

Original Article  
Epidemiology, Occupation  
& Environmental Medicine



# Recent Trend and Associated Factors of Harmful Alcohol Use Based on Age and Gender in Korea

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OPEN ACCESS

Received: Jun 26, 2017

Accepted: Oct 28, 2017

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Disclosure

The authors have no potential conflicts of interest to disclose.

Author Contributions

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## ABSTRACT

**Background:** Previous studies suggest that the impact of social factors on harmful alcohol use between men and women may be different. We aimed to explore the gender-based difference in temporal trend and social risk factors associated with harmful alcohol use.

**Methods:** The Korea National Health and Nutrition Examination Survey (2007–2014) was used to explore the recent trend of harmful alcohol use in the general population. Among all current alcohol drinkers aged 20–64 years, the frequencies of harmful alcohol use in each age group, year of birth, marriage, income, education, and occupation were analyzed based on gender.

**Results:** A total of 34,478 people (14,544 men and 19,834 women) who reported drinking alcohol in the last month at the time of interview were included in the analysis. The proportion of harmful alcohol use in men decreased ( $P$  for trend = 0.002) during the study period, whereas significant change was not observed in women ( $P$  for trend = 0.173). The prevalence of harmful alcohol use was highest in men aged 35–49 years and women aged 20–34 years. For both men and women, lower level of education and service occupation were the common risk factors of harmful alcohol use. Additionally, low income was a risk factor of harmful alcohol use in women but not in men. Marriage increased the risk of harmful alcohol use in women but decreased in men.

**Conclusion:** Public health interventions in reducing harmful alcohol use should consider the different high-risk groups between men and women.

**Keywords:** Harmful Alcohol Use; Gender; Birth Cohort; Korea

## INTRODUCTION

Harmful alcohol use is generally defined as an excessive use of alcohol, which eventually leads to health problems and often includes adverse social consequences.<sup>1,2</sup> The prevalence is higher in men than in women.<sup>3,4</sup> Previous studies suggested that women more likely have protective factors against alcohol drinking, such as social sanctions, than men do.<sup>5</sup> In addition, men are more affected by aggressiveness, distress-relieving drinking, behavioral under-control, and anti-sociality, which are linked with excessive alcohol drinking, compared to women.<sup>6</sup>

Although alcohol-related health problems are more common in men, effects of excessive alcohol consumption are more profound in women.<sup>7</sup> Biologically, the same level of alcohol

intake can cause more damage to women than men and lead to more pronounced health outcomes, such as malignancy and gastrointestinal or cardiovascular diseases.<sup>8,9</sup> Alcohol use during pregnancy poses potential risks to the fetus, such as fetal alcohol syndrome and/or low birth weight, resulting to intergenerational impact.<sup>10</sup> In addition, women who use alcohol are more likely victims of violence and accident.<sup>11</sup> Despite the specific concerns regarding the harmful effects of alcohol use in women, its prevalence has increased in a number of societies with changes in the gender role and social environment, leading to a gender convergence in alcohol use behaviors.<sup>12-14</sup>

The risk factors of harmful alcohol use may differ depending on the specific population and groups of countries.<sup>15</sup> Previous studies suggest that there may be a gender-based difference in social factors associated with harmful alcohol use.<sup>16</sup> Several researchers showed that older and highly educated women were most likely the heavy drinkers, while less-educated and younger men were more at risk.<sup>15,17</sup> However, conflicting reports indicating that harmful alcohol use is more prevalent in young, unmarried, less-educated, low-income, and employed women are present.<sup>17,18</sup> In a gender comparative study, the impact of economic deprivation was significant in men, but not in women.<sup>19</sup>

