HEALTH-RELATED KNOWLEDGE AND BEHAVIOURS ASSOCIATED WITH LEVELS OF OBESITY AMONG MANITOBANS: ANALYSIS OF THE 1990 MANITOBA HEART HEALTH SURVEY

By

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Health-Related Knowledge and Behaviours Associated With Levels of Obesity Among Manitobans: Analysis of the 1990 Manitoba Heart Health Survey

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A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirements of the degree

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THE THESIS IS DEDICATED

To my respected supervisor, Dr. T. Kue Young,

To my dear husband, Dr. Wei Ren,

To my Dad and Mom,

To my son, Yale,

------In love and gratitude.

Abstract

Introduction: Obesity is now recognized as a significant public health risk for Canadians. Little is known about how health-related knowledge is associated with the level of obesity and awareness of obesity. Also, there is a concern about the accuracy of obesity categorization through Body Mass Index (BMI) from self-reported data.

Methods: Data from the *1990 Manitoba Heart Health Survey* were analyzed to assess the level of knowledge about the risk factors of heart diseases among normal weight, overweight and obesity groups, and to compare self-reported behaviors, behavioral changes and perceived barriers and benefits among the three weight groups. The discrepancy between self-reported and measured height and weight and its impact on the classification of obesity were examined.

Results: From multivariate analysis, the level of obesity was not an independent predictor of knowledge level. The difference in knowledge scores between the three weight groups can be accounted for by a few confounders. There was no discrepancy between two methods of knowledge measurements. Both final linear models supported that health knowledge level was significantly associated with age, sex, aboriginal status, education and family incomes. Some distinctions were observed among the three weight groups in health-related behaviors and behavioral changes. Obese and overweight people were less likely to be current smokers and alcohol-drinkers than normal weight people. More persons in the obesity group reported that they were less active than others in the normal weight and overweight groups. While 64% of obese people and 46% of overweight people were trying to loss weight, 21% of normal weight were doing so too. More normal weight people chose an exercise strategy to loss weight than obese people. In terms of the most important change last year, more normal weight persons mentioned that they "were more active" or "improved their eating habits" while more obese/overweight persons stated that they were involved in "losing weight" and "got medical treatments". Self-reported values of weight and height were highly correlated with their measured values ($r=0.920$ for weight, $r=0.918$ for height). Overall, 82.8% of BMIs derived from self-reported measure fell into the same obesity categories as actually measured BMI.

Conclusions: Health education program should not merely target on overweigh/ obese people and include normal weight people as well. This study supports a population strategy over a high-risk strategy in health promotion. Self-reported weight and height are valid measure compared to actually measured data but minor discrepancy does result in some changes in the categorization of obesity.

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LIST OF ABBREVIATIONS

BED	Binge-Eating Disorder
BKI	Binary Knowledge Index
BMI	Body Mass Index
CHD	Coronary Heart Disease
CHHI	Canadian Heart Health Initiative
CPHHS	Canadian Provincial Heart Health Survey
CVD	Cardiovascular diseases
LTPA	Leisure Time Physical Activity
MHHS	Manitoba Heart Health Survey
NCD	Non-communicable Diseases
NES	Night Eating Syndrome
NHANES	National Health and Nutrition Examination Survey
NIDDM	Non-insulin Dependent Diabetes Mellitus
NIH	National Health Institutes (in the USA)
PAL	Physical Activity Level
RCT	Random Clinical Trials
SES	Soicoeconomic Status
TSKI	Total Score Knowledge Index
WHO	World Health Organization
WHR	Waist to Hip Ratio

CHAPTER 1
INTRODUCTION

1.1 The Problem

The North American population is rapidly gaining weight! Obesity is now recognized as a major public health threat; it has already affected a large proportion of the population including the younger generation. One-third of Canadian adults are obese (Macdonald et al., 1997) and half of the US adult population is somewhat overweight (Rippe, 1998). In the United States, the Third National Health and Nutrition Examination Survey (NHANES III) reported that 13.7% of American children and 11.5% of American adolescents were overweight (cited in National Institute for Health, 1998, p118). Between the 1960's and 1990's, the overall prevalence of obesity in the US has doubled. Moreover, a recent study of Behavioral Risk Factor Surveillance System (BRFCC) data from the US indicates that the prevalence of obesity increased in every state, in both sexes, and across all age groups (Mokdad et al., 1999).

WHO (1997) and the newly released "Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults" (NIH, 1998) have declared that obesity is a chronic disease for the following six reasons: a) insidious onset; b) long duration and frequently recurring; c) morbid process with characteristic symptoms; d) affects entire body; e) known pathology and prognosis; f) rarely cured. Previous studies show that obesity is associated with increased all-cause mortality (Manson, 1987; Stevens, 1999). It is a major risk factor for coronary heart diseases, hypertension, type 2 diabetes, and dyslipidemia. It is also related to gallstones, osteoarthritis, sleep apnea, some cancers (colon, breast, endometrial and gallbladder cancers), varicose veins, arthritis, respiratory problems (Pickwickian syndrome, a breathing blockage linked with sudden death), liver malfunction,

complications in pregnancy and surgery, flat feet and even a high accident rate (NIH, 1998; WHO, 1997; Sizer & Whitney, 1997). The consequences of obesity definitely have a negative impact on the quality of human life.

The causes of obesity are still not completely understood. Like many other chronic diseases, there are multi-level determinates. Ravussin et al. (1994) studied two groups of Pima Indians, who lived in the southwestern U.S. and northwestern Mexico. These two groups of people were separated 700-1000 years ago and now live under very different environmental conditions. Results show American Pimas were heavier than Mexican Pimas, had a much higher cholesterol level and had five times the rate of diabetes (cited by Carlson, 1997, p402). These striking findings demonstrate the inter-relationship between genes and environments. Genes of an efficient metabolism are of benefit to people who must work hard for their calories, like Mexican Pimas and other populations in developing countries. But the same genes turn into a liability when people live in an environment where the physical activities are low and food is cheap and plentiful, like the population in the US, Canada and many European countries.

The development of intervention programs needs information on population behavior and knowledge. Several studies have concluded that physicians and other primary health care practitioners have incomplete, confused and occasionally incorrect knowledge about obesity and nutrition issues (cited in WHO, 1997, p171). Obesity is generally not viewed as a serious medical condition, and many doctors fail to advise and treat their obese patients (cited in WHO, 1997, p171). Harris et al (1990) found that obese subjects were less knowledgeable about nutrition than thinner subjects. Smith et al. (1995) stated that knowledge is strongly predictive of dietary change. Beech and his colleagues (1999) pointed out that although the knowledge and consumption levels of adolescents with regard to fruits and vegetable were

low, their attitudes toward learning about healthier eating were favorable. Knowledge is positively related to education, but does not necessarily lead to risk-reducing behaviors (Avis, et al., 1990). Besides knowledge, many other factors influence behaviors. For example, black overweight women were less likely to lose weight than the white overweight women because of the absence of strong negative social pressure combined with a relatively positive body image (Kumanyika, 1993).

There are no published research papers addressing the association between health-related knowledge with the level of obesity and awareness of obesity. In other words, do overweight or obese individuals' health knowledge levels differ from that of normal weight individuals?

This study will conduct secondary analyses of the 1990 Manitoba Heart Health Survey (MHHS), to examine knowledge levels about heart health and some self-reported behaviors related to obesity among Manitobans.

Obesity assessment is another important issue. Body Mass Index (BMI) is the favored indirect measure of obesity among obesity researchers because it is strongly correlated with body fat. It is cheap, available, and easy to administer (US Preventive Service Task Force in1996, p.219). BMI is expressed as body weight in kilograms divided by height in meters squared. As many large-scale population studies rely on self-reported weight and height when their actual measurement is not practical or funds are limited, there is a concern about the accuracy of BMI. This study will investigate the differences between actual and self-reported measures and their impact on BMI and categorization of persons as overweight or obese.

1.2 Objectives

The three objectives of this study are:

1. to compare three weight groups (normal weight, overweight and obesity) on:

a. their level of knowledge about the risk factors of heart diseases;

b. their self-reported changes in health-related behaviors;

c. their perceived barriers and benefits to attempt to change health-related behaviors;

2. to assess the discrepancy between self-reported and measured height and weight and its impact on BMI and categorization of obesity;

3. to examine the differences in heart health knowledge and self-reported behavior changes between the agreement* and disagreement* BMI subgroups.

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* "Agreement subgroup" denotes individuals whose BMI from self-reported weight and height are in the same category as measured BMI when subjects are divided into three weight groups. "Disagreement subgroup" denotes individuals whose BMI from self-reported weight and height are in different weight categories as measured BMI.

CHAPTER 2
LITERATURE REVIEW

2.1 Concept Clarification

2.1.1 Overweight or Obese?

There has been confusion with the definitions of obesity and overweight. According to the glossary of the NIH Clinical Guidelines on Obesity (p173), **obesity** is " the condition having an abnormally high proportion of body fat, defined as a body mass index of greater than or equal to 30. Subjects are generally classified as obese when body fat content exceeds 30 percent in women and 25 percent in men." According to the same document, **overweight** is "an excess of weight but not necessarily body fat." In other words, this term includes weight in muscle, bone and water besides fat. Thus the concept of obesity is distinct from overweight because obesity emphasizes the excess of body fat while overweight emphasizes the excess of body weight. However, since most overweight persons are obese, it is difficult to separate obese people from the overweight people.

The terms overweight and obesity are often used inter-changeably. The Canadian Guideline for Healthy Weights (Health Welfare Canada, 1988), the Report of the Task Force on the Treatment of Obesity (Health Welfare Canada, 1991) and Canada's Food Guideline (Health Welfare Canada, 1992) define those persons with a BMI equal to or greater than 27 kg/m^2 as obese. Many surveys in Canada have used this cut-point to calculate the obesity prevalence (e.g., the 1978 Canada Health Survey, the 1983 Canada Fitness Survey, 1989 Canadian Heart Health Survey and the 1996/97 National Population Health Survey). However, the US National Health and Nutrition Examination Survey (NHANES I, II & III) used the terms "overweight" and "severely overweight", instead of "obese". In NHANES, the 85^{th} percentile of BMI was used to define overweight, and the 95^{th} percentile of BMI was

used to define severely overweight. For males, these cut-points were 27.8 and 31.1; for females, 27.3 and 32.3, respectively (cited by Jeor, 1997, p48). In Europe, both the terms overweight (25<BMI<30) and obese (30<BMI<40) have been used (http://www.roche-obesity.net/). This lack of consistency in cut-points makes prevalence comparisons across time and across countries very difficult.

This study will use the newly released NIH Clinical Guidelines on obesity to define obesity and overweight. In the NIH Clinical Guidelines "overweight" represents a special term between healthy weight and obese weight. "Overweight" does not just mean the excess of body weight. Overweight people might have an excess of body fat, but their BMIs are lower than obese people.

2.1.2 Obesity Measure Based on BMI

The classification of obesity from the NIH Clinical Guidelines is based on BMI. It clearly states: "This classification is designed to relate BMI to the risk of diseases. It should be noted that the relation between BMI and diseases risk varies among individuals and among different populations. Therefore, the classification must be viewed as a broad generalization" (p 58). Sometimes BMI is an inappropriate measure of individual obesity in persons who have a condition such as edema, high muscularity and very short body height. However, it is good at estimating relative risk for disease compared to normal weight at the population level.

Body Mass Index (also called the Quetelet Body Mass Index) is a simple index calculated as the weight in kilograms divided by the square of the height in meters. The formula is as follows:

$$\mathbf{BMI = Weight\ (kg) / Height^2\ (m^2)}$$

The classifications of overweight and obesity by NIH are displayed in Table 2.12. Actually, this standard was adapted from the "Report of a WHO Consultation on Obesity", and it has been tested in the MONItoring of trends and determinants in CArdiovascular diseases (MONICA) project involving 48 countries (WHO, 1989), so it has a potential value for global use.

Table 2.1.2 Classification of Overweight and Obesity by BMI

	Obesity Class	BMI (kg/m^2)
Underweight		<18.5
Normal		18.5 - 24.9
Overweight		25.0 - 29.9
Obesity	I	30.0 - 34.9
	II	35.0 - 39.9
Extreme Obesity	III	> or = 40

(Source: National Institute of Health. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: the Evidence Report. 1998. USA. Page x)

BMI is a good measurement for adult obesity, but not for children. Adult BMI increases very slowly with age. However, children's BMI changes substantially with age, rising steeply with infancy, falling during the pre-school years, and then rising again into adulthood. Age-related reference curves are being developed in Europe to determine the best method for classifying overweight and obesity in childhood (Rolland-Cachera, et al., 1991; Hammer, et al., 1991).

2.2 The Burden of Disease in North America

The trend data on obesity in Canada and the USA are well documented. Studies show that people in North America have been gaining body fat since the late 1970's. Using the new

cut-point of BMI = or > 30 kg/m^2, WHO recalculated the prevalence of obesity in Canada and the USA from previous studies (Table 2.2.).

Table 2.2 Trends in obesity (BMI = or > 30) in Canada and USA as Recaculated by WHO

Country	Year	Ages	Prevalence of obesity (%)	
			Men	Women
Canada	1978[a]	20-70	6.8	9.6
	1981[b]	20-70	8.5	9.3
	1988[c]	20-70	9.0	9.2
	1986-92[d]	18-70	13.4	14.0
USA	1960[e]	20-70	10.0	15.0
	1973[e]		11.6	16.1
	1978[e]		12.0	14.8
	1991[e]		19.7	24.7

(Sources: WHO, Obesity: Prevention and Managing the Global Epidemic. Report of a WHO Consultation on Obesity. Geneva, 3-5 June. 1997. Page 24)

a: 1978 Canada Health Survey
b: 1981 Canada Fitness Survey
c: 1988 Campbell's Survey
d: 1986-92 Canada Heart Health Survey
e: data from US HCHS, Centers for Disease Control and Prevention

Data in Table 2.2 provide comparable historical data on the prevalence of obesity and trends for North America. The table shows that the overall prevalence of obesity has been increasing in both Canada and the USA over the past three decades. There are two stages; from 60's to 80's, the prevalence rates only slightly increased however, from the end of the 70's or 80's to the beginning of the 90's, the prevalence rates in both countries have increased dramatically. Data also show that obesity was more widespread in the USA than in Canada. More women were obese than men. It has been predicted that if obesity is not controlled, that by the year 2230, 100% of the adult US population could be obese. (Petrie, 1998). The same trends are also observed in many European nations (Sedell, 1998).

Why did the prevalence of obesity increase so dramatically in North America and Europe during the 1980's and 1990's? Most studies attribute the change to diminished physical activity, high-fat diets and inadequate adjustments of energy intake. Prentice and Jebb (1995) proposed that limited physical activity might play a more important role than energy or fat consumption in explaining the time trends of obesity. In addition, changes in smoking behavior may contribute to changes in BMI at the population level. Moreover, since obesity is defined by BMI, the consequence of minor changes in average weight and/or height could increase or decrease the prevalence of obesity (cited by Sedell, 1998, p10-11).

While developed countries are recognizing the obesity problem, some developing countries have just entered the nutrition transition. They may face obesity in the near future. Nutrition transit is referred to as a shift in the structure of the diet, reduced physical activity and rapid increase in the prevalence of obesity (Popkin, 1994). In short, it means overnutrition replacing undernutrition. Data from Brazil (Monteiro et al. 1995), Thailand (Leelahagul & Tanphaichitr 1995) China and Russia (Popkin, et al., 1996) have demonstrated this trend. The WHO (1997) pointed out sharply, "it is only a matter of time before developing countries are likely to experience the same high mortality rates for such diseases that industrialized countries with well-established market economies exhibited 30 years ago." (p1).

2.3 Economic Cost

Obesity is now the second leading cause of preventable premature death in the United States (after smoking), and accounts for approximately 300,000 deaths per year, and almost 8% of the total cost of illness (http://www.bassetthealthcare.org/research/index.html#Community).

Studies from the USA, U.K. and New Zealand reported that obesity has placed a burden on the health care system. Wolf and Colditz (1998) found that the direct costs

associated with obesity (BMI> or =30) represent 5.7% of the health expenditure in the U.S., about US$99.2 billion, in1994. They used a prevalence-based approach to estimate the direct and indirect costs in 1995 dollars attributable to obesity for a few chronic diseases such as diabetes, coronary heart disease (CHD), hypertension, gallbladder disease, breast, endometrial and colon cancer, and osteoarthritis. They analyzed patients' excess physician visits, work-days lost, restricted activity, and bed-days attributable to obesity using the medical component of the consumer price index (direct costs), and all the items of the consumer price index (indirect costs) from the 1988 and 1994 National Health Interview Survey (NHIS) data. Compared with 1988 NHIS data, the number of physician visits attributed to obesity increased 88%; restricted activity increased 36%; bed-days increased 28% and work-days lost increased 50%. A similar study in New Zealand (Swinburn, et al., 1997) reported that 2.5% of total health expenditure or NZ$135 million were attributable to obesity.

Two US studies indicated that increasing BMIs were associated with greater health care utilization, primarily through greater morbidity (Sansone, et al. 1998 & Quesenberry, et al., 1998). They related BMI to the annual rates of inpatient days, number, costs of outpatient visits, costs of outpatient pharmacy and laboratory services as well as total costs. Results showed that the total cost was 25% greater among those with a BMI of 30 to 34.9, and 44% greater among those with a BMI of 35 or over than those with a normal weight BMI. Increased coronary heart diseases, hypertension and diabetes among obese individuals explained the elevated costs.

The above evidence indicates a significant potential for a reduction in health care expenditures through obesity prevention efforts.

2.4 Adverse Effects of Obesity

Numerous research projects have documented the negative effects of obesity on human health. These effects include all-cause mortality and related disease morbidity, and psychological well-being. Most information about these effects is gathered from observational epidemiological studies.

Many studies reported the relationship between mortality and BMI was a 'U' or 'J' or even linear shape. Mortality rates were high both in persons with low and high BMI. Mortality began to increase with BMI above 25 kg/m^2. No matter what shape the curve is, it appeared that the lowest mortality risk was associated with a BMI between 18 and 25. While the prevalence of obesity is going up in North America, the overall death rate is dropping. Experts attribute it to the reduction of cardiovascular diseases (CVD) due to smoking control and dietary improvement. They also anticipated that if we did not control obesity, the mortality rate would increase again because of the strong association between obesity and a series of chronic diseases. Three aspects of the associations between obesity and mortality remain unclear. Firstly, no evidence shows that intentional weight gain in persons with low BMIs will lead to a reduction in mortality. Secondly, the relationship between BMI and mortality becomes weak among persons age 75 and over. Thirdly, lower-than-average mortality has been observed among some ethnic groups with a high BMI level. (cited in NIH, 1998, p23-24) Due to many confounding factors, the relationships between obesity and mortality have not been clearly explained. However, one still can not ignore the negative effect of obesity on general mortality rates.

Obesity is a risk factor for a number of non-communicable diseases (NCD). First of all, a positive association between obesity and the risk of developing **Type II Diabetes** (called NIDDM, non-insulin-dependent diabetes mellitus) has been repeatedly observed in

American Indians. An example is reflected in the study of the Pima. Currently, 80% of adult Pimas are obese and the prevalence of NIDDM is 40% in adults, and 70% of those over age 60 (Zimmet, 1982. Cited in Wilding & Willians, 1998, p309). Obesity further increases the risk of developing NIDDM after controlling for age, smoking and family history of NIDDM. The relative risk of diabetes increases by approximately 25% for each additional unit of BMI over 22 kg/m^2. Two prospective studies showed that about 64% of male and 74% of female cases of NIDDM could theoretically have been prevented if all persons had a BMI under 25 (WHO, p53). Abdominal obesity is an independent risk factor for NIDDM. A Swedish study showed an interaction of WHR (waist to hip ratio) with BMI on the 10-year risk of developing NIDDM. People with a high BMI and high WHR had a much higher risk for developing NIDDM (Larsson et al., 1994). Obesity and NIDDM share several characteristics. Both are genetically determined and are related to physical inactivity as well as unhealthy diet. It has been hypothesized that obesity induces insulin resistance, which may lead to impaired glucose tolerance and NIDDM. Other factors such as feeding behavior, type of food (e.g. high-fat diet) consumed and sedentarity may influence both weight gain and insulin sensitivity.

Obesity is a risk factor for **CHD**. Obesity predisposes an individual to several cardiovascular risk factors including hypertension, dyslipidemias and impaired glucose tolerance. Obesity at the upper range of body weight is associated with death due to CVD. Excess abdominal obesity may also affect CVD risk (Newchaffer et al., 1999). A number of studies including the Framingham Heart Study have found a positive correlation between BMI and the risk of developing CHD (Hubert, et al., 1983; Alpert & Hashimi, 1993). The prevalence of hypertension and diabetes is three times higher among overweight people than among those of normal weight. Obesity is also associated with a high level of LDL-

cholesterol and low level of HDL-cholesterol (Ernst, et al., 1997). Men with a WHR (waist-to-hip-ratio) greater than 1.0 and women with a WHR greater than 0.8 experience increased CHD risk (Freedman, et al., 1995). A high WHR rather than BMI was the risk factor associated with stroke (Lasson, et al., 1984).

Obesity also is a potential risk factor for many other chronic health problems: gallstones, osteoarthritis, sleep apnea, certain cancers (colon, breast, endometrial and gallbladder cancers), varicose veins, arthritis, respiratory problems (Pickwickian syndrome, a breathing blockage associated with sudden death), liver malfunction, complications in pregnancy and surgery, flat feet and even a high accident rate.

Finally, obesity can lead to psychological problems. Obese people encounter social bias, prejudice and discrimination. They may have stronger body shape dissatisfaction, or low self-esteem. They may have eating disorders such as BED (binge-eating disorder) or NES (night eating syndrome). Obese people are more likely to be unemployed than non-obese people (NIH, 1998, P20-22).

2.5 Major Behavioral Risk Factors of Obesity

2.5.1 Overeating

Overeating can be a major source of excess calories that may lead to weight gain. According to the psychosomatic view of obesity, overeating occurs in response to emotional stimuli including anger, fear, anxiety and depression. There is a positive shift after eating, toward feeling calm and released. Thus overeating is a learned behavior that can be viewed as a coping response resulting from a confusion of internal cues associated with the activation of stress and hunger cues (Robbins & Fray, 1980). Food craving (e.g. 'carbohydrate caving') and food 'addiction' (e.g. chocoholism') can also be a cause of overeating (Mela & Rogers, 1998, p150).

2.5.2 Fat intake

Despite the problem of assessing dietary intake, Lissner & Heitmann (1995) reviewed 18 studies over the past 25 years and found relatively consistent positive associations between the percentage of energy from fat and obesity (cited in Mela & Rogers, 1998, p111). Another study showed that the relationship between percent dietary fat and percent body fat was significant, even after controlling for other relevant lifestyle and dietary variables (Tucker & Kano, 1995). Since fat possesses a lower satiation power than carbohydrate and protein, a diet rich in fat could increase energy intake (Bray & Popkin, 1998). The propensity to gain weight is enhanced in susceptible people, particularly sedentary people who have a genetic predisposition to obesity. Moreover, fat contains more stored energy than other nutrients.

