Trends in lifestyle cardiovascular risk factors in women: analysis from the Canadian National Population Health Survey

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Abstract

Cardiovascular disease (CVD) is the leading cause of death and disability among women. The present investigation analyzed data from the National Population Health Survey to examine the prevalence trends of self-reported lifestyle CVD risk factors in adult women. Results indicated an upward prevalence trend in physical activity and high blood pressure, and significant increased prevalence rates in obesity in the lower middle and middle income groups. Logistic regression analysis showed that increased physical activity and advancing age were significant predictors of CVD; age confers more than a one-fold risk for developing heart disease and hypertension. Implications of the study results for nursing practice are discussed. © 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Cardiovascular risk factors; Women; Prevalence trends

1. Introduction

Cardiovascular disease (CVD) is the leading cause of death world wide, but rates vary considerably among countries. Published studies clearly show that CVD is no longer a “man disease”; the Framingham Study reported that two-thirds of sudden death occur among women with no history of heart disease (Kannel, 1986). In the mid-1990s, age-standardized cardiovascular mortality rates in women ranged from a high of 633 deaths per 100,000 population in the Russian Federation to a low of 139.9 per 100,000 population in France (WHO, 1998). Among the 22 selected countries, England and Wales ranked 4th and 8th in ischemic heart disease (IHD) and CVD for women, respectively. The mortality rates were 117.9 and 238.4 per 100,000 population for IHD and CVD. Comparatively, Canada fared better, ranking 11th and 18th in mortality from IHD and CVD for women (WHO, 1998), and ischemic heart disease accounted for 49.7% among women (Heart and Stroke Foundation of Canada, 2000a).

Classic CVD risk factors such as hyperlipidemia, hypertension, cigarette smoking, physical inactivity, diabetes mellitus, certain lipoproteins and obesity apply to both sexes, but they affect women differently (Johansen et al., 1990). The strongest risk factors for women appear to be advancing age, low high-density lipoprotein cholesterol (HDL-c) concentrations, tobacco use and diabetes mellitus (Judelson, 1994).

Frequently, women fail to recognize the personal relevance of heart disease. They tend to focus on reproductive organ concerns rather than general health issues and are generally more fearful of breast, ovarian and uterine cancer than of heart disease (Walters, 1992; Pilote and Hlatky, 1995). Preventive health services to females during physician office visits are more likely to focus on cancer screening than on coronary heart disease (Horton, 1992). A recent Heart and Stroke Foundation Survey of Canadian women age 45–74 (Heart and Stroke Foundation of Canada, 2000b) reported some unsettling results with respect to
protecting their future heart health. Women with an immediate family history of CVD were no more likely to take charge of their heart health, in spite of the evidence that a positive family history of heart disease can double a woman’s own risk. Furthermore, awareness of the cardiovascular benefits of hormone replacement therapy (HRT) for postmenopausal women was low (29% rising to 65% when they were prompted). This scenario is troubling for two reasons, (1) it suggests that women appear to understand little or to deny their cardiac risks, and (2) despite an increasing attempt to educate the lay public, women do not seem to recognize their ability to control these risk factors. Based on Statistics Canada population projections and current trends in age-specific mortality rates, projections to 2016 suggest that the numbers of CVD for women will increase by 28% between 1995 and 2016 while the number of deaths attributed to CVD for men will not increase (LCDC, Health Canada, 1999). The number of cardiovascular-related deaths in women will most likely surpass deaths in men in the near future. Thus far, there are no published reports that track the sex-specific trends in CVD risk factors. Coronary heart disease (CHD) in women has not been studied as comprehensively as in men. Results from studies of men have frequently been generalized to women, which may not always be appropriate or even dangerous (Khan, 1993; Gurwitz et al., 1992). While there is considerable knowledge about major risk factors of CHD, less is known about the effects of altering these factors on reduction of CHD mortality and morbidity among women. A paucity of data on the sex-specific trends in CVD risk factors warrants population-based investigations. The present investigation set out to examine the prevalence trends of self-reported lifestyle CVD risk factors (hypertension, overweight, diabetes, inactivity, and current smoking) in adult women for the period 1994–1997 using data from the National Population Health Survey. Knowledge about and recognition of these risk factors will enable nurses and other health professionals to design more responsive and targeted clinical interventions for this vulnerable population.

2. Existing knowledge

2.1. Physical inactivity and cardiovascular disease

Physical inactivity, an independent risk factor for coronary artery disease (CAD) in women, is the most prevalent coronary risk factor (Anda et al., 1990). Exercise appears to have beneficial effects on cardiovascular risk factors for women. A study of an Australian cohort reported that previously sedentary women who increased their fitness level over 4 years showed significant improvement in their blood lipid levels and systolic blood pressure (Sedgwick et al., 1993). Blair et al. (1989) reported that women with the lowest fitness had a relative risk of death nearly five times higher than the physically fit women. Even in older age, a reduction in myocardial infarction risk by 50% was evident with modest leisure-time activities, equivalent to 30–45 min of walking three times weekly (Lemaitre et al., 1995). This observation is confirmed by Kushi et al. (1997) who demonstrated a graded inverse association between physical activity and all-cause mortality in postmenopausal women. Ashton et al. (2000) examined the relationship between reported physical activity and a range of CHD risk factors in 1407 females aged 30–64 years. Their results indicated that increasing activity was associated with lower systolic and diastolic blood pressures, total triglycerides, cholesterol and body mass index.

