

ORIGINAL ARTICLE

Self-perceived health versus actual cardiovascular disease risks

Young KO¹ and Sunjoo BOO²¹College of Nursing, Gachon University, Incheon and ²College of Nursing, Ajou University, Suwon, South Korea**Abstract**

Aim: Self-perceived poor health is related to cardiovascular disease (CVD) risk perception, cardiovascular event, hospital readmission, and death from CVD. This study evaluated the associations between self-perceived health and actual CVD risk in South Koreans as well as the influence of sociodemographic and cardiovascular risk factors on self-perceived poor health.

Methods: This is a secondary data analysis of the 2010 Korea National Health and Nutrition Examination Survey. The sample was 4535 South Koreans aged 30–74 years without CVD. Self-perceived health status was compared with actual cardiovascular risk separately by sex using χ^2 -tests. Logistic regressions were used to identify potential sociodemographic and cardiovascular risk factors of self-perceived poor health.

Results: Self-perceived poor health was related to higher CVD risk but there were substantial gaps between them. Among cardiovascular risk factors, dyslipidemia, obesity, smoking, and a family history of CVD did not affect self-perceived health.

Conclusion: Gaps between perceived health and actual CVD risk should be closed to optimize cardiovascular health of South Koreans. Koreans need to increase risk perception to a level commensurate with their actual risk. Healthcare providers should try to provide individuals at increased CVD risk with better information more frequently, especially those who have favorable perceptions of their health but smoke or have elevated cholesterol levels and bodyweight.

Key words: cardiovascular disease, health status, risk assessment, self report.

INTRODUCTION

Cardiovascular disease (CVD) is the second leading cause of death in South Korea. CVD morbidity and mortality are currently on the rise (Korea National Statistical Office, 2012). CVD occurs in people with cardiovascular risk factors such as hypertension, diabetes, physical inactivity, and smoking. Such increased understanding about the epidemiology and risk factors of CVD has led to the development of “Health Plan 2010” initiated in 2002 in South Korea that has been recently updated to “Health Plan 2020” (Korea Health Promotion Foundation, 2013). The goal of the program is to reduce cardiovascular risk and promote public

health by improving awareness of cardiovascular risk factors and health benefits of physical activity and quitting smoking through mass media. National efforts have also been made to provide easy access to safe and affordable physical activity opportunities. Despite such national efforts implemented during the last decade, CVD mortality along with the prevalence of diabetes and obesity in South Korea is still increasing (Kim, 2011; Kim *et al.*, 2014), and a substantial number of South Korean men smoke (Hong *et al.*, 2013). This may be because general rather than personalized health information does not confirm who is likely to develop CVD. As a result, individuals may perceive that they are not likely to suffer from adverse health issues and therefore underestimate their risk. A study by Park, Lee, and Ham (2008) showed that South Koreans have a tendency to perceive that they are less at risk of experiencing health problems than others.

An individual's favorable perceptions of their health and underestimation of their risk may facilitate

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Received 11 September 2014; accepted 30 April 2015.

successful adaptation to life's challenges (Segerstrom, Taylor, Kemeny, & Fahey, 1998), but could impede risk reduction efforts as well as the adoption of healthy behaviors (Katapodi, Lee, Facione, & Dodd, 2004; Mosca *et al.*, 2006; Weinstein, Marcus, & Moser, 2005). Evidence has shown that willingness to engage in healthy behaviors is related to a person's perception of their health (Ladwig, Baumert, Löwel, Döring, & Wichmann, 2005; Lemon, Rosal, Zapka, Borg, & Andersen, 2009). The likelihood of adopting healthy behaviors may be greater if people perceive themselves as being in poor health and at risk. For instance, individuals with poor general health are more likely to try to quit smoking (Ladwig *et al.*, 2005), seek preventive health care (Katapodi *et al.*, 2004), and look for a healthcare provider (Mosca *et al.*, 2006). Perceived general health assessed with a simple single question asking respondents to rate their overall health is also associated consistently with a wide range of CVD-related outcomes such as cardiovascular events, hospital readmissions, and death from CVD of people with or without diagnosed CVD (Benjamins, Hummer, Eberstein, & Nam, 2004; Möller, Kristensen, & Hollnagel, 1996; Pedersen, Martens, Denollet, & Appels, 2007; Spertus, Jones, McDonell, Fan, & Fihn, 2002; van der Linde *et al.*, 2013). When combined with a small number of cardiovascular risk factors such as age, systolic blood pressure, and smoking, perceived general health is as accurate as the Framingham Risk Score (FRS), the most commonly used and extensively validated quantitative tool for assessing cardiovascular risk in those free of CVD (May, Lawlor, Brindle, Patel, & Ebrahim, 2006). Given that perceived general health data is easy to collect, this type of information can be used on a routine basis in primary care settings to identify people at increased risk for future cardiovascular events. Likewise, risk reduction efforts could be modified so that they target the specific groups to achieve the highest possible degree of CVD risk reduction at a national level.