The epidemiological link between fat intake and measures of fatness also extend to children. Eck et al. (1995) reported that children at risk (having an overweight parent) had a higher relative fat intake at baseline than controls (neither parent overweight), which suggested that this pattern of intake might be established early in life. Numerous other studies found fat intakes of young children and adolescents were related to measures of fatness of these subjects and their parents (Ortega et al., 1995; Maffeis et al., 1996; Fisher & Brich, 1995; Nguyen et al., 1996).

On the other hand, weight loss is positively correlated with the reduction in dietary fat content. A reduction in fat intake reduces the gap between total energy intake and total energy expenditure. Thus it may be an effective strategy in reducing the present epidemic of obesity. A review of the results from 28 clinical trials that studied the effects of a reduction in the amount of energy from fat in the diet showed that a reduction of 10% in the proportion of energy from fat was associated with a reduction in weight of 16g/day (Bray & Popkin,1998).

2.5.3 Physical Inactivity

A sedentary lifestyle with a low level of energy expended on physical activities is another major behavioral risk factor for obesity. Cross-sectional data revealed an inverse correlation between BMI and physical activity (Rising, 1994; Davies, 1995). Other studies found obesity was absent among elite athletes, but was more prevalent among those who gave up sports (Wiilianson, 1993 & 1996). Prentice and Jebb (1995) used proxies for inactivity (e.g. the amount of time watching TV or the number of cars per household) to demonstrate that decreased physical activity plays an important role in the development of obesity. Health experts thought one of the main causes of obesity in children is not getting enough exercise. Two studies found weak inverse associations between hours of TV viewing and physical activity among children (Robinson et al. 1993; DuRant et al., 1994). TV watching was strongly related to the onset of new cases of obesity and to the remission among obese children (Dietz & Gortmard, 1994). In addition, prospective data showed that a low level of physical activity during leisure time is predictive of substantial weight gains in adults (Rissanen, et al., 1991). Besides obesity, physical inactivity is also a risk factor for many other chronic diseases such as hypertension, CVD, NIDDM (Happanen, et al. 1996; Helmrich, 1991) and some cancers (White, 1996).

Intervention studies show the role of physical activity on weight control and maintenance. Although physical activity does not lead to greater weight loss than dietary therapy, it is more effective in maintaining a moderate weight loss over a prolonged period and it is the most effective tool to prevent further weight gain (Pronk & Wing, 1994; Ewbank, et al., 1995). Ten Random Clinical Trials (RCT) articles reviewed by NIH (1998) reported a mean weight loss of 2.4 (or 2.4% of weight) or a mean reduction in BMI of 0.7 kg/m^2 in the exercise group. Some longitudinal studies with a 2 to 10 year follow-up

observed that physical activity was related to less weight gain, less weight gain after smoking cessation and weight loss over 2 years (p45). Furthermore, physical activity in overweight post-menopausal women resulted in modest weight loss independent of the effect of caloric reduction through diet (Svendsen, 1994).

Regular physical activity can promote healthy weight because it not only increases the total energy expenditure including slightly increasing the RMR (resting metabolic rate) (Westerterp et al., 1994), but also changes body composition by burning more fat and building muscles. Physical activity helps the body to avoid weight gain by altering certain body functions such as thermoregulation, hormone balance and muscle function. However, these changes will be lost after several days of inactivity; therefore some studies have highlighted the benefit of regular and sustained exercise patterns (Tremblay, 1988). Moreover, physical activity has other advantages on body and mental health. It can improve cardiorespiratory fitness, help regulate appetite, help control stress and enhance self-esteem (Sizer & Whitney 1997, p192).

PALs has been introduced by the WHO (1997) for daily physical activity assessment. PALs means "physical activity level". According to the WHO, "PALs are a universally accepted way of expressing energy expenditure and help to convey an easily understandable concept." (p121) It has been suggested that "in order to avoid obesity, the population should remain physically active throughout life at a PAL of 1.75 or more." (p121). For people with a sedentary life, PAL is only 1.4. For people with limited activity, PAL is 1.55-1.60. Only for people who are physically active PAL equals 1.75 or more. To achieve a PAL of 1.75 or over, people have to choose either a daily one hour brisk walk, cycling 45 minutes, or playing soccer for 30 minutes, etc. The more strenuous the activity the less time is required. That makes sense for guiding the public to prevent obesity.

2.6 Knowledge Level and Body Weight

Individual knowledge in weight management is critical. Several studies from France, UK, and the US observed that the level of education was inversely associated with body weight (cited in WHO, 1997, p132). This finding may be partially attributed to the fact that higher educated people were more likely to follow dietary guidelines/recommendations and adapt other healthy behaviors than less educated people. The relationship between SES and obesity is another way to test the correlation between knowledge level and body weight. International studies repeatedly showed that high SES was negatively associated with obesity in developed countries but positively associated with obesity in developing countries. Further evidence demonstrated, as the less developed countries achieve a higher level of affluence, the positive relationship between SES and obesity was replaced by the negative association in developed countries (cited in WHO, 1997, p130).

The level of knowledge per se does not guarantee a change in lifestyle and achieve weight control. Many other factors including beliefs, attitudes and values also determine the motivation of the behavior change. Ettema and Kline (1977) argued that the knowledge gaps between higher and lower SES groups were not necessarily due to the effect of less formal education, but to different levels of motivation and interest. Some supporting studies showed the association between knowledge and individual variables such as interest, salience, motivation and involvement was greater than the association between knowledge and education (Zandpour et al.,1992; Fredin & Fellow, 1994). For example, one study examined attitudes of adolescents towards the dating of overweight people. It showed that women were more concerned about their own body weights than men, while men emphasized thinness in partners more than did women. In this case, stigmatization of overweight students in dating activities, not knowledge about health impacts of obesity, played an important influence on

desires of adolescents to be thin (Striegel-Moore, Wilfley & Caldwell, et al. 1996). Surveys indicate that although some people know how to follow a healthy diet, they preferred to consume a relatively unhealthy diet in practice (Laurier et al., 1991). Knowledge about heart health hazards of smoking is higher among smokers than non-smokers in the Canadian Heart Health Survey (Stachenko et al., 1992).

However, the individuals who are overweight or obesity-prone who want to lose weight or avoid becoming obese really need a very high level of knowledge (on nutrition, food health, physical activity and health), motivation, personal behavioral management skill and lifestyle flexibility. Since the acquisition of new habits is extremely difficult, assessing the knowledge level of overweight people before treatments, giving them motivating knowledge on change, informing them about the strategies of change and educating them to master the skills are still very important. So even though knowledge is not a sufficient reason for behavioral change, it is an essential condition.

2.7 The Reliability of Self-Reported Weight and Height

There is a debate on the validity and reliability of self-reported weight and height (about 12 papers, from 1969 to the present). Because self-reports are the most convenient and economical approach for studies, it was comprehensively used in the past despite the debate. Some studies have attempted to explore the problem of this method (Stewart, 1982; Piere, 1981). They found that although self-reported weight was highly correlated with measured weight ($r = 0{,}822 \sim 0.979$), there was still a systematic error. Usually obese individuals tend to underestimate their weight while slender individuals tend to overestimate. They also found that this tendency increased over a long period of recall. For example, the tendency became very obvious when they asked seniors to recall their weight as a young adult or for the majority of adult life. However, a study by Heaney and Ryan (1988) indicated that recall of

past height was highly valid. The correlation between the reported and measured height was 0.944 at age 45-50 year. Therefore, further research to investigate the association is still needed.

CHAPTER 3
METHODS

3.1 Research Questions and Corresponding Hypotheses

This study was designed to address three research questions. The three questions were:

1. What are the differences in the level of knowledge about the risk factors of CVD, health-related behavioral changes and the perceived barriers and benefits of the change among obese, overweight and normal weight adults in Manitoba?
2. What is the association between self-reported and measured body weight, height and BMI, and the impact of the discrepancy between these two sources of data on the categorization of obesity?
3. What are the differences in the level of knowledge about the risk factors of CVD, health-related behavioral changes and the perceived barriers and benefits of the change between BMI agreement and disagreement groups*?

The hypotheses based on the research questions are:

- Hypotheses for research question 1
  a) There will be a significant difference in the level of knowledge about risk factors of CVD among obese, overweight and normal weight groups.
  b) There will be a significant difference in health-related behavioral changes (such as exercise, eating habit or smoking cessation) among obese, overweight and normal weight groups.

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* "Agreement subgroup" denotes individuals whose BMI from self-reported weight and height are in the same category as measured BMI when subjects are divided into three weight groups. "Disagreement subgroup" denotes individuals whose BMI from self-reported weight and height are in different weight categories as measured BMI.

c) There will be no significant difference in the perceived barriers and benefits of a particular behavioral change among obese, overweight and normal weight groups.

- Hypotheses for research question 2:
  a) Self-reported body weight will be highly correlated with measured body weight.
  b) Self-reported body height will be highly correlated with measured body height.
  c) Calculated BMI based on self-reported body weight and height will be highly correlated with BMI based on measured body weight and height.
  d) There is no difference in the prevalence of obesity categories using BMI based on self-reported data and BMI derived from measured data.
- Hypotheses for research question 3:
  a) There will be no difference in the level of knowledge about risk factors of CVD between BMI agreement and disagreement groups.
  b) There will be no difference in health-related behavioral changes (such as increase exercise, improve eating habit or quit smoking) between BMI agreement and disagreement groups.

3.2 Data Source: 1990 Manitoba Heart Health Survey

Data for this study are from the Manitoba Heart Health Survey (MHHS) conducted from October 1989 to February 1990.

MHHS was a cross-sectional survey with complex sampling across eight health regions of Manitoba. The target population is all non-institutional adult residents of Manitoba aged 18-74, including residents of First Nation Reserves. The total population was about 754,644 people resident in 269 administrative units (cities, towns, villages) of Manitoba in 1989. About 4000 participants were sampled with equal numbers from each of three geographic strata (Winnipeg, regional centers and rural communities).

The objectives of the MHHS were to determine the prevalence of risk factors for CVD, the degree of knowledge about the cause and consequence of CVD and related behaviors, beliefs and attitudes (Young, et al., 1991).

The main procedures of the survey were a home interview and a clinic visit conducted by trained nurses under a standardized core protocol (a manual of field operation and training procedures). The home interview was conducted first. It included two sets of survey questionaires; Risk Factor Questionaire (RFQ) and Nutrition Questionaire (NQ). RFQ asked for information on demographics, lifestyle/behavior (smoking, alcohol intake, physical activity), diabetic status, hypertension status, knowledge and awareness of the risk factors and consequence of CVD. Blood pressure was measured both at the beginning and the end of the interview. The NQ was designed to collect information on regular dietary intake in order to assess the amount and frequency of different types of food consumption.

In the clinic visit (within two weeks of the home interview), blood pressure was measured twice again, and a fasting blood sample was collected for plasma lipid analyses (including cholesterol, triglycerides, high density lipoprotein and low density lipoprotein tests). In addition, four items of anthropometric data were gathered; body weight, height, waist circumference and hip circumference.

Before the interview, an informed consent was signed by all of the participants. The survey was approved by the Ethics Committee of the Faculty of Medicine at the University of Manitoba.

3.3 Sample Selection

The MHHS used a stratified, two-stage, replicated probability sampling design. At the first stage, the target population was subdivided into three geographic strata:

1) Winnipeg and adjacent rural municipalities (62% of total population)

2) Six regional centers with three adjacent rural municipalities (15% of total population)
3) Small rural communities, including First Nation Reserves, local government districts,
rural municipalities, towns and villages. (23% of total population).

At the second stage, the health insurance registries were used to select individual participants (random sampling). The first-time sampling involved 4080 people. Due to a low response rate in certain age-sex groups, a second sampling was implemented which consisted of 510 adults. From the located participants, the overall response rate was 77%. The final study sample consisted of 2792.

Each individual participant was assigned a sample weight reflecting the probability of selection (age, sex, geography). Using this weight allows prevalence estimates to be made which are representative of the Manitoba population.

3.4 Study Design and Variables of Interest

This study is a secondary data analysis using an existing data set from the MHHS. This is both a descriptive and analytical study. The descriptive study examines the differences in knowledge, belief or behavior, and the barriers or benefits of specific behavioral changes among obese, overweight and normal weigh individuals. The analytical study will test the hypotheses between the level of knowledge and the level of obesity and the association between self-reported anthropometric data (weight, height and BMI) and the corresponding measured data. This study will investigate whether the level of obesity is a determinant of health knowledge.

3.4.1 Dependent Variable

Based on the research questions and hypotheses, the dependent variable of primary interest is level of the knowledge about heart diseases. Measuring health knowledge is problematic. There is a dearth of literature addressing this question. The *Statistical Report on the Health of Canadians* (Statistics Canada, 1999) stated, "health knowledge is seldom assessed despite its alleged importance... Population data on health knowledge thus constitute one of the weakest areas in the Population Health Framework." (p.150).

There were two approaches presented in the *1990 Canada's Health Promotion Survey: Technical Report* (CHPS90: TP) (Health and Welfare Canada, 1993, p154). One approach suggested creating a Knowledge Index by tabulating the sum of the individual's correct answers. The other mentioned that a second summary index of health knowledge could be created by summing the percentages for each of the distinct causes of heart disease and dividing the total to produce an average percentage.

This study generated a "Total Score Knowledge Index" (TSKI). Instead of using one question only, ten knowledge questions were pooled together. Each question has five correct answers except one question. (See Appendix 2). One right answer counts one mark. The total score of a person was the sum of the correct answers. The full score was 50. This total score could range from 0 to 50.

However, there are some limitations if only TSKI is used. Two persons may have the same TSKI of 40, one can not tell the difference between a person who lacks knowledge in one or more areas and a person who has knowledge in all the areas but does not get all the correct answers on each question. Actually, the latter person may be more knowledgeable overall than the former. The latter person has some knowledge in all ten areas while the

former may have knowledge in only nine areas. In order to deal with this problem, another approach was added.

The second approach created a "Binary Knowledge Index" (BKI). There still are five correct answers in each of the ten knowledge questions. The difference is: if one chooses one or more of the five correct answers, the score is one. Otherwise the score is zero. In other words, each question only has two kinds of marks, either "1" or "0". BKI is the sum of the results from ten questions. So the range of the total score would be "0" to "10". A score of 7 indicates that the person lacks knowledge in three areas. Note, BKI is a continuous variable. The same statistical method can be employed for TSKI and BKI analyses.

3.4.2 Independent Variables

There are several factors hypothesized to have a potential impact on the level of heart health knowledge. These independent variables were:

1) Level of relative weight (normal weight, overweight and obesity. BMI was calculated from measured weight and height. Cut points are listed in Table 2.12)
2) Obesity Categorical Matching (binary variable: agreement vs disagreement)
3) Age (continuous variable: range from 18 to 74 years)
4) Sex (binary variable: male vs female)
5) Ethnic (binary variable: Aboriginal people vs all others)
6) Marital status (binary variable: married vs single & widowed)
7) Education Background (binary variable: university vs non-university)
8) Household Income (binary variable: "< $50,000" vs "= or > $50,000")

These variables will be used in the descriptive analyses. However, formats may be changed. For example, three categorical variables were used to describe the level of weight. "Age" sometimes is expressed an ordinal variable.

3.4.3 Other Variables

In terms of descriptive analyses, some other variables involved are :

- Behavioral variables
  1) Smoking (current smokers, past smokers and never smokers)
  2) Alcohol drinking (drinkers vs non-drinkers; light drinkers vs moderate drinkers vs heavy drinkers)
  3) Exercise (no exercise, low exercise, moderate exercise and high exercise)
  4) Weight loss (do nothing, trying to gain weight and trying to lose weight)
  5) Diet Change

     (change vs non change. The original question is, "how would you rate your diet compared to this time last year?" The list of answers are: "definitely different", "small change", "no change" and "not sure". So "definitely change" was combined with "small change" to create a "change" category.)
  6) Single Most Important Change

     (This is a nominal variable. One person only had one choice. There are fourteen answers, but five of them were included in this study.)
     - did nothing
     - increased exercise
     - improved eating habits
     - quite/reduced smoking
     - received medical treatment
- Anthropometric indices
  1) Body Weight (unit: kg, a continuous variable)
  2) Body Height (unit: meter, a continuous variable)

3) Body Mass Index (unit: kg / m^2, a continuous variable)

3.5 Data Preparation

3.5.1 Sub-Data Creation

Based on the objectives of this study a sub-set of data was generated from the MHHS data set. The sub-data set was named "MHHS_Obe". There are four features in the new data set. First, it is much smaller than the MHHS data set because about 61% of the original questionnaires were cut out. Only 35 questions were left in the MHHS_Obe. Second, the data were transferred into an SPSS data set. Third, the variables in the MHHS_Obe data were divided into three categories; knowledge, behavior and others. (See detail in Appendix 1). Fourth, all of the variables were re-coded for quick locating and accessing during analyses. The strategy used was to assign a character code (less than 7 letters) to each question. If that question had more than one variable, a number was followed after that character code to identify the variable. For example, Question 64 was coded as "HDCAUS" (refer to the causes of heart diseases). There were five responses. According to this strategy, each response was coded as "HDCAUS1", or "HDCAUS2", or "HDCAUS3", and so forth.

Data MHHS_Obe was trimmed before analyses. There were a few selection and exclusion criteria for this study. The selection criterion is that the variables included in the MHHS_Obe must be related to the three objectives of the study. The exclusion criteria are twofold. One is that individuals whose measured weight or height was missing are excluded from the MHHS_Obe. The other is that individuals whose BMI (based on measured weight and height) were less than 18.5 are excluded from the MHHS_Obe.

As a result, there were 2249 eligible subjects in the MHHS_Obe dataset. 911 (40.5% of the total), 866 (38.5% of the total) and 472 (21% of the total) persons fall into normal

weight, overweigh, and obesity categories respectively. The demographic characteristics of the participants are provided in Table 6.1.

3.5.2 Data Screening

MHSS data were created as a ASCII file and can be easily imported either as a SAS file or a SPSS file for analyses. Outliers and internal consistency have been checked before analyses.

Missing values and frequency for each variable were examined using SPSS. The results are shown in Appendix 2. With the exception of the variables "occupation" and "income", the majority of variables have less than 5% of their values missing. Pairwise deletion was used to deal with the missing values. *Pairwise deletion* means each correlation coefficient between two variables is calculated using all cases that have values for the two variables in a multiple regression. (Norusis, 1998, p460).

"Occupation" has 26% of its values missing while "income" has 11.2% of its values missing. Considering that a variable with too many missing values may draw incorrect conclusion, the "occupation" variable was deleted. In the case of "income", it was kept in the multiple models for two reasons: (1) Household income is an important component to define socioeconomic status. (2) The missing values were not excessive but caution will be noted when reporting the results.

3.6 Statistical Methods

Analyses were performed using various quantitative methods in SPSS. Those methods included Frequencies, Descriptives, Crosstabulation. Paired T-Test, ANOVA, Multiple Regression, Correlation Coefficient and Cohen's Kappa Coefficient. The first three methods were performed to examine the self-reported behavioral changes and perceived benefits and

barriers by the level of obesity. Corresponding tables were produced to summarize the percentage of frequencies and then make comparison among the three weight groups.

ANOVA and Multiple Regression were applied to analyze the knowledge level difference by the level of obesity. First, ANOVA was run to check whether there was a significant difference in knowledge level (expressed as two kinds of knowledge indices) between obesity groups, age groups, sex groups, ethnic groups, and education groups. respectively. Next, an unadjusted regression model was run, with one of the knowledge indices as the dependent variable while obesity (using as a dichotomous variable) as the only independent variable. Finally, Multiple Regression can be used to determine whether level of obesity is a real determinant of level of heart health knowledge.

Cohen's Kappa Coefficient was used to determine the strength of association between self-reported BMI and measured BMI. Cohen's Kappa Coefficient is ideal to measure the agreement of two rating scales. It corrects the observed percent agreement for chance and also normalizes the resulting values so that the coefficient always ranges from -1 to +1. "A value of 1 indicates perfect agreement, while a value of -1 indicates perfect disagreement. A value of 0 indicates that the similarity between two raters is the same as you would expect by chance." (Norusis, 1998). For example, if one gets a result of Kappa of 0.15, that means that there is some agreement between self-reported BMI and measured BMI, but this agreement is not very strong.

Throughout the analyses, P values below 0.05 were regarded as statistical significant in this thesis.

CHAPTER 4
RESULTS

4.1 Highlights

This chapter presents the results of the analyses of the three research questions presented in Chapter 4. The main findings are.

- The overall unadjusted obesity prevalence generated from the MHHS_Obes data set was 21% (BMI ≥ 30). There was a variation in the prevalence of obesity by gender, age, race and socioeconomic status. More women were obese than men. The middle aged, the elderly, the aboriginal, the married or common law, and those with secondary or lower education had a relatively higher obesity prevalence.
- Health knowledge level about the risk factors of heart diseases, expressed as TSKI and BKI in this study, was distinct among socio-demographic groups. Women were more knowledgeable that men. TSKI or BKI mean score of the non-aboriginal were almost twice that of the aboriginal. People with higher education had a higher level of CVD knowledge. The ANOVA analysis also displayed a trend that more obese people have lower CVD knowledge.
- The status of overweight/obesity was not an independent predictor of the level of CVD knowledge. The slightly general decline in CVD knowledge level from normal weight to obesity was confounded by a number of socio-demographic factors.
- The real determinants of CVD knowledge in this study were age, sex, aboriginal status, education level and household income. A person who was old, male, Aboriginal, with a low level of education or income was less familiar with CVD knowledge. Overweight/ obesity status and marital status were not determinants of CVD knowledge.

- In terms of overweight as one of the risk factors of CVD, more obese individuals than overweight and normal weight individuals indicated that overweight was the cause of heart diseases and the cause of high blood pressure.
- There was only a minor difference in health-related behaviors including cigarette smoking, alcohol-drinking and physical activity among normal, overweight and obese people. Fewer obese people were smokers or alcohol-drinkers. The lifestyle of obese people was more sedentary.
- Most people took action to change their lifestyle for better health during the previous year of the survey. Seventy-two percent of them reported that they had made some changes in health-related behaviors. More normal weight persons reported they had been engaged in exercise while more overweight/obese persons mentioned that they had tried to lose weight or received medical treatments.
- In terms of improving eating habit, only 13.6% of individuals reported a definite improvement in the year preceding the survey. A slightly larger proportion of obese people reported having made this change than normal weight people. Specifically, more obese people stated that they ate less lean meat, processed food, baked food, fried food and salty food. No significant difference was observed in the intake of high fiber food, lean meat and processed food among the three weight groups.
- More obese people had an intention to take action on behavioral change in the year following the survey. The proportion of those who wished to make a change in the obesity, overweight and normal weight groups was 87%, 78% and 76% respectively. Nearly half of the people in the obese group and 27% of the overweight group wanted to lose weight. Eighty percent of normal weight people wanted to lose weight.

