Short Communication

Cardiovascular risk prevalence, awareness, treatment, and control from 1998 to 2007 in Koreans

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This study estimated prevalence, awareness, treatment, and control rates of cardiovascular risk (CV) defined as hypercholesterolemia, hypertension, and diabetes from 1998 to 2007 among Koreans. Data using self-report or screening examination were obtained from the Korean National Health and Nutrition Examination Survey (KNHANES) conducted in 1998, 2001, 2005, and 2007, for the 30-79 year age range. The age-adjusted prevalence of hypercholesterolemia slightly increased across the surveys, while those values of hypertension and diabetes revealed decreasing trends. Awareness and control rates among participants with diabetes and hypertension improved over the period of surveys in both genders, but treatment rate varied among risk factors (24-39% for those with prior diagnosis of hypercholesterolemia, 59-90% for hypertension, and 52-99% for diabetes). In the survey of 2007, participants who achieved target levels made up 67-90% of those who received hypercholesterolemia treatment, 55-73% of those who received hypertension treatment, and 62-74% of those who received diabetes treatment. Although awareness and control rate of CV risk factors improved across survey periods, strategies for reducing disparity from the assessment and control between CV risk factors will be required.

Key Words: cardiovascular disease, risk factor, hypercholesterolemia, diabetes, hypertension

INTRODUCTION

Death caused by cardiovascular disease (CVD) among Koreans has been ranked second in the past 10 years[1] and is comparable to cardiovascular mortality of Western countries.[2] As hypercholesterolemia, hypertension, and diabetes have been indicated as risk factors strongly related to CVD development,[3] the assessment of these conditions in the past 10 years is an initial step for planning preventive strategy toward future development of CVD. The present study assessed the prevalence, awareness, treatment, and control rates of hypercholesterolemia, hypertension, and diabetes among Korean populations.

MATERIALS AND METHODS

Data analyzed for this study were obtained from the Korean National Health and Nutrition Examination Survey (KNHANES), a community-based cross-sectional survey conducted in 1998, 2001, 2005, and 2007 by the Korean Ministry of Health and Welfare using a multi-stage probability sampling method.[4-7] For the respective surveys, 6356, 5380, 4701, and 2831 subjects, aged 30-79 years, completed both the examination and interview survey. Medical history (including treatment for each disease) of hypercholesterolemia, hypertension, and diabetes were assessed using a standardized questionnaire. Overnight fasting blood samples were drawn by vein puncture to measure fasting plasma glucose (FPG) and serum total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) and triglyceride levels. Blood pressure (BP) was measured at least two times. Hypercholesterolemia, hypertension, and diabetes were defined as CV risk factors. Hypercholesterolemia which was restrictively surveyed in 2005 and 2007, was defined as a self-reported prior diagnosis or a fasting TC of ≥240 mg/dL.[8] Hypertension was classified as a prior diagnosis or an averaged BP of ≥ 140/90 mmHg upon examination.[9] Diabetes mellitus was defined as prior diagnosis or a FPG of ≥126 mg/dL.[10] Target values of control for each risk factor were as follows: for hypercholesterolemia, LDL-C target values of ≤ 160, 130, or 100 mg/dL for low, moderate, and high coronary heart disease (CHD) risk, respectively[8]; systolic BP of <140 mmHg and diastolic BP of <90 mmHg for hypertension[9]; and FPG of ≤130 mg/dL for diabetes.[11] Coronary heart disease risk was assessed using the National Cholesterol Education Program-Adult Treatment Panel III guidelines and risk of CHD was estimated using the Framingham risk score (FRS), determined by calculating the number of Framingham points assigned to each risk factor.[8] The high-risk category includes those with CHD or CHD risk equivalents. In the current study, the CHD risk equivalents were defined as >20% risk of CHD within 10 years using the FRS, a self-reported history of stroke, or diabetes

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mellitus (includes a fasting plasma glucose of ≥126 mg/dL). The moderate-risk category consisted of those with two or more major risk factors of CHD in whom CHD or CHD risk equivalents were absent (i.e. FRS ≤20% within 10 years). In the current study, cigarette smoking, hypertension (BP ≥140/90 mmHg or on antihypertensive medication), low HDL (<40 mg/dL), and age (men ≥45 years; women ≥55 years) were considered as positive risk factors; while HDL ≥60 mg/dL was considered as a negative risk factor. The low-risk category consisted of those with one or no major risk factors in whom CHD or CHD risk equivalents were absent.[8]

Direct standardization was applied to adjust the observed rates based on the age distribution obtained in the 2005 Korea Residential Population Census. The study protocol conforms with the ethical guidelines of the 1975 Declaration of Helsinki, as reflected in *a priori* approval by the Inje University Busan Paik Hospital institutional review board, Korea.