Despite the government's prevention agenda, increasing mortality from CVD in South Korea may be due to people in this country perceiving their health favorably and therefore underestimating their disease risk. Increasing general knowledge through the media may be necessary but not sufficient for eliciting preventive actions. Taking preventative steps may occur when a person accurately perceives their risk. Discrepancies between self-perceived health and actual risk of CVD should be addressed to optimize outcomes. In recognition of the public health challenges associated with CVD in South

Korea, the current study evaluated the self-reported general health status of South Koreans and determined whether the rating was associated with actual CVD risk. Additionally, the influence of sociodemographic and cardiovascular risk factors on self-perceived poor health using data from a recent South Korean national survey was assessed. Understanding the gap between self-perceived health and actual risk for CVD can promote the development of innovative educational strategies to lower CVD risk.

METHODS

Study design and sample population

This is a secondary data analysis of a cross-sectional national survey exploring the associations between self-reported health and actual CVD risk. Data from the 2010 Korea National Health and Nutrition Examination Survey (KNHANES) were used. The KNHANES was conducted to assess the health and nutritional status of South Koreans using face-to-face interviews, self-administered questionnaires, and physical examinations. Analyses performed for this study were limited to individuals who: (i) completed the survey without omitting items on either perceived health status or cardiovascular risk factors of interest; (ii) had not been diagnosed with CVD; and (iii) were aged 30–74 years, because the FRS was developed for people in this age range (D'Agostino *et al.*, 2008). Diagnosed CVD in the present study was defined as self-reports of heart attack, angina pectoris, or stroke. Pregnant or breast-feeding women were also excluded because cardiovascular risk factors such as body mass index (BMI) may be affected by these conditions. Out of the 8958 participants in the original survey, 4789 were aged 30–74 years and had completed the survey. Among these, 195 had been diagnosed with CVD while 59 were women who were pregnant or breast-feeding. Excluding these individuals yielded a final sample population of 4535 participants (1988 men and 2547 women) for analysis.

Definition of variables

In this study, self-perceived health status, cardiovascular risk factors, and actual CVD risk were defined as follows.

Perceived health status

Perceived health status was assessed by responses to the following survey questions: "How is your health in

general? Is it very good, good, fair, poor, or very poor?” The responses were dichotomized so that 0 = “good or fair” and 1 = “poor”.

Cardiovascular risk factors

Six cardiovascular risk factors were included in this study (hypertension, dyslipidemia, diabetes, obesity, smoking, and family history of CVD). Hypertension was defined as a systolic or diastolic blood pressure of 140/90 mm Hg or more or taking antihypertensive medications (Chobanian *et al.*, 2003). Total cholesterol of 200 mg/dL or more, low-density lipoprotein cholesterol levels of 130 mg/dL or more, and triglyceride concentrations of 150 mg/dL or more were considered elevated (Mosca *et al.*, 2007). High-density lipoprotein cholesterol (HDL-C) levels of less than 40 mg/dL in men and less than 50 mg/dL in women were considered low (Mosca *et al.*, 2007). These were all defined as CVD risk factors in the current study. Diabetes was defined as a self-reported previous history of diabetes, use of glucose-lowering medications, or a fasting blood glucose level of 126 mg/dL or more (American Diabetes Association, 2010). BMI was calculated according to measured height and weight (kg/m^2). A BMI of 23 kg/m^2 or more was considered an indication of overweight individuals (World Health Organization Asia-Pacific Region, 2000), and identified as a cardiovascular risk factor for this study. Smoking was assessed by self-reports of current smoking habits. Family history was defined as a self-reported parental or sibling history of heart attack, angina pectoris, or stroke.