- Regarding the reasons of quitting smoking and improving diet, all three weight groups checked off "health reasons" or "improving fitness" to be the most important reason. Also no significant difference was observed in each of the reasons among them.
- Regarding the barriers to being more active, there was not a pronounced difference. However, a slightly greater number of obese people reported "illness/disability" (Chi-square, $P<0.0001$) or "lack of interesting activities" ($P<0.05$), while slightly more normal weight people mentioned "lack of time" ($P<0.05$), "lack of incentive" ($P>0.05$) or "having no one to exercise with" ($P>0.05$).
- Self-reported weight, height and BMI were highly correlated with measured data. In this study, reported height was a valid measure (Paired t-test, $P>0.05$), but reported weight and BMI were not ($P<0.05$). Age, gender and Aboriginal status were determinants of the relative error from reported weight and height.
- A minor disagreement was observed in the categorization of obesity using self-reported weight and height. By percentage comparison, 82.8% of reported BMIs fell into the same category as measured BMIs, while 11.7% of reported BMIs were misclassified into the underestimated group and 5.1% of reported BMIs were misclassified into the overestimated group. Sensitivity of self-reporting decreased from normal weight to obesity. The Cohen's Kappa value was 0.734 in general, representing a good to excellent agreement. Among males, the Kappa value decreased with the age decreasing. The Kappa was low (0.551) in the Aboriginal group.
- There was no significant discrepancy in CVD knowledge between the agreement and disagreement groups. The pattern of health-related behaviors, behavioral changes and the barriers or reasons for changes were quite similar.

4.2 Sample Characteristics

4.2.1 Socio-Demographic Characteristics

Table 4.2.1 Socio-Demographic Characteristics of the Subjects in MHHS90_Obe Data

	NUMBER (N)	PERCENTAGE (%)
Age (years)		
Total, all ages	2243	100
18-34	645	29
35-64	815	36
65+	783	35
Sex		
Male	1163	52
Female	1080	48
Marital Status		
Married/common law	1644	73.5
Non-married	594	26.5
Ethnicity		
Aboriginal	141	6
Non-aboriginal	2102	94
Educational Level		
Secondary/Lower	1656	75
Post secondary	566	25
Household Incomes		
< $50,000	1633	82
$50,000+	358	18
Employment Status		
Employed	1120	50
Unemployed	1123	50

The socio-demographic characteristics of the people in MHHS_Obe data are presented in Table 4.2.1. The total number of subjects in the sample was 2243 persons, consisting of 52% males and 48% females. The sample was fairly evenly distributed in three age groups: 645 young adults (age 18-35), 815 middle-aged adults (age 36-64) and 783 elderly adults (age 65+). Mean age was 50 years. A majority of the subjects were the married or common law. There were 141 Aboriginal people included in these data, making up 6% of the total sample.

Seventy-four of them were males while 67 were females. Three-quarters of all subjects had no university education. Half of all the subjects were unemployed, including not hired, retired, laid-off, homemakers and students.

4.2.2 Behavioral Characteristics

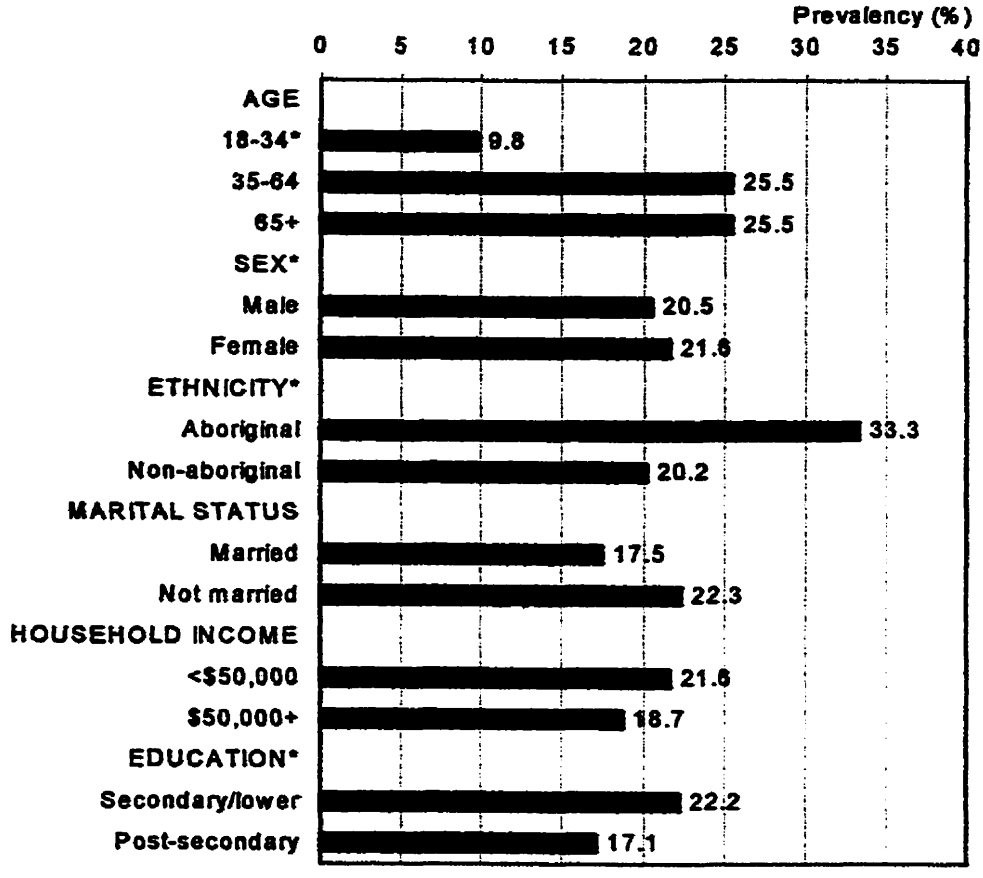
Behavioral characteristics of the sample are presented in Table 4.2.2. They included smoking, drinking, exercise and losing weight. Since these data are not standardized, it is not representative of the prevalence of characteristics in the Manitoba population. Table 4.2.2 shows that 40.5% of the total were current smokers, and 81.5% of them reported drinking alcohol at least once in the year prior to the survey, and 55.5% stated that they regularly engage (at least once a week during the past two months) in some exercise during their leisure time. Almost 40% reported that they had tried to lose weight in the past year.

Table 4.2.2 Behavioral Characteristics of the Subjects in MHHS_Obe Data

	NUMBER (N*)	PERCENT (%)
Smoking		
Non-smokers	579	25.9
Current Smokers	906	40.5
Ever Smokers	754	33.6
Alcohol-Drinking		
Drinkers**	1815	81.5
Non-drinkers	411	18.5
Physical Exercise		
Exercisers	1244	55.5
Non-exercisers	994	44.5
Trying to Loss Wt		
Persons Who Tried	895	39.9
Persons Not Trying	1348	60.1

Notes: * "N" total in each characteristic was not equal because of a small proportion of missing values.

Fig. 1 Crude Prevalence of Obesity (BMI>=30) by Selected Demographic Characteristics



* Chi-square test, $P < 0.05$.

4.3 Obesity Prevalence Comparison

The crude prevalence of obesity by various age, gender, ethnic and socioeconomic characteristics is presented in Fig. 1. The prevalence of obesity in the middle-aged groups was the same as the prevalence in the elderly group, which was 25.5%. However, the prevalence of obesity both in the middle aged and the elderly group was significantly greater than that in the young group (x^2- test, $P<0.05$). More women were obese than men. Aboriginal people had more than a 1.3 times higher likelihood to be obese than non-

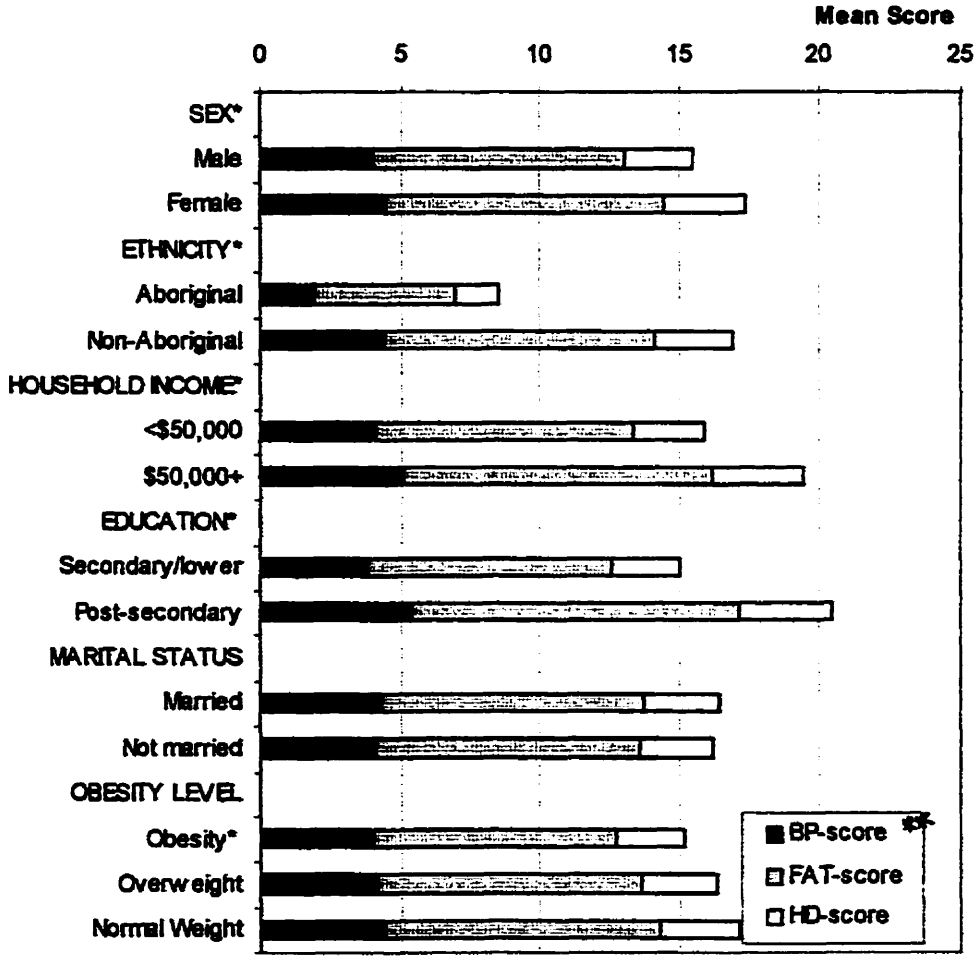
Aboriginals. The prevalence of obesity was 33.3% among Aboriginal people while 20.2% among non-Aboriginal people. (x^2 - test, P<0.05). Obesity was slightly more common among persons who were married or lived common law than persons who were single (x^2- test, P<0.05). People with higher education levels seemed less likely to be obese. Regarding gender and income variables, no statistical difference was associated with obesity prevalence.

4.4 Comparison of Three BMI Groups

4.4.1 Knowledge Level Comparison

4.4.1.1 Total Score Knowledge Index (TSKI)

Fig. 2 Mean TSKI by Selected Charicteristics



* ANOVA, P < 0.05. Note: Obesity* means that obesity group was significantly different from normal weight group.

** "BP-score", "FAT-score" and "HD-score" mean the knowledge scores about the risk factors of high blood pressure, high blood cholesterol and heart diseases respectively.

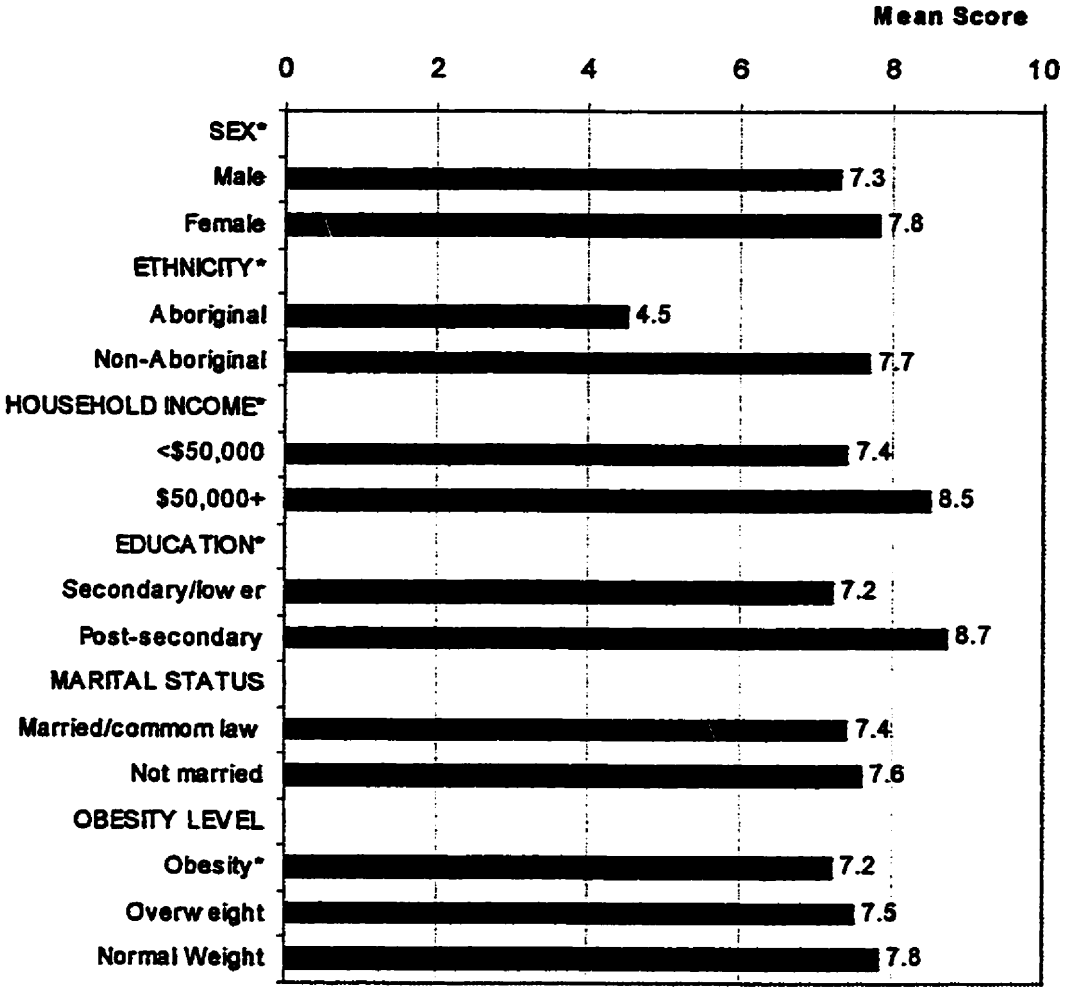
Generally speaking, the knowledge about the risk factors of heart diseases among the respondents in the 1990 Manitoba Heart Health Survey was rather poor. Overall average TSKI score was 16, which was less than half of the full score (50 points). Even the highest score coming from the post-secondary group was 21. (See Fig. 2).

There were variations of TSKI by gender, ethnicity, income, education and obesity levels. The most impressive figure difference was in ethnicity group. Mean TSKI among Aboriginals was half of the mean TSKI for non-Aboriginals (t-test, $P<0.05$). Other characteristics with significant differences between subgroups were household income, education and obesity status. People in the higher income group or in the higher educated group achieved higher CVD knowledge scores. The obesity group was slightly less knowledgeable than the normal weight group. No difference appeared between the obesity and overweight groups. Additionally, no significant diffence existed by gender or marital status.

4.4.1.2 Binary Knowledge Index (BKI)

The pattern of mean BKI in selected characteristics was identical to the pattern of mean TSKI (See Fig. 3). Here again, the Aboriginal, low-income, low-education and the obese were more likely to report significantly lower scores. Mean BKI in the obesity group was significantly lower than that in the normal weight group. One thing needs to be noted. Compared to the TSKI measure, the overall average score for BKI looked optimistic. The BKI mean was 7.4 out of 10 points, indicating that participants had covered at least one right answer in each of 7 of 10 areas of knowledge.

Fig. 3 Mean BKI by Slected Charisteristics



* ANOVA, $P < 0.05$.

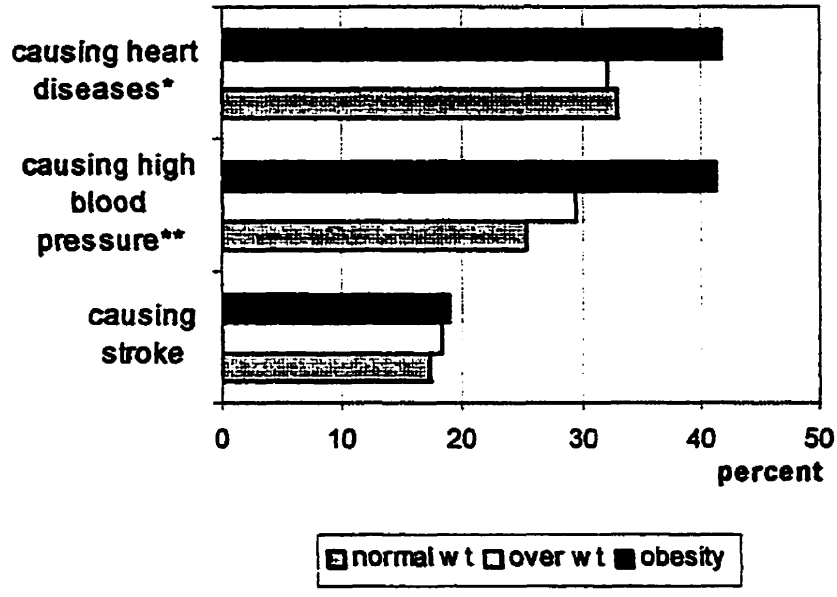
Note: Obesity group was only significantly different from normal weight group.

4.4.1.3 Were Obese People More Aware about Overweight as a CVD Risk Factor?

Fig. 4 shows that there was a significant knowledge gap on obesity as a risk factor of CVD between the obesity and the overweight groups, and between the obesity and the normal weight groups, but not between the obesity and overweight groups. Obese people were more knowledgeable than normal weight and overweight people in terms of overweight as a cause of heart diseases and a cause of high blood pressure. In respect to overweight as a risk factor

for stroke, there was no difference among the three weight groups. It is concluded that there is a difference in stroke knowledge by the level of obesity although overall knowledge scores showed no difference.

Fig. 4 Knowledge of Overweight as a Risk Factor of CVD by the Level of Obesity



* Chi-square test, P<0.05 between obesity and overweight, and between obesity and normal weight.
** Chi-square test, P<0.0001 between obesity and overweight, and between obesity and normal weight.

4.4.2 Predictors of Knowledge Level - Multivariate Analysis

Whether obesity level is a determinant of CVD knowledge level is one of the main research questions in this study. In other words, does the knowledge of obese or overweight people about the risk factors of heart diseases differ from that of non-obese people?

Two multivariate analyses were conducted to answer the above question. The strategy used was a multiple linear regression since the outcome variable was an interval scale. In the regression models for analysis, outcome variable was the level of knowledge about CVD.

CVD knowledge was expressed as a mean TSKI or mean BKI, which were generated from ten knowledge questions in the MHHS survey. The independent variables were defined as age, sex, race, education and income as well as obesity level. It should be clarified that the variable "obesity level" was a three-category variable. So two dummy variables, "obesity status" and "overweight status", were used to represent it in the regression models. When either of them takes the value of 1, the individual is in the obesity or overweight group. When both of them are 0, the individual is in the normal weight group, which serves as a reference category. The model summary is displayed in Table 6.3.

Before running stepwise linear regression using SPSS 8.0, three basic assumptions for linear regression were checked. Firstly, the distribution of outcome variables was examined. From a histogram and P-P plot chart, it was found that the distribution of TSKI was very close to normal while the distribution of BKI was a little skewed to the right. Since the logarithmic transformation did not show an improvement for BKI and the sample size was large enough, this study used the original data instead of a log form.

Secondly, data were checked to see if a linear relationship existed between the dependent variable and each of the independent variables. Plots of the model residuals against dependent variable and each of the independent variables were produced and a non-linear relationship was not observed. However, except for age, most of the plots failed to show linear relationship because they were binary variables.

Thirdly, all of the treatment groups should have an equal variation. This objective can be achieved through F values and degrees of freedom from the binary variable. The variance for each group of binomial variables was obtained through a "descriptives" menu in SPSS. Then their ratio was calculated (the larger F value was divided by the smaller one). Next, using an F table the ratio with two degrees of freedoms was tested at the 0.05 level. Most of

the predictors got a P value less than 0.05 even though the ratio was small (between 1 to 3). This was due to the large degrees of freedom.

In addition, no multicollinearity was found among predictors in the two models. It was supposed that independent variables in these data were measured exactly without error. Theoretically, only when all of these assumptions are matched, can one feel safe to employ linear regression. However, multiple regression is quite robust when the sample size is large, which is the case in this study.

Table 4.4.2 *Results of Multiple Linear Regression Analyses of TSKI/BKI for Obesity Status*

INDEPENDENT VARIABLES	MODEL R^2	STANDARDIZED COEFFICIENT (β)	P VALUE
(1) TSKI as the dependent variable			
• Obesity status, overweight status, age, sex, race, education, income	0.207	Obesity status (0.008) Overweight status (0.032) Income (0.046) The rest[1]	0.708 0.155 0.030 < 0.0001
• Age, sex, race, education, income	0.206	Income (0.048) The rest[2]	0.024 < 0.0001
(2) BKI as the dependent variable			
• Obesity status, overweight status, age, sex, race, education, income	0.222	Obesity status (0.290) Overweight status (0.018) Income (0.024) The rest[3]	0.428 0.290 0.004 <0.0001
• Age, sex, race, education, income	0.222	Income (0.061) The rest[4]	0.004 <0.0001

Notes: 1. age (-0.202), sex (-0.098), race (-0.259), education (0.210);
2. age (-0.196), sex (-0.095), race (-0.259), education (0.210);
3. age (-0.175), sex (-0.085), race (-0.330), education (0.181);
4. age (-0.169), sex (-0.083), race (-0.328), education (0.180).

Results from Table 4.4.2 indicate that CVD knowledge level in the obesity group was not significantly different from that in the normal weight group when adjusted for age, sex,

ethnic, education and income. CVD knowledge level in the overweight group was not significantly different from that in the normal weight group either. This result was different from the ANOVA. It not only refused the alternative hypothesis, but also demonstrated a presence of a number of confounders.

Besides confirming that the level of obesity was not an independent predictor of CVD knowledge about heart diseases, respondents' age, sex, Aboriginal status, education back ground and household income were the true predictors of knowledge level on the risk factors of heart diseases. CVD knowledge was related positively to being female, education level and income level, and it was related negatively to age and being Aboriginal. In addition, whether TSKI or BKI measures were used the same results were found.