Emerging evidence suggests that cardiovascular health benefits can also be realized in non-conventional physical activity programs. In a randomized clinical trial, Dunn et al. (1997) demonstrated that lifestyle physical activity counseling is as effective as a traditional structured exercise program in reducing CVD risk factors among healthy, sedentary, middle-aged men and women. After 6 months of intervention, 78% of lifestyle participants and 85% of Structured participants were engaging in 30 min or more of moderate-intensity physical activity on most days of the week. Both groups had significant reductions in total cholesterol, total cholesterol/high-density lipoprotein ratio, diastolic blood pressure, and percentage of body fat. These investigators concluded that these effective lifestyle physical activity and counseling strategies could be used in a wide variety of settings.

2.2. High blood pressure and cardiovascular disease

High blood pressure is an independent risk factor for heart disease in women (Johansen et al., 1990; Judelson, 1994). The incidence of hypertension increases with age in both sexes; but hypertension occurs significantly more frequently in women (Heart and Stroke Foundation of Canada, 1995). Isolated systolic hypertension with loss of arterial elasticity is more prevalent among older women than their male counterparts. Published data showed that these women have an elevated risk of death from stroke or CHD (Fiebach et al., 1989). The Framingham data showed that for coronary disease, hypertensive women and men have almost identical risk ratios: 2.2 for women versus 2.0 for men at 36 years' follow-up (Kannel, 1996).

Left ventricular hypertrophy (LVH) is a major sequela of chronic hypertension. Investigation of Levy et al. (1990) showed that for all cardiovascular deaths and deaths from all causes, women with LVH had a greater increase in relative risk than men. In addition, these
investigators also found that women with isolated systolic hypertension had more than twice the odds of having LVH as did their male counterparts.

Hypertension studies conducted in Europe and the United States involving over 13,000 women aged 30–69 reported a decrease in all causes of mortality among treated versus control women (Medical Research Council, 1985; Hypertension and Detection Follow-up Program, 1979). In general, trials that have included a large number of women have shown favorable effects of hypertensive therapy in terms of CAD events for older women (SHEP, 1991; Dahlof et al., 1991).

2.3. Cigarette smoking and cardiovascular risk

Cigarette smoking is a powerful risk factor for CAD with the risk of cardiac events increases in relation to the number of cigarettes smoked daily. In the Systolic Hypertension in the Elderly Program Study, both men and women over 60 years of age who smoked had 73% more CAD-related events than did non-smokers (Frost et al., 1996). The Nurses Health Study reported a significant correlation among the number of cigarettes smoked and the risk of angina pectoris, non-fatal myocardial infarction, and fatal CAD (Willet et al., 1987). However, the risk declines rapidly after smoking cessation and approaches non-smokers' level by 3–5 years. In a longitudinal study, Prescott et al. (1998) observed that cigarette use increases the risk of coronary events more for women than for men. One notable aspect of cigarette smoking is that it appears to alter estrogen metabolism in premenopausal (Michnocicz et al., 1986) and postmenopausal women (Baron et al., 1988).

Cigarette smoking is also a risk factor for stroke (Oparil, 1998). The risk of stroke for smokers was higher for women than for men, and the risk for former smokers has been found consistently to be lower than that for current smokers (Wolf et al., 1992). Thus, smoking imparts the greatest risk for women already at high risk due to older age, overweight, hypertension and diabetes.

2.4. Diabetes and cardiovascular disease

Women with diabetes assume a risk for heart disease that closely approaches that of men (Barrett-Connor et al., 1991). Data from the Nurses Health Study showed that maturity-onset diabetes mellitus confers a three- to seven-fold excess of cardiovascular events (Manson et al., 1990). Diabetes is associated with less favorable prognosis for women than for men compared with their non-diabetic counterparts (Fuller et al., 1980; Donahue et al., 1987).

Non-insulin dependent diabetes mellitus is associated with marked increase in the risk of CAD. Premenopausal diabetic women experience a rate of CAD similar to that of diabetic men, and a risk of CAD five times greater than their age-matched non-diabetic peers (Barrett-Connor and Bush, 1991). The reasons for the relatively greater impact of diabetes on CAD risk in women remained undefined, but are likely related to atherogenic lipids and lipoprotein changes associated with insulin resistance (Walden et al., 1984).