Actual CVD risk

The well-known and widely used FRS (D’Agostino *et al.*, 2008) was used to predict actual CVD risk in this study because no specific CVD risk assessment tool for South Koreans is available. The FRS estimates an individual’s risk of having a cardiovascular event in the next 10 years based on the following factors: age, sex, total cholesterol concentration, HDL-C level, and systolic blood pressure as quantitative variables, and current smoking habits, diabetes, and treatment for hypertension as dichotomous variables. A higher 10 year risk reflects a greater probability of a cardiovascular event occurring within the next 10 years. Based on the FRS, study participants were classified as low (<6%), moderate (≤ 6 to <20%), and high risk ($\geq 20\%$) for CVD (D’Agostino *et al.*, 2008). Clustering of cardiovascular risk factors in this study was evaluated by counting the number of modifiable cardiovascular risk factors

included in the FRS (total cholesterol ≥ 200 mg/dL, HDL-C <50 mg/dL for women/HDL-C <40 mg/dL for men, currently smoking, hypertension, and diabetes). Sociodemographic factors included in this study were sex, age, marital status, education level, and economic level.

Statistical analysis

Data management and statistical analyses were performed with SPSS Complex Samples version 19.0 (SPSS, Chicago, IL, USA). Suspected errors, missing data, and outliers were screened before the analyses were performed. The original survey used a stratified, multistage probability sampling design; thus, weighed means or percentages were calculated to describe the participants’ characteristics and the prevalence of cardiovascular risk factors stratified by sex. Self-perceived health status was compared with actual CVD risk estimated using the FRS with cross-tabulations according to sex. χ^2 -tests were performed to test differences in cardiovascular risk factors and actual CVD risk based on perceived health status. Logistic regressions were used to identify potential sociodemographic and cardiovascular risk factors associated with self-perceived poor health among South Koreans. Bivariate analyses, χ^2 -tests and correlations, were first conducted to examine the relationship between the dependent variable (self-perceived poor health) and potential independent variables. Independent variables were examined for multicollinearity. Significant variables in the bivariate analyses were entered into the multivariate logistic regression. Treatment variables (i.e. medications for hypertension, dyslipidemia, or diabetes) were highly correlated with the diagnosis variables (i.e. diagnosed hypertension, dyslipidemia, or diabetes), and were better correlates of self-perceived poor health than the diagnosis variables. Therefore, the treatment variables were entered into the final logistic model. The level of significance was set at 0.05.

Ethical considerations

The Korea Centers for Disease Control and Prevention Institutional Review Board (IRB no. 2010-02CON-21-C) approved the national survey. Informed consent was obtained from each participant before data collection. This study used only de-identified pre-existing data with no subject contact, and permission to conduct the present study was approved by the appropriate institutional review board (IRB no. 1044396-201408-HR-015-01).

RESULTS

Characteristics of the study population are presented in Table 1. The average age was 47 years and approximately half were women. The proportion of less educated (high school or less) was higher among women than men. Men tended to have a greater incidence of hypertension, elevated triglyceride levels, diabetes, obesity, and smoking. A low HDL-C level was more common in women (49.9%) than men (34.4%).

Approximately 47% of the study population reported their health status as “fair”. The proportion of participants who perceived themselves to be in good health (“good” or “very good”) was higher among men (38.5%) than women (32.5%), whereas the proportion of individuals with perceived poor health (“poor” or “very poor”) was higher among women (21.7%) than men (13.9%).

