Research Article

Cardiovascular Risk Factors and 10-year Risk for Coronary Heart Disease in Korean Women

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ARTICLE INFO

Article history:
Received 17 August 2011
Received in revised form
13 February 2012
Accepted 15 February 2012

Keywords:
coronary heart disease
Korea
risk assessment
risk factors
women

SUMMARY

Purpose: The purpose of this study is to describe the prevalence of cardiovascular risk factors and to estimate the 10-year risk for coronary heart disease (CHD) in a nationally representative sample of Korean women.

Methods: This is a secondary data analysis using the data set from the 2008 Korea National Health and Nutrition Examination Survey IV. The sample was 2,998 Korean women (weighted n = 14,420,987) aged 20–79 years without cardiovascular disease or diabetes. Prevalence of cardiovascular risk factors was calculated using sampling weights and presented in percentages. Ten-year risk for CHD was estimated with the Framingham Risk Score, and the proportions for three levels of 10-year risk were presented.

Results: About 18% of the sample had hypertension, 7.5% are current smoker, 30.0% had total cholesterol ≥ 200 mg/dL, 25.7% had low-density lipoprotein cholesterol ≥ 130 mg/dL, and 47.3% had high-density lipoprotein cholesterol < 50 mg/dL. About 46% of Korean women were overweight or obese, and 33.3% were sedentary. About 75% of women had one or more major risk factors. In this study sample, 98.5% had a 10-year risk for CHD of < 10%, 1.4% had a risk of 10–20%, and 0.1% had a risk of > 20%.

Conclusion: Modifiable cardiovascular risk factors are highly prevalent in Korean women, and the combination of risk factors is common. Development and implementation of multifaceted nursing interventions are required to confront the current epidemic rise of CHD in Korean women.

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Introduction

Although cardiovascular disease (CVD) has been considered a disease of men in Korea, women can and do get CVD. In fact, more women than men die of CVD in Korea, accounting for 1 in 4.5 deaths in women in 2009, compared to 1 in 5.8 in men in 2009 (Korea National Statistical Office, 2010). Of important concern to Korean women is the dramatically increasing mortality rate from coronary heart disease (CHD). Between 1983 and 2009, mortality from CHD increased approximately 15-fold in Korean women (Korea National Statistical Office). Furthermore, current projections suggest a continued increase in CHD with the aging population and a westernized lifestyle and diet (Kim, Kim, Jung, Park, & Park, 2007; Lee et al., 2007). There is no doubt that occurrence of CHD has become a significant burden in Korean women, and primary prevention of CHD should be a public health priority.

Primary prevention of CHD requires an accurate assessment of CHD risk and identification of those at high risk for future cardiac events and in need of preventive care (Adult Treatment Panel III [ATP III], 2001; Grundy et al., 2004). CHD occurs in individuals with cardiovascular risk factors. The major risk factors include hypertension, diabetes, dyslipidemia, and cigarette smoking. These risk factors have been considered causal to CHD because of their independent, reproducible, temporal, and dose-response relationship to the development of CHD (Wilson et al., 1998; Yusuf, Reddy, Ounpuu, & Anand, 2001). The major risk factors are suitable for widespread clinical use because they are common, measurable at low cost, and, importantly, modifiable. In addition to the major risk factors, lifestyle factors such as obesity and physical inactivity have the potential to increase the risk for CHD by elevating blood pressure, glucose, or lipids (Wilson et al.; Yusuf et al.). Lifestyle factors are also important in terms of risk reduction because lifestyle modification constitutes the direct target for nursing intervention and is an integral part of long-term CHD risk reduction (ATP III; Mosca et al., 2007).

