.279*, OR=.757) showed an association that decreased the probability of obesity compared to the reference group (Newfoundland).

Statistically significant associations between health variables and obesity included: not having arthritis (β=-.352***, OR=.704) which decreased the probability of obesity compared to the reference group (has arthritis); not having high blood pressure (β=-.819***, OR=.441) which decreased the probability of obesity compared to the reference group (has high blood pressure); not having diabetes (β=-1.102***, OR=.332) which decreased the probability of obesity compared to the reference group (has diabetes); not having asthma (β=-.339***, OR=.712) which decreased the probability of obesity compared to the reference group (has asthma); not having emphysema (β=.563**, OR=1.755) increases the probability of obesity compared to the reference group (has emphysema). All levels of personal stress increased the probability of obesity compared to the

reference group (none at all), including not very (β=.188**, OR=1.207), quite a bit (β=.179**, OR=1.196) and extremely (β=.296**, OR=1.345).

Associations between lifestyle variables and obesity included: occasional smoking (β=.249**, OR=1.283) which increased the probability of obesity compared to the reference category (daily smoker) and non-smoking (β=.326***, OR=1.385), which also increased the probability of obesity compared to the reference group (daily smoker). An association between occasional alcohol consumption and obesity (β=.226***, OR=1.253) and former alcohol consumption (β=.175***, OR=1.191) both increased the probability of obesity compared to the reference group (regular drinker), while never drinking (β=-.228*, OR=.796) decreased the probability of obesity compared to the reference group (regular drinkers). Associations between physical activity level and obesity included moderate physical activity (β=.130**, OR=1.139), which increased the probability of obesity compared to the reference group (active) and inactive physical activity (β=.326***, OR=1.386), which increased the probability of obesity compared to the reference group (active).

Table 16 CCHS MALE '04 Final Block & Model Significance

CCHS 2004 Male	Chi-Square	df	Sig.

Block	148.606	7	***
Model	1654.077	43	***

The final block of the hierarchical regression for males in the '04 CCHS was statistically significant at the p<=.001 level while the entire analytic model was statistically significant at the p=<=.001 level.

The following tables are comparisons of coefficients and their associated odds ratios and statistical significance levels for females in the NPHS & CCHS final blocks.

Table 17 NPHS '94 FEMALES Significant Odds Ratios in Final Block of Regression Analysis

NPHS 1994 FEMALES Block 4 - Final	Coefficient	Odds Ratio	Confidence Interval (95%)
Variable	**(β)**	**Exp(β)**	**C.I. (lower – upper)**
Working Status - Not Working Past 12 months (Working REF)	.381***	1.464	1.161 – 1.846
Age Group 50-54 (35-39 REF)	-.420*	.657	.465 - .928
Age Group 55-59	-.545**	.580	.402 - .835
Non-Immigrant (Immigrant REF)	.672***	1.959	1.453 – 2.640
Chronic Illness – Arthritis (Yes REF)	-.625***	.535	.409 - .701
Chronic Illness - High Blood Pressure (Yes REF)	-.605***	.546	.396 - .752
Chronic Illness – Emphysema (Yes REF)	-.644**	.525	.334 - .825
Chronic Illness – Diabetes (Yes REF)	-1.276***	.279	.170 - .460
Stress Index 1 (0 REF)	-.337*	.714	.541 - .942
Smoking – Former (Daily REF)	.419**	1.520	1.128 – 2.047
Alcohol Consumption – Occasional (Regular REF)	.566***	1.762	1.387 – 2.237
Alcohol Consumption - Former	.582***	1.791	1.314 – 2.440
Physical Activity Index Inactive (Active REF)	.486**	1.626	1.173 – 2.256

Significance: p<=.05*; p<=.01**; p<=.001***

The above table shows statistically significant variables predicting obesity among females in the final block of the hierarchical logistic regression of the '94 NPHS.

One socioeconomic variable exhibited a statistically significant association with obesity after all other variables had been controlled. Working status – not working in past 12 months (β=.381***, OR=1.464) increased the probability of females being obese, compared to the reference group (working all of the past 12 months).

Statistically significant associations between demographic variables and obesity included being older - 50-54 year age group (β=-.420*, OR=.657) and 55-59 year (β=-.545**, OR=.580), both of which decreased the probability of obesity compared to the reference group (35-39). Also, being a non-immigrant (β=.672***, OR=1.959) increased the probability of obesity compared to the reference group (immigrant).

Statistically significant associations between health variables and obesity included not having arthritis (β=-.625***, OR=.535) which decreased the probability of obesity compared to the reference group (has arthritis); not having high blood pressure (β=-.605***, OR=.546) which decreased the probability of obesity compared to the reference group (has high blood pressure); not having emphysema (β=-.644**, OR=.526) which decreased the probability of obesity compared to the reference group (has emphysema); and not having diabetes (β=-1.276***, OR=.279) which decreased the probability of obesity compared to the reference group (has diabetes). A negative association between self-reported stress rating 1 (β=-337*, OR=.714) decreased the odds of obesity compared to the reference group (stress rating 0).

Statistically significant associations between lifestyle variables and obesity, included being a former smoker (β=.419**, OR=1.520) which increased the probability of obesity compared to the reference group (daily smokers), being an occasional drinker (β=.566***, OR=1.762) and being a former drinker (β=.582***, OR=1.791), both of which increased the probability of obesity in females compared to the reference group (regular drinker). A statistically significant positive association between inactivity (β=.486**, OR=1.626) and obesity increased the odds of obesity compared to the reference group (active).

Table 18 NPHS '94 FEMALE Final Block & Model Significance

NPHS 1994 Female	Chi-Square	df	Sig.
Block	51.172	10	***
Model	259.644	44	***

The final block of the hierarchical regression for females in the 94 NPHS was statistically significant at the p<=.001 level while the entire analytic model was statistically significant at the p=<=.001 level.