RESULTS

The age-adjusted prevalence of hypertension and diabetes showed decreasing trends over 10 years and age-adjusted awareness rates improved over the survey period. Of those with hypertension, awareness of hypertension increased from 19-30% in the 1998 survey to 50-73% in 2007. Likewise, awareness of diabetes among those with diabetes steadily rose from 29-34% in 1998 to 59-66% in 2007. Additionally, age-adjusted control rates of hypertension and diabetes reveal increasing trends over the 10-year survey period. Among participants receiving treatment of hypertension, those who attained the target value BP were 24-32% in 1998 and 55-73% in 2007. In the case of diabetes, 29-40% in 1998 and 62-74% in 2007 achieved optimal levels of glucose control. For hypercholesterolemia, age-adjusted prevalence, awareness and control rates over the 2-year survey period did not changed much, whereas the prevalence of high- and moderate-risk groups of CHD exhibited an increasing trend (Table 1). With regard to treatment rates, there were big differences among CV risk factors: 71-82% for hypertension, 66-80% for diabetes, 36-39% for hypercholesterolemia in the 2007 survey.

DISCUSSION

This national-level data from the KNHANES reveal that Koreans' awareness and control of CV risk factors are moving towards the positive direction over the past 10 years. Although awareness of having hypercholesterolemia was relatively low among participants who had hypercholesterolemia, the awareness rate for diabetes reached 75%. Additionally, the proportion of those with