4.4.3 Health-Related Behaviors

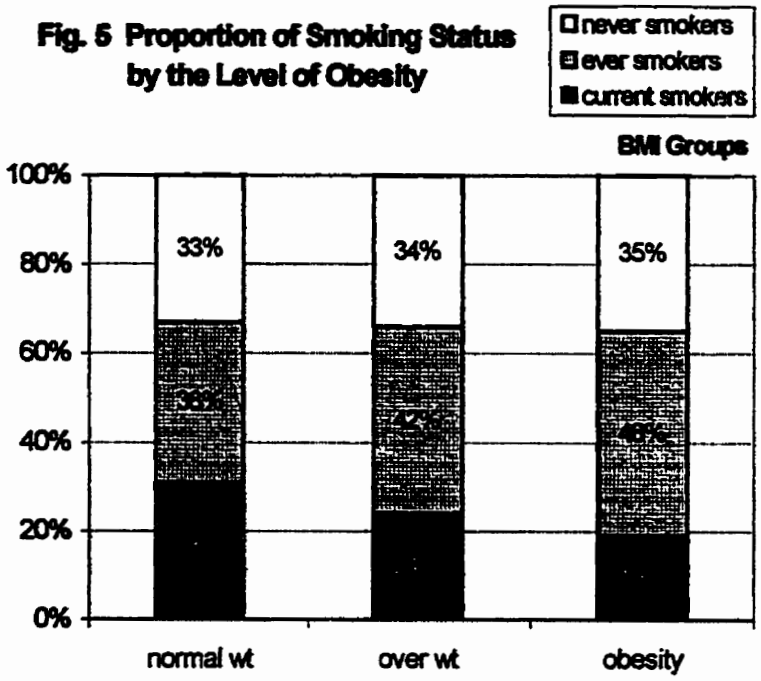
Three behavioral factors available in the MHHS data and strongly associated with health problems were smoking, excessive drinking and physical inactivity. The prevalence and extent of smoking, alcohol drinking and exercise were compared among the three weight groups. The analysis of "trying to lose weight" also is included. Although weight loss is usually considered as an outcome (Winett, et al., 1988) the process of trying to lose weight involves a number of behaviors.

4.4.3.1 Smoking

Among the three weight groups, the obesity group had the smallest proportion of current smokers and the largest ever smokers. In contrast, the normal weight group had the largest proportion of current smokers and smallest proportion of ever smokers. The proportion of non-smokers in each weight group was very similar (Fig. 5).

One of the survey questions covered daily cigarette consumption among smokers. Respondents were asked, "how many cigarettes do you usually smoke per

Fig. 5 Proportion of Smoking Status by the Level of Obesity

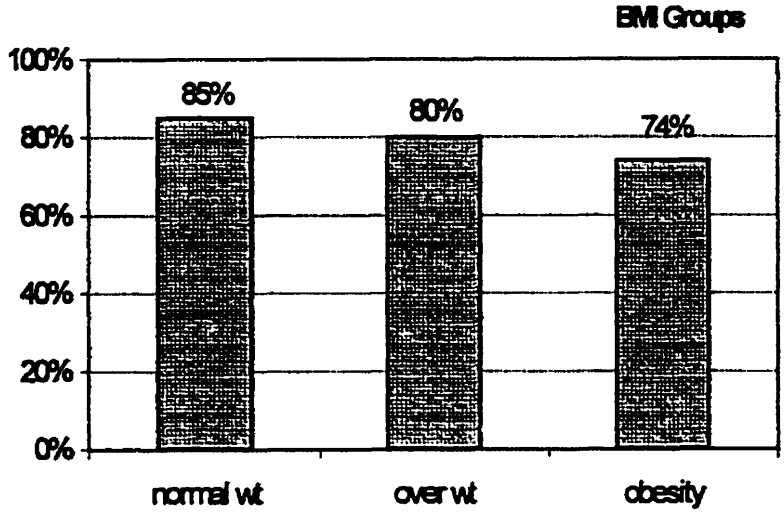


day?" By using the ANOVA and Tukey test to compare the mean number of cigarette smoked per day among the three weight groups, it was found only the mean number of cigarette smoked per day in the overweight group was significantly higher than that of the normal weight group (P=0.022). No significant difference was found among smokers between and other two weight groups. The actual mean number of cigarettes smoked per day by smokers in the normal weight, overweight and obesity groups were 16, 19 and 17 respectively, not very much different.

4.4.3.2 Alcohol-drinking

There was a tendency that as weight increased the rate of alcohol drinking decreased. Fig. 6 shows that both overweight and obese people were less likely than normal weight people to be the drinkers (P value was from 0.024 to less than 0.0001).

Fig. 6 Proportion of Alcohol Drinking by the Level of Obesity



To look at the frequency of drinking by level of obesity, the number of alcohol drinks per month or per week were converted into a monthly base, then transformed this continuous variable into a three-level ordinal variable, named "light drinkers", "moderate drinkers" and "heavy drinkers". "Light drinkers" was defined as those who had under 8 drinks per month. "Moderate drinkers" was defined as those who had 8 to 20 drinks per month. "Heavy smokers" was defined as those who had over 20 drinks per month. The results of cross tabulation are presented in Table 4.4.3.2. No significant difference was found among the three weight groups (Pearson Chi-square, P=0.198).

Table 4.4.3.2 The Level of Alcohol Drinks * The Level of Obesity Crosstabulation

	NORMAL WT		OVERWEIGHT		OBESITY		TOTAL	
	N	(%)	N	(%)	N	(%)	N	(%)
Light drinkers	534	(71.9)	462	(68.4)	256	(75.1)	1252	(71.2)
Mod drinkers	146	(19.7)	140	(20.7)	58	(17.0)	344	(19.6)
Heavy drinkers	63	(8.5)	73	(10.8)	27	(7.9)	163	(9.3)
TOTAL	743	(100.0)	675	(100.0)	341	(100.0)	1759	(100.0)

4.4.3.3 Physical Activity

According to the Canada's Health Promotion Survey 1990, frequency and duration of exercise can be combined into an index called Leisure Time Physical Activity (LTPA) Index. There were three categories in LTPA; high, moderate and low level of exercise. They were defined in Table 4.4.3.3.

Table 4.4.3.3 Leisure Time Physical Activity Index Definition

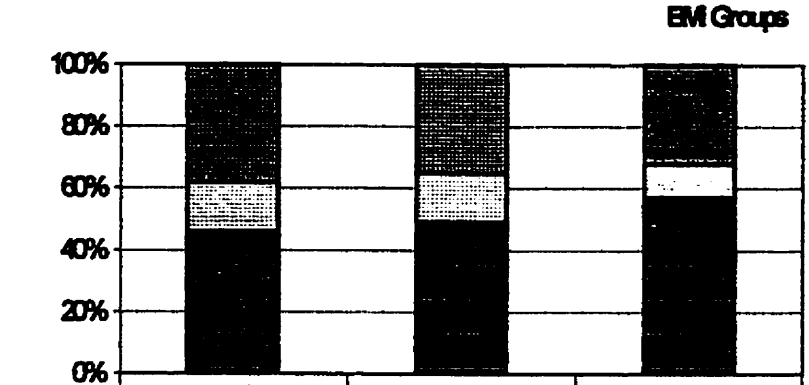
	Usual Duration of Activity		
Average frequency	>30 minutes	30 - 15 minutes	<15 minutes
Daily	High	High	Mod
5-6 times / week	High	High	Mod
3-4 times / week	High	High	Mod
1-2 times / week	Mod	Mod	Low
Less than once / week	Low	Low	Low
Never, don't know	Low	Low	Low

Note: "Mod" means moderate.
(Source: Canada's Health Promotion Survey 1990, p141)

In the MHHS, the responses to two questions were used to calculate LTPA for the three weight groups. Respondents were asked, "How long do you usually exercise?" There were five options: 1) less than 15 minutes; 2) 15-30 minutes; 3) half an hour - an hour; 4) more

than an hour; 5) not sure. Then, the respondents were asked, "how many times per week do you exercise at least 15 minutes?" Eight options were provided: daily; 5-6 times/week; 3-4

Fig. 7 Proportion of Physical Activities by the Level of Obesity



	normal wt	overwt	obesity
High_Ex	39%	35%	32%
Mod_Ex	16%	16%	11%
Low_Ex	4%	5%	3%
No_Ex	42%	44%	54%

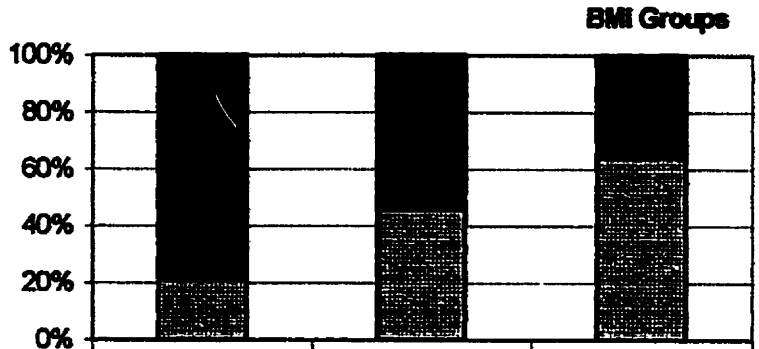
times/week; 1-2 times/week; less than once/week; never; not sure.

Of the three weight groups, the obesity group had the highest proportion of persons with "no exercise" and the lowest proportion of the persons with "high level exercise", "moderate level exercise" and "low level exercise".

4.4.3.4 Losing Weight

Sixty-four percent of obese and 46% of overweight individuals reported that they were trying to lose weight at the time of survey. Twenty-one percent of normal weight persons did so. However, 35% of obese and 52% of overweight individuals were not involved in losing weight. It was not clear why 2% of overweight and 1% of obese people were trying to gain weight.

Fig. 8 Proportion of Those Presently Trying to Lose Wt, Gain Wt or Neither by the Level of Obesity



	normal wt	over wt	obesity
Neigher	70%	52%	35%
Gain weight	9%	2%	1%
Lose weight	21%	46%	64%

4.4.4 Health-Related Behavioral Changes

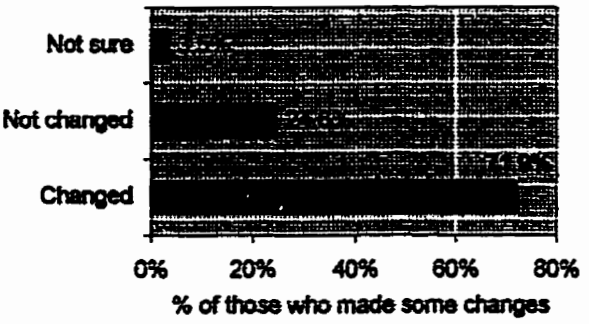
Four questions in the MHHS survey covered health-related behavioral changes.

1) Respondents were asked, "what would you say is the single most important thing you have done in the past year to improve your health?" (Q.79)
2) "Is there anything you intended to do to improve your health in the next year?" (Q.80)
3) "How would you rate your diet compared to this time last year?" (Q.30)
4) "Compared to last year, would you say you are eating more, less or about the same of the following list of foods?" (Q.30)

4.4.4.1 The Most Important Changes

Close to three-quarters of Manitobans reported some behavioral changes to improve their health in the year prior to the survey. Of those who reported behavioral changes, improving eating habit was cited most often (24.6%), followed by increasing exercise (19%), losing weight (5.4%), quitting smoking (5.3%), managing stress (2.9) and reducing alcohol intake (1.8%).

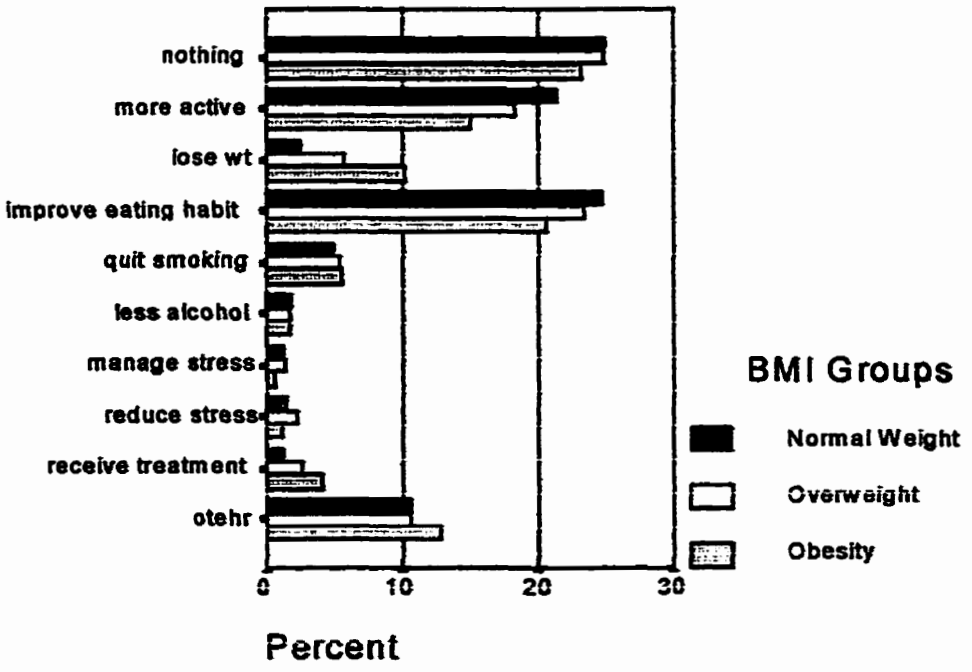
Fig. 9 Self-Reported Single Most Important Change in Previous Year



4.4.4.2 Patterns of the Most Important Changes among Weight Groups

Normal weight people were more likely than overweight and obese people to report "more active" or "improve eating habit", while they were less likely to report "lose weight" or "received treatments". In addition, slightly more overweight people reported "reduce stress" than the other two weight groups. Fewer obese people fell into the non-change ("nothing") category.

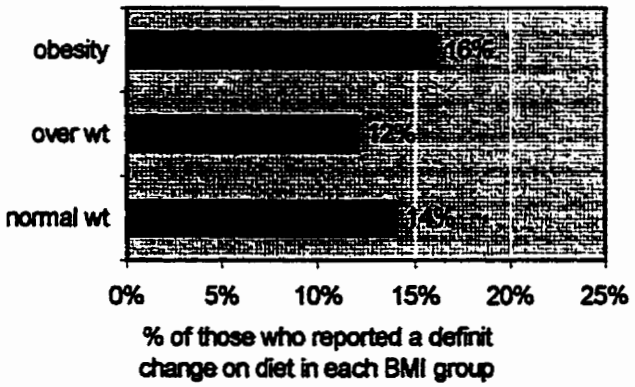
Fig 10. Comparison of the Single Most Important Change Among the Three Wt Groups in Previous Year



4.4.4.3 Dietary changes

Almost 14% of Manitobans reported that they definitely changed their diet in the previous year. Another 24.3% mentioned a small change in diet. However, the majority (61%) of Manitobans did not report a change. Fig.11 displays the percentage comparison of those who made a definite diet change among the three weight groups. It shows the obesity group was most likely to report a diet change in the last year.

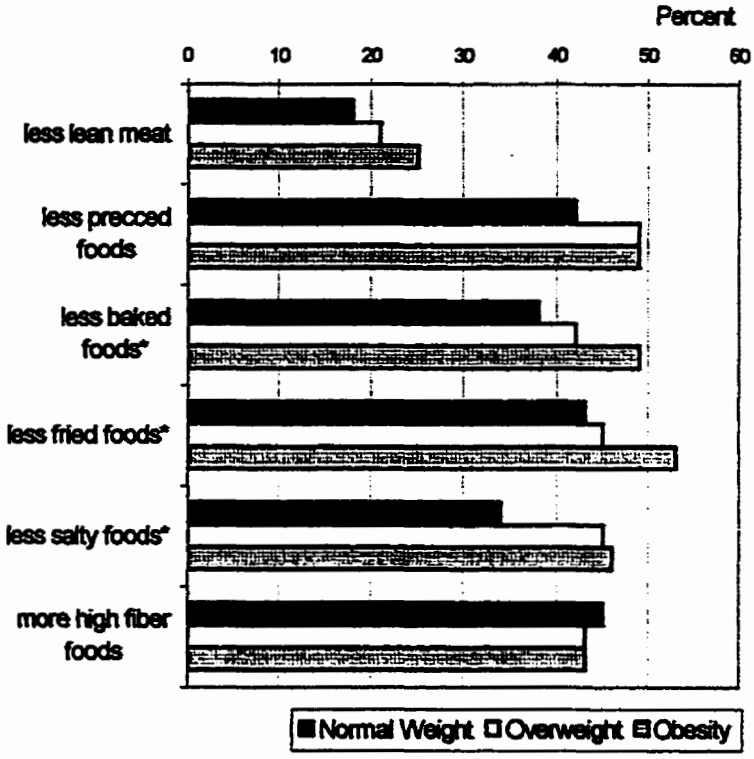
Fig.11 Self-Reported Diet Change by Weight Groups in Previous Year



4.4.4.4 What Ingredients Changed in Diet?

Fig.12 shows that more overweight/obese people reported that they ate less lean meat, baked foods, fried foods and salty foods than normal weight people, while more normal weight people pointed out that they ate more high-fiber foods. However, results from the Chi-square showed three categories with significant differences ($P<0.05$, see * sign in Fig.9). So there was a tendency that obese or overweight persons ate less baked foods, fried foods than normal weight persons, and obese persons ate less salty foods than overweight or normal weight persons. In consuming lean meat, processed food and high fiber foods, obese and overweight persons actually did not differ from normal weight persons.

Fig. 12 The Detail of Diet Change in Privous Year

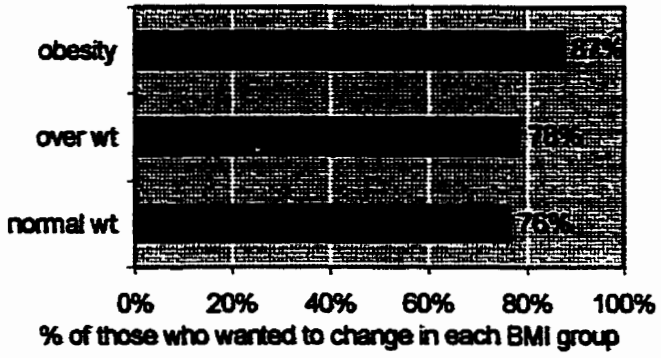


*Chi-square Test, $P < 0.05$

4.4.4.5 Intended Changes in the Coming Year

Of the three weight groups, the obesity group (87%) had the largest proportion of

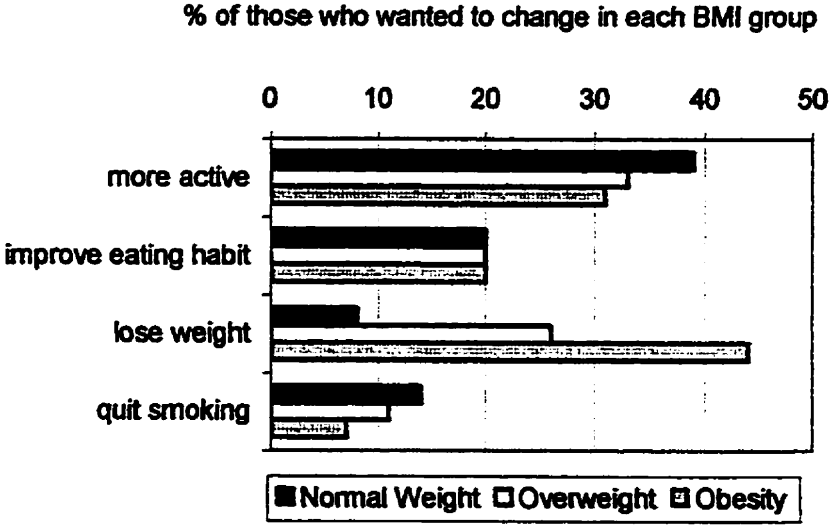
Fig. 13 Self-Reported Intended Changes Next Year



wished to make a change in the year following the survey. Over seventy percent of people in the other two groups had a plan to change, too. See Fig.13.

What kinds of changes were they going to make? Fig.14 reports the pattern of the changes in the coming year. It showed that the obese/overweight people were less likely to become more active, but they were 3 to 5 times more likely to report losing weight than normal weight people. On improving eating habits, there was no difference among the three weight groups. Finally, there was a tendency that fewer overweight or obese people wanted to quit smoking.

Fig. 14 Specific Intended Changes by Weight Groups Next Year



4.4.4.6 Reasons for Changing Diet

When asked in the context of the survey what was the main reason for changing their diet (Q.32), "Health reasons" was the most often answered next to "other" reasons. The next main reason was "doctor's advice", followed by "improve appearance" and "food available". "Economic reasons" was not a big reason for diet change in this study.