Table 2 shows results of the sex-specific analysis for cardiovascular risk factors based on perceived health

Table 1 Participant characteristics ($n = 4535$)

Variable	Men ($n = 1988$)	Women ($n = 2547$) Mean or % (SE)	Total ($n = 4535$)
Sex (%)	50.4 (0.7)	49.6 (0.7)	
Age (years), mean	46.8 (0.4)	47.9 (0.3)	47.4 (0.4)
30–39	31.6 (1.8)	28.8 (1.4)	30.2 (1.4)
40–49	30.0 (1.5)	29.0 (1.3)	29.5 (1.2)
50–59	22.6 (1.3)	23.4 (1.1)	23.0 (1.0)
≥60	15.9 (1.0)	18.8 (0.9)	17.3 (0.9)
Marital status (married and living together) (%)	84.2 (1.2)	81.3 (1.1)	82.7 (0.9)
Education (high school or less) (%)	59.6 (2.0)	72.9 (1.5)***	66.2 (1.6)
Below poverty level (%)	26.8 (1.5)	26.7 (1.3)	26.8 (1.3)
CVD risk factors (%)			
Hypertension [†]	36.9 (1.5)	25.7 (1.2)***	31.3 (1.0)
Diagnosed hypertension [†]	17.0 (1.1)	17.7 (1.0)*	17.4 (0.8)
Taking antihypertensive medication	14.1 (1.0)	16.0 (1.0)	15.1 (0.7)
TC ≥200 mg/dL	40.1 (1.4)	36.9 (1.3)	38.5 (1.0)
LDL-C ≥130 mg/dL	29.2 (1.4)	30.8 (1.1)	30.0 (0.9)
Low HDL-C levels	34.4 (1.5)	49.9 (1.1)***	42.1 (1.0)
TG ≥150 mg/dL	42.2 (1.4)	20.1 (1.0)***	31.2 (0.8)
Diagnosed dyslipidemia	8.0 (0.7)	9.6 (0.7)	8.8 (0.5)
Taking lipid-lowering medication	3.7 (0.5)	5.4 (0.6)*	4.5 (0.4)
Diabetes [§]	10.0 (0.8)	7.5 (0.7)*	8.8 (0.5)
Diagnosed diabetes ^{††}	6.7 (0.6)	5.8 (0.5)	6.2 (0.4)
Taking insulin or antidiabetic medication	5.6 (0.5)	4.8 (0.5)	5.2 (0.3)
BMI ≥23 kg/m ²	65.3 (1.3)	51.7 (1.4)***	58.5 (0.9)
Currently smoking	49.2 (1.4)	5.9 (0.7)***	27.7 (0.9)
Family history of CVD	17.3 (1.0)	16.5 (1.0)	16.9 (0.7)
Perceived general health status (%)			
Very good	4.2 (0.5)	4.5 (0.5)***	4.3 (0.3)
Good	34.3 (1.3)	28.0 (1.2)	31.2 (0.9)
Fair	47.6 (1.6)	45.8 (1.3)	46.7 (1.2)
Poor	13.3 (1.2)	18.6 (1.0)	15.9 (0.9)
Very poor	0.6 (0.2)	3.1 (0.4)	1.8 (0.2)
10 year risk for CVD [¶] (%)			
Low (<6%)	37.7 (1.5)	71.0 (1.3)***	54.2 (1.2)
Moderate (6–20%)	42.5 (1.4)	23.9 (1.2)	33.3 (0.9)
High (>20%)	19.8 (1.2)	5.1 (0.5)	12.6 (0.7)

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$. [†]Blood pressure ≥140/90 mm Hg or on antihypertensive medication. [‡]Self-report of diagnosed hypertension.

[§]Fasting blood glucose ≥126 mg/dL or taking glucose-lowering medications; ^{††}Self-report of diagnosed diabetes. [¶]10 year risk was estimated based on the Framingham Risk Score. BMI, body mass index; CVD, cardiovascular disease; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; SE, standard error; TC, total cholesterol; TG, triglycerides.