2.5. Obesity and cardiovascular risk

Obesity in women is clearly linked to a worsening of cardiovascular risk (Johansen et al., 1990; Reeder et al., 1992; Manson et al., 1990). The relationship of obesity to CAD risk in women may be due to body fat, estrogen synthesis, and lipoprotein metabolism (Keys et al., 1984). Furthermore, the type of obesity is an independent risk for CAD in women. Upper body obesity pattern is common among older women. A preponderance of abdominal fat has been shown to be a risk factor for cardiovascular disease and diabetes, whereas proportionally more femoral fat is not statistically associated with these diseases (Bjorntop, 1988).

The Nurses Health Study (Manson et al., 1990) has provided convincing evidence on the relationship of obesity and changes in weight with the risk of coronary events. The risk of each type of coronary events (coronary death, myocardial infarction, angina with stress test, angioplasty, or bypass surgery) increases with greater body mass index (BMI). In the subsequent evaluation of women in “normal” weight ranges, Willett and colleagues (1995) demonstrated a graded increase in the risk of myocardial infarction or coronary death with higher weight and BMI over 14 years of follow-up.

2.6. Socioeconomic status and cardiovascular disease

Socioeconomic status (SES) has been demonstrated to be a strong and consistent determinant of health. There is substantial evidence for an inverse relationship between socioeconomic status, CVD mortality and risk factors. Lynch et al. (1996) observed that, compared with the highest income quintile, individuals in the lowest income quintile had age-adjusted relative hazards of 2.66 and 4.33 for cardiovascular mortality and acute myocardial infarction, respectively. Similarly, Escobedo et al. (1997) reported that indicators of low SES (family income, occupational status, and educational attainment) account for most of the excess premature coronary heart disease among black Americans in their study. The relationship between SES and cardiovascular mortality extends to CVD risk factors where highly significant relationships have been documented between various indicators of SES and blood pressure, total cholesterol, physical inactivity, smoking, and BMI (Winkleby et al., 1990; Shea et al., 1991; Luepker et al., 1995).
1993). Winkleby and colleagues (1999) examined the association between education and income, two indicators of SES and ethnicity with six risk factors — smoking, hypertension, obesity, leisure-time inactivity, hypercholesterolemia, and diabetes. Both indicators of SES and ethnicity were independently associated with CVD risk factors. This finding is consistent with Poduri and Grisso’s investigation (1998) in which they observed a substantial increase in the prevalence of CVD risk factors among the low-income women.

3. Objectives of the study

The present investigation was designed to:

1. assess the impact of SES on lifestyle CVD risk factors in adult Canadian women,
2. examine the prevalence trends of lifestyle cardiovascular risk factors in this population, and
3. explore the association between these risk factors and the prevalence of cardiovascular disease (heart disease and hypertension).

4. Methods

4.1. Study design

The present study analyzed the cross-sectional data from cycles 1 and 2 of the National Population Health Survey (NPHS). The NPHS is the first national health survey of its kind conducted in Canada. The purpose of this survey was to measure the health status of Canadians in order to expand knowledge of the determinants of health. The following is a brief description of the study design and data collection procedure of the Survey (Statistics Canada, 1998).

The initial wave of data collection (cycle 1) took place from June 1994 to June 1995. Data for cycle 2 were collected from June 1996 to August 1997. The NPHS covered household and institutional residents in all provinces and territories, except persons living on Indian Reserves, on Canadian Forces bases and some remote areas. The Survey focused on behaviors or conditions amenable to prevention, treatment, or intervention. Thus, data collected were factors related to good health, not just those related to illness.

The 1994–95 Survey sample was created by first selecting households and then within each household choosing one member to be the longitudinal respondent. For the second cycle, the distinction was made between the sample selected for longitudinal purposes and the sample chosen for cross-sectional purposes. The core sample selected was 20,095 and 17,276 for cycles 1 and 2, respectively. Cross-sectionally, the core target population for cycle 2 Survey included all household members living with longitudinal respondents. The sample size in the second cycle was slightly diminished from the first cycle due to attrition of the sample, deaths, out-of-scope case, untraceable cases and non-respondents. The present study analyzed only data from the first and second cycles of the NPHS obtained from the female respondents aged 20 or older.

4.2. Data collection

The Survey used questions that were designed for computer-assisted interviewing (CAI) to allow programming of the associated logical flow into and out of the questions. With CAI, the interview can be controlled based on answers provided by the respondent. On-screen prompts are displayed to the respondent and interviewer for correction of inconsistencies. Clarity and quality of the questions were pre-tested before the main Survey was implemented in the field. This was accomplished by using focus groups during developmental stages of the questionnaires to study various aspects of their content. In addition, two field tests were carried out with the aim to observe respondent reaction to the Survey, to obtain estimates of time for the various sections, and to study the response rates.

The 1994–95 NPHS was collected primarily by personal interview whereas the second cycle of the Survey was collected primarily by telephone; respondents in the core sample were first contacted by telephone. Personal visits were made only if the respondent did not have a telephone, if the interviewer made a personal visit in the course of tracing a respondent, or upon request by the respondent. Interviews were conducted by interviewers who were part-time employees hired and trained specifically to carry out the CAI interviewing method.