Globally, the gender gap in harmful alcohol use is being narrowed by decreasing men's drinking and/or an increase in women's.<sup>13</sup> As Koreans are the biggest consumers of alcohol in the Asia-Pacific region, the trend and risk of harmful alcohol use can be more profoundly identified in Korea.<sup>20</sup> In accordance with the rapid economic expansion in the past several decades, Korea has experienced rapid social transition, such as increased female economic participation and enlarging socioeconomic and gender inequality.<sup>21</sup> The female-to-male ratio of labor force participation has consistently increased from 0.65 in 2000 to 0.69 in 2014.<sup>22</sup> However, men earned more than women by 33.6%–46.9% with comparable skills, suggesting a gender discrimination in wages.<sup>23</sup> These changes can lead to increased heavy drinking habits in Korean women.<sup>24</sup> To address the high rate of harmful alcohol use in Korea, recent trends and associated factors of harmful alcohol use in the high-risk population should be identified. Although a few studies have been conducted to explore the gender-specific risk factors for harmful alcohol use in Korea, most of them did not include the potential effect of period and birth cohort.<sup>25</sup> Considering the rapid change in recent decade such as national economic recession and generational difference in employment, these factors should be included in the analysis. In this study, therefore, population-based data was used to explore the period, birth cohort effect and socioeconomic risk factors associated with harmful alcohol use.

## METHODS

To explore the temporal trend and risk factors of harmful alcohol use, 8 periods of the Korea National Health and Nutrition Examination Survey (KNHANES) from 2007 to 2014, measuring the alcohol use behaviors using the same questionnaires, were used in this study. The KNHANES is a nationwide survey on Korean residents and is approved by the ethical committee of the Korea Centers for Disease Control and Prevention. Each wave provides a nationwide representative data of the Korean population. For stratification, the “rolling survey sampling” was used to identify the samples of the survey population, which has been previously described elsewhere.<sup>26</sup> During the KNHANES surveys, trained interviewers assessed the participants' socio-demographic characteristics. Since alcohol consumption is only allowed in individuals aged > 19 years by law, only participants aged 20–64 years were

included in the analysis. To identify especially the risk factors for harmful use, only current alcohol users were analyzed.

### Study variables

The outcome variable was harmful alcohol use. Self-reporting questionnaires were administered to obtain information on alcohol use. Persons who drunk any kind of alcoholic beverages in the past 12 months were defined as current alcohol users.<sup>27</sup> Harmful alcohol use was defined as consumption of > 60 g pure alcohol per drinking day for men and > 40 g for women.<sup>28</sup> When conversion into units of drink is made, the alcohol consumption corresponds to were  $\geq 7$  cups of soju per occasion for men and  $\geq 5$  cups of soju for women twice or more per week, as the alcohol content (percentage of alcohol by volume) is considered.<sup>3,29</sup> Potential covariates, such as level of education (elementary, middle, high school, and college or higher), absolute and relative (standardized monthly household income according to the number of family members, 4 quartile groups: lowest, lower middle, higher middle, and highest) mean monthly household income, and type of occupation (International Standard Classification of Occupations [ISCO]-08), were included as ordinal variables.

### Statistical analysis

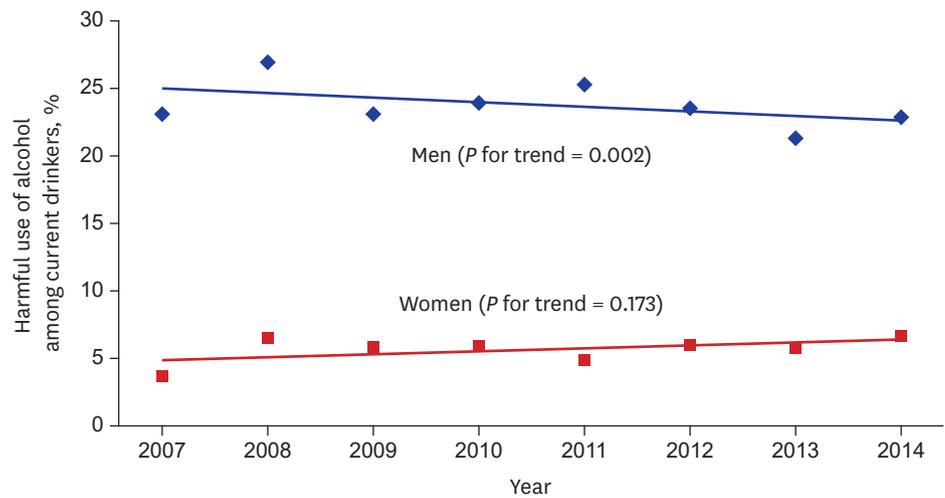
Weighted values were used in calculating the prevalence of harmful alcohol use. Mantel-Haenszel  $\chi^2$  statistic was used for exploring annual trends of harmful alcohol use among current alcohol user. The prevalence of harmful alcohol use was also explored in each socioeconomic gradient. The  $\chi^2$  test was used to compare the proportion of the study populations for each covariates. Considering the complicated combination of diverse socioeconomic characteristics in women, the trend should be analyzed by controlling the effects of age, cohort, and period. To control the effects of birth cohort and period, a hierarchical linear model with a cross-classified structure proposed by Yang and Land<sup>30</sup> was used. This structure nested individuals in both periods and cohorts which are not exclusive of each other. As the data are cross-sectional, an individual is only observed once for each age and period. The cohort and period were thus treated as high-level random effects, in which individuals reside, in generalized linear mixed model.<sup>30</sup>