Fig. 15 Percentage of the Reasons Given for Improving Diet

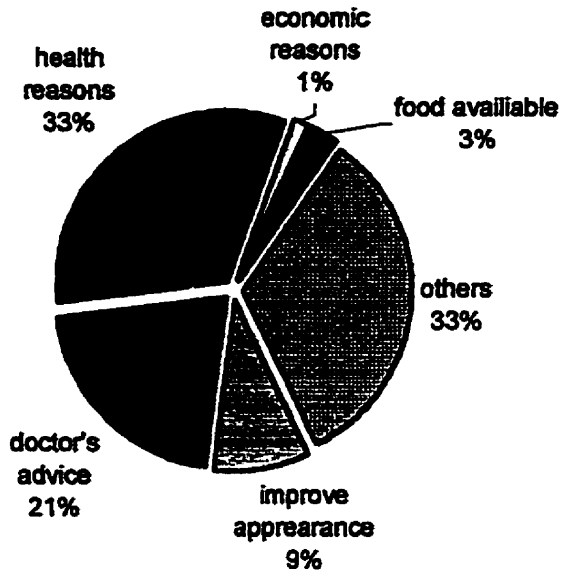
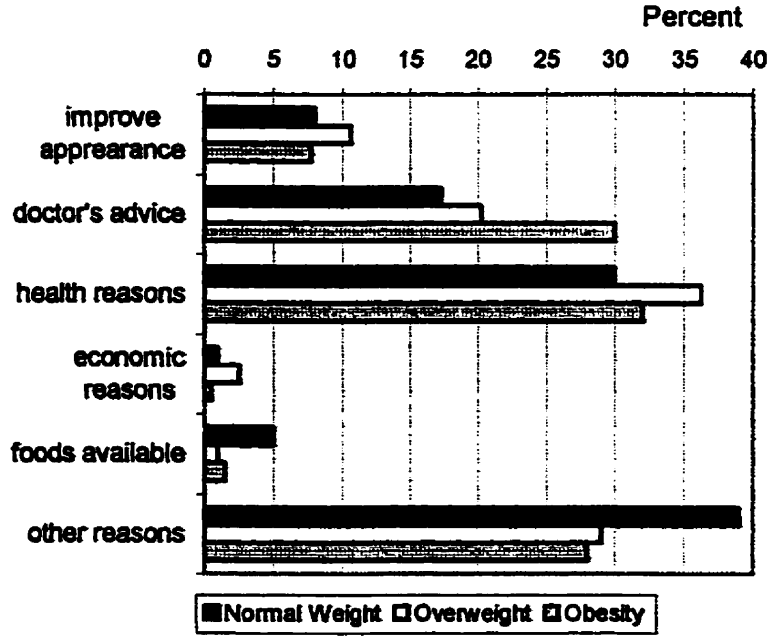


Fig. 16 Comparison of the Reasons of Diet Change among Three BMI Groups

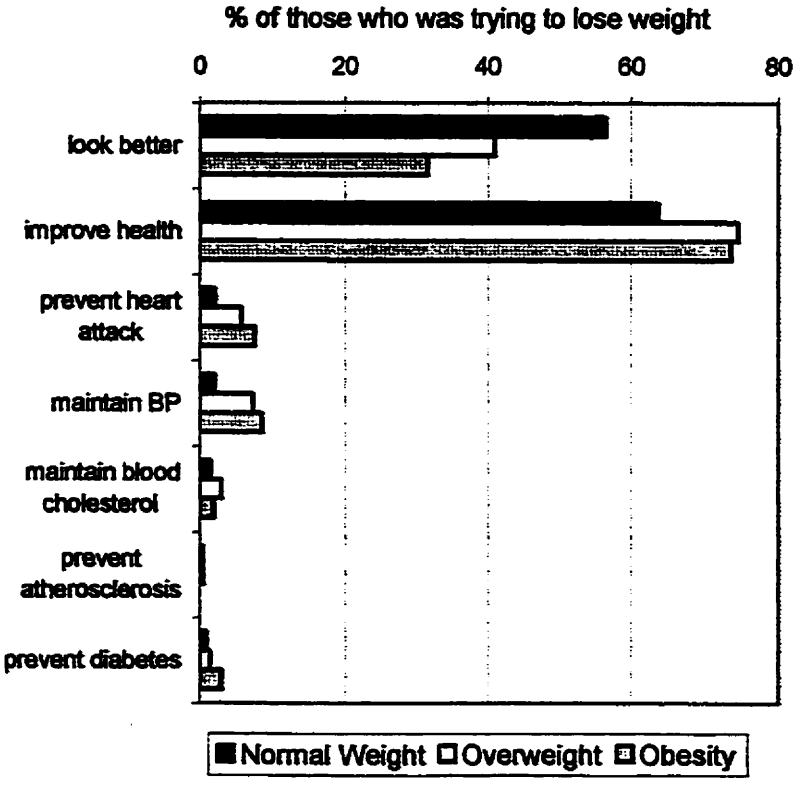


Although "health reasons" was the most frequent answer in each of the weight groups when "other reasons" was excluded, relatively more overweight /obese persons checked off this category than normal weight persons. More obese people checked off "doctor's advice" while more normal weight people checked "other reasons" as their main reasons for diet change. Overweight individuals were more likely to answer "improve appearance" while normal individuals were more likely to check off "foods available" as the reasons of change.

4.4.4.7 Reasons for Losing Weight

"Look better" and "feel better" (or improve health) were two major reasons cited by the respondents who tried to lose weight the year previous to the survey. There was a

Fig. 17 Frequency of the Reasons for Losing Weight by Weight Group



different pattern of answers between the normal weight and the overweight / obesity groups. Overweight/obese individuals were more likely to check weight loss was a way to improve health and to prevent chronic diseases, while more normal weight individuals linked losing weight to improving appearance. Moreover, fewer normal weight people checked off "prevent heart diseases", "maintain BP" and "prevent diabetes".

4.4.4.8 Reasons of Quitting Smoking

Table 4.4.4.8 shows that the majority of the respondents checked off "most important" or " somewhat important" in the first six categories ("to improve fitness" to "to respect the wishes of non-smokers"). Over 90% agreed that "to prevent diseases" was "very important" or "somewhat important" reason to quit smoking with a slightly larger proportion in the overweight group, but no statistical difference. The second reason given was "to improve fitness". About 88% of the individuals thought it was "very important" or "somewhat important". Obese people had a slighter smaller proportion. For the reasons "to set a good example to the family" and "to save money", percentages were similar. Close to half of the individuals checked off the two reasons were "very important" and "somewhat important". Two-thirds of people also checked off "to demonstrate self-control" as a "very important" or "somewhat important" reasons to quit smoking. On the other hand, over half of the respondents agreed that "to be social" and "to be more attractive" were the least important reasons to quit smoking. No significant differences were observed among the weight groups in each of the reasons for quitting smoking in Table 4.4.4.8.

Table 4.4.4.8 Comparison of the Reasons to Quit Smoking among Smokers by the Level of Obesity

	VERY IMPORTANT (%)	SOMEWHAT IMPORTANT (%)	NOT IMPORTANT (%)	NOT SURE (%)
To improve fitness	**60.5**	**28.2**	**9.6**	**1.6**
Normal weight	61.4	27.8	10.1	0.7
Overweight	61.7	28.2	8.7	1.5
Obesity	55.2	29.9	10.3	4.6
To prevent diseases	**80.3**	**14.6**	**3.9**	**1.2**
Normal weight	77.9	16.7	5.1	0.4
Overweight	84.5	10.7	2.4	2.4
Obesity	71.9	17.4	3.5	1.2
To set a good example to the family	**49.2**	**26.4**	**22.1**	**2.3**
Normal weight	48.4	26.0	23.5	2.2
Overweight	51.9	25.4	19.9	2.9
Obesity	50.3	30.2	23.3	1.2
To save money	**47.8**	**26.3**	**24.7**	**1.2**
Normal weight	48.6	25.9	24.5	1.1
Overweight	46.9	27.1	25.1	1.0
Obesity	47.7	25.6	24.2	2.3
To demonstrate self-control	**33.3**	**32.8**	**28.4**	**5.5**
Normal weight	33.7	33.3	27.9	5.1
Overweight	32.4	32.9	29.0	5.8
Obesity	34.5	31.0	28.6	6.0
To respect the wishes of non-smokers	**33.5**	**34.5**	**28.7**	**3.3**
Normal weight	32.1	38.6	25.6	3.6
Overweight	35.0	30.6	31.6	2.9
Obesity	34.1	30.6	31.8	3.5
To be sociable	**16.0**	**28.4**	**50.6**	**4.9**
Normal weight	15.9	28.9	51.3	4.0
Overweight	16.0	28.2	50.0	5.9
Obesity	16.7	27.4	50.0	6.0
To be more attractive	**13.2**	**18.8**	**64.3**	**3.7**
Normal weight	13.7	17.3	65.0	4.0
Overweight	10.7	19.4	67.0	2.9
Obesity	17.4	22.1	55.8	4.7

4.4.4.9 Why could not change?

There was only one question addressing the barriers to changing behavior in the MHHS data. In Q.62 (Appendix 3), respondents who felt they did not exercise enough were asked: "do any of the following reasons prevent you from doing more exercise or being more active?"

Fig. 18 Frequency of Barriers Being More Active by Weight Groups

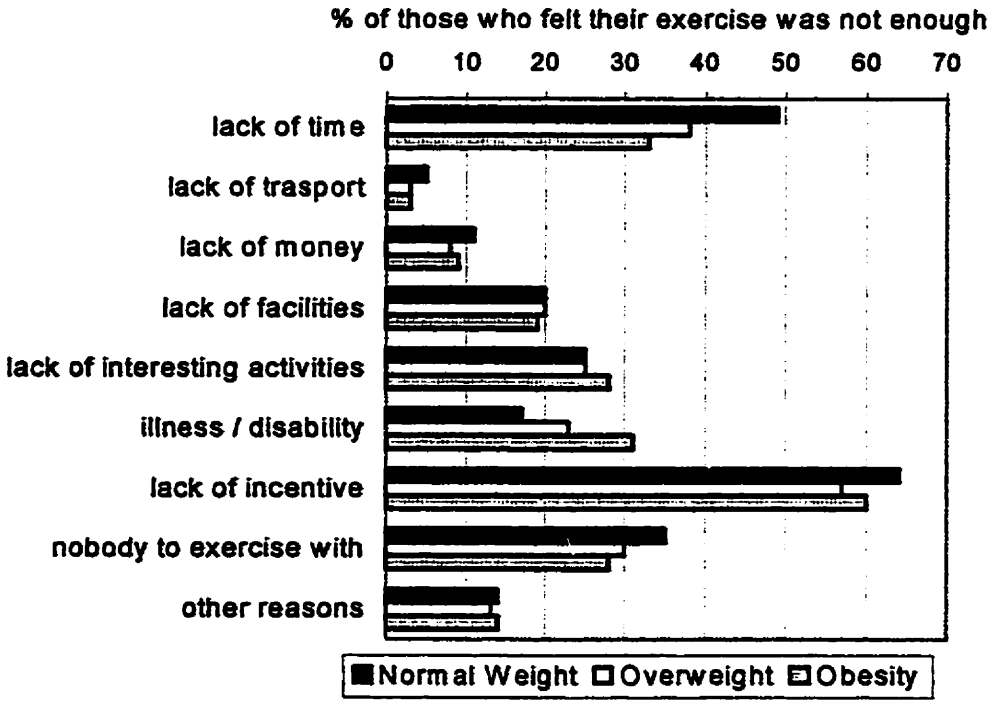


Fig.18 shows that "lack of incentive" and "lack of time" were the two major barriers selected for not doing more exercise. The rank of the barriers in each of the three weight groups was almost the same. However, a slightly larger proportion of obese people than normal weight people reported "illness/disability" (x^2 test, $P<0.0001$) or "lack of interesting activities" (x^2 test, $P<0.05$) as barriers to doing more exercise. On the other hand, more normal people than overweight/obese people checked off "lack of time" (x^2 test, $P<0.05$), "lack of incentive" (x^2

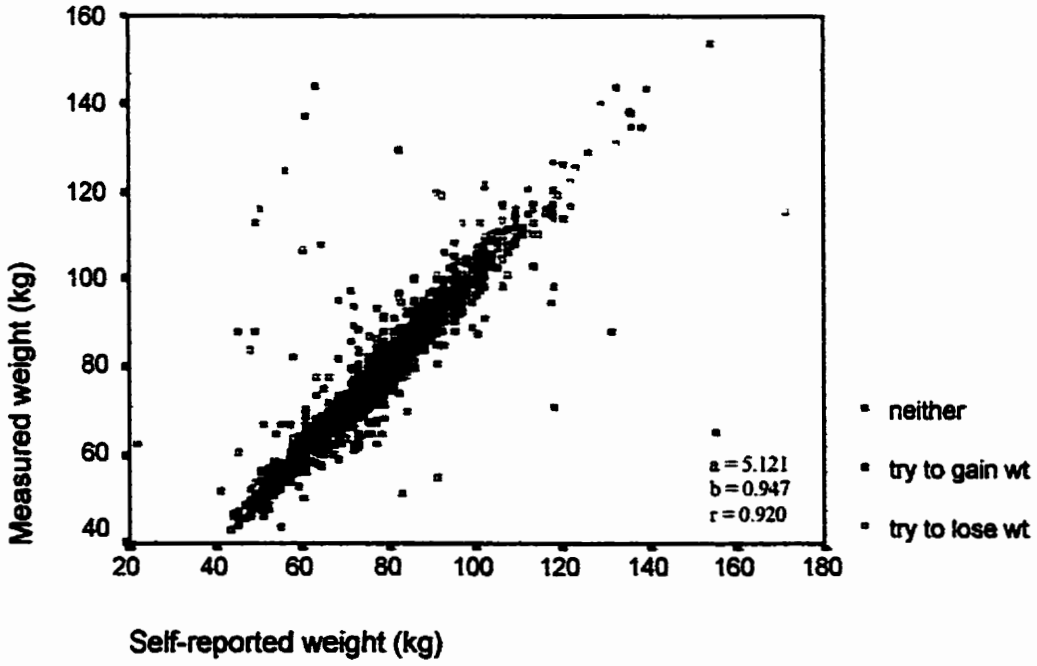
test, P>0.05) or "having no one to exercise with" (x^2 test, P>0.05) as the barrier to being more active.

4.5 Analysis of Self-Reported Weight, Height and BMI

Self-reported weight and height were obtained from the interview questionnaire. Respondents were asked, "how tall are you without your shoes?"(Q.25) and "How much do you weight (indoor clothing, without shoes)? (Q.26) Height was reported in feet and inches while weight was reported in pounds. They were later transformed into meters and kilograms. Correspondingly, BMI was the reported weight in kilograms divided by reported height in meter square.

4.5.1 Weight

Fig. 19 Relationship between Reported and Measured Wt for 2187 Subjects



The association between self-reported body weight and measured body weight had a correlation coeffficient (r) of 0.920, which was significant at the 0.01 level. The scatter plot in Fig.19 displays the details of this relationship. It showed that most of the dots stuck to the straight line with slop close to 1. That means that the reported data matched the measured data very well. When the causes of outliers was investigated, it was found that persons who did not engage in either losing or gaining weight were more often the outliers. (See the blue dots in Fig.19).

Another way to validate the self-reported data is to do a paired t-test between reported and measured data. Table 4.5.1 shows that the mean of reported body weight was only 1.12 kg from the mean of measured weight. However, there was a significant difference between the self-reported weight and measured weight with P<0.0001.

Table 4.5.1. The Results of Paired T-Test for Weight, Height and BMI

PAIRS	MEAN DIFFERENCE	SD	N	T	SIG. (2 TAILED)
Reported-Measured Wt (kg)	-1.12	6.13	2187	8.537	0.000
Reported-Measured Ht (cm)	-0.075	3.95	2183	0.892	0.373
Reported-Measured BMI (kg/m^2)	-0.36	2.59	2161	6.491	0.000

Moreover, an investigation of the error among different segments identifies the origin of these errors. Table 4.5.2 shows a comparison of relative errors. ANOVA was employed to compare the magnitude of error by age, sex and race.

Table 4.5.2. Comparison of Mean Per Cent Discrepancy[#] between Reported and Measured Weight, Height and BMI by Sex, Age, Ethnic and the Level of Obesity

SEX, AGE (YR) & RACE	WEIGHT MEAN(%)	N	HEIGHT MEAN(%)	N	BMI MEAN(%)	N
Males	**-0.82***	**1140**	**0.001***	**1140**	**-0.72**	**1133**
18-34	0.25	322	-0.20	325	0.83	322
35-64	-0.88	415	0.07	416	-0.89	414
65+	-1.23	403	0.35*	399	-1.79*	397
Females	**-1.44***	**1047**	**-0.003***	**1043**	**-1.19**	**1028**
18-34	-2.32	314	-0.84	315	-0.50	311
35-64	-1.40	387	-0.39	386	-0.46	380
65+	-1.42	346	0.75**	342	-2.65**	337
Race	**-1.20**	**2187**	**-0.03**	**2183**	**-0.94**	**2161**
Aboriginal	-2.26	111	-2.08*	103	2.18*	97
Non-Aboriginal	-1.10	2076	0.07*	2080	-1.09*	2064
Weight Groups	**-1.12**	**2187**	**-0.007**	**2183**	**-0.36**	**2126**
Normal Wt	0.09**	890	-0.005**	887	0.18**	882
Overweight	-1.09**	847	0.002*	844	-0.38**	836
Obesity	-3.53**	450	0.003*	452	-1.39**	443

Note: #: Per cent discrepancy = $\frac{\text{Reported data - Measured data}}{\text{Measured data}}$ x 100%,
so the "MEAN" in the table is a percentage with no unit.

* & ** : represent that there was a significant values at the 0.05 level by ANOVA.
* denotes only significant difference between two extreme groups, while ** denotes that the attached value differed from each of the values in other two groups.

The first column of Table 4.5.2 indicates that there was a significant difference in mean per cent difference between gender. The error for women was larger than that for men. Among men, weight was underreported on average by 0.82%. Among women, weight was underreported on the average by 1.44%. Although the results from the ANOVA did not show a statistical different among age groups in both sexes, there was a tendency for average error to increase with age in males and to decrease with age in females. Another important feature

was that the error significantly increased with weight. The obese group more seriously underreported their weight.

An examination of the factors influencing the discrepancy between reported and measured weight clarified what factors were the determinants of the relative error (mean per cent difference). A multiple regression model was employed to determine this. The outcome variable was the relative error while explanatory variables were age, sex, race, education, income, marital status and weight loss (trying to lose weight or gain weight vs not trying). Only gender was found to be the significant predictor for the relative error of self-reported body weight (r-square of the model was 0.003, standardized coefficients for sex was 0.056 at P=0.015 level.). The multiple regression further confirmed that reported weight for females was less accurate than that for males in this study.

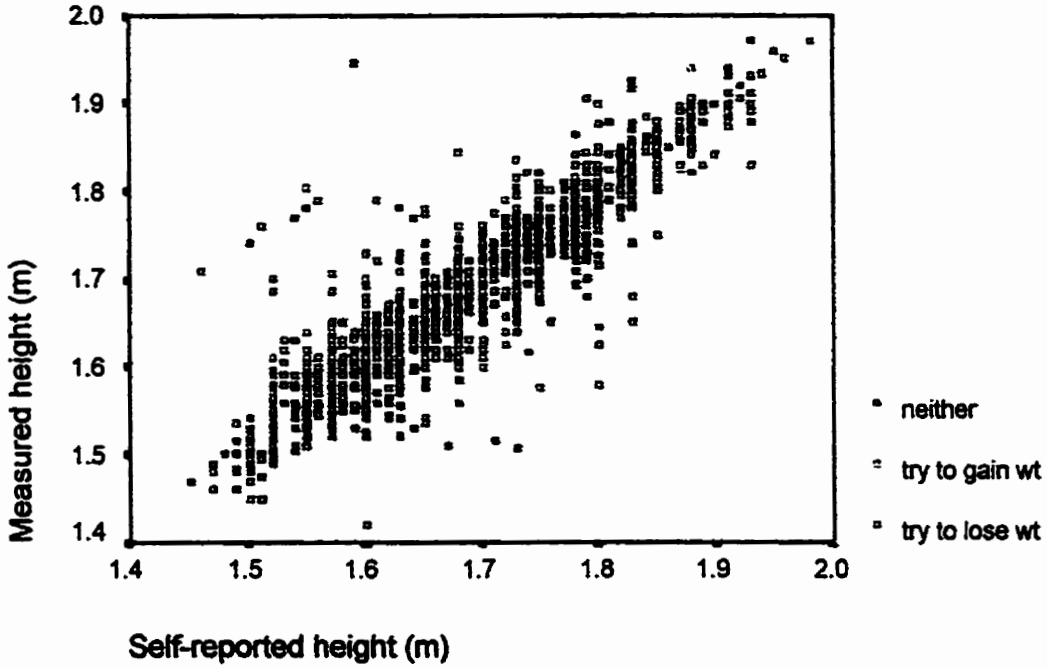
4.5.2 Height

Fig. 20 (on page 62) shows that the association between self-reported body height and measured body height is very strong. The correlation coeffficient (r) between them was 0.918. Scatter dots were along the line with the slop close to 1. The dots in Fig. 20 appear more spread than Fig.19 because the change between grids was much smaller than that of the weight scatter plot. Here again, it was found that most of the data on the edge of the stream and outliers were reported by those who did not engage in weight loss or weight gain activities (see blue dots in Fig. 20).

The second row in Table 4.5.1 provides the results of the Paired t-test for reported and measured height. It showed that the mean reported height was 0.076 cm from that of measured height and no statistical difference (P=0.373) existed between the variability of the two measures. It was concluded that self-reported height from the MHHS_Obe data had an extremely high degree of accuracy and self-reported height was valid.

Although reported height in this study was valid, it was not error free. The second column of Table 4.5.2 indicated that there was a significant difference in mean percent difference of reported height between gender, race and age groups. The sign of relative error changed from "-" to "+" along with age change in both genders. This indicates that the error changed from underestimation to overestimation when age increased. Among males, the elderly were more likely to overstate their height while the young adults were more likely to understate their height. The mean percent difference was significant. Among females, the error in both the young and the middle-aged groups was significantly different from that in elderly group. Young and middle-aged women underestimated their height while elderly women overestimated their height. This similar pattern in males and females indicated that the discrepancy among age groups might be due to the special periods of body development. Fast growth in the young and body shrinking in the elderly may have an impact on their reported height. Finally, the reported heights from Aboriginal people were less accurate that that from non-aboriginal people.

Fig. 20 Relationship between Repoted Ht and Measured Ht for 2161 Subjects



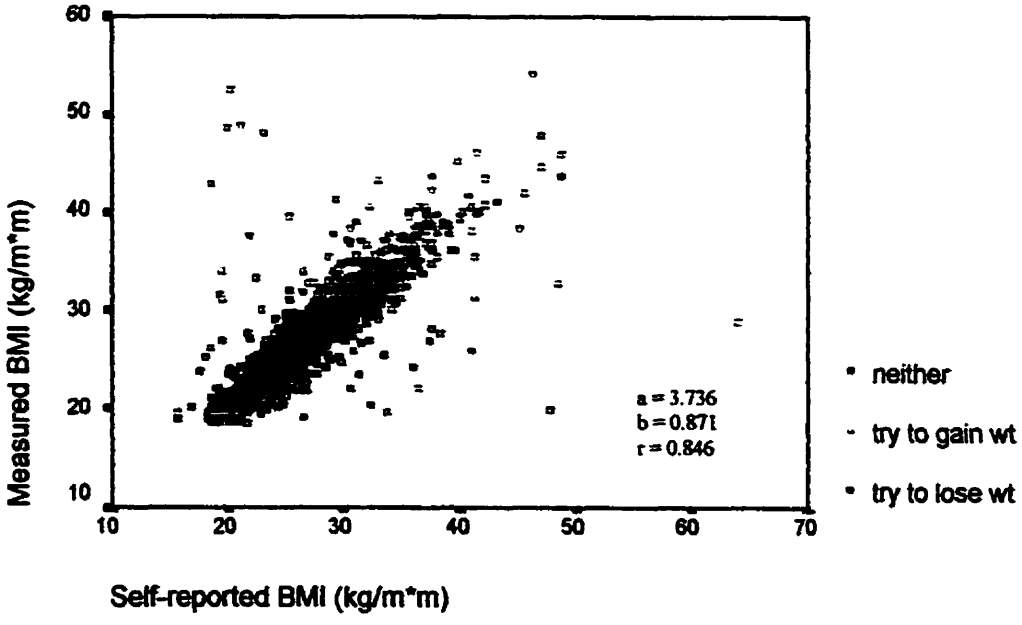
A multivariate analysis was run to examine the determinants of relative error in self-reported height. In this liner regression model the mean per cent disfference (relative error) was the dependent variable and age, sex, race, education, income, marital status and weight loss were the independent variables. The results showed that age, sex and race were the independent predictors of the relative error from self-reported height (r-square of the final model was 0.078, standardized coefficients for age, sex and race were: 0.163 at P<0.0001, 0.061 at P=0.006 and -0.208 at P<0.0001 level respectively).