Table 2 Prevalence of cardiovascular risk factors according to self-perceived health status and gender (n = 4535)

Variable	Men		Women		Total	
	“Good” or “fair” (%)	“Poor” (%)	“Good” or “fair” (%)	“Poor” (%)	“Good” or “fair” (%)	“Poor” (%)
Hypertension	35.3	46.8**	22.1	38.5***	29.1	41.8***
Diagnosed hypertension	14.8	30.6***	14.8	28.3***	14.8	29.2***
Taking antihypertensive medication	11.9	27.5***	12.8	27.6***	12.4	27.5***
TC \geq 200 mg/dL	40.7	36.1	36.6	37.9	38.8	37.2
LDL-C \geq 130 mg/dL	29.3	29.0	30.6	31.5	29.9	30.5
Low HDL-C	34.2	35.4	48.8	53.8	41.1	46.6*
TG \geq 150 mg/dL	42.1	43.0	18.8	24.8*	31.1	31.9
Diagnosed dyslipidemia	7.0	14.0**	8.1	14.9***	7.5	14.6***
Taking lipid-lowering medication	3.2	7.1**	4.4	8.9***	3.7	8.2***
Diabetes	7.9	22.8***	5.5	14.9***	6.8	18.0***
Diagnosed diabetes	4.8	18.4***	3.6	13.6***	4.2	15.5***
Taking insulin or antidiabetic medication	3.7	17.1***	2.9	11.7***	3.3	13.9***
BMI \geq 23 kg/m ²	65.7	62.5	50.1	57.5*	58.4	59.4
Currently smoking	48.1	56.0	5.7	6.8	28.1	26.1
Family history of CVD	17.6	15.5	16.8	15.5	17.2	15.5

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$. BMI, body mass index; CVD, cardiovascular; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TC, total cholesterol; TG, triglycerides.

status. The prevalence of hypertension and diabetes was higher among both men and women who reported their health as poor. Women who were hypertriglyceridemic and obese were more likely to perceive their health as poor. Clustering of cardiovascular risk factors in South Koreans based on perceived health status is depicted in Figure 1. The clustering distribution of cardiovascular risk factors was generally unfavorable among men, and women with self-perceived poor health. Furthermore, approximately 50% of men and 30% of women who indicated that they were in good health had three or more cardiovascular risk factors.

Comparison between perceived health status and actual cardiovascular risk is presented separately for men and women in Table 3. The proportions of participants with self-perceived poor health increased as actual CVD risk increased ($P < .0001$). Additionally, approximately 60% of men and 25% of women who reported that their health was good or fair were at increased (moderate or high) risk for CVD.

Table 4 shows the odds ratios (OR) for participants with perceived poor health according to sociodemographic and cardiovascular risk factors. More women than men reported their health as poor (OR = 1.8; 95% confidence interval [CI] = 1.5–2.2, $P < 0.0001$). Taking medications to control blood pressure or blood glucose were significantly associated with self-perceived poor health for both South Korean men and women, but

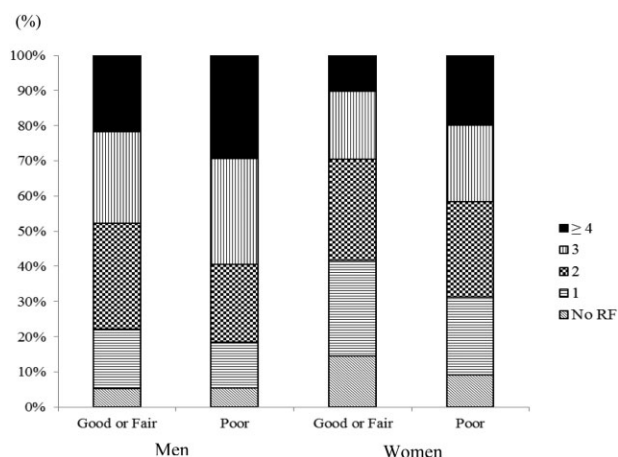


Figure 1 Clustering of risk factors according to perceived health status and sex. RF, risk factor. Hypertension, diabetes, low levels of high-density lipoprotein cholesterol, elevated low-density lipoprotein cholesterol levels, and smoking were considered risk factors.

these variables affected men more strongly. Compared with men of normal weight, overweight or obese men had an adjusted OR of 0.7 (95% CI = 0.5–0.9, $P = 0.018$), after controlling for other factors in the model. Taking medications to control blood lipid levels, smoking, and a family history of CVD were not

statistically significantly associated with self-perceived poor health among the study participants.