### Ethics statement

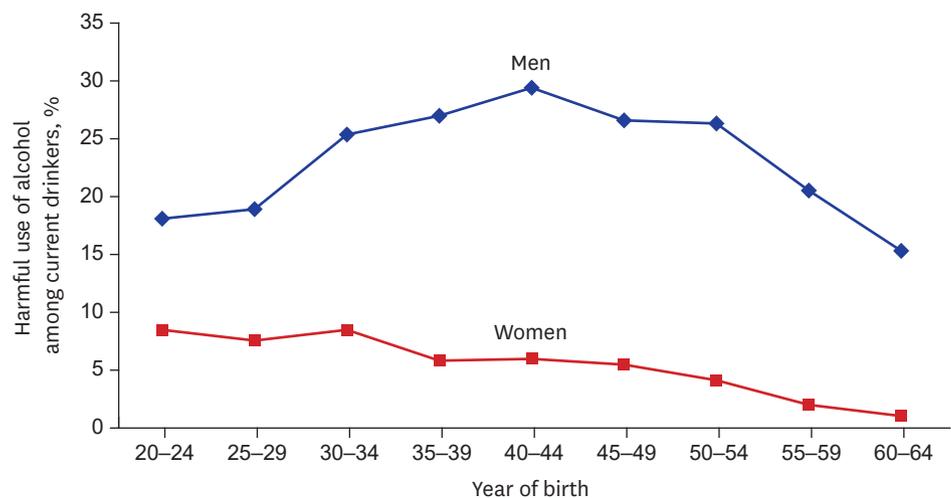
The KNHANES was approved by the Korea Centers for Disease Control and Prevention's Institutional Review Board (IRB No. 2014-12EXP-03-5C), and all participants provided written informed consent. This study adhered to the tenets of the Declaration of Helsinki.

## RESULTS

From 2007 to 2014, a total of 37,754 participants (total weighted value = 251,360,282 for 8 years) who aged 20–64 years were identified. Among them, 34,378 people (96.4%) reported drinking alcohol in the last month at the time of the interview were included in the analysis. The prevalence of current alcohol use was 95.9% for men and 96.9% for women ( $P$  for difference < 0.001). The harmful alcohol use criteria were met in 23.7% of men and 5.8% of women among participants with current alcohol use. As presented in **Fig. 1**, the proportion of harmful alcohol use in men decreased from 23.3% to 22.9% during the study period ( $P$  for trend = 0.002). In women, the prevalence was 3.7% in 2007 and 6.8% in 2014 ( $P$  for trend = 0.173). In the pooled data, the proportion of harmful alcohol use was highest in men aged 35–49 years and in women aged 20–34 years (**Fig. 2**).



**Fig. 1.** Trend of annual prevalence of harmful alcohol use in men and women, the KNHANES (2007–2014). Prevalence was calculated using weighted frequencies. The Mantel-Haenszel  $\chi^2$  statistic was used for trend test. KNHANES = Korea National Health and Nutrition Examination Survey.



**Fig. 2.** Percentages of harmful alcohol use among current alcohol drinkers in men and women by age groups, the KNHANES (2007–2014). Prevalence was calculated using weighted frequencies. KNHANES = Korea National Health and Nutrition Examination Survey.