4.3. Measurements

For the purpose of the present study, the following lifestyle CV risk factors were extracted from the NPHS (cycles 1 and 2) data set for analyses. Lifestyle risk factors included in the study were obesity, physical inactivity, cigarette smoking, high blood pressure, and diabetes mellitus. Although serum cholesterol concentrations is a well-documented CV risk factor in women, however, no measurements were made in any of the Survey cycles.

(a) Obesity was defined as a BMI $\geq 27$. BMI was calculated by dividing the weight in kilograms by the height in meters squared ($BMI = \text{weight (kg)} / \text{height (m$^2$)}$).

(b) Physical inactivity was reflected by the physical activity index, a derived variable based on the
respondent’s derived energy expenditure. Energy expenditure is calculated by using the frequency and time per session of the physical activity as well as its MET value. MET is a value of metabolic energy cost expressed as a multiple of the resting metabolic rate. NPHS did not ask the respondent to specify the intensity level of their activities, therefore, the MET values adopted correspond to the low-intensity value of each activity. Respondents who averaged 3.0+ kcal/kg/day of energy expenditure were categorized as active. An active physical activity index is approximately the amount of exercise that is required for cardiovascular health benefits. Individuals who averaged 1.5–2.9 kcal/kg/day were classified as moderately active; they might experience some health benefits but little cardiovascular benefit. Those respondents with an energy expenditure below 1.5 kcal/kg/day were considered inactive (Statistics Canada, 1998).

(c) High blood pressure—respondents’ response to the question “Do you have high blood pressure diagnosed by a health professional?” was used to categorize them as being hypertensives or normotensives.

(d) Cigarette smoking—type of smoker was used as a surrogate measurement of the frequency of cigarette smoking. Similar to the physical activity index, type of smoker is also a derived variable based on the respondent’s response to the following three questions: “At the present time do you smoke cigarettes daily, occasionally or not at all?”, “Have you ever smoked cigarettes at all?”, and “Have you ever smoked cigarettes daily?” The respondent was categorized into daily smoker, occasional smoker but was former smoker, always an occasional smoker, former daily smoker, former occasional smoker, and never smoked.

(e) Diabetes—NPHS did not specify the type of diabetes. Respondents were asked to indicate if they had been diagnosed with diabetes.

5. Data analysis

Data were grouped and analyzed using a Statistical Analysis Software (SAS) program package. Since the Survey data are either nominal or ordinal measurements, descriptive statistics (frequency distribution and percentages) were used to assess the prevalence rates in lifestyle CV risk factors. Chi-squared test was used to test significance of changes in prevalence. Logistic regression was employed to estimate the risk of developing heart disease and hypertension in women with these risk factors. A p-value <0.05 was considered statistically significant in single variable comparisons. Bonferroni correction for multiple variable analyses was used to determine the level of significance (Polit, 1996).

6. Results

6.1. Demographic statistics

Responses from 8653 adult women (age 20–80 and over) in the first cycle and 35701 women in the second cycle of the Survey were analyzed. The majority of the respondents were married (56.7% in the 1994–95 cohort, and 56.3% in the 1996–97 cohort). Overall, the prevalence rates of women in the low-income groups (no income to < $50,000) were significantly reduced in the second cycle of the Survey. Similarly, there was a reduced number of women with a reported annual household income ≥ $50,000; this reduction did not reach statistical significance (Fig. 1).

6.2. Association of SES and CV risk factors

We assessed the impact of SES (measured by the annual household income) on CV risk factors by examining the distribution of CV risk factor prevalence rates by income groups. In the present investigation, SES was arbitrarily divided into quintiles of annual household income: the first quintile was < $10,000; the second, $10,000–$29,999; the third, $30,000–$49,999; the fourth, $50,000–$79,999, and the fifth quintile ≥ $80,000. Table 1 presents changes in the prevalence of CV risk factors between two cycles of Survey according to income quintiles.

As shown in the Table 1, there was a downward trend in the prevalence of physical inactivity across
all income quintiles. In other words, women in this Survey became more physically active in the second cycle of the Survey, regardless of their income. However, the significant increase in physical activity level was observed only in the lowest, middle and highest income groups. The prevalence rates in both obesity and high blood pressure were increased significantly in the second and third income quintiles but was reduced significantly in the fifth income quintile.

Prevalence rates in diabetes remained unchanged over the two Survey cycles. The significant increase in smoking was observed in the fourth and fifth income quintiles.

6.3. Prevalence trends in cardiovascular risk factors in adult women

The factors included in this analysis were high blood pressure, obesity, level of physical activity, history of diabetes and cigarette smoking. Table 2 presents these trends.

Results show significant upward prevalence trends in high blood pressure, obesity, and physical activity, and significant downward trends in physical inactivity and cigarette smoking. The decline in the prevalence of diabetes is small and statistically non-significant.