Table 19 CCHS '04 FEMALES Significant Odds Ratios Final Block of Regression Analysis

CCHS 2004 FEMALES Block 4 - Final	Coefficient	Odds Ratio	Confidence Interval (95%)
Variable	**(β)**	**Exp(β)**	**Lowest - Highest**
Education - Secondary (< Secondary REF)	-.271***	.763	.678 - .858
Education - Post Secondary graduate	-.387***	.679	.611 - .755
Marital Status - Common Law (Married REF)	-.237***	.789	.687 - .906
Marital Status - Single	.298***	1.347	1.193 – 1.521
Non-Immigrant (Immigrant REF)	.625***	1.867	1.685 – 2.070
Province – Quebec (Newfoundland REF)	-.302*	.739	.580 - .942
Province - British Columbia	-.342**	.710	.550 - .917
Chronic Illness – Arthritis (Yes REF)	-.479***	.619	.569 - .684
Chronic Illness - High Blood Pressure (Yes REF)	-.824***	.439	.399 – .482
Chronic Illness – Asthma (Yes REF)	-.364***	.695	.621 - .779
Chronic Illness – Diabetes (Yes REF)	-1.202***	.301	.260 - .308
Personal Stress - Not Very (Yes REF)	-.303***	.739	.633 - .862
Personal Stress – Some (None at all REF)	-.266***	.767	.664 - .886
Personal Stress – Extremely	-.388**	.713	.578 - .881
Smoker – None at all (Daily REF)	.426***	1.531	1.393 – 1.693
Alcohol Consumption – Occasional (Regular REF)	.521***	1.684	1.546 – 1.834
Alcohol Consumption - Former	.363***	1.437	1.291 – 1.600
Physical Activity – Moderate (Active REF)	.272***	1.312	1.174 – 1.467
Physical Activity - Inactive	.522***	1.685	1.526 – 1.821

Significance: p<=.05*; p<=.01**; p<=.001***

The above table shows statistically significant variables predicting obesity among females in the final block of the hierarchical logistic regression of the '04 CCHS.

The socioeconomic variables that maintained statistically significant associations with obesity after all other variables are controlled, were secondary education (β=-.271***, OR=.763) and post secondary education (β=-.387***, OR=.679), both of which decreased the probability of females being obese compared to the reference group (< Secondary).

Statistically significant associations between demographic variables and obesity included common-law marital status (β=-.237***, OR=.789) which decreased the probability of obesity compared to the reference group (married), and single marital status (β=.298***, OR=1.347) which increased the probability of obesity compared to the reference group (married) in females. Being a non-immigrant (β=.625***, OR=1.867) increased the probability of obesity for females compared to the reference group (immigrant). Living in the province of Quebec (β=-.302*, OR=.739) and the province of British Columbia (β=-.342**, OR=.710) both decreased the probability of obesity compared to the reference group (Newfoundland).

Statistically significant associations between health variables and obesity included chronic illnesses: not having arthritis (β=-.479***, OR=.619) which decreased the probability of obesity compared to those in the reference category (has arthritis); not having high blood pressure (β=-.824***, OR=.439) which decreased the probability of obesity compared to the reference group (has high blood pressure); not having asthma (β=-.364***, OR=.695) which decreased the probability of obesity compared to the reference group (has asthma); and not

having diabetes (β=-1.202***, OR=.301) which decreased the probability of obesity compared to the reference group (has diabetes). Stress levels including not very (β=-.303***, OR=.739), some (β=-.266***, OR=.767) and extremely (β=-.338**, OR=.713) all decrease the likelihood of obesity in females.

Statistically significant associations between lifestyle variables and obesity included being a non-smoker (β=.426***, OR=1.531) which increased the probability of obesity compared to the reference group (daily smoker), being an occasional drinker (β=.521***, OR=1.684) and being a former drinker (β=.363***, OR=1.437) both of which increased the probability of obesity compared to the reference group (regular drinker). Moderate physical activity (β=.272***, OR=1.312) and inactive physical activity (β=.522***, OR=1.685) both increase the probability of obesity in females compared to the reference group (active).

Table 20 CCHS '04 FEMALE Final Block & Model Significance

CCHS 2004 Female	Chi-Square	df	Sig.
Block	379.797	7	***
Model	2067.637	43	***

The final block of the hierarchical regression for females in the '04 CCHS was significant at the p<=.001 level while the entire analytic model was significant at the p=<=.001 level.

Comparison of Statistically Significant Associations

The following tables contrast the significant coefficients and their significance levels for both males and females in the final blocks of regression analyses (all controls included) in both the '94 NPHS and the '04 CCHS.

Table 21 Summary Table of Statistically Significant Predictors of Obesity NPHS / CCHS

Variable	Category	MALES		FEMALES	
		1994 Association	2004 Association	1994 Association	2004 Association
Income Adequacy (Lowest REF)	Lower Middle	NS	NS	NS	NS
	Middle	-*	NS	NS	NS
	Upper Middle	NS	+*	NS	NS
	Highest	NS	NS	NS	NS
Education Level (< Secondary REF)	Secondary Graduate	NS	NS	NS	-***
	Other Post Secondary	NS	NS	NS	NS
	Post-Secondary Graduate	-***	-***	NS	-***
Working Status (Job all past year REF)	Without job for part of year & looking/not looking	NS	NS	+***	NS
Age Groups (35-39 REF)	40-44 years	NS	-*	NS	NS
	45-49 years	+*	-**	NS	NS
	50-54 years	NS	NS	-*	NS
	55-59 years	NS	-*	-**	NS

Variable	Category	MALES		FEMALES	
		1994 Association	2004 Association	1994 Association	2004 Association
Marital Status	Married / Common Law (REF)	NS	-*	NS	-***
	Single	NS	-*	NS	+***
Immigration Status (Immigrant REF)	Non-Immigrant	+**	+***	+***	+***
Province (NFLD REF)	Quebec	NS	+*	NS	-*
	British Columbia	NS	-*	NS	-**
Arthritis (Yes REF)	No	NS	-***	-***	-***
High BP (Yes REF)	No	-***	-***	-***	-***
Emphysema (Yes REF)	No	NS	+**	-**	NS
Asthma (Yes REF)	No	NA	-***	NA	-***
Diabetes (Yes REF)	No	-**	-***	-***	-***
Personal Stress Index (0 REF or Not at all '04)	1 (not very '04)	NS	+**	-*	-***
	2 (a bit '04)	NS	NS	NS	-***
	3 (quite a bit '04)	+*	+**	NS	NS
	5 (extremely '04)	NS	+**	NS	-**