The median estimates for age was 39.9 years in men and 40.6 years in women. For both gender, majority were current drinkers. **Table 1** shows the general demographic and socioeconomic factors of study population. More than half of the population had higher middle household income and educational level of high school graduation or higher for both men and women. While 17.8% of men reported they have no occupation, almost half of women (46.6%) reported no occupation. Overall prevalence of harmful alcohol use was 23.8% and 5.7% in men and women, respectively. During the study period, median age increased (from 39.0 to 41.5 in men and from 39.4 to 42.1 in women) and the percentage of married people decreased linearly (from 74.4% to 70.6% in men and from 84.8% to 80.9% in women). The relative proportion of each household income quartile did not change significantly for both men and women. Percentage of college or higher education increased in men (from 37.2% to 43.5%) and women (from 28.4% to 39.9%) (data not shown).

**Table 1.** Demographic and social characteristics of current alcohol user stratified by gender, the KNHANES (2007–2014)

Level	Men (n = 14,544)	Women (n = 22,074)	P for difference <sup>a</sup>
Weighted No.	143,927,455	140,068,258	
Age at the time of survey, yr	40.1	40.6	0.023
Married	12,019 (72.1)	17,402 (81.4)	< 0.001
Household income (10,000 KRW)	299.8	299.8	
Household income (quartile)			< 0.001
Lowest	1,452 (9.6)	2,269 (10.7)	
Lower middle	3,662 (25.3)	5,311 (27.3)	
Higher middle	4,767 (32.1)	6,151 (31.0)	
Highest	5,044 (32.9)	6,370 (31.0)	
Education <sup>b</sup>			< 0.001
Elementary school	1,386 (7.7)	3,362 (14.1)	
Middle school	1,510 (9.1)	2,205 (10.6)	
High school	5,786 (43.9)	7,727 (41.6)	
College graduation or higher	5,806 (39.3)	6,488 (33.7)	
Occupation <sup>c</sup>			< 0.001
Managers & professionals	2,812 (19.4)	2,461 (13.0)	
Clerical support workers	1,897 (12.6)	1,613 (8.7)	
Service and sales workers	1,992 (14.7)	3,169 (16.7)	
Skilled agricultural, forestry, and fishery workers	1,004 (5.0)	913 (3.1)	
Craft and machine operators and assemblers	3,341 (23.5)	615 (3.1)	
Elementary occupations	1,053 (7.1)	1,765 (8.7)	
No occupation (student, housewife)	2,287 (17.8)	9,214 (46.6)	

Values are presented as median or frequency (%).

KNHANES = Korea National Health and Nutrition Examination Survey, KRW = Korean Won.

<sup>a</sup>P values for difference between men and women; <sup>b</sup>Education data was not available in 641 men and 593 women; <sup>c</sup>Occupation data was not available in 743 men and 625 women. All percentages are calculated with weighted frequencies.

Proportion of harmful alcohol use by each level of demographic characteristics is summarized in **Table 2**. In men, rates of harmful alcohol use were not significantly different by household income level. However, women with lower household income showed generally higher rate of harmful alcohol use.

**Table 3** presents the adjusted odds ratios (ORs) from generalized linear mixed model. With controlling for random effects of cohort and period, lower level of education and service and sales workers were associated with high-risk of harmful alcohol use for both gender. The highest risk was observed in men aged 30–44 and in women aged 25–34 years. Marriage and relative household income revealed different relationships with harmful alcohol use for both gender. The relationship between marriage and harmful alcohol use is opposite for men (OR, 0.86; 95% confidence interval [CI], 0.74–0.99) and women (OR, 1.63; 95% CI, 1.29–2.07). The lowest household income quartile was observed to be a risk factor of harmful alcohol use only in women (OR, 1.45; 95% CI, 1.15–1.83). The estimated OR of harmful alcohol use in service and sales workers was almost twice as high in women (OR, 2.43; 95% CI, 1.89–3.12) as in men (OR, 1.32; 95% CI, 1.15–1.52). Interactions between income and education or between income and occupation were examined, revealing an insignificant result.

