

Changes in cardiovascular-related health behaviors during the COVID-19 pandemic

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Background: The COVID-19 pandemic has been the most pressing health challenge in recent years. Meanwhile, prevention for other diseases, such as cardiovascular disease (CVD) has been less prioritized during the pandemic. COVID-19, a novel infectious disease, both had a direct impact on public health and provoked changes in health-related behaviors, including those for CVD prevention. This study sought to examine changes in CVD-related health behaviors during the COVID-19 pandemic and related sociodemographic factors.

Methods: We used data from the Cardiovascular Disease Prevention Awareness Survey conducted in Korea in June 2022. A total of 2,000 adults across Korea's 17 provinces completed a structured questionnaire online or on a mobile device. Self-reported changes in CVD-related health behaviors were investigated. We used unadjusted and adjusted logistic regression models to explore the associations between negative changes and sociodemographic factors.

Results: In smoking, drinking, and healthcare service use, the proportion of those with positive changes surpassed the proportion of respondents who reported negative changes. In contrast, negative changes predominated for diet, exercise, and stress. Most individuals (52.6%) reported a deterioration of psychological distress. These negative changes were significantly associated with age, sex, marital status, and the presence of cardiometabolic disease.

Conclusions: The COVID-19 pandemic has affected CVD-related health behaviors. Based on these changes, CVD prevention should be encouraged with appropriate and prioritized strategies.

Keywords: Cardiovascular diseases; COVID-19; Prevention and control; Public health; Korea

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INTRODUCTION

The COVID-19 pandemic has been the most significant issue in global public health in recent years [1]. The disease both had a direct impact on public health and provoked changes in health-related behaviors, such as lifestyle and healthcare service use [2]. In particular, long-term prevention for other diseases, such as cardiovascular disease (CVD), was less prioritized than this impending health emergency [3]. For instance, there were fewer hospitalizations for myocardial infarction, and cardiac catheterization decreased by 38% in the United States during the pandemic [4]. These changes were attributable to reductions in healthcare service use, resulting from stay-at-home mandates, public hesitation to visit hospitals, and the concentration of health-related resources on COVID-19 [5].

The reduction in CVD hospitalization and treatment did not necessarily indicate a decreased burden of CVD; rather, CVD has continued to be the disease with the largest burden worldwide [6]. In Korea, stroke and ischemic heart diseases were the leading cause of mortality even after 2020, when the pandemic began to sweep through the country [7]. Physical inactivity and excessive body weight, which increased the risk of CVD before COVID-19, remained unmodified during the pandemic [8]. In fact, the containment measures for COVID-19 were likely to hinder the modification of these determinants of CVD. In addition, a considerable body of research reported that patients with underlying CVD showed a higher likelihood of severe respiratory complications and mortality from COVID-19 [2,9]. A study in Louisiana, USA, illustrated the association between cardiometabolic disease and mortality from COVID-19 [2]. As the COVID-19 pandemic is prolonged, an emphasis on CVD prevention may reduce both the harm from this communicable disease and the burden of CVD in the future. Thus, this study sought to examine changes in health-related behaviors during the pandemic and related sociodemographic factors, as part of an investigation exploring public awareness of CVD and its prevention.

METHODS

Data source

This study employed data from the Cardiovascular Dis-

ease Prevention Awareness Survey. The survey was conducted by the Korean Society of Cardiovascular Disease Prevention (KSCP) in June 2022 to examine the level of public awareness of CVD. A stratified sampling design was used on the basis of age and sex. A total of 2,000 adults across Korea's 17 provinces completed a structured questionnaire online or on mobile devices.

Questionnaires and variables

The structured web-based questionnaire comprised five factors (31 items): sociodemographic characteristics, the presence of cardiometabolic disease, CVD concern and self-assessed CVD likelihood, awareness and practice of CVD prevention, and changes in health behaviors after COVID-19.