Variable	Category	MALES		FEMALES	
		1994 Association	2004 Association	1994 Association	2004 Association
Type of Smoker (Daily REF)	Occasional	NS	+**	NS	NS
	Former Daily	NS	NA	+**	NA
	Never Smoked	NS	+***	NS	+***
Type of Drinker (Regular REF)	Occ. Drinker	+**	+***	+***	=***
	Former Drinker	NS	+***	+***	+***
	Never Drank	NS	-*	NS	NS
Physical Activity Index (Active REF)	Moderate	NS	+**	NS	+***
	Inactive	+**	+***	+**	+***

Significance: p<=.05*; p<=.01**; p<=.001***

In the 10 year span between the '94 NPHS and the '04 CCHS, the association between income level and obesity for males, changes. Middle income in '94 decreases the probability of obesity (OR=.556). However, within 10 years, the statistically significant effect of income on obesity moves up an income quintile to upper middle income (OR=1.273), but the association becomes a risk factor, increasing the odds of obesity in 2004. The association of obesity with post-secondary graduation continues to decrease the probability of obesity from '94 (OR=.642) to '04 (OR=.722), though it is of note that the odds ratio moves closer to 1.0 over that 10 year span.

For women however, associations with obesity and income at any quintile level did not retain any significance through to the last block of analyses. Working status (not working in past 12 months) (OR=1.464) in '94 increased the probability of obesity in '94, yet over the 10 years between data sets this association was lost entirely. The remaining socioeconomic variable with a statistically significant association with obesity for females was that of education at both the secondary education level (OR=.763) and the post-secondary graduate level (OR=.679) both of which decreased the probability of obesity. Interestingly, no levels of education had statistically significant associations with obesity for females in the '94 data.

Comparison of Obesity Increasing Odds Ratios for Both Data Sets

No socioeconomic variables had statistically significant associations with obesity for males in the '94 data, although for females, not working in the past 12 months ('94OR=1.464) increased the odds of obesity. Moving across the 10 years to the '04 data revealed that upper middle income ('04OR=1.273) had a positive association with obesity for males, while no SES variables had positive associations for females.

The demographic associations that increased the probability of obesity in males in the '94 data were age group ('94 OR=1.451) and non-immigrant status ('94 OR=1.495). In the'04 data, demographic associations included non-immigrant status ('04OR=1.872) which increased the level of association over in the10 years and living in Quebec ('04OR=1.370). The single demographic association that increased the probability of obesity in females was being a non-immigrant ('94 OR=1.959) ('04 OR=1.867) which was positive in both data sets.

The health variable showing a positive association with obesity in males in the '94 data was stress level 3 ('94OR=1.454). In the '04 data, all levels of personal stress (compared to none at all) including not very ('04OR=1.207), quite a bit ('04OR=1.196) and extremely ('04OR=1.345) increased the odds of obesity. Also, the single co-morbid chronic condition showing a positive association with obesity in the '04 data was not having emphysema ('04OR=1.755). There were zero health variables that had positive associations with obesity for females in both the '94 data set and the '04 data set.

Lifestyle variables that increase the odds of obesity for males in the '94 data include occasional alcohol consumption ('94OR=1.469) and inactive physical activity ('94OR=1.590). In the '04 data, lifestyle variables with positive associations with obesity include smoking occasionally ('04OR=1.283), never smoking ('04OR=1.385) compared to regular smoking; occasional alcohol consumption ('04OR=1.253), former alcohol consumption ('04OR=1.191); moderate physical activity ('04OR=1.139) and inactive physical activity ('04OR=1.386). The positive association between occasional alcohol consumption and obesity decreased in magnitude from the NPHS ('94OR=1.469) to the CCHS ('04OR=1.253). Being a "Former" alcohol drinker only increased the odds of male obesity in the CCHS ('04OR=1.191) compared to daily alcohol consumption.

Lifestyle variables with positive associations with obesity in the '94 data for females included being a former smoker ('94OR=1.520) and never smoking ('04OR=1.531) in the '04 data (compared to regular smokers). The probability-increasing association between occasional alcohol consumption decreased in magnitude from the '94 NPHS ('94OR=1.762) to the '04 CCHS ('04OR=1.684), as did the association for "former" alcohol drinker ('94OR=1.791) and ('04OR=1.437) compared to daily alcohol drinkers. Interestingly and similar to males, while only inactive physical activity ('94OR=1.626) had a positive association with obesity in the '94 NPHS, by the '04 CCHS the data showed that moderate physical activity ('04OR=1.312) and inactive physical activity ('04OR=1.685) both increased the probability of obesity compared to females who report regular physical activity. The

physical activity variables with positive odds ratios for obesity are also higher than those found for males in the '04 CCHS data.

CHAPTER 5: DISCUSSION

There were two aims of this study. First, we wanted to examine the influence of SES using measures of education, income and working status on the presence of obesity in Canadian baby boomers over a ten year time span in order to determine any changes in trends. The focus on the individual effects of SES factors on obesity was based upon published research showing that SES influences obesity levels. We also included the social determinants of health perspective, which specifically notes that different socio-economic groups in a given society experience different health outcomes.

Second, we wanted to examine the differential effects of sex on any interactions in SES variables and obesity over time. For this purpose, we conducted a trend analysis using two data sets gathered approximately ten years apart, controlled for any chronological age effects by including all age groups 35-54 in the regression analysis, and compared separate analyses by sex. The determinants of health adopted by Health Canada specifically highlight the importance of gender (Health Canada, 1998) on health outcomes. In order to examine trend of period effects we used Riley's Social Change Model which combined life course theory, cohort analysis, and age stratification theory. Combined with the social determinants of health these models suggest that the influence of SES on obesity in previous generations of males and females may be changing over time. This change is due in part to an individual's health status being rooted in social structures

and social change, within which gender, socioeconomic variables and social status are integral.

Ultimately, a person's health and health outcomes derive from complex etiologies. Socio-economic status and social determinants of health combine to provide supportive pathways or barriers to health, and in the case of this study, of obesity in Canadian baby boomers. As discussed in the literature review, research suggests that the factors behind rising BMI over time are undeniably complex. They are indicative of unfavourable social and environmental conditions that contribute to excessive caloric intake and poor nutrition, in part from eating fast and convenient foods. Shapin (2006) notes that "[t]echnology has made calories bountiful, cheap, and easy to consume, while new patterns of work, residence, mobility, and child rearing have squeezed the time that we are able or willing to commit to family or communal meals." (Shapin, 2006, p.7). Socio-economic factors continue to be major determinants of health as well as of lifestyle, but that may be differentially changing over time for males and females. Men and women are coping with social change differently while both sexes are experiencing work force changes, domestic role changes, stress and economic changes. Riley's Social Change Model combined with the social determinants of health perspective was therefore used as a framework elucidates how changes in technology, food culture and socioeconomics have influenced the outcomes found in these analyses.