Cardiovascular risk factors are associated with each other and have a multiplicative rather than additive effect on health. Even...
s slight elevations in two or more risk factors noticeably increase the risk for CHD (Smith, 2007). Thus, assessment of the overall effect of multiple risk factors on the development of CHD is crucial for accurately identifying women at high CHD risk. Office-based risk assessment tools help to assess multiple risk factors simultaneously rather than focusing on any single risk factor. Among several tools available (e.g., Reynolds Risk Score, Systemic Coronary Heart Evaluation), the Framingham Risk Score (FRS) is the most commonly used and most extensively validated CHD risk assessment tool. It is a mathematical model predicting the probability of developing CHD in the next 10 years with the major risk factors (ATP III, 2001; Wilson et al., 1998). Current evidence-based clinical guidelines for CHD prevention in the United States recommend estimating 10-year risk for CHD with the FRS as an initial step in primary prevention of CHD (ATP III; Mosca et al., 2007).

The nurses’ role includes patient and public education. Additionally nurses are actively involved with CHD risk reduction. Effective risk reduction requires an accurate estimation of CHD risk to more precisely select those needing nursing interventions and health education. It also ensures better and cost-effective use of limited resources. Given the current epidemic of CHD in Korean women, an important opportunity exists to screen for cardiovascular risk factors and estimate the 10-year risk for CHD in Korean women in order to prevent CHD. Comprehensive risk assessment for CHD not only describes the total burden of CHD but may also be useful for highlighting the potential for nursing interventions to reduce the burden of CHD. This can serve as important baseline information for public health planning. Therefore, the research purposes of this study were to (a) describe the prevalence of cardiovascular risk factors (hypertension, smoking, dyslipidemia, obesity, and physical inactivity), (b) describe the prevalence of combinations of risk factors, and (c) estimate the 10-year risk for CHD using the FRS in a nationally representative sample of Korean women.

Methods

Study design and data source

This is a secondary data analysis study using data from the 2008 Korea National Health and Nutrition Examination Survey IV (KNHANES IV) collected by the Korea Centers for Disease Control and Prevention (KCDC). Permission to use the data set was granted by KCDC free of charge, after reviewing the proposal of this study. The SPSS data set and the data directory were directly downloaded from the KCDC website (http://knhanes.cdc.go.kr/).

Sample and data collection procedure of original survey

The sample for the KNHANES IV was obtained through a stratified, multistage probability sampling design to represent community-residing Koreans (KCDC, 2008). Households were randomly sampled, and each individual within the household was interviewed separately. Selected households received a letter from the KCDC director introducing the survey. They were approached by trained interviewers to schedule a day to obtain written consent and to schedule personal interviews and physical examinations. On the scheduled day, upon obtaining informed written consent, health interviews and physical measurements were performed in a specially designed mobile center or in public health centers. The interview included questions about demographic, socioeconomic, medical history, and comorbid conditions. Information on health behaviors such as smoking and physical activity was collected via self-administered questionnaires. The health examination portion consisted of medical and physiological measurements including blood pressure (BP), height, and weight as well as laboratory tests. This process took an average of 60–100 minutes to complete; participants were encouraged to ask for assistance if needed. To encourage participation, compensation (snacks and KRW 10,000, corresponding to US $8.7) and a copy of the medical findings report were given to each participant. The response rate for the original survey was 77.8% (KCDC, 2008).

Sample for present study

The sample for this study was limited to women who completed the survey, did not have CVD or diabetes, and were aged 20–79 years, because the FRS was devised for people in this age range without CVD or diabetes. CVD was defined as self-reported myocardial infarction, angina pectoris, or stroke. Diabetes was defined as self-reported history of diabetes, or use of glucose lowering medications, or a fasting blood glucose ≥ 126 mg/dL (American Diabetes Association, 2010). Women who were pregnant or lactating were excluded from the analyses because pregnancy or lactation may influence BP, blood sugar, or body mass index (BMI). To determine if a woman was pregnant or lactating, self-report were used.