### Table 1
Changes in prevalence rates in CV risk factors between cycle 1 and 2 of the Survey. Values are expressed in percentage (%)

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Overall</th>
<th>Income quintile 1</th>
<th>Income quintile 2</th>
<th>Income quintile 3</th>
<th>Income quintile 4</th>
<th>Income quintile 5</th>
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</thead>
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<tr>
<td><strong>High BP</strong></td>
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<td></td>
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<tr>
<td>Cycle 1</td>
<td>13.6</td>
<td>18.9</td>
<td>18.9</td>
<td>10.4</td>
<td>16.6</td>
<td>6.9</td>
</tr>
<tr>
<td>Cycle 2</td>
<td>14.6</td>
<td>18.8</td>
<td>21.3</td>
<td>11.9</td>
<td>7.4</td>
<td>5.9</td>
</tr>
<tr>
<td>( \Delta )</td>
<td>+1.0</td>
<td>−0.1</td>
<td>+2.4(b)</td>
<td>+1.5(b)</td>
<td>+0.8</td>
<td>−1.0(b)</td>
</tr>
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<td><strong>Obesity (BMI &gt; 27)</strong></td>
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<td></td>
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<tr>
<td>Cycle 1</td>
<td>53.5</td>
<td>55.6</td>
<td>58.5</td>
<td>39.0</td>
<td>32.5</td>
<td>28.1</td>
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<td>53.0</td>
<td>50.2</td>
<td>59.8</td>
<td>41.0</td>
<td>34.4</td>
<td>26.0</td>
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<td>( \Delta )</td>
<td>−0.5</td>
<td>−5.4(b)</td>
<td>+1.3(b)</td>
<td>+2.0(b)</td>
<td>+1.9(b)</td>
<td>−1.0(b)</td>
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<td>13.4</td>
<td>13.0</td>
<td>14.6</td>
<td>17.5</td>
<td>8.2</td>
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<td>13.7</td>
<td>17.3</td>
<td>17.7</td>
<td>20.8</td>
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<td>( \Delta )</td>
<td>+1.0</td>
<td>+3.4(b)</td>
<td>+0.7</td>
<td>+2.7(b)</td>
<td>+0.2</td>
<td>+2.6(b)</td>
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<td>Moderately active</td>
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<td>5.9</td>
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<tr>
<td>( \Delta )</td>
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<td>+1.1(b)</td>
<td>+0.3</td>
<td>+1.2(b)</td>
<td>+0.8</td>
<td>−1.0(b)</td>
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<tr>
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<td>−2.2(b)</td>
<td>−1.5(b)</td>
<td>−1.8(b)</td>
<td>−3.0(b)</td>
<td>−1.4(b)</td>
<td>−3.8(b)</td>
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</tr>
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<td>6.4</td>
<td>6.0</td>
<td>2.4</td>
<td>2.0</td>
<td>1.6</td>
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<tr>
<td>Cycle 2</td>
<td>3.9</td>
<td>5.9</td>
<td>6.0</td>
<td>2.8</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>( \Delta )</td>
<td>−0.1</td>
<td>−0.5</td>
<td>0.0</td>
<td>+0.4</td>
<td>0.0</td>
<td>−0.1</td>
</tr>
<tr>
<td><strong>Smoking</strong></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Cycle 1</td>
<td>25.4</td>
<td>33.8</td>
<td>28.2</td>
<td>26.3</td>
<td>19.6</td>
<td>14.7</td>
</tr>
<tr>
<td>Cycle 2</td>
<td>25.0</td>
<td>33.7</td>
<td>27.8</td>
<td>26.9</td>
<td>21.2</td>
<td>16.7</td>
</tr>
<tr>
<td>( \Delta )</td>
<td>−0.4</td>
<td>−0.1</td>
<td>−0.4</td>
<td>+0.6</td>
<td>+1.6(b)</td>
<td>+2.0(b)</td>
</tr>
</tbody>
</table>

*a* Cycle 1 = 1994/95 Survey; cycle 2 = 1996/97 Survey; BMI = body mass index; \( \Delta \) = prevalence change between two Survey cycles.

\(b\) \( p < 0.05.\)
6.4. Relationship of risk factors to cardiovascular disease

Logistic regression analysis was used to estimate the odds of developing heart disease and hypertension in women with these CVD risk factors. In the regression model, self-reported diagnosis of heart disease was the dependent variable, and high blood pressure, BMI, physical activity index, diagnosis of diabetes, smoking, age group, and annual household income were the explanatory variables. A similar regression model was used to estimate the odds ratio for developing hypertension; in this model, hypertension was the dependent variable, and BMI, physical activity level, diagnosis of diabetes, smoking, age, and annual household income were the explanatory variables. Tables 3 and 4 present the analysis results.