Change is all around us and change is constant. Furthermore, development and transmission of technology is a marker of evolving human society and culture (Dawkins, 1989). Technological development in the virtual work, informational and

entertainment worlds are now moving at a pace that expedites communication as well as the automation of food production and food availability (Schlosser, 2001). This evolving technological culture enables obesogenic environments of largely sedentary work and leisure. We live in a fast-paced world full of busy schedules, automobile-dependent communities filled with fast food outlets (Sallis & Glanz, 2009), where we purchase lunch and coffee at the local drive-thru window and work and drive while we eat (Schlosser, 2001). While social and technological cultures have evolved and made burning calories less simple, the hard-wired biological cravings for sugars and fats have not (Sallis & Glanz, 2009; Schlosser, 2001). We speculate that the associations between obesity, socioeconomic status and sex have also evolved and differ among males and females.

Riley's Social Change Model

The findings in this thesis are interpreted using Riley's Social Change Model (1993) which suggests that as people age they change socially, psychologically and biologically, based on their position in the age structure. The ways in which people age over time are not static and differ from cohort to cohort and generation to generation. The ways in which obesity levels are affected by SES and sex in the baby boomer generation may differ from how they are affected by SES and sex in the following generations.

The four major components to Riley's Social Change Model (1993) suggest that: 1) The cohort comparison approach allows us to identify historical effects affecting health; 2) We can identify age-relevant life course trends and historical

period effects, such as the spread of processed food production technologies that influence a whole generation or just specific age groups; 3) Using the cohort approach, we can speculate upon what health characteristics of a population may look like in the future by identifying health patterns in successive cohorts; 4) Ultimately, the health of a population is best understood as a combination of successive birth cohorts with unique constellations of health and illness patterns which are tied to cohort size, composition, life experiences and exposure to changing structural norms and historical events (Riley, 1993).

Social change is a central component in this thesis. Public health experts agree that individual level changes in genes, biology, and psychology cannot explain the rapid rise in worldwide obesity, thus the explanation must lie in social changes and broader policies (Sallis & Glanz, 2009; Hill and Peters 1998).

As stated in the theoretical foundations chapter of this thesis, in Riley's model (1993), "social change means not only that new cohorts are continually entering the population while others are leaving, but also that the members of all existing cohorts are simultaneously ageing (sic) and thus moving from younger to older strata...cohort succession is the vehicle producing population changes, including changes in health and disease" (1993, p.45). For Riley, social change is influencing the health status of each aging cohort differently, although concurrently. In this thesis it is contended that social change is influencing the obesity levels of male and female baby boomers differently than those of successive age cohorts, though influencing obesity rates concurrently.

Social Determinants of Health

As discussed in the literature review of this thesis, Health Canada has identified 12 specific determinants of health, most of which are social determinants, including income, education level, working status and gender (Raphael, 2008). Each social determinant is associated with the extent to which a person possesses the capacity to achieve personal goals, meet needs and cope with their environment (Raphael, 2004). Thus, social determinants of health are directly and indirectly associated with health behaviours and outcomes.

The health of a Canadian baby boomer is determined in part, by how a given society, in this case Canada in 1994 and 2004, has organized and distributed economic and social resources (Raphael, 2004). Whether an individual Canadian baby boomer experiences obesity or not, is in part determined by sex in this study. Gender, though different from sex, is a social determinant of health that is associated with income, educational attainment and working status – the key elements of socio-economic status (SES), and is also associated with lifestyle and health behaviours (Kaufert, 1996). We have seen in the results of this study, that income, educational attainment, working status and sex are all social determinants of health affecting obesity levels in the samples of Canadian baby boomers from 1994 and 2004.

Summary of SES and Obesity Results

SES showed differential effects on obesity rates for men and women and there were interesting sex differences in several obesity associations. People's lifestyles, the economic and social conditions under which they live, and gender, all have substantial influence on obesity in this study.

With regards to Hypothesis 1 - the convergence hypothesis - no support was found at the bivariate level to support the suggestion that prevalence rates of obesity increased at a faster rate among higher SES strata than in lower SES strata for the total sample aged 35-54, which approximates the baby boomer generation. With specific regard to SES strata and obesity rates converging, a complex picture emerged that spoke to the individual importance of sex, income, education and working status on the convergence of obesity.

In the whole sample bivariate analyses, obesity rates were negatively associated with income groups in 1994 but by 2004 the association direction became positive. Obesity rates increased between 1994 and 2004 across all education level groups. Obesity rates by working status increased among those who had work for the whole previous year and decreased among those without work in the previous year.

In the bivariate analysis, when examining the obesity rates across income level for men compared to women, a unique pattern came to light. Obesity rates across income level among men were not statistically significant but the trend supported convergence. Obesity exhibited a decrease between 1994 and 2004 in

the lowest income group but increased through the remaining income groups. We observed a decrease between 1994 and 2004 in the lowest income group, increases in the lower middle, middle and upper middle income groups but a decrease again in highest income group. For women, the relationship between income and obesity was non-linear while for men it was largely linear. Among women, the case for convergence is less clear.

Examination of obesity rates across education level comparing men and women showed interesting differences. Among men, obesity rates increased between 1994 and 2004 for all levels of education. For women, the pattern showed an increase in less than secondary education and in secondary graduates and decreased among "other" post-secondary graduates and post-secondary graduates.

Obesity rates by working status for men increased between 1994 and 2004 both in those who had worked for the previous year and among those without work in the previous year. The associations were not statistically significant in 1994 but were statistically significant in 2004. For women, obesity rates by working status increased between 1994 and 2004 among those who had worked for the whole previous year and decreased for those without work in the previous year. Both associations were statistically significant for women in 1994 and 2004.

From the bivariate analyses, although obesity rates rose for the large part at most levels of income, education and working status between 1994 and 2004, the largest increase in obesity rate was found in persons in the lower middle income group and the less than secondary education group, suggesting that obesity rates

among individuals in lower SES strata are still increasing at a faster rate than those in higher SES strata. This finding diverges from Wister's (2005) study in which baby boomers with less than post-secondary education experienced a smaller rise in obesity than those with post-secondary education (2005). However, this may have been due to the fact that education was split into less than post-secondary education and at least some post-secondary education.