Of the 5,374 women participants in the original KNHANES IV survey, 3,956 women were aged 20–79 years. After applying the inclusion/exclusion criteria, 3,132 women were eligible for the analysis of this study. Among them, 89 women did not fast for at least 8 hours prior to the blood tests. Because lipid levels for those who fasted less than 8 hours are unreliable, they were excluded from the analysis of this study. Low-density lipoprotein cholesterol (LDL-C) was not directly measured in the original study, so it was estimated with the Friedewald equation for this study. The equation is unreliable and invalid when triglycerides are over 400 mg/dL (Friedewald, Levy, & Fredrickson, 1972). Forty-five women had triglyceride levels > 400 mg/dL; therefore, these women were excluded yielding a final sample of a 2,998 women for the analysis of this study.

Measurements and variables

Demographics and cardiovascular risk factors

Demographics such as age, marital status, educational level, work status, household income, menopausal status, and menopausal age were reviewed and included in this study to describe the sample characteristics. Below poverty level was defined as the household income levels below the Minimum cost of Living set by Health and Welfare in Korea.

Participants were considered smokers if they reported that they were currently smoking. BPs were measured three times, and the average of the second and third BP readings was used for this study. Participants were also asked whether they were currently taking antihypertensive medications. Hypertension was defined as a BP ≥ 140/90 mmHg or taking antihypertensive medications (Chobanian et al., 2003). Fasting lipid levels were analyzed in a national laboratory, and a total cholesterol ≥ 200 mg/dL, HDL-C < 50 mg/dL, LDL-C level ≥ 130 mg/dL, and triglyceride level ≥ 150 mg/dL were defined as risk factors for CHD in this study (Mosca et al., 2007). Overweight was defined as BMI ≥ 23 kg/m² (WHO, 2000). Physical activity was self-reported with the Korean version of the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003). Data collected with the IPAQ were scored in MET-minutes/week for the present study (IPAQ, 2003) (metabolic equivalent [MET]; 1 MET = the rate of energy expenditure while at rest). At least 30 minutes of moderate activity 3 days a week can benefit CHD prevention. This amount of physical activity is approximately 600 MET-minutes/week (IPAQ). Women with less
than 600 MET-minutes/week were considered sedentary in this study. To present the prevalence of combination of risk factors, the number of major risk factors included in the FRS (hypertension, HDL-C < 50 mg/dL, total cholesterol ≥ 200 mg/dL, and smoking) was counted.

Ten-year risk for CHD

Given that there is no specific risk assessment tool for Korean women, the widely used FRS was used to estimate Korean women's 10-year risk for CHD. It estimates a woman's risk of having a first heart attack in the next 10 years using seven variables: age, sex, total cholesterol, HDL-C, smoking status, systolic BP and whether the person was taking antihypertensive medication. The FRS was calculated using the downloadable spreadsheet calculator (http://hp2010.nhlbi.nih.gov/atpiii/riskcalc.htm). Age, lipids, and systolic BP were entered as continuous variables.

The FRS is continuous score, ranging from 0 to 100%. However, current clinical guidelines recommends categorizing asymptomatic individuals into low (FRS < 10%), intermediate (10–20%), and high risk subgroups (> 20%) for risk management purpose (ATP III, 2001; Grundy et al., 2004). People in the low-risk group can be reassured and followed with reinforcement of lifestyle changes. Intermediate-risk group may require further risk stratification with additional tests, whereas high-risk group are candidates for aggressive intervention (Grundy et al.). In this study, we used the same cut-points to categorize Korean women into three risk categories.

Statistical analysis

Data were analyzed with the SPSS Complex Samples 19.0 (SPSS Inc., Chicago, IL, USA). To account for the complex sampling design, sampling weights were applied, and weighted means or percentages were presented to describe demographics, prevalence of cardiovascular risk factors, and the distribution of three levels of 10-year CHD risk in Korean women without CVD or diabetes. A chi-square test was used to check for any differences in the distribution of 10-year CHD risk by age group.

Ethical aspects

All participants provided informed consent for the KNHANES IV: the survey was reviewed and approved by the KCDC Institutional Review Board. The present study used only de-identified existing data with no subject contact. Permission to conduct the present study was granted by the University of California San Francisco Committee on Human Research, and the directly downloaded SPSS data were protected with a password.