As shown in Table 3, age, physical activity, high blood pressure, and household income were significant dependent variables. A similar regression model was used to estimate the odds ratio for developing hypertension; in this model, hypertension was the dependent variable, and BMI, physical activity level, diagnosis of diabetes, smoking, age, and annual household income were the explanatory variables. Tables 3 and 4 present the analysis results.
predictors of heart disease in both Survey cycles \((p<0.007)\). However, age and level of physical activity emerged as the strongest risk factors and were directly related to an increased probability for developing heart disease. These findings imply that older women who were physically active had a one-fold risk of developing heart disease than the less active, younger women.

With respect to hypertension, age, household income, and history of diabetes were significant risk factors. However, age emerged as the most important predictor of hypertension in both Survey cycles (\(OR = 1.4\) in cycle 1 and 1.39 in cycle 2); it confers more than a one-fold risk for developing hypertension. Although diabetes and household income were also significant predictors of hypertension, they impart minimal risks (see Table 4).

### 7. Discussion

#### 7.1. Socioeconomic status and lifestyle cardiovascular risk factors

Socioeconomic factor may account for the increased prevalence rates in high blood pressure and obesity observed in our analysis. As shown in Fig. 1, a noticeable proportion of women in the Survey (40% in the first cycle and 28% in the second cycle) were in the lower middle income group. Logistic regression analysis indicated that household income was a significant predictor of cardiovascular disease, albeit not a major one (Tables 3 and 4). Low SES has been reported to be a risk factor for CHD incidence and mortality in women. Poduri and Grisso’s investigation (1998) showed that knowledge and understanding of CV risk factors is suboptimal among low-income women. In a prospective Swedish study, low socioeconomic status of the husband was significantly associated with risk of MI in middle-aged women (Lapidus and Bengtsson, 1986). In the Framingham cohort, women with eight years of education or less had almost four times the risk of developing cardiovascular disease than women with >12 years of education (Eaker, 1989). Furthermore, obesity is most prevalent among population with low income. Luepker et al. (1993) documented a significant relationship between several different indicators of socioeconomic status and body mass index. Obesity is an environmental issue, and the primary determinants of obesity are high calorie intake and low level of activity. The significant change in the prevalence of obesity and diabetes in our analysis may be best understood in light of emerging evidence that fasting hyperinsulinemia is typical of patients with non-insulin dependent diabetes mellitus, and is often associated with obesity (Nordt et al., 1995). Weight loss (especially with reduction of visceral

<table>
<thead>
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<th>Predictor variable</th>
<th>(\beta)</th>
<th>Wald chi-square</th>
<th>(p)-value</th>
<th>Odds ratio</th>
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<td></td>
<td></td>
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<tr>
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<td>Physical activity level</td>
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<td>3.2402</td>
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</tr>
<tr>
<td>Cigarette smoking</td>
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<td>0.7745</td>
<td>0.3788</td>
<td>1.017</td>
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<tr>
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</tr>
<tr>
<td>(-2) Log likelihood</td>
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<td>1 with 7 DF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(p)-value</td>
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<td></td>
<td></td>
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<td>(b) 1996/97 Survey</td>
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\(^{a}\)BMI = body mass index.
7.2. Trends in cardiovascular risk factors in adult women

There is evidence to suggest that physical activity reduced heart disease mortality and morbidity for women (Blair et al., 1989; Powell et al., 1987). Indeed, published data have clearly demonstrated that physical activity is associated with favorable levels of CVD risk factors (Bijnen et al., 1996; Stender et al., 1993). A steady decline in cardiovascular disease death rates in women since mid-1960s in Canada (Heart and Stroke Foundation of Canada, 2000a) corroborates our finding of a significant increase in the prevalence of physical activity and a reduction in cigarette smoking. Our finding of an upward prevalence trend in physical activity and high blood pressure is puzzling and unexpected. This observation is at odds with the published data, which showed favorable effects of increased physical activity on CV risk factor reduction. However, a search of literature indicates that such paradoxical trend indeed exists, and has been previously reported. The finding of an increasing trend in physical activity and blood pressure in our study is compatible with that of the study by Pols et al. (1997) of 4575 women age 49–70 years in which they noted that blood pressure (systolic and diastolic) was highest in women who performed heavy manual work, and was inversely related to the time spent in leisure-time activities. Housework, walking and cycling were the three physical activities most frequently reported by the study subjects. Vaz de et al. (1999) also found that nearly three-quarters of the population participants engaged in some type of physical activity, but more than one-third were overweight (31%) or obese (10%). The significant association between obesity and high blood pressure has been reported in the literature (Ford and Cooper, 1991; Weir, 1991), but the exact mechanism responsible for the observation of a rise in physical activity with a corresponding increase in blood pressure remains to be elucidated.