4.5.3 Body Mass Index

Self-reported BMI was highly correlated with measured BMI with a correlation coefficient (r) of 0.86. The scatter plot, Fig. 21., displays this relationship. The pattern of Fig. 21 was a little different from Fig. 19 and 20. Blue dots (representing those who did not

engage in weight change activities) still looked more spread; however, when the reported BMI was over 30, red dots (representing those who were trying to lose weight) suddenly became spread, most of which were on the underestimated side. This phenomenon gave an impression that obese persons had a tendency to report an underestimated BMI.

Fig. 21 Relationship between Reported BMI and Measured BMI



The third row in Table 4.5.1 shows that reported BMI was significantly different from measured BMI ($P<0.0001$) from the Paired t-test. Reported BMI slightly underestimated the true BMI with the mean difference at 0.36 kg/m^2 and standard deviation at 2.59 kg/m^2. Reported weights were significantly underestimated but reported height was not, thus underreported BMI may be due to underreported weight.

Although the results from the Paired t-test demonstrated that general underestimated BMI was due to underestimated weight in self-reported data, Table 4.5.2 shows that some impacts of reported height on BMI. Looking at the last column of Table 4.5.2, it was found

that the pattern of relative error from BMI was just opposite to that for height. The error from BMI in elderly males showed some underestimation while the error from height showed significant overestimation. Similarly, the error from BMI in elderly females showed overestimation while the error from height showed significant underestimation. Among the Aboriginal subjects it was observed that both their weight and height errors were underestimated, but their BMI errors were significantly overestimated. This result was still reasonable because the impact of underestimated height might stronger than the impact of weight. Height is squared in the BMI formula while weight is not.

The results from the multivariate analysis showed only age and race were the independent predictors of the relative error from self-reported BMI in this study (r-square of the final model was 0.012, standardized coefficients for age and race were: -0.073 at P=0.001 and 0.078 at P=0.001 level respectively). These results were matched with the results from the ANOVA in Table 4.5.2.

4.5.4 Impact of Reported BMI on Obesity Categorization

Cells on the main diagonal of Table 4.5.4 represented observations which were classified identically by both observers. In the MHHS_Obe data, 82.8% of reported BMIs were in the same category as measured BMIs when all of the subjects were divided into normal weight, overweight and obesity categories. Cells under the main diagonal showed the overestimated proportion while cells over the main diagonal represented the underestimated proportion. In these data 11.7% of reported BMIs were lower than measured BMIs, and 6.6% of reported BMIs were higher than measured BMIs. These percentage comparisons demonstrated that overall self-reported data were strongly correlated with measured data. It also explored a minor discrepancy between the two measures resulting in some changes in

the categorization of obesity. Underestimated proportion was almost double the overestimated proportion.

Cohen's Kappa coefficient is a better standard statistical measure of observer agreement because it excludes the agreement expected by chance. The overall value of kappa generated from the MHHS_Obe data was 0.734. According to Joseph L. Fleiss's (1981, p. 218), this number was near an excellent agreement ("values greater than 0.75 or so may be taken to represent excellent agreement beyond chance"). Further examination of the different kappa values among subgroups found that kappa decreased when age went up among males, from 0.741 in young adult males down to 0.686 in middle aged males, then to 0.664 in the elderly males. Different from men, women's kappa values were quite stable. Kappa for young, middle aged and elderly women were 0.750, 0.755 and 0.755 respectively. In addition, the kappa for the Aboriginal group was much lower than the kappa for the non-Aboriginal, 0.551 vs 0.742. Thus, it was concluded that the impact of reported BMI on obesity categorization was stronger in elderly males and Aboriginal people.

Table 4.5.4. BMI Category Agreement Assessment for the MHHS_Obe Data

REPORTED BMI	**MEASURED BMI**			
	Normal Wt No. (%)	Overweight No. (%)	Obesity No. (%)	Total No. (%)
Normal Wt	**803 (37.2%)**	152 (7.0%)	11 (0.5%)	966 (44.8%)
Overweight	71 (3.3%)	**648 (30.0%)**	91 (4.2%)	810 (37.6%)
Obesity	7 (1.8%)	33 (1.5%)	**341 (15.8%)**	381 (17.7%)
Total	881 (40.8%)	833 (38.6%)	443 (20.5%)	2157 (100%)
Sensitivity	91.1%	77.8%	77.0%	

Moreover, the sensitivities of reported BMI associated with the three weight groups were shown in the last row of Table 4.5.4. It was observed that the normal weight group had the highest sensitivity, and the sensitivity of self-reported BMI decreased as the relative weight went up.

4.6 Comparison of Agreement and Disagreement Groups

The third objective of this thesis is to examine the difference on the level of knowledge about risk factors of heart diseases, self-reported behavior and behavior changes between agreement and disagreement groups.

4.6.1 Definitions of Agreement and Disagreement Groups

"Agreement groups" in this study denotes the individuals whose BMI from self-reported weight and height is in the same category as measured BMI when subjects are divided into three categories based on their BMI. On the contrary, "disagreement group" denotes the individuals whose BMI from self-reported weight and height is in a different category than measured BMI. They can be fall into lower or higher categories. For example, a person with a reported BMI of 26 and a measured BMI of 28 is in agreement group because both measures make him fall into overweight category. However, another person whose reported BMI is 28 and measured BMI is 30 should be in the disagreement group because the reported BMI put the person into the overweight but measured BMI put the person into the obesity category.

The null hypothesis for the third research question is there will be no difference between agreement and disagreement in terms of knowledge level about heart diseases, reported behaviors and health-related behavioral changes.

4.6.2 Knowledge Level Analysis

Results from Table 4.6.2 indicate that there was no significant difference in

knowledge on the risk factors of heart diseases between the agreement and disagreement groups when adjusted for age, gender, race, education and income. No matter whether using TSKI or BKI, "agreement" variable was removed by the final liner regression model.

Table 4.6.2 Results of Multiple Linear Regression Analyses of TSKI/BKI for Agreement Status

INDEPENDENT VARIABLES	MODEL R^2	STANDARDIZED COEFFICIENT (β)	P VALUE
(1) TSKI as the dependent variable			
• Agreement, age, sex, race, education, income	0.173	Agreement (-0.007) Income (0.050) The rest[1]	0.728 0.023 < 0.0001
• Age, sex, race, education, income	0.173	Income (0.066) The rest[2]	0.023 < 0.0001
(2) BKI as the dependent variable			
• Agreement, age, sex, race, education, income	0.165	Agreement (-0.027) Income (0.066) The rest[3]	0.205 0.003 < 0.0001
• Age, sex, race, education, income	0.164	Income (0.066) The rest[4]	0.003 < 0.0001

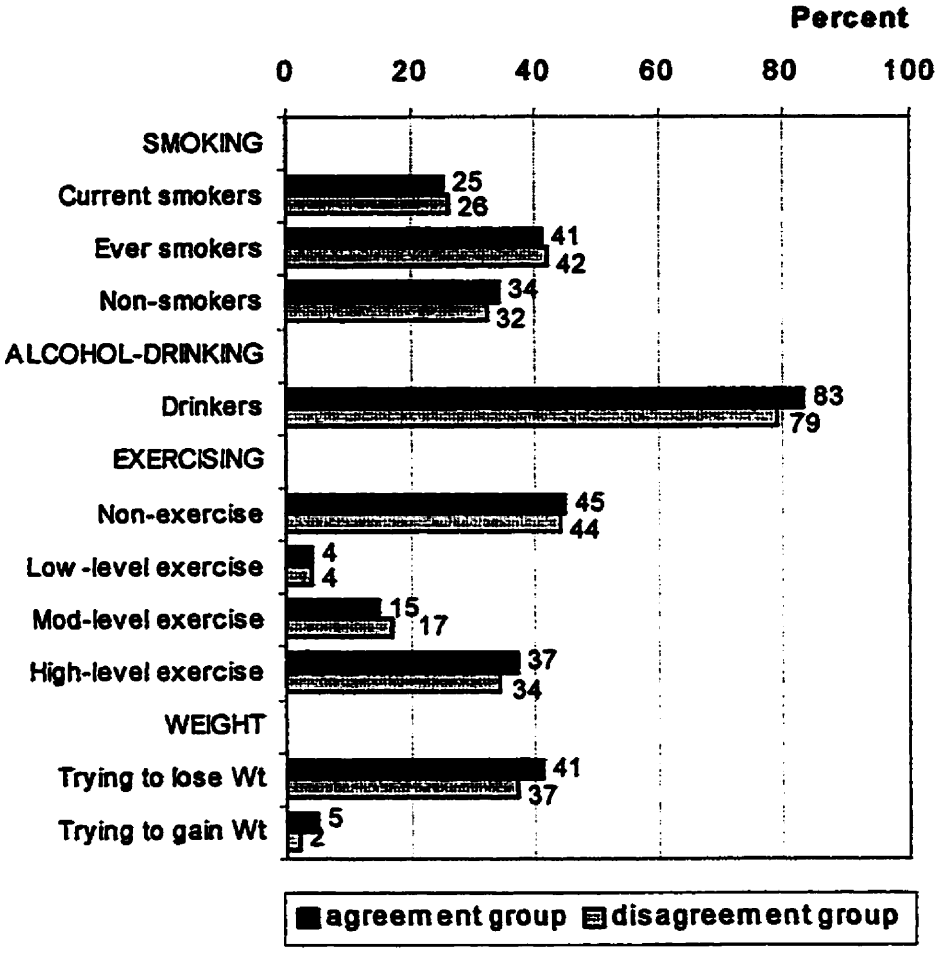
Notes: 1. age (-0.198), sex (0.102), race (-0.348), education (0.213);
2. age (-0.198), sex (0.102), race (-0.348), education (0.213);
3. age (-0.165), sex (0.094), race (-0.238), education (0.184);
4. age (-0.166), sex (0.096), race (-0.240), education (0.185);

4.6.3 Behaviors and Behavioral Change

- **Health-Related Behaviors**

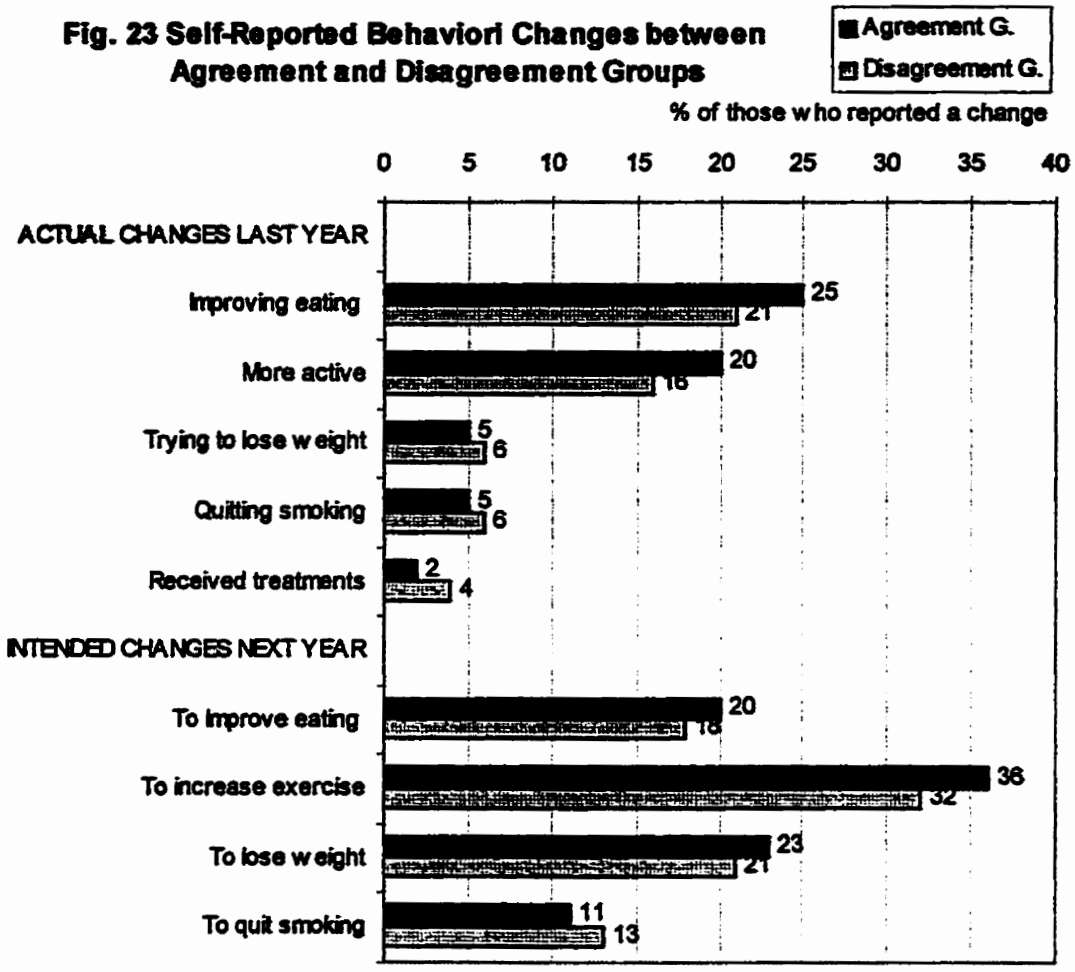
Fig. 20 shows that the difference between the agreement and disagreement groups was small in the proportion of smokers, alcohol-drinkers, people who engaged in exercise and weight adjustment. Through using the Chi-square test, no significant difference was found in each of the segments listed in Fig. 22. Thus, it was concluded that no significant relationship existed between a person's health behavior and the awareness of body weight and height.

Fig. 22 Comparison of Health-Realted Behavior between Agreement and Disagreement Groups



Regarding the relationship between behavioral changes (changes before survey and intended changes) and awareness of body size, no significant association was found using the Chi-square test. However, Fig. 23 shows that some minor difference between the two groups. Among the items of actual changes in the year prior to the survey, the members in the agreement group seemed more likely to have "improved their eating" and "exercised more" than those in disagreement group. Also, among the items of the intended changes in the year following the survey the same trends were seen. Since both the subject numbers and the differences between the two percentages in other items were relatively small, it was not useful to interpret the rest of them.

Fig. 23 Self-Reported Behaviori Changes between Agreement and Disagreement Groups



4.6.4 Barriers and Reasons of Changes

Except for one item in Table 4.6.4, no significant difference was found between the agreement and disagreement groups in other reasons for improving diet, reasons for quitting smoking and barriers to do more exercise. The one item which showed a statistical difference by Chi-square was "lack of incentive", as a barrier to doing more exercise. The persons in the agreement group cited this reason more often. Generally speaking, there was not much different in health-related behavioral changes between the agreement and disagreement groups.

Table 4.6.4 Results of Percentage Comparison Between Agreement and Disagreement Groups In the Reasons and Barriers of Behavioral Changes

REASONS OR BARRIERS FOR THE CHANGES	AGREEMENT GROUP (%)	DISAGREEMENT GROUP (%)
Reasons of improving diet		
To improve appearance	9.0	12.0
Doctor's advice	20.3	24.1
Health reasons	33.5	30.6
Economic reasons	1.5	0.9
Availability of foodstuffs	2.7	0.0
Reasons of quitting smoking (very important category)		
To improve fitness	59.4	67.4
To prevent diseases	79.7	84.2
To set a good example	48.1	48.4
To save money	47.5	41.1
To demonstrate self-control	32.5	33.7
To respect the wishes of non-smokers	33.2	32.6
To be social	16.0	15.8
To be more attractive	14.0	9.5
Barriers of doing more exercise		
Lack of time	25.2	20.8
Lack of transport	2.2	0.5
Lack of money	5.7	4.9
Lack of facilities	11.7	11.5
Lack of interesting activities	15.0	15.6
Illness or disability	13.4	11.0
Lack of incentive*	37.1	29.3
No one to exercise with	18.4	18.6

* denotes that there was a significant difference at the 0.05 level by Chi-square test.

CHAPTER 5
DISCUSSION

5.1 Measures of Health Knowledge

The most commonly used method of knowledge assessment in previous studies is the percentage of corrected responses to specific questions (Health Canada, Statistic Canada & CIHI, 1999; Avis, et al. 1990). Often this comparison cuts across demographic subgroups and other factors of interest. The advantage of this approach is its simplicity. However, its validity and reliability are sample specific and liable to change depending on sample characteristics. An alternative approach is to create a specific knowledge index by tabulating the sum for one correct answer, two correct answers and three or more correct answers of one question. The patterns of response can be compared between various subgroups (Health and Welfare Canada, 1993, p155). However, respond trends are sometimes obscure and difficult to interpret. Better methods for knowledge assessment were used in this study.

The use of TSKI and BKI in this study is an attempt at the development of health knowledge assessment. They are comprehensive measures covering almost all of the knowledge questions in the MHHS. They are absolute values with an interval scale. They can be used for individual knowledge assessment, like the score in a test. Not only can they be conveniently analyzed by sophisticated statistical methods such as linear or logistic regression, they can also link knowledge to other factors such as behaviors to detect their associations. The results from the TSKI and BKI analyses show remarkable consistency providing support to the validity of the conclusions.

The TSKI and BKI do have several defects. The TSKI can lead to underestimation whereas the BKI can lead to overestimation to the true level of knowledge. From Fig. 2 and Fig. 3, it is shown that overall the TSKI mean was lower than 50% of the full score (16 out of

50 points), which gives an impression that Manitobans' CVD risk knowledge was poor. On the other hand, overall the BKI mean passed 70% of the full score (7.5 out of 10 points), which indicates that Manitobans' CVD risk knowledge was not as bad as the TSKI indicated. However, if the focus of the analysis is subgroup comparison, this systematic error is less of a concern. In my study, the objective is to compare knowledge level among normal weight, overweight and obesity groups, so the advantages of using TSKI or BKI are outweigh their disadvantages.

The depth of knowledge about health is influenced by many factors, so it is difficult to capture all of them in one study. Commonly assessed factors include age, sex, ethnicity, available information, and education level. Other factors are personality, occupation, personal interest, self-relevant self-efficacy and motivation to learn. So using one measure for knowledge assessment in a study is very limiting. The design of a survey questionnaire has an impact on how health knowledge is measured. Probed questions and unprobed questions are widely used and usually considered to be valid, but they certainly have different effects on the results. Probed questions are more likely to get optimistic results. Also, how one distributes the number of questions in each knowledge area in the questionnaire may affect the outcomes. In addition, the risk factors and processes of many chronic diseases and health problems are still not completely understood. Thus sometimes even health professionals have different opinions on the correct answers for various test questions. All of these problems can hinder the correct assessment of knowledge.

The accuracy of health knowledge measurement can be improved by better survey design, better understanding of health problems, comprehensive literature review and appropriate statistical analysis.

5.2 Knowledge Level and Obesity Status

The results of this study showed that the level of obesity was not an independent predictor of CVD risk knowledge when adjusted for age, sex, race, education and incomes.

The association between obesity status and the awareness of obesity consequences also demonstrates that self-relevance might increase the knowledge on the risk factors of CVD. Fig. 4 shows that non-obese persons are less likely to mention obesity as a risk factor of CVD because it was not relevant to them. Some smoking research studies (Glanz, G et al., 1996. p51) reported that smokers were more aware of the consequences of smoking. Strecher and his colleagues (1995) found that smokers were likely to perceive a heightened personal risk for heart attack, cancer, and stroke. However, awareness of threat does not always lead to behavioral changes. Strecher's study on smoking also showed that smokers tend to perceive a health risk, but underestimated the magnitude of that risk. Another study (Glanz, G et al., 1996. p50) showed that increasing the perceived threat sometimes even increased the frequency of smoking and decreased the likelihood of cessation because smoking is often linked with stress and emotional arousal. In obesity research, the MHHS_Obe data could be further analyzed for the relationship between awareness of obesity consequences and behavioral changes among obese individuals. One might speculate that relevance is associated with obesity and its consequences.

5.3 Health Related Behaviors and Obesity Status

There were minor differences in health related behaviors among the three weight groups. The results showed that overweight and obese individuals were less likely to be current smokers and drinkers, and they had lower rates of exercise.

In smoking, the proportion of smokers (current and ever smokers together) in the three weight groups were quite similar, but the overweight and obesity groups had a lower

proportion of current smokers and increased proportion of those who were "ever smokers". This phenomenon might indicate that more overweight and obese smokers than normal weight smokers had quit smoking in the past. In terms of the most important change in the previous year before survey, there was no difference in smoking cessation among the three weight groups. Data showed more normal weight people had an intent to quit smoking in the year following the survey. There was no difference in perceived benefits to quit smoking among the three weight groups.

Regarding alcohol consumption, the results showed that slightly fewer obese and overweight people than normal weight people were current drinkers. No association was found between the amount of alcohol consumed and the level of obesity among drinkers. The majority of epidemiological studies suggest absent or weak associations between alcohol and obesity in men and strong inverse associations in women (Colditz, et al., 1991; Williamson, et al., 1987). However, a study from Japan found that alcohol intake is strongly associated with waist-to-hip ratio (WHR), but not associated with BMI (Sakurai, et al., 1997).

Alcohol is one of the most energy-dense macronutients and is very efficiently absorbed. It suppresses the oxidation of fat, favors fat storage and can serve as a precursor for fat synthesis. Moreover, the body has no capacity for alcohol storage in the way that it does for fat and protein. In addition, alcohol is a poison for the body and must be detoxified quickly. On the basis of this foregoing knowledge, obesity might be expected to correlate with alcohol consumption. An explanation for the lack of association between alcohol intake and BMI is that ethanol increases metabolic rate. Other explanations are that alcohol suppresses the intake of other foods (Prentice, 1995) or people who drink more might have other life style such as being social and active. In addition, diet culture has an impact on drinking pattern. The Japanese and Chinese usually drink while eating foods rich in protein,

which will protect an individual from the effects of alcohol such as malnutrition or organ damage (Patek & Post, 1941). On the other hand, drinking alcohol while eating high-fat foods or overeating may promote obesity.

With respect to dietary changes, results from this study show that slightly more obese people reported a definite change than overweight and normal weight people (see Fig.8). However, slightly more normal and overweight people than obese people mentioned "improved eating habit" as their most important change in the year previous to the survey (see Fig.7). With respect to the intended changes in eating habit following the survey, there was no difference among the three weight groups (Fig.11).

Dietary changes are difficult for both normal weight and overweight/obese individuals because food choice is largely determined by food preference. Food preference may be determined by environmental, cultural, genetic and sensory variables. All those variables could interact with each other in complex ways (Rozin, 1984), but how they interact is poorly understood. People must choose foods from those that are available and affordable. However, in a developed and multicultural society like Canada, the foods selected to be grown and sold vary greatly among different cultures. Within a given culture, individual food selection depends on socioculture systems that govern food production, distribution and consumption (Harris, 1985). Preference for flavor and taste are learned, culturally determined, and are dependent on the degree of exposure (Story & Brown, 1987). Since making a dietary change is so hard, it may require increased cost, skill, time, or effort needed for food preparation (Glanz, 1986).