Results

Table 1 shows the demographic characteristics of Korean women (n = 2,998; weighted n = 14,420,987). The mean age was 43.7 years. About 29% of women were postmenopausal, and the average menopausal age was 49.1 years. About 18% of women had a BP ≥ 140/90 mmHg or was taking antihypertensive medications to control blood pressure (Table 2). The prevalence of smoking was 7.5%. Thirty percent of Korean women aged 20–79 years had total cholesterol ≥ 200 mg/dL. 25.7% had LDL-C ≥ 130 mg/dL, 47.3% had HDL-C < 50 mg/dL, and 16.4% had triglycerides > 150 mg/dL. About 46% of women were categorized as being overweight/obese, having a BMI ≥ 23 kg/m². One in three was categorized as sedentary.

The mean values and the distribution of each risk factor by age group were graphically depicted in Figure 1. The prevalence of hypertension and dyslipidemia generally increased with age, especially after age 50. The prevalence of smoking was highest in women aged 20–29 years. The rate decreased with age until 50 years and was lowest in women aged 50–59 years but after age 60, the rate increased again with age. Obesity was most prevalent in women aged 60–69 years. Women aged 50–59 years were the most active; whereas women aged 70–79 years were the most sedentary.

Based on the FRS, 98.5% of asymptomatic Korean women had a 10-year risk for CHD of less than 10%, 1.4% had 10–20% risk, and 0.1% had a risk greater than 20% (Table 3). Figure 2 presents the prevalence of combinations of risk factors in Korean women and the average of the FRS by age group. Overall, only about 25% of Korean women had no risk factors, and one in three women had two or more major risk factors for CHD. The prevalence of combination of two or more risk factors increased with age, and more than 50% of women older than 60 years had two or more major cardiovascular risk factors. Even for women in their 20s, approximately 1 in 2 had one or more major risk factors for CHD. The average of the FRS increased especially after age 50.

Discussion

This study presented cardiovascular risk factors and risk classification of Korean women at three levels of CHD risk in a large

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Demographic Characteristics of Korean Women Aged 20–79 Years Without Cardiovascular Disease or Diabetes (n = 2,998, Weighted n = 14,420,987)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics characteristics</td>
<td>M or % (SE)</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>43.7 (0.4)</td>
</tr>
<tr>
<td>Marital status (married and living together)</td>
<td>67.7 (1.3)</td>
</tr>
<tr>
<td>Education (high school or less)</td>
<td>72.4 (1.3)</td>
</tr>
<tr>
<td>Work status (yes)</td>
<td>49.3 (1.2)</td>
</tr>
<tr>
<td>Below poverty level</td>
<td>19.7 (1.1)</td>
</tr>
<tr>
<td>Menopausal status (n = 2,716)</td>
<td>Having periods</td>
</tr>
<tr>
<td></td>
<td>66.7 (1.1)</td>
</tr>
<tr>
<td>Menopause</td>
<td>28.5 (1.1)</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>4.8 (0.5)</td>
</tr>
<tr>
<td>Menopausal age (yr; n = 938)</td>
<td>49.1 (0.2)</td>
</tr>
</tbody>
</table>