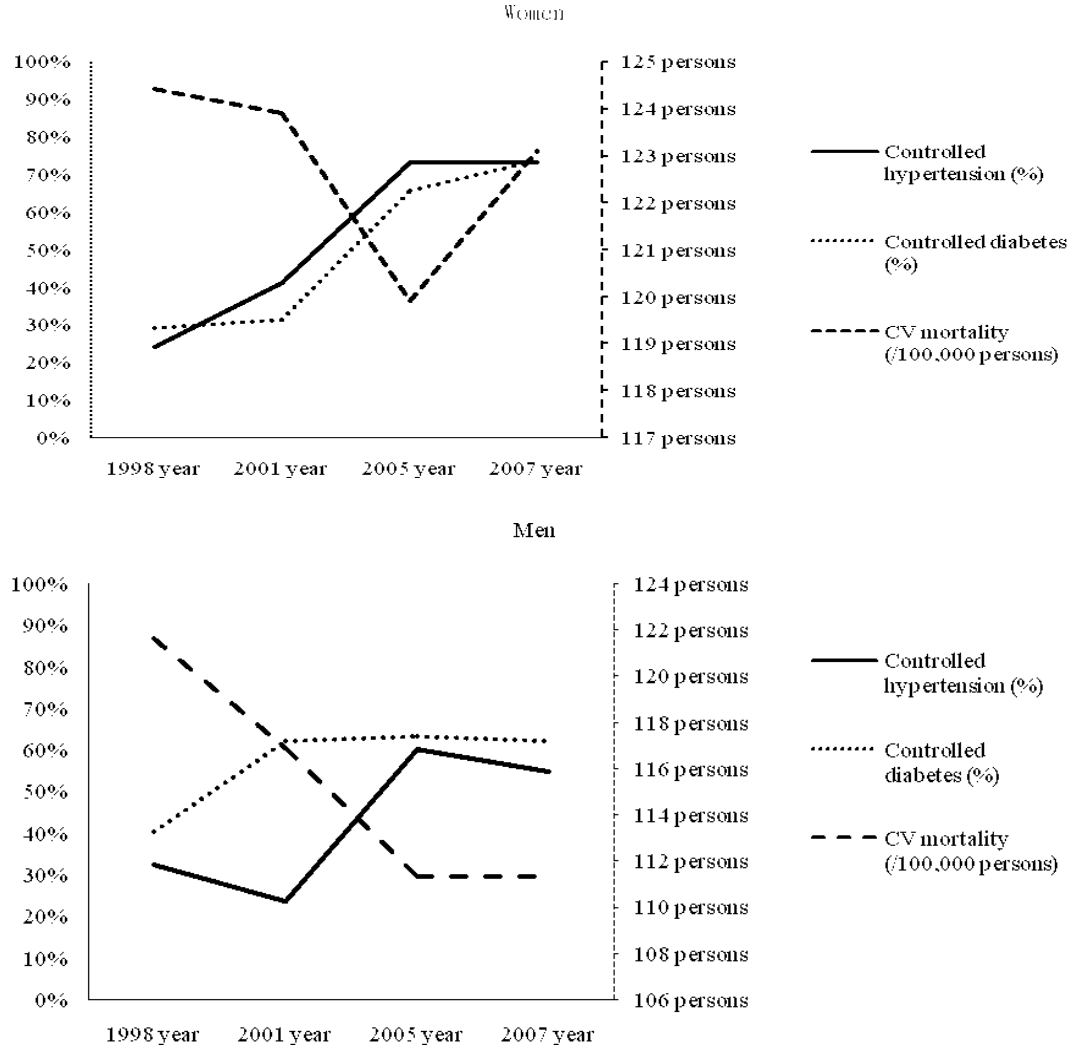

Figure 1. Trends of cardiovascular (CV) mortality and controlled rates of CV risk factors from 1998 to 2007 among Koreans

Table 1. Age-adjusted prevalence, awareness, treatment, and control rates of cardiovascular risk factors from 1998 to 2007 among Koreans

	KNHANES§ I		KNHANES§ II		KNHANES§ III		KNHANES§ IV-1	
	Men	Women	Men	Women	Men	Women	Men	Women
Prevalence (prior & newly diagnosis) (%, 95% C.I.)								
Hypercholesterolemia	-	-	-	-	10.9 (10.9-10.9)	10.1 (10.1-10.1)	12.7 (12.7-12.7)	12.9 (12.9-12.9)
Hypertension	33.7 (33.7-33.7)	27.4 (27.4-27.4)	33.5 (33.5-33.5)	24.7 (24.7-24.7)	32.2 (32.2-32.2)	24.6 (24.6-24.6)	28.1 (28.1-28.1)	21.7 (21.7-21.7)
Diabetes	13.4 (13.4-13.4)	10.2 (10.2-10.2)	9.2 (9.2-9.2)	8.1 (8.1-8.1)	11.1 (11.1-11.1)	7.4 (7.4-7.4)	11.4 (11.3-11.4)	8.0 (8.0-8.0)
CHD† risk category								
High	6.3 (6.3-6.3)	1.2 (1.2-1.2)	21.8 (21.8-21.8)	0.5 (0.5-0.5)	11.5 (11.5-11.5)	1.5 (1.5-1.5)	16.0 (16.0-16.1)	1.9 (1.9-1.9)
Moderate	48.9 (48.9-48.9)	26.3 (26.3-26.4)	46.0 (46.0-46.1)	24.9 (24.9-24.9)	52.2 (52.2-52.3)	24.7 (24.7-24.8)	64.4 (64.4-64.4)	35.4 (35.4-35.4)
Prior diagnosis among those with each CV‡ risk factor (%, 95% C.I.)								
Hypercholesterolemia					46.7 (46.7-46.7)	37.4 (37.4-37.5)	55.0 (55.0-55.0)	35.6 (35.6-35.6)
Hypertension	19.2 (19.2-19.2)	30.3 (30.2-30.3)	24.6 (24.6-24.6)	34.9 (34.9-35.0)	46.5 (46.5-46.5)	57.2 (57.2-57.2)	50.3 (50.2-50.3)	72.6 (72.6-72.6)
Diabetes	29.2 (29.2-29.2)	34.1 (34.1-34.2)	32.8 (32.8-32.9)	30.5 (30.5-30.5)	59.2 (59.2-59.2)	58.4 (58.3-58.4)	65.8 (65.8-65.8)	58.9 (58.9-58.9)
Received treatment among those with prior diagnosis (%, 95% C.I.)								
Hypercholesterolemia					29.8 (29.7-29.8)	23.6 (23.6-23.6)	36.1 (36.1-36.1)	38.5 (38.5-38.5)
Hypertension	83.2 (83.2-83.2)	89.7 (89.7-89.7)	79.5 (79.5-79.5)	82.9 (82.9-82.9)	61.2 (61.2-61.3)	58.9 (58.9-58.9)	70.7 (70.7-70.7)	81.7 (81.6-81.7)
Diabetes	91.0 (90.9-91.0)	98.9 (98.9-98.9)	88.1 (88.1-88.1)	83.1 (83.1-83.1)	54.1 (54.1-54.1)	51.7 (51.7-51.7)	79.7 (79.7-79.7)	65.5 (65.5-65.6)
Controlled risk factor among those who received treatment (%, 95% C.I.)								
Hypercholesterolemia					74.9 (74.9-74.9)	60.5 (60.5-60.5)	67.1 (67.1-67.2)	89.9 (89.9-89.9)
Hypertension	32.3 (23.3-32.3)	24.1 (24.0-24.1)	23.6 (23.5-23.6)	41.2 (41.2-41.2)	60.2 (60.2-60.2)	73.0 (73.0-73.1)	54.8 (54.8-54.8)	73.2 (73.2-73.2)
Diabetes	40.3 (40.3-40.4)	29.2 (29.2-29.2)	62.2 (62.2-62.3)	31.3 (31.3-31.3)	63.4 (63.3-63.4)	62.6 (62.5-62.6)	62.2 (62.2-62.2)	73.7 (73.7-73.7)