DISCUSSION

Self-perceived poor health is related to CVD risk perception, cardiovascular events, hospital readmission, and death from CVD (Benamins *et al.*, 2004; Møller *et al.*, 1996; Pedersen *et al.*, 2007; Spertus *et al.*, 2002; van der Linde *et al.*, 2013). Therefore, assessing how an individual perceives his or her health and identifying those who underestimate their risk may be an important first step for efficiently preventing CVD. In this study

population, approximately one in two (46%) reported their health to be fair while approximately 18% said that they had poor health. It is difficult to simply make cross-country comparisons of perceived health status because of at least two reasons. First, how an individual perceives their health is subjective and can be affected by social or cultural factors. Second, the response categories to measure perceived health status varies from study to study. In this investigation, symmetrical response categories (“very good”, “good”, “fair”, “poor”, or “very poor”) were used to measure self-perceived general health. Other studies used different response categories such as “excellent”, “very good”, “good”, “fair”, or “poor” (Benamins, Hummer, Eberstein & Nam, 2004; Choi, Rankin, Stewart & Oka, 2008) and “excellent”, “very good”, “fair”, or “poor” (van der Linde, Mavaddat, Luben, Brayne, Simmons, Khaw & Kinmonth 2013). Nevertheless, the proportion of individuals in the current study who believed their health to be fair or poor seemed relatively high. Kandula (2007) showed that Asians are more likely to report having fair or poor health in response to general health status questions compared with other ethnic groups even with less chronic disease. Due to the substantial proportion of participants who self-reported fair health, we dichotomized perceived health to be “good” (“very good”, “good”, or “fair”) or “poor” (“poor” or “very poor”) for our analyses. Thus, caution is required when interpreting the results. Future studies characterizing discrepancies between the levels of self-rated health among South Koreans and identifying which factors influence each response category of the self-rated health question may better explain how South Koreans rate their own health.

Table 3 Distribution of 10 year risk for cardiovascular disease according to perceived general health status ($n = 4535$)

10 year risk [†]	Perceived general health status		<i>P</i>
	“Good” or “fair” % (SE)	“Poor” % (SE)	
Men			<0.000
Low	39.3 (1.6)	27.6 (3.3)	
Moderate	42.7 (1.5)	40.9 (3.7)	
High risk	18.0 (1.3)	31.6 (3.0)	
Women			<0.000
Low	74.9 (1.3)	56.9 (2.9)	
Moderate	21.6 (1.2)	32.3 (2.7)	
High risk	3.6 (0.5)	10.8 (1.5)	
Total			<0.000
Low	56.1 (1.2)	45.4 (2.6)	
Moderate	32.7 (1.0)	35.7 (2.2)	
High risk	11.2 (0.8)	19.0 (1.5)	

[†]10 year risk was estimated based on the Framingham Risk Score. SE, standard error.

Table 4 Multiple logistic regression analysis for predicting perceived poor health status ($n = 4535$)

Variables	Men			Women			Total		
	OR	95% CI	<i>P</i>	OR	95% CI	<i>P</i>	OR	95% CI	<i>P</i>
Women							1.8	1.5–2.2	<0.000
Age (per 10 years)	1.2	1.1–1.4	0.003	1.3	1.1–1.4	<0.000	1.2	1.1–1.3	<0.000
Married and living together	1.5	1.0–2.2	0.066	1.2	0.9–1.5	0.195	1.3	1.0–1.5	0.030
High school education or less	1.4	1.0–1.9	0.063	1.5	1.1–2.0	0.010	1.4	1.2–1.8	0.001
Below poverty level	1.6	1.2–2.1	0.002	1.3	1.0–1.6	0.023	1.4	1.2–1.7	<0.000
Hypertension medication	1.6	1.1–2.3	0.006	1.5	1.1–1.9	0.003	2.7	2.1–3.6	<0.000
Cholesterol medication	1.0	0.5–1.8	0.927	0.9	0.6–1.3	0.602	1.6	1.3–1.9	<0.000
Diabetes medication	3.1	2.1–4.7	<0.000	2.4	1.7–3.5	<0.000	0.9	0.7–1.3	0.608
BMI ≥ 23 kg/m ²	0.7	0.5–0.9	0.018	1.1	0.9–1.3	0.627	0.9	0.8–1.1	0.324
Currently smoking	1.3	1.0–1.7	0.052	1.4	0.9–2.2	0.131	1.4	1.1–1.7	0.007
Family history of CVD	0.9	0.6–1.3	0.669	0.9	0.7–1.2	0.382	0.9	0.7–1.1	0.332

BMI, body mass index; CI, confidence interval; CVD, cardiovascular disease; OR, odds ratio.