With respect to exercise level, results showed that not only were obese individuals less active currently (Fig.5, Fig.7), but they also were less likely to be more active in the near future (Fig.11). More obese people expressed their intention to change than normal weight

people, but most of them pointed out their change to "losing weight" rather than increasing exercise level (Fig.14). The MHHS database also explored the barriers to exercise (Fig.18). It showed that more obese people reported that "illness/disability" was one of their major barriers than normal weight and overweight groups. Slightly more obese individuals checked off that "lack of interesting activities" as their barrier to be more active. It also showed that fewer obese and overweight people indicated that "lack of time" as their barrier than normal weight people did. So where is the problem? It is suspected that obese people may not have access to adequate information and effective exercise programs. Their conditions also can cause them discomfort in exercise programs. They might not have enough confidence to participate in physical activity, might be less likely to see the exercise benefit and might anticipate an immediate negative effect from exercise. Behavioral capability and social supportive factors also could keep them away from being more active. Therefore, further studies are needed to look at the reasons; why obese individuals are hard to be motivate to do exercise and what are effective programs.

5.4 Implications for Health Promotion

The most important contribution of this study is the results from the CVD knowledge analyses. Firstly, findings of this study indicated that the knowledge about risk factors of heart diseases was not different among normal weight, overweight and obese Manitobans. There was also no knowledge discrepancy between agreement and disagreement groups regarding reported-measured BMI difference. Secondly, CVD knowledge among all three weight groups was still universally poor. What does this mean for policy makers?

The findings of this study suggest a population based health promotion strategy over targeting a high-risk group strategy. Based on the Precede-Proceed Model, policy makers need to emphasize health promotion and target on all factors including the person

(predisposing factor), environments (reinforcing and enabling factors) and behaviors, rather than to target on the person only using education programs. In addition, universal health promotion is a cost-efficient strategy. It will not only help to prevent obesity and the outcomes of obesity, but also prevent many other chronic diseases as well as increase the quality of life. Moreover, it is the one way to reduce the burden on the Canadian health care system.

The findings of this study suggest that a better understanding of obesity and its relationship with CVD among obese people themselves, the general public, governments, and health professionals is still needed (changing people's values and attitudes) since the level of CVD risk knowledge is low among Manitobans. Mass media, health education programs and continuous medical education programs should put more effort into stressing that obesity is a chronic disease and a serious public health problem, in order to change the population view that obesity is a normal condition or personal affair. Education programs need to highlight that obesity is preventable for most people. Although the risk factors of obesity are complex and entangled, the fact is that obesity is an epidemic in North America and is due to unhealthy eating practice and reduced physical activity levels. Furthermore, many studies have demonstrated that diet change and increasing leisure time exercise helps to reduce body weight and prevent other diseases (NIH,1998. p47-48). Genetic factors can not explain all obesity cases.

The findings of this study call for disseminating the information about an urgent need for obesity control and the threat of obesity outcomes through mass media. While raising awareness about obesity in Canada, governments and health professionals should begin to take action to combat obesity immediately, like the US and other countries in Latin America (changing government and health providers' behaviors for changing environments). Canadian

governments should put obesity on the list of health priorities and set goals for both short term and long term. They should supply more funds for population based health promotion and introduce improved programs for health education, prevention, detection and treatment. Government also can stimulate further basic, epidemiological and clinical research on obesity. In terms of the role of health professionals, they should increase their knowledge and develop capabilities in primary care for the integrated management of obesity. In short, the right strategies for obesity control are to prevent obesity among normal weight people and help overweight people as early as possible.

What should be the focus regarding population based health promotion? There are generally three aspects: changing social environment, changing physical environment and changing policies. Firstly, regarding change in the broad social environment, strategies are needed for both diet and physical activities. For diet, issue food industry advertising guidelines, encourage governments to subsidize low-fat / low-sugar foods and tax high-fat / high-sugar foods, and provide a variety of fresh foods around the seasons. For physical activities, there is a need for supportive environments that encourage leisure time exercise such as walking, swimming, Yoga or Tai-Chi clubs. Special support is needed to involve less active groups such as obese people or the elderly to be more active. Low-cost public exercise programs are especially important for skill development. Also, we must encourage the entertainment industry to promote a health message. Secondly, consider changing the physical environment, target diet and physical activities. For diet, use simple food labels in supermarkets and grocery stores. Suggest that restaurants supply healthy dish options. Besides, encourage the provision of healthy fast food for the public. For physical activities, city planning is very important to promote walking and cycling, which includes paths, maintenance, lighting, city bus with bicycle racks, subway station with secure bicycle

storage, incentives to walk/cycle and disincentives to cars. Other physical environmental changes are to build more green space / parks, to supply indoor recreation facilities for winter exercise and to design buildings for the encourage the use of stairs. Lastly, regarding policy change, it can target on society, community and individual levels. All of the social and physical environmental changes need the guarantee of government priority and policy changes. In summary, when we plan health promotion programs all three aspects above should be considered (B. Reeder's personal communication).

While this study supports population based health promotion it does not mean to completely exclude health intervention among high-risk groups such as children and Aboriginal people. However, their functions are different. High-risk group intervention programs could be used to complement the population health promotion strategy.

The relationship between knowledge and behaviors can be depicted by an analogy. One can compare disseminating knowledge to spreading "seeds" into the soil. In the Western World including Canada, after many year of health campaigns and media advocacy, the public have already achieved a certain level of knowledge in nutrition and physical activities, and they recognize that something is wrong in their diet pattern and sedentary life. While the "seeds" are there, why don't they sprout, grow and bloom? Now researchers from health promotion and epidemiology realize that education alone will not work well to change health behaviors. More effort on external factors is needed. That means creating an appropriate environment to push forward behavioral changes rather than persuading individuals to change themselves.

5.5 Validity and Reliability of Reported Weight and Height

To a large extent, the results of the validity analysis for reported weight and height are quite consistent with the results from the previous studies. First of all, both self-reported body weight and body height was highly correlated with measured weight and height.

R values in this study were 0.920 while they were between 0.822 and 0.979 in previous studies (Rowland, 1990; Stewart, et al., 1982). Next, reported height was more reliable than reported weight with lower relative errors. Plats study (1981) found that the relative errors from reported height were less than that from reported weight. This study further confirmed that not only reported error in height was much less than that in weight, but also that the mean of reported height did not differentiate from the mean of measured height among Manitoban adults (Paired T-test, $P>0.05$). Therefore, reported height is a valid measure in this study. Moreover, reported weight from males seemed more accurate than that from females. Similar to Plats, this study showed that women significantly underestimated their weight more than men did. The average reporting errors (mean per cent) in women was -1.44% vs -0.82% (minus means understate here) in men. An analysis on absolute error for self-reported weight and height was not done in this study. However, Stewart and his colleagues reported the mean difference between self-reported and measured weight for both sexes combined was -0.58 kg with a 99% confidence interval of -0.75 to -0.41, and mean difference for height was 1.94 cm with a 99% confidence interval of 1.78 to 2.10. In addition, body weight errors came from certain subgroups. This study showed that obese people, young women and Aboriginal people were more likely to state an underestimated weight in the survey. It also was found that age, sex, being engaged in weight loss and overweight/obesity status were the predictor of reporting error (relative error). Rowland (1990) has analyzed 11284 aged 20-74 y from 2nd National Nutrition Examination Survey of 1979-1980 in the US. His results showed that errors in self-reported weight increased directly with the magnitude of overweight. Errors in reported weight were greater in overweigh females than in overweight males, race (whites vs blacks), age, and end-digital preference were ancillary predictor of reporting error in weight.

There were also some discrepancies between the previous studies and this study. Firstly, the results in this study showed that reported height was extremely accurate. No significant difference was found using the Paired T-Test even through the sample size was laege. Whereas Stewart's study (1982) reported that the participants consistently overestimated their height. Secondly, this study found that there was a tendency for relative errors in height from slight overestimation to slight underestimation when age increased for both among males and females. However, Stewart's study (1982) found that height overestimation became greater with increasing age in each sex group. Thirdly, the relative errors of reported height in this study were 200 to1600 time less than that of a previous study (Palta, et al., 1981) with 0.001% vs 1.6% by men and –0.003% vs 0.6% by women.

The participants in this study tended consistently to underestimate their weight with very accurate height, which resulted in an underestimation of their BMI. Palta's (1981) and Steward's studies (1982) showed that a consistent underestimation in weight and overestimation in height caused more serious underestimation in BMI. There are few previous studies on analysis of categorization of obesity level based on BMI. The results from this study demonstrate that self-reported BMI only has a minor impact on categorization of obesity level. The concordant pairs from measured and reported BMI were 82.8%, and the Kappa analysis reported there was a very good agreement. However, the Kappa value has decreased among elserly males and the Aboriginal people. The sensitivity of reported BMI was lower among overweight and obesity individuals.

The implication of the above analyses above are: (1) There is a need to better anticipate the potential area of bias. (2) Caution must be used with the reported data in weight from certain population subgroups. For example, young female adults, the Aboriginal and obese people. (3) We have to realize that the underestimation of weight would have an impact on

the observed differences in weight-mortality pattern. (4) Categorical variables based on reported BMI would become more unreliable when reported weight and/or height were less accurate. According to the major information from this study, one must keep in mind those areas that could result in a systematic reporting error in the data. If possible using measured weight and height to capture the level of obesity is more reliable.

5.6 Study Limitations

The limitations of this study are: first, the MHHS data are 10 years old. Since the MHHS data were collected between 1989 and 1990, any changes in the prevalence of obesity, CVD knowledge level and behavior difference among the three weight groups may not be the applicable in 2000. Second, health knowledge was measured by unprobed questions, which treated not mentioning a specific risk factor about CVD the same as not knowing it. So this method could underestimate the level of knowledge among Manitobans. Third, the Manitoba Heart Health survey focused on CVD, not obesity, thus this study failed to examine the level of obesity knowledge among normal weight, overweight and obese people. Fourth, for secondary data analysis, it is difficult to check back outliers and explain unexpected results such as "why 2% overweigh and 1% obese people still wanted to gain weight". Fifth, binary measure in education, income, ethnicity, marital status might bias original data. It might obscure some important trends that can be shown when more categories are used. For example, setting $50,000 as the cut point for high and low level of income may hide the difference between those with less than $25,000 and over $25,000 annual family income. "Ethnicity" only divides subjects into "Aboriginal" and "non-Aboriginal", so it will hide the difference between other ethnicity. Lastly, the accuracy of self-reported behaviors is a concern.

5.7 Future Research

This study raises several important issues that should be addressed in future studies. The findings suggest that considerable research needs to be done to examine the association between obesity relevant knowledge and behaviors, between environments and behaviors and among different health behaviors, for understanding the causes and mechanisms of obesity, and for generating effective strategies in weight control. In particularly, more research is needed to identify the characteristics of individuals who have successfully made a change and maintained their weight loss over a long period.

A specific survey should be conducted on obesity-related knowledge assessment. The questionnaire should cover the definition of obesity, potential risk factors of obesity, health consequences of obesity and the possible treatments of obesity. Many knowledge assessments in previous studies focused on the knowledge of CVD, smoking and nutrition (Health Canada & Statistical Canada, 1999; Health and Welfare Canada, 1993). Obesity-related knowledge assessment is a field that remains to be explored.

It is desirable to identify the most effective ways to promote increased physical activity and prevent overeating in the general population. Physical inactivity and overeating are two clear risk factors of obesity. They happen gradually in out modern society and seem out of control. Besides motivating people to be more active and educating them to eat balanced meals, one should think about more strategies on the external environment.

It would be interesting to further explore the inter-relationships among different types of health behaviors because one may find out more effective strategies to promote multiple healthy behaviors through one health promotion program. Research questions such as the following could be asked. Are people who changed their eating habits more willing to be physically active? Are those who quit smoking more likely to engage in weight loss? Is there

a connection between quitting or reducing alcohol consumption, quitting smoking and changing diet?

Qualitative studies are needed to investigate how some people could made a successful change, how they coped with the suffering of the changes, and how they integrated those changes into their daily activities to achieve a life-time weight control. Qualitative research is also needed to examine why people can not make the changes. What are their major barriers? And needs? Moreover, qualitative studies can help us to evaluate how effective a health promotion program is so that we can sum up experience, improve the programs and ask for more resources.

Regarding the further research on self-reported height and weight assessment, there are two suggestions. (1) The National Heart Health Survey data set is a good resource to do research on reported-measured weight, height and BMI comparison. (2) New methods could be attempted to do an analysis on reported-measured weight, height and BMI comparison. May's paper (1994) suggested that log liner regression did a better job than Kappa coefficient in the analysis of observer agreement data. Future researchers may want to attempt a log liner regression on reported-measured height weight comparison.

5.8 Conclusions

Through the completion of this study, a few major conclusions can be draw as follows.

First and the most important, this study found that obesity status is not an independent determinant for the level of health-related knowledge. That means that obese people had the same level of knowledge on the risk factors of heart diseases as overweight or normal weight people. In addition, being aware of their weight and height is not relevant with the level of

health knowledge either. The implementation of these findings is that governments should give priority to population based health promotion for obesity control and prevention.

Secondly, this study also found that obese and overweight people were less likely to be current smokers and alcohol-drinkers. They were less active than normal weight people. More obese and overweight individuals checked off "losing weight" and "got medical treatments" as their most important change in the year prior to the survey, while more normal weight individuals reported "were more active" or "improved their eating habits". In terms of the intended changes in the year following the survey, relatively more obese people wished to take action, but still they were more likely to engage in "weight loss" and less likely to be "more active" than overweigh and normal weight people.

Finally, the results of this study showed that self-reported weight, height and BMI were highly correlated with measured data. The correlation coefficients are 0.920, 0.918 and 0.846 respectively. Overall, 82.8% of BMIs derived from self-reported measure fell into the same obesity categories as actually measured BMI. Although self-reported weight and height are valid data, weight was found to be underestimated in some subgroups such as obese people, young females and Aboriginal people. The impact of using reported data to categorize obesity is minor.

Since the MHHS sampled all of the non-institutional residents in Manitoba, the results of this study can represent the general population in Manitoba area. Thus all the results form this study can be used in the planning and implementation of health promotion programs in Manitoba district. They also can server as a baseline for future program evaluations.

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Appendix 1:

Variables in the MHHS_Obe Data for Secondary Analysis

Question/Variable	Variables Name	Missing Value	Categories
Q11. How do you think of high blood pressure can affect your health?	BPHEAL 1~5	No	knowledge
Q12. What things do you think can cause high blood pressure?	BPCAUS 1~5	No	knowledge
Q13. Do you think that high blood pressure is related to things people eat or drink?	BPFOOD	No	knowledge
Q.14 what things that people eat and drink, do you think are related to high blood pressure?	FOODT 1~5	No	knowledge
Q19. In the past 12 months, have you taken a drink of beer, wine, liquor or other alcoholic drink?	YRDRINK	No	behavior
Q22. Are you presently trying to lose weight?	LOSEWT	No	behavior
Q23. Which of the following are you doing to lose weight?	LOSEW 1~5	No	behavior
Q224. Why would you like to lose weight?	RSONLW 1~7	No	others
Q25. How tall are you without your shoes?	SFHT	2.7%	others
Q26. How much do weight?	SFWT	2.5%	others
Q29. As far as you health is concerned, do you think you eat too much, too little, or about the right amount of the following foods?	FOODEAT 1~6	< 1%	behavior
Q30. How would you rate your diet compared to this time last year?	DIETCHAG	No	behavior
Q31. Compare to last year, would you day you are eating more, less or about the same of: read the list and enter number for each item.	DCHAG 1~6	1.2~4.5%	behavior
Q32. What was the main reason to change your diet?	RDCHAG 1~5	1.6%	others

Q33. What health problems do you think might be related to the amount of fat that people eat?	FATF 1~5	No	knowledge
Q34. Do you think that cholesterol is found in: Food, blood or both?	CHOLESF 1~3	0.2%	knowledge
Q35. How do you think foods which are rich in cholesterol can affect you health?	CHOLF 1~5	No	knowledge
Q36. How do you think that high levels of cholesterol in your blood can affect you health?	BCHOL 1~5	No	knowledge
Q37. Have you ever had your blood cholesterol measured?	CHOCHEK	No	behavior
Q43. What do you think a person can do to lower his/her blood cholesterol level?	LOWCHO 1~5	No	knowledge
Q49. At the present time do you smoke cigarettes?	CIGARET	No	behavior
Q52 Of the following reasons for giving up smoking, which do you think are very important, some important, or not important?	SMOKQR 1~8	1.2~1.9%	others
Q53. Would you yourself like to give up smoking?	SMOKGP	< 1%	others
Q56. Do you regularly engage in physical exercise during your leisure time? (at least once a week in the past two months)	EXERCI	< 1%	behavior
Q62. Do any of the following reasons prevent you from doing more exercise or being more active?	RSONEX	No	others
Q64. What do you think are the major causes of heart disease or heart problems	HDCAUS 1~5	No	knowledge
Q69. What do you think the major causes of a stoke?	STROCAU 1~5	No	knowledge
Q79. We are talk about health and health behaviors, what would you say in the single most important thing you have done in the past year to improve your health?	IMPOB 1~5	< 1%	behavior

Q80. Is there anything you intend to do to improve your health in the next year?	NEXTDO 1~5	No	others
Q81. Enter respondent's sex	SEX	No	others
Q82. What is your date of bith?	AGE	No	others
Q3 What is your current employment status?	EMPLOY	< 1%	others
Q84 What is your occupation?	OCCU	26%	others
Q85. What is you current marital status?	MARRAG	< 1%	others
Q86. What is the highest grade or year of education you have competed?	EDUCA	< 1%	others
Q87. What language do you first speak in childhood?	RACE	< 1%	others
Q88. How many people living in this household?	HOUSEHS	< 1%	others
Q89. Could you please indicate from the following list the income rang for you household?	INCOME	11.2% (252 people refused)	others
Body Mass Index	BMI	No	others
Aboriginal people	RACE	No	others
Measured weight	MWT	No	others
Measured height	MHT	No	others

Appendix 2:

Ten Knowledge Questions for Creating TSKI and BKI

1. (Q.11) How do you think high blood pressure can affect your health?

Right answers:
a. stroke
b. kidney trouble
c. heart attack / problems
d. hardening of the arteries
e. eye problems

2. (Q.12) What do you think can cause high blood pressure?

Right answers:
a. being overweight
b. smoking
c. eating too much salt
d. worrying, tensing, stress
e. eating fatty foods

3. (Q.14) What things that people eat and drink, do you think are related to high blood pressure?

Right answers:
a. salt / salty foods / sodium
b. alcohol
c. fats
d. saturated fats
e. cholesterol

4. (Q.33) What health problems do you think might be related to the amount of fat that people eat?

Right answers:
a. overweight / obesity
b. heart disease / coronary disease / heart problems / heart attack
c. high blood cholesterol
d. high blood pressure
e. arteriosclerosis / hardening of the arteries/ fat build up in the arteries

5*. (Q.34) Do you think cholesterol is found in:

Right answers:
a. foods
b. your blood
c. both

6. (Q.35) How do you think foods which are rich in cholesterol can affect you health?

Right answers:
a. hardening or clogging of the arteries
b. increase blood pressure
c. heart attack / angina
d. stroke
e. increase blood cholesterol

7. (Q.36) How do you think that high levels of cholesterol in you blood can affect your health?

Right answers:
a. hardening or clogging of the arteries
b. increase blood pressure
c. heart attack / heart disease
d. stroke
e. angina

8. (Q.12) What do you think a person can do to lower his / her blood cholesterol level?

Right answers:
a. exercise regularly
b. take prescribed medication
c. eat food with less cholesterol
d. eat less fatty food
e. lose weight

9. (Q.64) What do you think are the major causes of heart disease or heart problems?

Right answers:
a. being overweight
b. smoking
c. eating too much salt
d. worrying, tensing, stress
e. eating fatty foods

10. (Q.69) What do you think are the major causes of a stroke?