Our finding of reduced prevalence in smoking and increased prevalence in obesity is consistent with the observation of Hu et al. (2000) of a substantial decline (40%) in the numbers of female participants who smoked, but an increase (38%) in the prevalence of overweight, defined as a BMI ≥ 25. The explanation offered by Hu and co-workers is that the dietary glycemic load in their subjects was increased due to a high intake of refined carbohydrates. In contrast, Rosengren et al. (2000) reported an upward trend in obesity over a period of 30 years among smokers and former smokers in their study. However, their study involved men only, and it is possible that smoking might have differential effects on body weight in women.

In our study, prevalence of obesity and high blood pressure increased significantly in the lower middle income (group 2) and middle income (group 3) groups; their level of physical activity increased minimally and non-significantly in income group 2 (0.7%) but substantially and significant in group 3 (2.7%). It is likely that these two income groups engaged in activity such as housework or some type of manual work, which may not require much energy expenditure. In the present investigation, we used self-reported data of physical activity. Roberts (1995) challenged the accuracy of self-reported data as scientific measurement of the prevalence of CV risk factors. Overestimation or underestimation of physical activity may account for the observed upward prevalence trends in hypertension and obesity among women in the lower income groups, despite an increase in physical activity levels.

Our finding of a significant upward prevalence trend in hypertension (0.5%) is in agreement with previously published data (Fortmann et al., 1990; Puska et al., 1983). Several explanations may account for this observation. First, an increased awareness of hypertension as a major risk factor for CVD may motivate the Survey participants to have their blood pressure checked regularly. In fact, 58% and 59% of women in the NPHS reported having their blood pressure test less than 6 months in the first and second cycles of the Survey, respectively (data not shown). This increase in the proportion of women having regular blood pressure monitoring, can translate into an increased percentage of women diagnosed with high blood pressure. Secondly, our analysis indicated that the rise in the prevalence of high blood pressure is associated with an increase in obesity (Table 2). The close association between hypertension and obesity has been firmly established. Investigation by Ford and Cooper (1991) demonstrated that BMI was positively related to the probability of developing hypertension, independent of age. The exact mechanism responsible for this relationship remains unclear, but it is postulated that augmented BMI requires both an increase in intravascular volume and cardiac output to meet metabolic requirements. Such volume overload can result in elevated blood pressure (Weir, 1991).

7.3. Relationship of risk factors to cardiovascular disease

The logistic regression analysis of heart disease and high blood pressure showed that physical activity and age were significant predictors of CVD. The finding of a direct relationship between increased physical activity and cardiovascular disease is unexpected but is consistent with that of the investigation by Pols et al. (1997) in which they observed an association between a higher
activity level of work or housework and a higher level of cardiovascular disease risk indicators (blood pressure, heart rate, BMI, waist/hip ratio, and waist circumference). The mechanism underlying this positive association is unknown, but one may surmise that older participants in the NPHS might have subclinical heart disease, hypertension or both, which might not have been diagnosed by the health professionals. If this were the case, high level of physical activity could precipitate a cardiovascular event in those whose cardiac function might have been compromised secondary to augmented blood pressure. The inverse relation between heart disease and high blood pressure noted in our analysis (Table 3) argues against the speculation that hypertension contributes to an increased odds for developing heart disease. The self-reported diagnosis of high blood pressure may inflate or deflate its prevalence; this might account for the inverse relationship between hypertension and heart disease. Nonetheless, the fact that age was positively related to heart disease and high blood pressure clearly suggests that older women are at high risk for CVD.

8. Implications for nursing

Cardiovascular disease is primarily a lifestyle disease, and is amenable to changes. Research shows that CVD can be slowed significantly or progression halted when preventive programs have been instituted at the beginning stages of the disease (Chesebro et al., 1982). Health professionals have advocated primary prevention of CVD for many years, but it seems that women in general are not heeding the message. Despite increased physical activity, women participants in the NPHS demonstrated an increase in the prevalence of obesity and high blood pressure. In the last two decades, a number of community-based heart health programs have been developed in the US and UK (Carleton et al., 1995; Brownson et al., 1996; Baxter et al., 1997; Tudor-Smith et al., 1998), but reports of these projects indicated inconclusive and inconsistent results with respect to program efficacy. Hu et al. (2000) speculated that the recent lack of decline in the incidence of coronary heart disease may be a reflection of stagnation of changes attributable to prevention. The issues of program relevance and appropriateness perceived by participants with varied needs and lifestyle may also contribute to a lack of demonstrable program effectiveness.