Compared with women, men showed a more favorable attitude toward their health in this study but had more unfavorable risk factor profiles. This finding is consistent with results of a study by Park *et al.* (2008) showing that South Korean men tend to perceive their health more optimistically than women. This may be, in part, because men use different sources of information when appraising their health. Men tend to assess their overall health based on whether or not they have been critically ill while women assess their health based on both serious and minor health issues (Benyamini, Leventhal, & Leventhal, 2000). Sex-based differences in perceived health found in this study suggest that distinctive methods of measuring general health such as using sex-specific expressions in questionnaires are warranted. Additionally, future studies should be conducted to determine whether such sex-associated differences in perceived health status in this population affect behavior as well as cardiovascular health outcomes.

Cardiovascular risk factors such as hypertension, diabetes, dyslipidemia, and obesity are related to each other. When clustered, these factors produce a multiplicative effect on the development of CVD. In order to effectively reduce the public burden of CVD, comprehensive risk assessment and multifaceted interventions focusing on several risk factors simultaneously are required. Assessing the prevalence of risk factor clustering and actual risk for future CVD development using tools like the FRS that account for several risk factors simultaneously is crucial for accurately identifying individuals at high CVD risk. In this study, clustering of risk factors and actual CVD risk were positively and significantly related to perceived health status. However, there were substantial discrepancies between perceived health and actual risk for CVD. Among those who reported their health as good, approximately 50% of men and 30% of women had three or more cardiovascular risk factors (Fig. 1). Based on CVD prevention guidelines (Adult Treatment Panel III [ATP III], 2001; Mosca *et al.*, 2007), individuals with a 10 year risk of 20% or higher are considered to be at high CVD risk and candidates for aggressive risk reduction efforts. Even among individuals at high risk for CVD in this study, 78.0% of men and 54.3% of women thought their health was good (data not shown). A favorable perception of health may negatively affect a person's decision to adopt and maintain risk reduction behaviors. Given that perceived poor general health is associated with CVD risk perception (Choi, Rankin, Stewart, & Oka, 2008; Frijling *et al.*, 2004), cardiovascular events, or death from CVD (Benjamins *et al.*, 2004; Møller *et al.*, 1996; Pedersen

et al., 2007), differences between perceived general health and actual CVD risk should be eliminated to optimize cardiovascular health. South Koreans may lack knowledge about the effects of cardiovascular risk factors and thus may not accurately perceive their health status.

To identify potential predictors of perceived poor health, a multiple logistic regression with sociodemographic and cardiovascular risk factors was performed. Consistent with previous studies (Badawi, Garipey, Pagé, & Schmitz, 2012; Salomon, Nordhagen, Oza, & Murray, 2009), advanced age and a low poverty level significantly increased the chance of an individual perceiving his or her health to be poor. Taking medications to control high blood pressure and high blood glucose significantly and independently increased the chance of perceiving oneself as having poor general health. These variables affected more men than women when controlling for other factors in the model. Use of glucose-lowering medications had the greatest effect on the participants' perception of their health. This factor increased the probability of an individual rating their health as poor 3.1 times among men and 2.4 times for women. Previous studies showed that perceived poor health is significantly related to CVD risk perception among patients with diabetes (Choi *et al.*, 2008; Frijling *et al.*, 2004). Future investigations comparing CVD-specific perceived risk and actual risk for CVD among people with diabetes is warranted given that development of CVD is frequently observed in these individuals (ATP III, 2001; Mosca *et al.*, 2007).