## DISCUSSION

The primary finding of this study is that the prevalence of harmful alcohol use decreased in men but not in women. The effect of age was highest in men aged 30–44 years and in women aged 25–34 years. Low educational level and service and sales occupation were common risk factors for both gender. Lowest household income and marriage increased the risk of harmful

**Table 2.** Proportion of harmful alcohol use by each level of demographic characteristics stratified by gender, the KNHANES (2007–2014)

Level	Men (n = 14,544)	P for difference <sup>a</sup>	Women (n = 22,074)	P for difference <sup>a</sup>
Weighted No.	143,927,455		140,068,258	
Age group		< 0.001		< 0.001
20–24	202 (18.0)		145 (9.2)	
25–29	264 (18.4)		140 (7.7)	
30–34	415 (25.2)		172 (8.1)	
35–39	589 (27.2)		182 (6.1)	
40–44	622 (29.8)		162 (6.0)	
45–49	493 (26.2)		139 (5.3)	
50–54	530 (26.0)		113 (4.3)	
55–59	396 (21.0)		60 (2.4)	
60–64	298 (16.1)		30 (1.2)	
Household income (quartiles)		0.232		< 0.001
Lowest	353 (23.4)		139 (6.8)	
Lower middle	902 (23.3)		318 (6.4)	
Higher middle	1,171 (23.1)		374 (6.1)	
Highest	1,340 (25.0)		299 (4.6)	
Education <sup>b</sup>		< 0.001		< 0.001
Elementary school	357 (24.6)		131 (4.3)	
Middle school	397 (26.7)		123 (6.1)	
High school	1,584 (24.5)		575 (7.3)	
College graduation or higher	1,402 (21.8)		297 (4.3)	
Occupation <sup>c</sup>		< 0.001		< 0.001
Managers & professionals	685 (22.2)		125 (4.8)	
Clerical support workers	538 (25.7)		107 (5.7)	
Service and sales workers	637 (30.0)		355 (10.6)	
Skilled agricultural, forestry, and fishery workers	253 (25.4)		14 (2.1)	
Craft and machine operators and assemblers	919 (25.5)		30 (4.8)	
Elementary occupations	258 (22.1)		93 (5.4)	
No occupation (student, housewife)	425 (16.2)		397 (4.6)	

Values are presented as median or frequency (%).

KNHANES = Korea National Health and Nutrition Examination Survey.

<sup>a</sup>P values were calculated for difference of harmful alcohol use rate among each level of variable; <sup>b</sup>Education data was not available in 641 men and 593 women;

<sup>c</sup>Occupation data was not available in 743 men and 625 women. All percentages are calculated with weighted frequencies.

alcohol use in women, whereas marriage was a protective factor in men. This study revealed the gender convergence of harmful alcohol use in Korea during 2007–2014 and it may be due to the temporal change of composition of risk groups in men and women.

It is noteworthy that women aged 20–34 years have the highest prevalence of harmful alcohol use. Policies aiming to reduce alcohol consumption have generally focused on young people aged < 18 years and binge drinkers who were mostly men. Significant birth cohort effects in women revealed increased harmful alcohol use in the recent generation. However, this cohort effect was insignificant in men. A recent study of the United States revealed that white women's heavy drinking habits are highest throughout their 20s, followed by a steep decline in their succeeding years.<sup>31</sup> However, in African-American women, drinking problems are more common in middle-aged than younger age groups.<sup>7</sup> The effect of age between men and women was not significantly different regardless of ethnicities in the US data.<sup>31</sup> Based on the common reasons-for-drinking in the literature, people drink alcohol to cope with stress or to have social influences.<sup>32</sup> Since heavy drinkers consider harmful alcohol use for coping reasons than social-effect motives,<sup>32</sup> middle-aged men and younger women usually resort to heavy drinking for personal-effect motives, leading to the high prevalence of harmful alcohol use in Korea. The highest risk of harmful alcohol use in service and sales occupation, which mostly comprised of younger women, may explain the source of stress in this age group.

**Table 3.** Adjusted ORs for harmful alcohol use for social risk factors in multivariable generalized linear mixed model, the KNHANES (2007–2014)