Primary prevention is directed towards reducing an individual's encounter with CV risk factors. Giardina (1998) argued for early dialogue between the physician and patient to foster preventive steps, and to identify those women who are at high risk for CVD. However, there is evidence indicating that a high proportion of patients' visits to physician office does not include counseling for prevention of CVD (Giardina, 1998; Centers for Disease Control and Prevention, 1998). Furthermore, published data showed that women's confidence in their physicians is not optimal, citing communication problems as the leading reason of their dissatisfaction (Taylor et al., 1993; Tobin et al., 1987). Health promotion and patient education historically falls in the domain of nursing (Novak, 1988), a window of opportunity now exists for nurses to lead the health promotion movement. Lile (1990) maintained that identifying women who are at risk for CVD and initiating programs to achieve an optimal risk profile and to delay the progression of the disease is a challenge to the professional nurse. She proposed a plan to meet this challenge; it consists of (a) providing health information to maintain or strengthen the existing women's health, (b) focusing on and supporting of positive behaviors and coping strategies, and (c) desensitizing the existing or possible deleterious risk factors. Although primary prevention efforts such as a healthier diet, increased physical activity, and smoking cessation carry great promise in reducing CVD risk factors, to our knowledge, few interventions are designed specifically for women, in particular older women. Thus, prior to designing and implementing any primary intervention strategies, it is imperative for nurses to obtain information about women's health behavior profile, their readiness to change, as well as their interest in dietary, physical activity, and smoking cessation interventions, either at the community or individual level.

It is well documented that socioeconomic status is strongly associated with cardiovascular risk factors (Martinez et al., 1999; Margettes et al., 1999; Choiniere et al., 2000). This SES (income) gradient for CVD risk factors is also borne out by our analysis. One reason might be that lower socioeconomic groups tend to be associated with an unhealthy lifestyle including consuming a more atherogenic diet, engaging in less exercise, having higher blood pressure, and smoking more. Hazuda et al. (1986) observed that employed women ate a less atherogenic diet than full-time housewives. In view of this evidence, nurses need to consider the individuals' SES to ascertain that strategies for reducing CVD risk factors are perceived as relevant and realistic. The goal of nutrition teaching and counseling is to develop an enjoyable eating style that will result in better health and quality of life. Nurses and dietitians focus their teaching on fat, cholesterol, sodium and calorie information of food, including culturally specific foods.

Recently, there is a better understanding of the complex relationship between physical activity and life circumstances in women. Scarff et al. (1999) noted that women who have children performed less structured and less intense physical activities of daily living. Those in...
the oldest age category cited health as the most common motivator for physical activity, but were also the least to perform physical activity. Wilcox et al. (2000) also reported that older age, less education, and lack of social support are the major barriers to leisure-time physical activities among rural and urban women in their study. These findings imply unequivocally that community-based cardiovascular prevention programs need to be developed specifically for the older, less educated women. Furthermore, our finding of a significant and positive association between level of physical activity and cardiovascular disease suggests that the intensity of physical activity for this high-risk group needs to be prescribed and these women's responses to increased physical activity must be monitored regularly by health professionals.

The objective of physical activity intervention is to enhance the individuals' quality of life when performed on a regular basis. Hence, creative, flexible strategies that incorporate physical activity into the daily routine should be used in CV risk reduction program to meet the unique needs of women at different stages of their life. Nurses experienced in conducting behavior change teach women problem-solving approaches to learn cognitive and behavioral skills appropriate for their level of motivational readiness for physical activity adoption and life circumstances (Dunn et al., 1997).

Pearson (1999) maintained that efforts to control CVD should invest strategically in research to understand the prevalence of, and risks associated with, CVD risk factors, as well as in measures to prevent or modify risk. The discrepancy between increased physical activity, high blood pressure, obesity and lower SES could not be explained physiologically. Further nursing research is warranted to examine the relationship between SES status, employment status, and the prevalence of CV risk factors. Different types of physical activity such as leisure-time, occupational, transportation and household activities should be evaluated with respect to their impact on CV risk in women across the life span. In addition, the impact of SES status and employment status on various types of physical activity needs to be explored. These qualitative and quantitative data would invariably illuminate the diversity and sociocultural specificity of women's perspectives that may be important if healthy lifestyle and quality of life are to be achieved.

9. Conclusion

Cardiovascular disease is not only the leading cause of death among women in developed countries, it is more lethal and less aggressively treated in women than in men. Despite an intense education campaign aiming at improving cardiovascular risk profile, discouraging statistics on the status of women's heart health emerge. To date, there are few heart health programs that target exclusively on women. In addition, the misconceptions about women's risk of cardiovascular disease shared by both patients and physicians, may be partly responsible for women being unaware of their risk for heart disease.

The focus of contemporary nursing has shifted from provision of care to patients in the acute care setting to health promotion and illness prevention. Nursing has a responsibility to develop strategies to decrease the risk of CVD and its often tragic consequences. The emphasis of primary prevention should be placed on increased physical activity and weight reduction in overweight women, to reduce the chance in developing hypertension and heart disease. This intervention must be relevant to the women' socioeconomic status and culture. The public, particularly women, must be encouraged to participate in community-based or individual-based programs directed at reducing the risk for heart disease, and improving the quality of life. Barrett-Connor (1994) maintained that prevention programs directed towards women would have a broader public health impact than those directed towards men. Behavior modification by a woman often will result in better diet and behavior for her partner and children.

References


elderly men in Finland, Italy, and the Netherlands. American Journal of Epidemiology 143 (6), 553–561.