Note. SE = standard error.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Cardiovascular Risk Factors in Korean Women Aged 20–79 Years Without Cardiovascular Disease or Diabetes (n = 2,998, Weighted n = 14,420,987)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular risk factors</td>
<td>M or % (SE)</td>
</tr>
<tr>
<td>Blood lipids</td>
<td></td>
</tr>
<tr>
<td>Total cholesterol (mg/dL)</td>
<td>185.3 (0.8)</td>
</tr>
<tr>
<td>Total cholesterol ≥ 200 mg/dL</td>
<td>30.0 (1.6)</td>
</tr>
<tr>
<td>LDL-C (mg/dL)</td>
<td>113.3 (0.7)</td>
</tr>
<tr>
<td>LDL-C ≥ 130 mg/dL</td>
<td>25.7 (0.9)</td>
</tr>
<tr>
<td>HDL-C (mg/dL)</td>
<td>51.4 (0.3)</td>
</tr>
<tr>
<td>HDL-C &lt; 50 mg/dL</td>
<td>47.3 (1.2)</td>
</tr>
<tr>
<td>Triglycerides (mg/dL)</td>
<td>102.9 (1.3)</td>
</tr>
<tr>
<td>Triglycerides ≥ 150 mg/dL</td>
<td>16.4 (0.7)</td>
</tr>
<tr>
<td>Blood pressure</td>
<td></td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>110.7 (0.4)</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>72.3 (0.3)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>17.7 (0.8)</td>
</tr>
<tr>
<td>Hypertension treatment</td>
<td>11.1 (0.7)</td>
</tr>
<tr>
<td>Current smoking</td>
<td>7.5 (0.6)</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>23.0 (0.1)</td>
</tr>
<tr>
<td>Body mass index ≥ 23 kg/m²</td>
<td>45.9 (1.2)</td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>33.3 (1.3)</td>
</tr>
</tbody>
</table>

Note. SE = standard error; LDL-C = low density lipoprotein cholesterol; HDL-C = high density lipoprotein cholesterol.

4 Self-reported myocardial infarction, angina pectoris, stroke, or diabetes mellitus.
5 Calculated result of LDL-C = Total cholesterol – (HDL-C + Triglycerides/5).
6 Physical inactivity refers to women with < 600 MET-minutes/week.
Figure 1. Prevalence and mean values of cardiovascular risk factors in Korean women by age group (n = 2,998, weighted n = 14,420,987).

Notes. HTN = hypertension; blood pressure ≥ 140/90 mmHg or taking antihypertensive medications; SBP = systolic blood pressure; DBP = diastolic blood pressure; TC = total cholesterol; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol; TG = triglycerides; BMI = body mass index; physical inactivity = women with less than 600 MET-minutes/week.
randomly selected sample. The most important finding of this study is that major cardiovascular risk factors are highly prevalent in Korean women who are free of CVD or diabetes. Most risk factors generally became more prevalent as one gets older, increasing the risk for CHD with advancing age. But this study also found that even in the younger age groups (20–39 years old), cardiovascular risk factors were already present. Smoking was much more common in women less than 40 years old, and a high percentage of them were sedentary and overweight. The high prevalence of unhealthy lifestyles in young women warrants increased attention because prolonged unhealthy lifestyles convey substantial risk for CHD (Manson et al., 1999; Willett et al., 1987; Yusuf et al., 2004), and maintaining a healthy lifestyle is a core aspect of CHD risk reduction in women (Mosca et al., 2007). Facilitating an effective nursing intervention to motivate young women to be active, maintain weight, and quit smoking may put a brake on the current epidemic rise of CHD in Korea. It should be a priority to reduce the public burden of CHD.

It is well known that menopausal transition in women contributes to increased CHD risk. Estrogen deficiency after menopause makes existing hypertension, obesity, and dyslipidemia worse or more prevalent, eventually increasing the risk for CHD (Bairey Merz et al., 2003; Shaw et al., 2006). However, current evidence-based guideline does not recommend estrogen replacement therapy for counteracting the increased risk attributable to menopause in those without existing CHD (Mosca et al.). The best possible way to reduce the risk may be to increase the frequency of risk factor screening during menopausal transition in order to accurately assess a woman’s CHD risk in a timely fashion. The average age of Korean women at the time of menopause in this study was 49 years. The prevalence and combination of cardiovascular risk factors and the FRS significantly increased after the age of 50. Korean women should be aware that their risk for CHD sharply increases after menopause. They need to be assessed frequently for their cardiovascular risk during and after menopause and should be counseled to emphasize therapeutic lifestyle changes to prevent CHD.