Dyslipidemia is an independent risk factor for CVD but it did not affect how South Koreans perceived their health in the present study. This may be because South Koreans lack knowledge about blood lipids and their role in the development of CVD. In a recent study, approximately one in two middle-aged South Korean women failed to recognize high cholesterol as a risk factor for CVD and more than 95% were unaware of healthy lipid levels (Choi *et al.*, 2010). An individual's level of perceived risk is significantly and positively related to obtaining relevant information from healthcare providers (Mosca *et al.*, 2006). Given that dyslipidemia is the most underdiagnosed and undertreated cardiovascular risk factor in South Korea (Boo & Froelicher, 2012), lack of awareness or non-adherence to treatment guidelines by healthcare providers can be a possible reason for participants' lack of awareness of dyslipidemia. The prevalence of dyslipidemia is currently on the rise in South Korea (Lee *et al.*, 2012). Healthcare providers should actively

provide information about the relationship between dyslipidemia and CVD, and motivate people with sub-optimal lipid levels to appropriately control this disorder. Future study about knowledge and attitude of healthcare providers in the management of dyslipidemia is needed.

Unhealthy lifestyle behaviors, if persisting for a long period, can lead to a higher lifetime CVD risk (Mosca *et al.*, 2007). CVD prevention guidelines underscore the importance of a healthy lifestyle including smoking cessation and maintaining a normal weight (Mosca *et al.*, 2007). Lifestyle modification is a core feature of intervention programs and an integral part of long-term CVD risk reduction. Unhealthy lifestyle behaviors such as smoking are also related to perceived poor general health (Frijling *et al.*, 2004). Despite the high prevalence of smoking and obesity among South Koreans (Table 1), neither factor appeared to affect self-perceived health status. Among men, obesity even lowered the probability of an individual perceiving their health as poor by 30% (OR = 0.7, 95% CI = 0.5–0.9; Table 4). In a recent investigation, approximately one out of two South Korean adults underestimated their weight (Boo, 2014). Appropriate interventions such as providing information about appropriate weight range for each height could enhance accurate weight perception and promote efforts to lose weight.

Approximately 17% of the study population reported a family history of CVD but this did not affect self-perceived health status. A family history of CVD is not modifiable but apparently increases the risk of CVD (Bachmann, Willis, Ayers, Khera, & Berry, 2012). Individuals with a familial history of CVD should be counseled with an emphasis on therapeutic lifestyle changes and increased frequency of risk factor screening to accurately assess their risk for CVD in a timely fashion.

The current investigation had some limitations that should be considered. First, perceived health status is subjective and the response categories for perceived health questions vary by studies. Thus, caution is required when making cross-study comparisons. Nevertheless, self-perceived general health is a reliable and valid measure of a population's health, reflecting both physical and mental functions. Thus, it is recommended for use in health monitoring by several organizations (De Bruin, Picavet, & Nossikov, 1996; Kramers, 2003). Second, other cardiovascular risk factors such as depression or comorbid conditions (i.e. cancer and chronic renal failure) could also influence perceived health but were not controlled in this investigation. However, this study was conducted using data collected nationwide.

We found that perceived general health and actual CVD risk are positively related but substantial differences between these two factors exist. Findings from our study emphasize the need to increase risk perception to a level commensurate with actual risk.

CONCLUSION

During the last decade, important national efforts have been made in South Korea to improve public awareness of cardiovascular risk factors. However, CVD-associated death has increased. This may be because South Koreans do not fully understand their own health risks. Accurate perception of personal risk is possible when an individual receives relevant information from healthcare providers or data about their personal risk status (Weinstein & Klein, 1995). At this point, continuing national efforts including the “Health Plan 2020” are being implemented. Additionally, healthcare providers should try to provide people at increased CVD risk with more information, especially individuals who have elevated cholesterol levels, increased bodyweight, or smoke but maintain favorable perceptions of their health. Providing South Koreans with their FRS score as a part of an intervention program may result in a more accurate perception and increased awareness of risk, and motivate individuals to reduce their risk of CVD. Future studies are needed to evaluate discrepancies between the levels of self-rated health among South Koreans associated with sex and age. Data for assessing the knowledge and attitude of healthcare providers involved in the management of cardiovascular risk factors are also needed.

ACKNOWLEDGMENT

The authors wish to thank the Korea Centers for Disease Control and Prevention in providing the data used for this study.

DECLARATION

No conflict of interest has been declared by the authors.

AUTHOR CONTRIBUTIONS

Study design, data analysis, interpretation of data, and manuscript writing were performed by Y. K. and S. B.

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