Level	Men	Women
<b>Age group</b>		
20–24	1.78 (1.34–2.36)	10.68 (6.32–18.04)
25–29	1.94 (1.51–2.51)	13.88 (8.42–22.89)
30–34	2.45 (1.96–3.05)	14.43 (8.98–23.21)
35–39	2.58 (2.10–3.17)	10.89 (6.80–17.42)
40–44	2.65 (2.17–3.25)	9.00 (5.63–14.39)
45–49	2.23 (1.83–2.73)	6.74 (4.26–10.67)
50–54	2.18 (1.80–2.65)	3.75 (2.38–5.92)
55–59	1.46 (1.20–1.77)	2.00 (1.22–3.26)
60–64	1.00	1.00
<b>Married</b>	<b>0.86 (0.74–0.99)</b>	<b>1.63 (1.29–2.07)</b>
<b>Household income (quartiles)</b>		
Lowest	1.02 (0.87–1.19)	1.45 (1.15–1.83)
Lower middle	0.91 (0.81–1.01)	1.09 (0.91–1.31)
Higher middle	0.89 (0.80–0.98)	1.10 (0.93–1.30)
Highest	1.00	1.00
<b>Education</b>		
Elementary school	1.77 (1.49–2.11)	4.10 (3.03–5.56)
Middle school	1.59 (1.35–1.87)	3.01 (2.28–3.98)
High school	1.35 (1.22–1.49)	1.99 (1.67–2.38)
College graduation or higher	1.00	1.00
<b>Occupation</b>		
Managers & professionals	1.00	1.00
Clerical support workers	1.10 (0.96–1.27)	1.13 (0.85–1.51)
Service and sales workers	1.32 (1.15–1.52)	2.43 (1.89–3.12)
Skilled agricultural, forestry, and fishery workers	0.99 (0.82–1.20)	0.45 (0.25–0.82)
Craft and machine operators and assemblers	0.97 (0.85–1.10)	0.93 (0.60–1.46)
Elementary occupations	0.90 (0.75–1.09)	1.27 (0.92–1.75)
No occupation (student, housewife)	0.79 (0.68–0.93)	0.91 (0.72–1.16)
<b>Covariance parameter estimates</b>		
Cohort	0.002	0.000
Year of survey	0.005	0.026

The 95% CIs are presented in parentheses. The ORs are adjusted for all the covariates shown in the table. Birth cohort and year of survey were included as random effects. OR = odds ratio, KNHANES = Korea National Health and Nutrition Examination Survey, CI = confidence interval.

The general pattern of vulnerability of the disadvantaged and unhealthy behaviors can be presented differently depending on the culture and country-specific context. The general patterns of harmful alcohol use in men, such as increasing risk with aging and low socioeconomic status, are similar in most countries. However, for women, these patterns are inconsistent in various countries. Studies have shown that women with high level of education and professional occupation are more at risk of heavy drinking and alcohol problems in high-income European countries, showing a significant gender convergence pattern.<sup>14,15</sup> This socioeconomic gradient in heavy alcohol use was not evident in several low- and middle-income countries.<sup>33</sup> Since women in developing countries or countries in transition do not drink at the same levels as those in developed countries, the inequalities of harmful alcohol use with regard to the socioeconomic gradient are not clear.<sup>34</sup> In addition, Asian women generally had a less tendency of harmful alcohol use due to the traditional gender norms, emphasizing that women's modesty may protect women against heavy drinking episodes.<sup>35</sup> However, the higher risk of harmful alcohol use in married women in this study contradicts the traditional gender norm in Korea. Following many societies where rapid change in their cultural and gender role occurred, Korean would have been influencing the changing patterns of harmful alcohol use in women.

High-risk of harmful alcohol use in women working in service and sales can ameliorate gender-based health disparities, if the employment disparities are the result of market

distortion and gender segregation.<sup>36,37</sup> Accessibility to alcohol, social pressure to drink, separation from normal social relationships, and autonomy at the workplace were suggested to directly contribute to the harmful alcohol use in paid-workers.<sup>37</sup> Although occupational risk factors were insignificant in women in the 1990s,<sup>38</sup> the association between sales and service occupation and harmful alcohol use was evident in our study.

As a cross-sectional study using pooled data, the causality between the risk factors and harmful alcohol use cannot be determined. Considering the previous qualitative and quantitative studies reporting higher risk of heavy or binge drinking in service and sales workers, a causal relationship can be postulated.<sup>39</sup> In addition, as most of previous studies, there is a limitation as a study using self-reported measures. Since women are more likely to underestimate for drink than men,<sup>40</sup> more refined measures for alcohol consumption would be necessary especially in women.

In conclusion, the gap between men and women in the prevalence of harmful alcohol use decreased and its risk factors are different between men and women. In the development of public health intervention for reducing harmful alcohol use, therefore, gender-specific targeting would be needed.

## ACKNOWLEDGMENTS

We appreciate the Korea Centers for Disease Control and Prevention for providing the Korea National Health and Nutrition Examination Survey data.

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