Interestingly, partial support for the convergence hypothesis was found in the multivariate regression analysis. At this level of analysis, we would have support for convergence if we had found that income and education effects disappeared between 1994 and 2004. What we found was that the income effect present in 1994 for men did not disappear, but it flipped direction. The protective effect of higher income on obesity that has been present in other research became a risk factor for obesity in men in this study (in the upper middle income group). However, the education effect that is protective against obesity was still present for men in 1994. For women, neither the income nor the education effects were present in 1994 but in 2004 the education effect presented itself. Thus, at both the bivariate and multiple regression levels of analyses, the convergence hypothesis was partially supported for men but not supported for women.

The different findings between this study and Wister's (2005) findings are interesting and may show that several changes have taken place. These changes in obesity may stem in part from lifestyle, social and cultural technology evolutions. With regard to population health between 2000/01 and 2004, a "slowing" of obesity rates in higher income and higher education level groups has taken place over time.

Wister's (2005) analysis used a crude, dichotomized measure, whereas the present study is more sensitive to SES associations. It is also important to note that the research in this thesis examines only two points in time, 1994 and 2004, thus statements about "speed" of obesity rates increasing are cross-sectional and require longitudinal analysis to better build upon the longer-term trend analysis of Wister's (2005) analyses.

Obesity rates for mid-life men aged 35-54 rose between 1994 and 2004 and decreased for women. Indeed, Kuhle & Veugelers (2008) suggest that survey data from several industrialized countries continue to show a negative association between SES and obesity for women and an inconsistent relationship for men. In their own study reviewing the Canadian Heart Health surveys, Kuhle and Veugelers (2008) found that the greatest increase in obesity prevalence since late 1980's was among men in higher income groups and that the prevalence of obesity in lower income groups was nearly unchanged (Kuhle & Veugelers, 2008). A similar finding by Borders et al. (2006) showed that women of higher income were protected against obesity, but men were not.

The application of Riley's Social Change Model here, suggests social changes have occurred differentially for baby boomers with regard to body image, social status and SES opportunities, or barriers. These social changes may have interacted with social determinants of health over ten years to create an overall drop in obesity among women but an increase among men. Zhang & Wang (2004) found that SES affected the body weight status of men and women differently, particularly in developed nations within which men and women could have strikingly different

attitudes towards body weight status and have different practices for controlling body weight.

The most striking findings in the analyses in this thesis highlighted the effect that SES has on obesity. The second and third hypotheses state that: the independent effects of income, education and working status on obesity will decrease over the ten year period of study and an interaction effect between sex and SES will show as a decreased effect for women and an increased effect for men.

In these analyses the effect of income on men switched direction in a large income quintile across ten years. The income effect went from being protective in the middle income group in 1994, to being a risk for obesity in the upper middle income group in 2004. This is an important nuance specific only to men, given that the income effect did not show for women in either 1994 or 2004. Associations of obesity with all levels of income for women in 1994 were in the expected, protective direction, while approximately ten years later in 2004, associations of obesity with all levels of income increased in magnitude but remained statistically insignificant. These findings indicate no support for Hypothesis 2 but partial support for Hypothesis 3.

This risk of obesity for men in higher income groups is opposite to results found in a Statistics Canada report that LePetit & Berthelot (2005) conducted using NPHS data from 1994/95-2002/03. In that report, LePetit & Berthelot (2005) found that overweight individuals who lived in high income households were less likely to become obese than were those in the lowest income category. LePetit & Berthelot

(2005) used a longitudinal, large cohort analysis using only NPHS data. The opposite result found in this thesis may be due in part to the simple trend analysis design across approximately 10 years in two different data sets. This thesis is not a cohort analysis using one national level survey (NPHS) longitudinally and did not compare overweight to obese risks as LePetit & Berthelot's research did (2005).

Link to Social Change Theory

Riley's Social Change Model (1993) applied here leads us to speculate that those in higher SES have different social experiences from those in lower SES, which enabled either intake of more calories or increased sedentary time, leading to higher obesity. This difference could be in part due to Kuhle & Veugelers' (2008) finding, where individuals in higher SES tend to be more physically active during leisure time. Perhaps the benefits of having more active leisure time are negated by sedentary activity in the work place (Sallis & Glazer, 2009). In the 2007/08 Canadian Economic Observer: Historical statistical supplement, it is demonstrated that in 1994 there were slightly fewer white collar jobs than blue collar jobs (9,500 : 9,700 in 000's of jobs) and more than half of the work force was thus, more physically active due to the nature of their jobs. By 2004, the number of white collar jobs had surpassed blue collar jobs (12,5000 : 12,000 in 000's of jobs) and therefore more than half of the labour force was less physically active at work.

Additionally, the use of technologies that decrease physical energy expenditure and make communication and entertainment more efficient and accessible (i.e. computers, Playstations, cellular phones, iPhones, Blackberries etc.) may be a material benefit of higher SES job categories, but over time, have become

more available for individuals at all levels of socioeconomic strata (Salliz & Glanz, 2009). We live in a consumerist society, where those that "have" want more, and those that "don't have", want the same things as others.

The education effect on obesity also differed for men and women. Education protected men from obesity in the post-secondary group in 1994 and again in 2004. The education effect was not supported for women at all in 1994. In 2004 however, women in both the secondary graduate group and post-secondary graduate group were protected against obesity. It appears that over the ten years between these two data sets, the education effect increased for women and remained the same for men. Wister (2005) found a relatively strong education effect for midlife Canadians aged 35-54 who approximated the baby boomers in 2000/01. In his analyses, those with at least some post-secondary education showed lower rates of smoking and obesity (Wister, 2005). Borders and colleagues (2006) found differing results in their examination of SES factors and obesity, where education as a whole was insignificant for women and men but, having a college degree or more education was associated with lower adjusted odds of obesity. In this thesis, the education effect is supported for women in 2004 and this may suggest that the same technologies that decrease physical energy expenditure and make communication and entertainment more efficient and accessible are making education more efficient and accessible for women over time. Perhaps women are early adaptors of technology and apply it to educational pursuits in different ways from males.