Right answers:
a. overweight
b. high blood cholesterol level
c. lack of exercise
d. smoking
e. high blood pressure

Note: *Question 5 only has three answers. Choosing "a" or "b" will get 2.5 points while answering "c" will get 5 points for TSKL

Appendix 3

THE MANITOBA HEART HEALTH PROJECT

Reference Number V1 ☐☐☐ - V2 ☐☐☐☐ - V3 ☐ - V4 ☐☐

1 2 3 Cluster | 4 5 6 7 Sample | 8 Group | 9 10 Interviewer

Interviewer's Name _____

RECORDS OF CONTACTS

Call	Date	Time	Notes/ Comments
1			
2			
3			
4			
5			
6			

Circle the number which you feel indicates the:

Quality of interview 1 2 3 4 5 (Low … High)

Reliability of information 1 2 3 4 5 (Low … High)

Note: 1 is Low, 5 is High

Final status of interview:

1 ☐ Complete
2 ☐ Refused
3 ☐ Moved
4 ☐ Unable to locate
5 ☐ Deceased
6 ☐ Other non-interview(specify) _____

Variable No.		Column No.
	Reference Number V1 □□□ · V2 □□□□ · V3 □ · V4 □□ (1 2 3 Cluster · 4 5 6 7 Sample · 8 Group · 9 10 Interviewer)	
5	First Blood Pressure Reading — Systolic	11 12 13
	Diastolic	14 15 16
	SECTION 1: BLOOD PRESSURE	
	To begin with I'd like to ask you a few questions about blood pressure.	
6	Q1. Before this interview, have you ever had your blood pressure checked?	17
	1. Yes 2. No - Go to Q6	
7	Q2. When did you last have your blood pressure checked?	18
	1. Last 6 months 2. 6 - 12 months 3. 1 to 2 years 4. More than 2 years 8. Don't know	
8	Q3. Who checked your blood pressure at that time?	19
	1. doctor 2. nurse 3. family member or friend 4. coin operated machine 5. self 6. other (specify)_____ 8. not sure	
9	Q4. Which of the following describes the information you were given? Was it: (read list)	20
	1. described in numbers 2. described in numbers and in words like high/low/normal 3. described in words only 4. not described — Go to Q6 8. not sure	

Variable No.			Column No.
10	Q5. What was your blood pressure reading in numbers when it was last taken?		
	Leave blank if can't remember — Systolic		21 22 23
	Diastolic		24 25 26
11	Q6. Have you ever been told by a doctor or nurse that you had high blood pressure?		
	1. Yes 2. No — Go to Q10 8. Can't remember — Go to Q10		27
12	Q7. Was any treatment or program prescribed for your high blood pressure?		
	1. Yes 2. No — Go to Q10 8. Not sure — Go to Q10		28
	Q8. What were you told to do? Do not read list.		
13	a. take medicine	a	29
14	b. take medicine and some other treatment	b	30
15	c. go on salt-free diet (salt reduced, low salt)	c	31
16	d. watch weight	d	32
17	e. avoid stress, slow down and relax	e	33
18	f. cut down or stop smoking	f	34
19	g. cut down alcohol intake	g	35
20	h. start exercise program	h	36
21	i. use biofeedback	i	37
22	j. other treatment (specify) _____	j	38
23	k. not sure	k	39
	Q9. What treatment or program are you now following? Do not read list.		
24	a. take medicine	a	40
25	b. on salt-free diet (salt reduced, low salt)	b	41
26	c. watch weight	c	42
27	d. other diet change	d	43
28	e. avoid stress, slow down and relax	e	44
29	f. cut down or stop smoking	f	45
30	g. cut down alcohol intake	g	46
31	h. exercise program	h	47
32	i. use biofeedback	i	48
33	j. other treatment (specify) _____	j	49
34	k. not sure	k	50

Variable No.			Column No.
35	Q10. As far as you know, is your blood pressure high now? 1. Yes 2. No 8. Don't know/not sure		___ 51
	Q11. How do you think high blood pressure can affect your health? Do not read list, but if respondent is hesitant then probe.		
36	a. Stroke	a	___ 52
37	b. Kidney trouble	b	___ 53
38	c. Heart attack/problems	c	___ 54
39	d. Hardening of the arteries	d	___ 55
40	e. Eye problems	e	___ 56
41	f. Nose bleed	f	___ 57
42	g. Headache	g	___ 58
43	h. Dizziness	h	___ 59
44	i. Swelling	i	___ 60
45	j. Other _____	j	___ 61
46	k. Not sure	k	___ 62
	Q12. What things do you think can cause high blood pressure? Do not read list, but if respondent is hesitant then probe.		
47	a. Being overweight	a	___ 63
48	b. Smoking	b	___ 64
49	c. Eating too much salt	c	___ 65
50	d. Race or Ethnic group	d	___ 66
51	e. Worrying, tension, stress	e	___ 67
52	f. Eating fatty foods	f	___ 68
53	g. Drinking coffee	g	___ 69
54	h. Regular hard exercise	h	___ 70
55	i. Being pregnant	i	___ 71
56	j. Heredity (runs in family)	j	___ 72
57	k. Drinking too much alcohol	k	___ 73
58	l. Using birth control pills	l	___ 74
59	m. Being underweight	m	___ 75
60	n. Low income, low education	n	___ 76
61	o. Too much blood in system	o	___ 77
62	p. Getting little exercise	p	___ 78
63	q. Old age	q	___ 79
64	r. Other _____	r	___ 80
65	s. Not sure	s	___ 81
66	Q13. Do you think that high blood pressure is related to things people eat or drink? 1. Yes 2. No → Go to Diabetes Q15 8. Not sure → Go to Diabetes Q15		___ 82

Variable No.			Column No.
	Q14. What things that people eat and drink, do you think are related to high blood pressure? Do not read list.		
67	a. salt/salty foods	a	___ 83
68	b. sodium	b	___ 84
69	c. alcohol	c	___ 85
70	d. fats	d	___ 86
71	e. saturated fats	e	___ 87
72	f. cholesterol	f	___ 88
73	g. calories/eating too much	g	___ 89
74	h. additives/preservatives/food coloring	h	___ 90
75	i. caffeine/coffee	i	___ 91
76	j. sugar/sweet foods	j	___ 92
77	k. starch/starchy foods	k	___ 93
78	l. pork	l	___ 94
79	m. specific meat other than pork	m	___ 95
80	n. meats generally	n	___ 96
81	o. fried foods/greasy foods/oily foods	o	___ 97
82	p. calcium	p	___ 98
83	q. red meats	q	___ 99
84	r. fast foods	r	___100
85	s. other _____	s	___101
86	t. not sure	t	___102
	* * * * *		
	SECTION 2: DIABETES		
	The next few questions are about diabetes.		
87	Q15. Have you ever been told by a doctor that you have diabetes? 1. Yes 2. No → Go to "ALCOHOL" Q18 8. Not sure → Go to "ALCOHOL" Q18		___103
88	Q16. How old were you when you were first told you had diabetes? Enter age leave blank if not sure		104 105
	Q17. Are you now on any treatment for your diabetes? Do not read list.		
89	a. no current treatment	a	___106
90	b. insulin	b	___107
91	c. pills to control blood sugar	c	___108
92	d. diet	d	___109
93	e. weight loss	e	___110
94	f. other _____	f	___111
95	g. not sure	g	___112
	* * * * *		

Variable No.		Column No.
	SECTION 3: ALCOHOL	
	Now I would like to ask some questions about alcohol consumption.	
96	Q18. Have you ever taken a drink of beer, wine, liquor or other alcoholic drink? 1. Yes 2. No 9. Refused	___113
97	Q19. In the past 12 months, have you taken a drink of beer, wine, liquor or other alcoholic drink? 1. Yes 2. No ┐Go to "WEIGHT" Q22 9. Refused┘	___114
98	Q20. How often, on average, did you have an alcoholic drink in the past 12 months? By that I mean Number of times per week or Number of times per month 88. Don't know 99. Refused - Go to "WEIGHT" Q22	1 ___ ___ wk 2 ___ ___ mo 115 - 117
99	Q21. On a day when you drink alcohol, how many drinks on average do you have throughout the day? When we use the word "drink" it means: One bottle of beer or glass of draft or One small glass of wine or One shot or mixed drink with hard liquor Enter number of drinks Leave blank if refused * * * * *	118 119

Variable No.		Column No.
118	Q27. Ask females only: To be sure we use the information correctly, I just need to ask if you are pregnant 1. Yes 2. No) Go to Q29	___142
119	Q28. How many months? * * * * *	___143
	SECTION 5: EATING HABITS	
	The next section deals with eating habits.	
119	Q29. As far as your health is concerned, do you think you eat too much, too little, or about the right amount of the following foods? Read list and enter number for each item.	

		Too much	Too little	About right	Not sure	
120	a) Lean meat, fish, poultry (chicken, turkey)	1	2	3	8	___144
121	b) Processed meats (wieners, salami, luncheon meats)	1	2	3	8	___145
122	c) Baked foods (cookies, muffins, cakes, pies)	1	2	3	8	___146
123	d) Fried foods (french fries, doughnuts)	1	2	3	8	___147
124	e) High-fibre foods (cereals, veg., wholegrain bread, fruit, beans)	1	2	3	8	___148
125	f) Salt or salty foods (pretzels, chips, salted nuts, pickled foods)	1	2	3	8	___149

Variable No.		Column No.
126	Q30. How would you rate your diet compared to this time last year? Read list. 1. Definitely different 2. Small change only 3. No change → Go to Q33 8. Not sure	___150
	Q31. Compared to last year, would you say you are eating more, less or about the same of: Read list and enter number for each item	

		More	About the same	Less	Not sure	
127	a) Lean meat, fish, poultry (chicken, turkey)	1	2	3	8	___151
128	b) Processed meat (wieners, salami, luncheon meats)	1	2	3	8	___152
129	c) Baked foods (cookies, muffins, cakes, pies)	1	2	3	8	___153
130	d) Fried foods (french fries, doughnuts)	1	2	3	8	
131	e) High-fibre foods (cereals, veg., wholegrain bread fruit, beans, etc.)	1	2	3	8	___155
132	f) Salt or salty foods (pretzels, chips, salted nuts, pickled foods)	1	2	3	8	___156

Variable No.		Column No.
133	Q32) What was the main reason for changing your diet? Do not read list. 1. Mainly to improve appearance (e.g., to improve figure) 2. Mainly for medical reasons (e.g., on the doctor's advice) 3. Mainly for health reasons (e.g., to feel fitter or to eat "healthy" foods) 4. Mainly for economic reasons (e.g., a change in income) 5. Availability of foodstuffs 6. Other _____	___157

* * * * *

SECTION 6: FATS & CHOLESTEROL

I would like to ask you some specific questions now, about fats and cholesterol.

Q33. What health problems do you think might be related to the amount of fat that people eat?
Do not read list.

134	a. overweight/obesity	___158
135	b. heart disease/coronary disease/ heart problems/heart attack	___159
136	c. high blood cholesterol	___160
137	d. high blood pressure	___161
138	e. arteriosclerosis/hardening of the arteries/fat build up in the arteries	___162
139	f. other _____	___163
140	g. not sure	___164

Variable No.			Column No.
141	Q 34. Do you think that cholesterol is found in: Read list (1-4) 1. Foods — Go to Q35 2. Your blood — Go to Q36 3. Both — Go to Q35 4. Neither 8. Don't know — Go to Q37		___165
	Q35. How do you think foods which are rich in cholesterol can affect your health? Do not read list.		
142	a. hardening or clogging of the arteries	a	___166
143	b. increase blood pressure	b	___167
144	c. heart attack	c	___168
145	d. stroke	d	___169
146	e. angina (pain in the chest)	e	___170
147	f. increase blood cholesterol	f	___171
148	g. other _____	g	___172
149	h. not sure	h	___173
	Q 36. How do you think that high levels of cholesterol in your blood can affect your health? Do not read list.		
150	a. hardening or clogging of the arteries	a	___174
151	b. increase blood pressure	b	___175
152	c. heart attack/heart disease	c	___176
153	d. stroke	d	___177
154	e. angina (pain in the chest)	e	___178
155	f. other _____	f	___179
156	g. not sure	g	___180
157	Q37. Have you ever had your blood cholesterol measured? 1. Yes 2. No — Go to Q39 8. Not sure		___181
158	Q38. Were you told what your blood cholesterol level was? 1. Yes 2. No 8. Not sure		___182

Variable No.			Column No.
159	Q39. Were you ever told by a doctor, nurse or other health professional that your blood cholesterol was high? 1. Yes 2. No — Go to Q41 8. Not sure		___183
160	Q40. Did the doctor prescribe any treatment or tell you what to do to lower your blood cholesterol? 1. Yes 2. No 8. Not sure		___184
161	Q41. Are you presently on a diet, which was recommended by a doctor or other health professional, to lower your blood cholesterol? 1. Yes 2. No 8. Not sure		___185
162	Q42. Are you presently on any medication, which was recommended by a doctor or other health professional, to lower your blood cholesterol? 1. Yes 2. No 8. Not sure		___186
	Q43. What do you think a person can do to lower his/her blood cholesterol level? Do not read list.		
163	a. exercise regularly (be more active)	a	___187
164	b. control stress	b	___188
165	c. control fatigue	c	___189
166	d. take prescribed medication	d	___190
167	e. eat food with less cholesterol	e	___191
168	f. eat less fatty food	f	___192
169	g. lose weight	g	___193
170	h. use skim milk/ low fat dairy products	h	___194
171	i. other _____	i	___195
172	j. not sure	j	___196

* * * * *

Variable No.		Column No.
	SECTION 7: SMOKING	
	I would now like to ask you some questions about smoking.	
173	Q44. Have you ever smoked cigarettes, cigars, or a pipe? 1. Yes 2. No) Go to Q54	___197
174	Q45. At the present time do you smoke a pipe? 1. Yes 2. No) Go to Q47	___198
175	Q46. At the present time do you smoke a pipe regularly (usually every day) or occasionally (not every day)? 1. Regularly 2. Occasionally	___199
176	Q47. At the present time do you smoke cigars? 1. Yes 2. No) Go to Q49	___200
177	Q48. At the present time do you smoke cigars regularly (usually every day) or occasionally (not every day)? 1. Regularly 2. Occasionally	___201
178	Q49. At the present time do you smoke cigarettes? 1. Yes 2. No) Go to Q54	___202

Variable No.		Column No.
179	Q50. At the present time do you smoke cigarettes regularly (usually every day) or occasionally (not every day)? 1. Regularly 2. Occasionally) Go to Q52	___203
180	Q51. How many cigarettes do you usually smoke per day? number of cigarettes	204 205
	Q52. Of the following reasons for giving up smoking, which do you think are very important, somewhat important, or not important? Read list and for each item enter: 1= Very Important 2= Somewhat Important 3= Not Important 8= Not sure	
181	a) To improve fitness	___206
182	b) To prevent disease and ill-health	___207
183	c) To set a good example to the family	___208
184	d) To save money	___209
185	e) To demonstrate self-control	___210
186	f) To respect the wishes of non-smokers	___211
187	g) To be sociable	___212
188	h) To be more attractive	___213
189	Q53. Would you yourself like to give up smoking? 1. Yes 2. No 8. Not sure	___214

Variable No.		Column No.
190	Q54. How often are you exposed to other people smoking? Read 1 - 4 1. Frequently 2. Occasionally 3. Rarely 4. Never 8. Not sure ┐Go to Q56 9. No response┘	___215
191	Q55. What do you usually do if you're bothered by other people smoking? Do <u>not</u> read list. 1. Leave the area 2. Ask them to stop or move 3. Other _____ 4. Nothing 5. I'm not bothered by it 8. Not sure	___216
	* * * * *	
	<u>SECTION 6: PHYSICAL ACTIVITY</u> **The next few questions are about your current physical exercise.**	
192	Q56. Do you regularly engage in physical exercise during your leisure time? By regularly we mean at least once a week during the past two months. 1. Yes 2. No } Go to Q60 3. Just started	___217
193	Q57. How much of this exercise is strenuous enough to cause sweating or breathing heavily? Read list 1. Most of it 2. Some of it 3. None of it	___218
194	Q58. How long do you usually exercise? Read list. 1. less than 15 minutes 2. 15 - 30 minutes 3. half an hour - an hour 4. more than an hour 8. not sure	___219

Variable No.		Column No.
195	Q59. How many times per week do you exercise <u>at least</u> 15 minutes? Do not read list. 1. daily 2. 5-6 times/week 3. 3-4 times/week 4. 1-2 times/week 5. less than once/week 6. never 8. not sure	___220
196	Q60. Which of the following choices best describes the work or other daytime activity you usually do? Read list. 1. I am usually sitting down during the day and do not walk around very much. 2. I stand or walk around quite a lot during my day, but I do not have to carry or lift things very often. 3. I usually lift or carry light loads or I have to climb stairs or hills often. 4. I do heavy work or carry very heavy loads. 8. Not sure	___221
197	Q61. Do you feel you get as much exercise as you need or less than you need? 1. Less than needed 2. As much as needed ┐Go to Q63 8. Not sure ┘	___222

Variable No.		Column No.
	Q62. Do any of the following reasons prevent you from doing more exercise or being more active? Read list.	
198	a. Lack of time	___223
199	b. Lack of transport	___224
200	c. Lack of money	___225
201	d. Lack of easily available facilities in the community	___226
202	e. Lack of interesting or relevant activities	___227
203	f. Illness or disability	___228
204	g. Lack of incentive	___229
205	h. No one to exercise with	___230
206	i. Any other reasons _____	___231
207	Q63. Overall, would you say you were physically more active, about the same, or less active than others your age? 1. More active 2. About the same 3. Less active 8. Not sure	___232
	* * * * *	

Variable No.		Column No.
	SECTION 9: HEART DISEASE	
	Now I would like to ask you a few questions about cardiovascular disease.	
	Q64. What do you think are the major causes of heart disease or heart problems? Do not read list.	
208	a. poor diet	a ___233
209	b. overweight	b ___234
210	c. excess fat	c ___235
211	d. excess salt	d ___236
212	e. high blood cholesterol level	e ___237
213	f. foods with high cholesterol	f ___238
214	g. excess stress, worry or tension	g ___239
215	h. overwork or fatigue	h ___240
216	i. lack of exercise	i ___241
217	j. smoking	j ___242
218	k. heredity	k ___243
219	l. high blood pressure/hypertension	l ___244
220	m. arteriosclerosis/hardening of the arteries	m ___245
221	n. Other _____	n ___246
222	o. Not sure	o ___247
223	Q65. Based upon what you have heard or read, do you believe that heart disease can be prevented? 1. Yes 2. No 3. Sometimes 8. Not sure	___248
224	Q66. Have you ever had a heart attack? (If necessary, explain what a heart attack is). 1. Yes 2. No 8. Not sure	___249
225	Q67. Do you suffer from any other kind of heart disease? 1. Yes. What is it? _____ 2. No	___250
226	Q68. Are you presently taking any medicine that your doctor prescribed for your heart? 1. Yes 2. No 8. Not sure	___251

Variable No.			Column No.
	Q69. What do you think are the major causes of a stroke? (If necessary explain what a stroke is.) Do not read list.		
227	a. poor diet	a	252
228	b. overweight	b	253
229	c. excess fats	c	254
230	d. excess salt	d	255
231	e. high blood cholesterol level	e	256
232	f. foods with high cholesterol	f	257
233	g. excess stress, worry or tension	g	258
234	h. overwork or fatigue	h	259
235	i. lack of exercise	i	260
236	j. smoking	j	261
237	k. heredity	k	262
238	l. high blood pressure/hypertension	l	263
239	m. arteriosclerosis/hardening of the arteries	m	264
240	n. other _____	n	265
241	o. Not sure	o	266
242	Q70. Have you ever had a stroke? 1. Yes 2. No 8. Not sure		267
243	Q71. Based upon what you have heard or read, do you believe that strokes can be prevented? 1. Yes 2. No 3. Sometimes 8. Not sure		268
	Q72. Has anyone in your immediate family (parents, siblings, children) ever had any of the following health problems? (Grandparents are not immediate family.) Read list.		
244	a. Heart disease	a	269
245	b. High blood pressure	b	270
246	c. Stroke	c	271
247	d. Diabetes	d	272
248	e. High cholesterol	e	273
	Q73. ASK WOMEN ONLY: Are you presently taking..		
249	Oral contraceptives		274
250	Other hormonal pill		275
	* * * * *		

Variable No.			Column No.
	SECTION 10: GENERAL		
	Finally, I'd like to ask you a few general questions about health.		
	Q74. In the past year, have you seen the following or received any information about health topics at your place of work? (e.g., posters, bulletin boards, pamphlets) Read list.		
251	a) Heart Health	a	276
252	b) Smoking	b	277
253	c) Exercise	c	278
254	d) Stress	d	279
255	e) Diet	e	280
256	f) Safety	f	281
257	g) Drugs/Alcohol	g	282
258	h) Other _____	h	283
259	Q75. To what extent have you found the information helpful? Read 1-3. 1. Very helpful 2. Somewhat 3. Not at all 8. Not sure		284
260	Q76. Do you think your place of work is an appropriate place to promote heart health? 1. Yes 2. No 8. Not sure		285
	Q77. Where else do you think heart health should be promoted? Do not read list.		
261	a. schools	a	286
262	b. television	b	287
263	c. radio	c	288
264	d. newspapers	d	289
265	e. church	e	290
266	f. service clubs	f	291
267	g. recreational facilities	g	292
268	h. doctor's offices	h	293
269	i. public health offices	i	294
270	j. hospitals	j	295
271	k. Other _____	k	296
272	l. Not sure	l	297

Variable No.			Column No.
	Q78. At your workplace, is smoking permitted? Read list. 1=Yes 2=No		
273	a. In your immediate work area	a	298
274	b. In designated areas only	b	299
275	c. Not at all	c	300
276	Q79. We've been talking about health and health behaviors; what would you say is the single most important thing you have done in the past year to improve your health? Do not read.		
	1. Nothing 2. Increased exercise (become more active) 3. Lost weight 4. Improved eating habits 5. Quit/ reduced smoking 6. Reduced drugs/medication 7. Drank less alcohol 8. Had blood pressure checked 9. Attempted to control blood pressure 10. Learned to manage stress 11. Reduced stress level 12. Received medical treatment 13. Other _____ 88. Not sure		301 302
	Q80. Is there anything you intend to do to improve your health in the next year? Do not read.		
277	a. Nothing	a	303
278	b. Increase exercise	b	304
279	c. Lose weight	c	305
280	d. Improve eating habits	d	306
281	e. Quit/ reduced smoking	e	307
282	f. Reduce drugs/medication	f	308
283	g. Drink less alcohol	g	309
284	h. Have blood pressure checked	h	310
285	i. Attempt to control blood pressure	i	311
286	j. Learn to manage stress	j	312
287	k. Reduce stress level	k	313
288	l. Receive medical treatment	l	314
289	m. Other _____	m	315
290	n. Not sure	n	316

Variable No.		Column No.
	DEMOGRAPHIC INFORMATION The last few questions let us look at health factors by different groups like age, sex, income and occupation.	
291	Q81. Enter respondent's sex: 1. Male 2. Female	317
292	Q82. What is your date of birth? Day Month Year	318 319 320 321 322 323
293	Q83. What is your current employment status? Read this list. 1. full time (35 hours or more a week) 2. part time (less than 35 hours a week) 3. unemployed 4. laid off 5. retired 6. other _____ 7. homemaker 8. student Go to Q85	324
294	Q84. What is your occupation? _____. Do not read 1. Professional 2. Management 3. Office/Clerical/Sales 4. Foreman 5. Semi-skilled 6. Unskilled 7. Other _____ 8. No response	325
295	Q85. What is your current marital status? Do not read list. 1. single 2. married/common law 3. widowed/widower	326

Variable No.		Column No.
296	Q86. What is the highest grade or year of education you have completed? 1. No schooling 2. Elementary (Grade 6) 3. Secondary (Grade 12) 4. Post secondary 5. Not sure/no response	___327
297	Q87. What language did you first speak in childhood? 1. English 2. French 3. Other _____ 8. Not sure	___328
298	Q88. How many people live in this household?	329 330
299	Q89. For statistical purposes only, we need to know the range of your total, gross household income last year. Could you please indicate from the following list the income range for your household? Read list. 1. under $12,000 2. $12,000 to $24,999 3. $25,000 to $49,999 4. $50,000 to $74,999 5. $75,000 and over 8. respondent refused to answer	___331
	Thank you for taking time to answer these questions. * * * * *	
300	Second Blood Pressure Reading Systolic	332 - 334
	Diastolic	335 - 337

Variable No.			Column No.

SECTION 4: WEIGHT

Next there are some questions about weight.

102 wgtnow — Q22. Are you presently trying to lose weight, gain weight or neither? — Interaction — B — 120

1. lose weight — 1094
2. gain weight — Go to Q25 — 157
3. neither — 1541

2792

Q23. Which of the following are you doing to lose weight? Read list. — B change

103	wgtdiet	a. dieting (most followed closely by e)	a	690	121
104	wgtexer	b. exercising	b	640	122
105	" meals	c. skipping meals	c	168	123
106	" pills	d. taking diet pills (least)	d	10	124
107	" prgm	e. attending weight control programs	e	60	125
108	" oth	f. other _____	f	228	126

Q24. Why would you like to lose weight? Do not read list. — benefits

109	wgtlook	a. To become more attractive (look better)	a	451	127
110	" hlth	b. To improve general health (feel better)	b	776	128
111	" heart	c. To decrease the risk of heart attack	c	58	129
112	" BP	d. To maintain an acceptable level of blood pressure	d	69	130
113	" chol	e. To maintain an acceptable level of blood cholesterol	e	23	131
114	" art	f. To slow down the hardening of the arteries	f	3	132
115	" diab	g. To decrease the risk of getting diabetes	g	19	133
116	" oth	h. Other _____	h	228	134
117	____	i. Not sure	i	8	135

A

118 Hgt — Q25. How tall are you without your shoes?

Feet ____ Inches ____ — 62 (?) – 198 Cm — valid 2715 — missing 77 — 136 – 138

119 Wgt — Q26. How much do you weigh? (indoor clothing, without shoes)

Pounds ____ — Kg — 22 – 172 — valid 2716 — missing 76 — 139 – 141