Another striking finding of this study is that overweight/obesity is highly prevalent in Korean women. In this study, 45.9% of women aged 20–79 were overweight (21.2%) or obese (24.6%). Asians have a higher percentage of body fat and more centralized fat distribution compared to Caucasians of the same gender, age, and BMI so they are prone to obesity-associated diseases such as CHD or diabetes even at a lower BMI. For this reason, the World Health Organization (WHO) proposed lower BMI cut-points for overweight (23 kg/m\(^2\) ≤ BMI < 25 kg/m\(^2\)) and obesity (BMI ≥ 25 kg/m\(^2\)) for Asians (WHO, 2000). An accurate perception of normal weight is important because individuals will take actions to improve their health if they are aware of the problem. Korean women need to be informed about the culture specific cut-points for obesity, and future research about the gap between perceived body image and actual BMI is warranted.

In this study, 17.7% of Korean women had hypertension. Koreans have a higher salt intake than most other populations; it is thought that this contributes to such a high prevalence of hypertension (Kesteloot et al., 1980). Reducing the burden of hypertension in those free of CVD is extremely important because, among the major risk factors, hypertension contributes the most to the population-attributable risk of total CVD in Koreans. It is estimated that about 34% of all cardiovascular events in Koreans could be

### Table 3 Distribution of 10-Year Risk\(^a\) for Coronary Heart Disease in Korean Women Aged 20–79 Years Without Cardiovascular Disease\(^b\) or Diabetes

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>n</th>
<th>Weighted n</th>
<th>10-year risk &lt;10%</th>
<th>10-year risk 10–20%</th>
<th>10-year risk &gt;20%</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>20–29</td>
<td>899</td>
<td>2,817,678</td>
<td>100.0 (0.0)</td>
<td>–</td>
<td>–</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>30–39</td>
<td>61</td>
<td>3,316,734</td>
<td>100.0 (0.0)</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>40–49</td>
<td>657</td>
<td>3,553,365</td>
<td>99.9 (0.1)</td>
<td>0.1 (0.1)</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>50–59</td>
<td>525</td>
<td>2,456,566</td>
<td>100.0 (0.0)</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>60–69</td>
<td>445</td>
<td>1,382,460</td>
<td>96.4 (0.9)</td>
<td>3.4 (0.9)</td>
<td>0.2 (0.2)</td>
<td></td>
</tr>
<tr>
<td>70–79</td>
<td>289</td>
<td>894,544</td>
<td>81.5 (2.9)</td>
<td>16.8 (2.7)</td>
<td>1.7 (0.8)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,998</td>
<td>14,420,987</td>
<td>98.5 (0.2)</td>
<td>1.4 (0.2)</td>
<td>0.1 (0.1)</td>
<td></td>
</tr>
</tbody>
</table>

* Ten-year risk was estimated with the Framingham Risk Score; b Self-reported myocardial infarction, angina pectoris, stroke, or diabetes mellitus; Values are presented in percentages (Standard error).

**Figure 2.** Prevalence of combination of cardiovascular risk factors and average of FRS in Korean women by age group (n = 2,998, weighted n = 14,420,987).

Notes: RF = risk factor (counted risk factors; hypertension, total cholesterol ≥ 200 mg/dL, high-density lipoprotein cholesterol < 50 mg/dL, and current smoking); FRS = Framingham Risk Score.
prevented by controlling high BP alone (Suh, 2001). Given the high impact of hypertension on CVD in Koreans, important national efforts should be made to improve early detection of hypertensive individuals and to keep track of their medication usage. Furthermore, identification of subgroups susceptible to hypertension, and preventing the development of hypertension among them should be the ultimate goal.