That the analyses in this study found an increasing protective effect of education on obesity for women and a consistent effect for men, can be interpreted

as positive. If education is significantly associated with obesity among men and women (independent of income and working status) it suggests that education is one of the SES variables that should be most amenable to improvement (Wardle et al., 2002). Indeed, Wister (2005) suggests that more improvements have been made at increasing the education level of Canadians than increasing the relative income level. Wardle and colleagues (2002) suggest that if education affects activity and eating behaviour, then by empowering people to integrate healthy lifestyle choices into their daily lives, we might expect equivalent obesity-reducing effects for men and women over time.

Not having worked in the past year was a risk for obesity among women in 1994 but by 2004 this association lost any significance. Working status showed no effect in either data set for men. The male/female differences in relation to occupational status are important and might have a number of different explanations (Wardle et al., 2002, p.1303). In the 2007/08 Canadian Economic Observer it is revealed that in 1994 there were 7,142 men (in thousands of people) employed, compared to 5,917 females. By 2004 this gap narrowed to 8,481 men (in thousands of people) and 7,466 women employed. Over time, more women have entered the work force while still raising children or have delayed having children in order to achieve working success.

Many women with more education have delayed having children until both education and careers were established. Perhaps these same, more educated women are child-rearing at home and using their more educated health knowledge, leading to a decrease in obesity for those not working in the past year by the 2004

results. The culture of the stay-at-home mommy may have changed between 1994 and 2004. Not having worked outside the home in the past year is not necessarily indicative of a sedentary lifestyle, especially if a woman is raising children. Middle aged female parents may have experienced a social shift between 1994 and 2004, with more population health information promoting parent/child "mommy and me" style physical activity and healthy eating. Community-level opportunities for physical activity and healthy eating may have also increased due to this health promotion change.

Differential changes in the income effect for men between 1994 and 2004 as well as the change in significance of working status on women between 1994 and 2004, after controlling for the other individual-level factors, are assumed to be due to macro-level social change. The macro-level social change is assumed to be related to the increased use of widely available technologies such as internet communications, electronic entertainment, automation of processed and fast-food production technologies, transportation technologies (Sallis & Glanz, 2009; Schollser, 2001). These increased uses of technologies are affecting all concurrent generations and cohorts, albeit differently and changes are occurring differently between men and women within cohorts.

Supplementary Findings

This study showed that, overall, the number of variables associated with obesity increased for both men and women between 1994 and 2004, which may in part be due to changes in measurement between data sets. However, it also

suggests that the complexity of obesity in baby boomers also growing. Not surprisingly, some of the most influential predictors of obesity included demographic factors such as age group and being a non-immigrant as well as health variables such as comorbid chronic conditions, stress level and of course, lifestyle variables such as smoking, alcohol intake and physical activity level. For instance, women, those having post-secondary education and immigrants were less likely to be obese in 2004. These findings match those in Kaplan et al.'s (2003) research on predictors and correlates of obesity in adults aged 65+.

There was a distinct sex difference in the relationship between stress and obesity. None of the objective health variables increased the risk of obesity for women in either 1994 or in 2004. For men, stress level 3 (middle) increased the risk of obesity in 1994, but by 2004, every level of stress increased the risk for obesity. For women however, stress levels were associated with decreased risk for obesity. We speculate that men's stress levels may be linked to increased work hours and work stress, given the risk associated with upper middle income and obesity.

Lalukka and colleagues (2008) examined the associations between job strain, working overtime, adverse health behaviours and obesity among 45 to 60 year old white-collar employees of the Whitehall II Study from London, the Helsinki Health Study and the Japanese Civil Servants Study. In their study, Lalukka and colleagues (2008) found that in the London data, men reporting passive work were more likely to be physically inactive and high job strain was associated with physical inactivity. In Japan, men working overtime reported less smoking, whereas those with high job strain were more likely to smoke. Lalukka and colleagues (2008)

concluded that job strain and working overtime had some, associations with adverse health behaviors and obesity in middle-aged, white-collar employee cohorts from Britain, Finland, and Japan.

Kahn et al. (1998) tested the association between living in geographic regions with relative income inequality (a measure of socio-environmental stress) and the likelihood of weight gain at the waist for men and women. They too, found a sex difference with regard to weight and stress. After controlling for age, other individual-level factors, and each state's median household income, men's likelihood of weight gain at the waist was positively associated with household income inequality and men from states with a high HII (households above the median) described weight gain at the waist more often than men from states with a low HII (households below the median). Women's results showed a non-significant trend in the same direction. Kahn et al. (1998) suggest that the relationship between the socio-environmental stress and weight gain at the waist may truly not exist among women, perhaps because women more successfully buffer their socio-environmental stressors through enhanced psychosocial supports from family and friends.

In 1994 no effects for geographical region / province of residence were demonstrated for men or women. By 2004 however, living in Nova Scotia increased the risk of obesity among men but not among women. Living in British Columbia decreased the risk of obesity among both men and women, while living in Quebec decreased the risk of obesity only among women. Some change has occurred between the two provinces over ten years, placing males at risk for obesity. This

may be due in part to differences in provincial health authority population health initiatives or differences in unemployment rates.

Women however, may either experience different stress or may cope with stress differently. Lalukka and colleagues (2008) found that in the London data, women reporting passive work were less likely to be heavy drinkers and smokers. We speculate that where men may eat, smoke or drink more or spend more time in sedentary relaxation to cope with work stress, women may use more physical activity and lean on their social support network to cope with their work stress (Lalukka et al., 2008). This may also diffuse the influence of stress on obesity among women.

Understandably, the associations between comorbid chronic conditions and obesity were largely in one direction, where those without comorbid chronic illnesses showed decreased risk for obesity. Thus, presence of a comorbid chronic illness is positively associated with obesity. This was an expected result given the wealth of literature that details the relationship between chronic conditions and obesity (Lalukka et al., 2008; Kaplan et al., 2003). In a Statistics Canada report on adult obesity in Canada, Tjepkema (2005) notes that the link between obesity and chronic illness varies in severity as BMIs vary. Obesity is therefore divided into three categories, with successive values representing escalating health risks. People in Class I (BMI 30.0 to 34.9) have a high risk of developing health problems; in Class II (BMI 35.0 to 39.9), the risk is very high, and in Class III (BMI 40 or more) the health risks are extremely high. In 2004, 15.2% of Canadian adults had a BMI in Class I; 5.1% were in Class II, and 2.7%, in Class III (Tjepkema, 2005, p.3).