†CHD, coronary heart disease;
‡CV, cardiovascular;
§KNHANES I, II, III, IV-1, Korean National Health and Nutrition Examination Survey conducted in 1998, 2001, 2005, and 2007.
Hypercholesterolemia was defined on the basis of self-reported prior diagnosis or a fasting total cholesterol of ≥240 mg/dL; hypertension was defined as prior diagnosis or an averaged BP of ≥140/90 mmHg; diabetes was defined as prior diagnosis or a fasting glucose of ≥126 mg/dL; High CHD risk category was defined as Framingham risk scores (FRS) >20% and ≥2 risk factors (smoking, HDL-C <40 mg/dL, hypertension/ BP ≥ 140/90 mmHg, and age (men ≥45 y; women ≥55 y) for positive CVD risk factors; HDL-C ≥60 mg/dL for negative risk factor) and moderate CHD risk category was defined as FRS ≤20% and ≥2 risk factors; Target value for control are as follows: for hypercholesterolemia, coronary heart disease (CHD) risk determined LDL-C target values, i.e. ≤160, 130, and 100 mg/dL for low, moderate, and high risk, respectively; systolic and diastolic blood pressure of <140 mmHg and <90 mmHg for hypertension; fasting plasma glucose of ≤130 mg/dL for diabetes.

risk factors under control among participants who reported receiving treatment was higher than 60%. The awareness and control rates of each risk factor in 2007 are comparable to or even higher than those of the United States.[12] The observed discrepancy in levels of awareness, treatment and control between CV risk factors may reflect differences in screening, use of risk assessment tools, and concern about the significance and management of each CV risk factor among physicians and patients. As the accuracy of information on the awareness and treatment of risk factors was assessed using questions that have not been validated, recall bias and differences in understanding of questions about treatment between participants may result in conservative estimates for treatment rate. Additionally, as screenings for CV risk factors were not repeatedly conducted, the detected rates of risk factors may be overestimated. Therefore, the estimated awareness rate and rate of receiving treatment may be underestimated.

Despite these possible limitations, the awareness, treatment, and control of CV risk factors observed in Korean participants demonstrate an improving trend over the past 10 years. Probably the increased control rates of CV risk factors may explain a decreasing trend of CV mortality in Koreans[13] over the same periods (Figure 1). However, disparity in these estimates between CV risk factors still persists and those with high CHD risk are increasing. Therefore, strategies for reducing the disparity between CV risk factor assessment and control of CV will be required.

AUTHOR DISCLOSURES

There are no financial or other relationships that might lead to a conflict of interest.

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1998 年至 2007 年韓國的心血管疾病風險之盛行率、自覺、治療及控制

本研究評估 1998 至 2007 年韓國國民心血管疾病風險的盛行率、自覺、治療及控制率，而心血管疾病風險者的定義為有高膽固醇血症、高血壓及糖尿病患者。資料來源為 1998 年、2001 年、2005 年及 2007 年韓國國民健康及營養調查(KNHANES)，30 至 79 歲國民的自述或篩檢資料。調查結果顯示，年齡調整後的高膽固醇血症盛行率有些微的上升，而高血壓及糖尿病則有下降的趨勢。對於糖尿病及高血壓盛行率的自覺與控制率，不論是男性或女性，在這幾年調查期間皆有改善的情形。但是治療率則依危險因子而有不同(診斷為高膽固醇血症者是 24-39%，高血壓者是 59-90%，糖尿病者是 52-99%)。在 2007 年的調查中，達到治療標準者的比率分別為：接受高血壓膽固醇血症治療者為 67-69%，接受高血壓治療者 55-73%，而接受糖尿病治療者 62-74%。雖然對於心血管疾病危險因子的自覺及控制率隨著調查期間有改善，但是需要策略以減少心血管疾病危險因子的評估與控制不一致的情形。

關鍵字：心血管疾病、危險因子、高膽固醇血症、糖尿病、高血壓