The prevalence of current smoking in this study was 7.5%, which is higher than the 4.8% from 2001 KNHANES data set (Ko, Kim, & Nam, 2006). Smoking among younger women is on the rise compared to the previous study (Ko et al.), and women 20–30 years of age showed the highest smoking prevalence. The prevalence of smoking decreased with age, but the rate increased again in women after age 60. This pattern of smoking prevalence may be associated by marital status. Previous studies conducted in Korea as well as in Western countries have reported that people living with a partner have lower smoking rates than people living alone (Cho, Khang, Jun, & Kawachi, 2008; Chung, Lim, & Lee, 2010; Cox, Feng, Cañar, Ford, & Tercyak, 2005). But in contrast to the strong beneficial effect of marital status on men’s smoking in Western countries, in Korea, this relationship was much stronger in women (Cho et al.; Chung et al.). In Korea, women’s smoking has long been considered inappropriate (HateF, 2008; Kim, Chun, Dooyk, Payne, Cho, & Kim, 2006). Living with a partner may constrain Korean women from smoking. In contrast, being single after a divorce or a loss of a partner could liberate women from the social constraints on smoking. Such a feeling may allow women to smoke cigarettes again. Restarting smoking even in old age apparently makes a woman vulnerable to CHD and significantly increases mortality from all causes of death (Center for Disease Control [CDC], 2001). Smoking cessation may be the most modifiable risk factor for CHD. It yields not only immediate but long-term benefits for prevention of CHD (CDC). Educating women to quit smoking as soon as possible and developing nursing interventions to prevent relapse in advanced age appear crucial to prevent CHD in Korean women.

There is a strong association between elevated LDL-C levels and increased risk for CHD, so the primary focus of CHD prevention targets lowering LDL-C. In this study, 25.7% of Korean women had LDL-C ≥ 130 mg/dL, and the rate increased with advancing age. Although the prevalence of elevated LDL-C is relatively low compared to the US (32% for general population age ≥ 20 years; Rosamond et al., 2008), extra attention to LDL-C is required with the current increases in dietary total fat intake. Furthermore, Koreans could be at increased risk for CHD even with a smaller amount of fat intake than Caucasians, because they have maintained low levels of dietary fat intake for a long time (Suh et al., 2001). Koreans may need lower dietary fat recommendations than other populations to prevent CHD, and culture-specific LDL-C guidelines are required.

The most common risk factor in Korean women found in this study was low levels of HDL-C. Compared to the US, reduced HDL-C is highly prevalent in Korean women, and about 48% of women had a HDL-C < 50 mg/dL. Generally HDL-C levels are higher in women than in men before menopause. But after menopause, HDL-C levels dropped, and triglycerides, LDL-C, and the risk for CHD increase (Stangl, Baumann, & Stangl, 2002). Low levels of HDL-C increase the risk for CHD independent of total cholesterol or LDL-C, especially in women (Gordon et al., 1989). Previous studies found that high prevalence of reduced HDL-C in Korean women is related to a sedentary lifestyle and excessive carbohydrate intake (Kim, Kim, Choi, & Huh, 2008; Kim, Lee, Park, & Kim, 2007). Koreans eat unbalanced diets with high carbohydrate and low protein content. Women over 60 years of age obtain the majority of their daily energy intake from carbohydrates, mainly from white rice (KCDC, 2005). A prospective study showed that high carbohydrate diets increase the risk of CHD (Liu et al., 2000). High carbohydrate diets lead to dyslipidemia and must be viewed with concern in terms of cardiovascular health and more tailored diet recommendations are needed for Korean women.

Given the high prevalence of cardiovascular risk factors in Korean women found in this study, assessing the overall effect of multiple risk factors on the development of CHD is helpful in order to prevent the disease. The FRS is a simple way of assessing 10-year risk for CHD. In addition, a free web-based FRS calculator is available (http://hp2010.nhlbihin.net/atpiii/calculator.asp?usertype=prof) so women can easily assess their own risk by themselves. This may give women a more accurate perception and awareness of their risk and motivate them to reduce their risk of CHD.