Risks to health via obesity lend to a controversial argument about mortality risk versus morbidity risk, in which there are conflicting results in research. In a recent study, Orpana and colleagues (2009) examined the relationship between BMI and all-cause mortality in a nationally representative sample of Canadian adults, using the 1994/95 NPHS. Orpana et al. (2009) found a significantly increased risk of mortality over 12 years of follow-up among underweight individuals and obesity class II+ categories. They found that being overweight was associated with a significant protective effect, compared to those in the acceptable weight category. Obesity class I was not associated with a significantly increased risk of mortality and subsequent analyses showed a U-shaped relationship between BMI and mortality at smaller increments of BMI. At a simplistic level, to say that obesity does not increase risk of death in adults is misleading and it is important to note the difference in risk based on obesity class.

In this thesis, lifestyle variables that increased the probability of obesity among men in 1994 included occasional alcohol consumption and being physically inactive. By 2004 these were joined by occasional smoking, never smoking, occasional alcohol consumption, former alcohol consumption, inactive and moderate physical activity. For women in 1994, lifestyle variables that increased the probability of obesity included: being a former smoker, occasional and former alcohol consumption and being physically inactive. By 2004 these were joined by being a non-smoker and moderate physical activity. Wister (2005) found that in Canadians aged 35-54 in 2000/01, those with at least some post-secondary

education showed slightly less unhealthy exercise levels, lower rates of smoking and heavy drinking.

In this thesis, those who are less than "active" show risk for obesity as it is well established that calorie intake and calorie burn regulate weight. Wister (2005) found a unique paradox in which Canadian baby boomers participate in more physical activity than previous generations while gaining weight more quickly and showing more comorbid illnesses.

Sallis & Glanz (2009) suggest that physical activity environments, which are places where people can be physically active on a daily basis, have decreased in recent history. Settings for sedentary behaviour, according to Sallis & Glanz (2009), include homes filled with electronic entertainment and labour-saving devices, workplaces, educational institutions and roads built to optimize travel by car. They further suggest that television viewing, computer use, computer games, and driving/riding in cars are some of the largest contributors to modern sedentary behaviour and obesity (2009).

The association between obesity and alcohol consumption is not surprising, given that alcohol is calorie-rich, nutrition poor and is usually takes place in a sedentary environment. The association between obesity and regular smoking may be indicative of the appetite suppressive effects of nicotine which are lost to former smokers or those who have never smoked. Kuhle & Veugelers (2008) suggest that smoking cessation may account in part, for the lack of a clear gradient for SES and overweight. Indeed, smoking and social drinking often go hand-in-hand, though recent provincial legislation has made smoking in public restaurants and pubs illegal

in regions of Canada. This may affect the association between smoking and obesity in future research.

Limitations of Study

There are several limitations to this research. First, there is no direct measure of social change in this analysis. For the purpose of this study, change in the effect of SES and other predictors of obesity, after controlling for the other individual-level factors, is assumed to be due to macro-level social change. This macro-level change is assumed to be related to the increased use of widely available technologies such as internet communications, electronic entertainment, processed and fast-food production technologies, transportation technologies, increased availability of and consumption of fast food etc. which are supportive of sedentary behavior and the creation of sedentary environments for daily life. Technological evolution has translated into the co-evolution of obesogenic environments.

Second, this study examines the effects of SES on baby boomer aged Canadians in a retrospective, cross-sectional secondary data analysis that looks at only 10 years of data. The use of cross-sectional data in a trend analysis precludes making statements about causation or direction of obesity trends in the future and could not elucidate age-period-cohort complications.

Third, this study cannot speak completely to the complex etiology of obesity in Canadian baby boomers. BMI, the level of analysis used to measure obesity, is controversial in its measurement and accuracy, for example, BMI provides no

information on fat distribution on the body which may influence disease risk (Xie et al. 2007).

Fourth, this study employs chronic condition variables as correlates of obesity in the hierarchical regression model. Research has shown that obesity leads to chronic conditions. This study used comorbid chronic conditions as indicators of objective health that could be isolated and controlled. This idea was predicated upon Kaplan et al's (2003) research model which used chronic conditions as a comorbidity predictor variable in their analysis of overweight and obesity among older Canadian adults.

Fifth, this study compares two different, large, national data sets that are not perfectly matched in variables, methodology and sample population size. The '94 NPHS data on obesity is based upon self-reported height and weight, which tends to over-represent height and under-represent weight (LePetit & Berthelot, 2005). The manner, in which anthropomorphic data such as height and weight are collected, such as self-report surveys or researchers taking measurements directly, will of course influence the reliability of the obesity probabilities garnered.

Sixth, statistical adjustments were not made for the complex and different design of each data set (i.e. the Bootstrap method was not employed). However, sample sizes in each data set were quite large and the 95% confidence intervals were small, indicating that findings were robust. The NPHS '94 and CCHS '04 data sets were bootstrapped by Statistics Canada to calculate variance for all variables.

Conclusions

This study has demonstrated nuances in the effects of socioeconomic status on obesity in Canadian baby boomers. Although finding limited support for the research hypotheses, this study found that increasing income becomes a risk factor for obesity in men and does little to affect obesity levels in women. The convergence hypothesis was partially supported for men at the multiple regression level, where the income effect switched from being protective in 1994 to being a risk for men in the upper middle income group in 2004. There was a difference in the education effect on obesity for men and women, such that over the ten years between these two data sets, the education effect increased among women and remained the same for men. Not having worked in the past year was a risk factor for obesity for women in 1994, but by 2004 this association lost its significance. Working status showed no effect in either data set for men.

With regard to health and lifestyle, a distinct sex difference in the relationship between stress and obesity was apparent. For men, stress level 3, which was between 0-5 thus indicating a moderate level of stress, increased risk of obesity in 1994 and by 2004, every level of stress above the lowest level, increased the risk for obesity. For women, stress levels were associated with decreased risk for obesity. Lifestyle variables that increased the probability of obesity among men and women included alcohol consumption, smoking and physical inactivity. Perhaps ideal body images for males and females are changing along with society and yet, are staying the same. Women remain body-conscious in Western cultures while the "real

beauty" movement is also occurring. The ideal body image for men seems more flexible, more open to expanding as the average BMI rises.

There may be a bidirectional causal relationship between SES and obesity. As the social determinants of health approach suggests, gender, income, educational attainment and working status are resources distributed by a given society, in this case, Canada in 1994 and 2004. In the baby boomer sample in 2004, upper middle income became a risk factor for obesity in males but not in females, while post-secondary educational attainment protected both males and females from obesity. Over time, the social determinants of obesity are operating differently among males and females, thus gender, a social determinant of health, is operating differently over time.

Obesity may adversely affect one's opportunities for education, occupation, income and marriage as well as operating in the opposite direction. Social determinants of health work in multiple directions – both as facilitators and barriers to health. Immigrants showed decreased risk for obesity, indicating a selection effect and a time-lag due to enculturation into the Canadian food culture. Educational attainment stands out as a protective element against obesity for both men and women. Those with more education are both more able to engage in healthy behaviours and attain better paying jobs (Weberian), and those with more education will enjoy better health because they will earn more income and will be able to purchase better foods in adequate quantities (Marxian). Discrimination against those in lower SES strata and those who are obese limits access to educational opportunities, employment opportunities and healthy environments.

Modern technological evolutions have created obesogenic environments in which sedentary behaviour is extensive. Men and women are interacting and living within these obesogenic environments differently, perhaps through coping mechanisms and social supports, as well as lifestyle and health beliefs. SES and the independent effects of income, education and working status operate differently for Canadian male and female baby boomers and will continue to do so in the future as long as socio-cultural differences exist for age and gender in the workplace and in society in general.

This study used Riley's Social Change model to help understand how social change immerses the birth cohorts of the Canadian baby boomer generation. Socially, the baby boomer cohorts have experienced the communications, entertainment, internet and food-production and automation technology boom largely as adults. Psychologically, the baby boomer cohorts have grown to expect technology to work for them and thus, to make their lives easier. Biologically, this has translated into burning fewer calories and increasing obesity. This macro-level social change has decreased the number of physical activity supportive environments and increased the modern opportunity to be sedentary on a daily basis (Sallis & Glanz, 2009). This may help explain the paradox found in Wister's (2005) work which showed that Canadian baby boomers were more active than previous generations, but were concurrently more obese and had more chronic illnesses such as hypertension and diabetes.

In order to continue research on the influence of social change on obesity among future Canadian generations, future research needs to use large census-

track data sets longitudinally and ask questions pertaining to the daily use of all technologies that induce sedentary behaviour. Research must also seek to answer not just the "how" of obesity growth in a population, but also the "why". Qualitative research should be included in obesity research in order to illuminate individual level nuances in the obesity paradoxes we face. Future research questions should consider how individual socioeconomic position changes over time with increasing education or loss of a career, and how that SES change over time affects obesity. It should also investigate the differential associations between stress and obesity among men and women, and how that relationship is linked to technology use and social change. The future impact of obesity on the Canadian health care system should be considered.

Finally, all future research on obesity in Canadian generations should consider gender differences and social determinants of health. With specific regard to social change in use of technologies, questions should be included to assess any sex/gender differences in the reliance or role of technology in daily life at the home and workplace. Questions need to be asked about supportive physical activity environments in the built environment and at the community level.

APPENDICES

Appendix A – List of Regression Variables Entered in Order of Hierarchy by Data Set

Block 1 – Socioeconomic Variables

NPHS 94 – All stratified by SEX
DVINC594 – Income adequacy 5 categories
DVEDQUART – Educational attainment recoded into 4 categories
RECODE_DVWK94 – Working status over past 12 months recoded into currently working and all others
CCHS 04 – All stratified by DHHC_SEX
INCADIA5 – Income adequacy 5 categories
EDUCRO4 - Educational attainment in 4 categories
RECODE_LBFCGJST – Job status over last year recoded into currently working and all others

Block 2 – Demographic Variables

NPHS 94
SEX – Sex
AGE – age in 5yr categories
MARSTATG – Marital status
IMMIG_FLAG – Immigrant status
PROVINCE – Province of residence
CCHS 04
DHHC_AGE – Age in 5yr categories
DHHCGMS – Marital status
SDCCFIM – Immigrant status
GEOPRV – Province of residence

Block 3 – Physical & Psychological Health

NPHS 94
CHRQI_D – chronic illness arthritis
CHRQI_F – chronic illness high blood pressure
CHRQI_H – chronic illness bronchitis / emphysema
CHRQI_J – chronic illness diabetes
CHRQI_N – chronic illness stomach / intestinal problems
DVCSI494 – Personal stress index
CCHS 04
CCCC_051 - chronic illness arthritis
CCCC_071- chronic illness high blood pressure
CCCC_91B – chronic illness emphysema

CCCC_31 – chronic illness asthma
CCCC_101 – chronic illness diabetes
CCCC_141 – chronic illness stomach
GENC_07 – Self-perceived stress

Block 4 – Lifestyle Variables

NPHS 94
DVSMT94 – Type of smoker
DVALT94 – Type of drinker
DVPAID94 – Physical activity index
CCHS 04
SMKC_202 – Type of smoker
ALCCDTYP – Type of drinker
PACCDPAI – Physical activity index

Appendix B – CD Rom Data

The CD Rom attached forms part of this work.

Data set files and data output files can be opened using SPSS 17.0. and MS Word 2007.

Data Files:

- NPHS 1994 Health_weighted Sept 08 (SPSS) 19,470 KB
- CCHS 2004_weighted Sept 08 (SPSS) 224,594 KB
- NPHS Regression & CI's (SPSS) 340 KB
- CCHS Regression & CI's (SPSS) 112 KB
- NPHS_Crosstab_Obesity by SES vars_sex split (SPSS) 65 KB
- CCHS_Crosstab_Obesity by SES vars_sex split (SPSS) 65 KB
- NPHS_Crosstab_Whole sample obesity by SES vars (SPSS) 59 KB
- CCHS_Crosstab_Whole sample obesity by SES vars (SPSS) 59 KB
- NPHS_Regression sans chronic health variables (SPSS) 397 KB
- CCHS_Regression sans chronic health variables (SPSS) 95 KB
- NPHS_FINAL_FREQS (MS Word) 437 KB
- CCHS_FINAL_FREQS (MS Word) 542 KB

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