When using the FRS, there are two important things to keep in mind for its appropriate use. First, the FRS is a prediction model, thus it only can be applied to estimate 10-year CHD risk in individuals who are free of CVD. Once clinical CVD has been established, the risk for future cardiac events is much higher than for those without CVD. Also, the 10-year risk for development of CHD in individuals with diabetes is so high that diabetes is considered to be equivalent to CHD for risk-classification purposes (ATP III, 2001; Wilson et al., 1998). Therefore, the application of the FRS to those with already established CVD or diabetes is likely to be less useful. Second, interpretation of the FRS requires an accurate definition of CHD. The end point of the FRS is “hard CHD,” which includes only myocardial infarction and coronary death, and excludes angina pectoris (ATP III; Wilson et al.). Therefore, the interpretation of its results is limited to the risk for myocardial infarction or coronary death in the next 10 years.

In this study, most Korean women younger than 60 years old had a 10-year risk that fell below 10%. However, about 20% of women aged 70–79 years and 3.6% of women aged 60–69 had a 10-year risk of 10% or higher. Even though they do not have established CVD or diabetes, they are at increased risk for CHD. Those women would benefit from additional testing or aggressive risk factor modification therapy. Focusing on this population with appropriate interventions would play a major role in CHD prevention in Korea.

There are several issues that may have affected the accuracy of the findings of this study. First, the FRS was used to estimate the 10-year risk for CHD, given that there is no specific tool for estimating Korean women’s risk for CHD. Although, the FRS has been most extensively validated and adopted in the current clinical guidelines in the US., when data are available, recalibration of the FRS should be considered to more accurately define Korean women’s risk for CHD. Second, the average age of Korean women in this study was relatively young, given that the risk for CHD in women sharply increased after menopause. Also, this study was limited to those who completed the national survey which took 60–100 minutes including self-administered questionnaires. Only elderly women healthy enough might be able to participate and complete the survey, and this could have affected our results. Third, this study used self-reported data about diagnoses of CVD, medication use, and smoking status thus the findings may be subject to response bias. This may be especially true for smoking status because there is a strong social taboo against women smoking in Korea. Participants may respond in a socially desirable way so the risk of CHD may be underestimated. Fourth, the prevalence of combination of risk factors in this study was based on the number of dichotomous major risk factors. It neither reflects which combinations of risk factors, nor adequately account for the severity of risk factors. It is likely that some combinations of risk factors may convey higher risk for the development for CHD than others. Also the severity of risk factors such as cholesterol levels or duration/amount of smoking matters more in the development of CHD. These
limitations should be considered in order to appropriately interpret the results of this study. However, the strengths of this study are a large randomly selected sample of Korean women and therefore the findings can be useful for defining Korean women's risk for CHD at the national level. These findings could be especially helpful for public health planning and estimating costs associated with CHD prevention. Such information may also be helpful for evaluating the public burden of CHD over time.

Conclusion

Modifiable cardiovascular risk factors are highly prevalent in Korean women across all age, and the combination of risk factors is common. Korean women should be regularly assessed for their CHD risk and should be counseled to emphasize therapeutic lifestyle changes to prevent CHD. Given the multifactorial nature of CHD, development and implementation of multifaceted nursing interventions are required to confront the current epidemic rise of CHD in Korean women. Furthermore, efforts to raise public awareness about CHD in women and its risk factors are essential at the national level as well as in all clinical settings. Korean women should “Know their Numbers.”

Estimating 10-year risk helps to more accurately select those needing intervention or additional testing. This study provides estimates of the distribution of 10-year CHD risk in Korean women at the national level. Focusing on women at increased CHD risk by providing appropriate nursing interventions and health education would play a major role in overall reduction in CHD. Repeated research needs to be continued in order to evaluate the public burden of CHD over time. Such information can hold promise for surveillance purposes.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgments

The authors wish to thank Nancy Stotts, RN, EdD, Catherine Waters, RN, PhD, and Dianne Christopherson, RN, PhD, for their advice during manuscript preparation, Steven Paul, PhD for his advice on statistical analysis, and Christine Hansen for her editorial effort. We extend our appreciation to the Korea Centers for Disease Control and Prevention in providing the data used in this study. This study was supported by the University California at San Francisco, Graduate Student Research Award.

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