Changes in health behaviors after the COVID-19 outbreak were investigated through the following question: "The items below are lifestyle patterns known to be related to cardiovascular health. How has your lifestyle changed during the COVID-19 pandemic?" The CVD-related health behaviors were based on the guideline for CVD prevention published by the Korea Disease Control and Prevention Agency (KDCA) [10]. Six behaviors were investigated: (1) the frequency and amount of smoking; (2) the frequency and amount of drinking; (3) compliance with a healthy diet; (4) the frequency and amount of physical activity; (5) stress and mental health; and (6) healthcare service use and the management of symptoms or diseases [10]. Respondents rated their changes on a 5-point scale (very negative, somewhat negative, no change, somewhat positive, very positive). We merged the responses into three categories: negative change, no change, and positive change.

Respondents' sociodemographic data were also collected: age, sex, marital status (single, married, bereaved/separated/ divorced), monthly household income (less than KRW 3 million, KRW 3 to 6 million, more than KRW 6 million), and educational attainment (middle school or less, high school, college or more). We also asked whether respondents had been diagnosed with coronary heart disease, cerebrovascular disease, hypertension, diabetes, or dyslipidemia, which were referred to as cardiometabolic diseases.

Statistical analyses

Sociodemographic characteristics and behavior changes after COVID-19 are presented as frequency (%). Since public awareness and health-related behaviors are anticipated to be different between those with and without cardiometabolic disease, we stratified participants accordingly and analyzed the resulting two groups along with the total study population. For the association between negative behavioral changes and sociodemographic factors, we used univariate and multivariate logistic regression models. In the univariate model, age (10-year groups), sex, marital status, education, monthly household income, and the presence of cardiometabolic disease were independently regressed. In the multivariate model, all sociodemographic factors in this study were included for each behavioral change assessed by the corresponding six items. All analyses were carried out using SAS ver. 9.4 (SAS Institute Inc).

RESULTS

Behavioral changes after COVID-19

Table 1 shows sociodemographic features and changes in CVD-related behaviors during the COVID-19 pandemic. The proportion of those with positive changes surpassed that of participants with negative changes in smoking, drinking, and healthcare service use; in particular, 30.6% of respondents self-reported a decreased frequency and amount of smoking during the COVID-19 pandemic, whereas 7.5% described a negative change. In contrast, health behaviors related to diet, exercise, and stress were aggravated more frequently than they improved; for instance, 52.6% of participants reported higher stress and poorer stress management than before the pandemic, and only 11.4% said that their stress level had improved.

Fig. 1 depicts these changes according to the presence of cardiometabolic disease. Overall, the two groups showed similar patterns of predominant changes for each behavior. However, the magnitude of changes in smoking, drinking, diet, and healthcare service use showed statistically significant differences, and those with cardiometabolic disease showed a higher prevalence of positive changes than those without.

Table 1. General characteristics of the survey participants (n=2,000)

Characteristic	No. (%)
Sociodemographic feature	
Age (yr)	
50s or more	578 (28.9)
40s	542 (27.1)
30s	446 (22.3)
20s	434 (21.7)
Sex	
Female	975 (48.8)
Male	1,025 (51.2)
Marital status	
Married	1,097 (54.9)
Single	810 (40.5)
Bereaved, separated, or divorced	93 (4.7)
Education	
College, university, or more	1,594 (79.7)
High school	393 (19.7)
Middle school or less	13 (0.7)
Monthly household income (KRW)	
More than 6 million	424 (21.2)
3 to 6 million	868 (43.4)
Less than 3 million	708 (35.4)
Cardiometabolic disease	
None	1,264 (63.2)
Coronary heart disease	53 (2.7)
Cerebrovascular disease	36 (1.8)
Hypertension	389 (19.4)
Diabetes	135 (6.8)
Dyslipidemia	442 (22.1)
Behavioral change after COVID-19	
Smoking	
Negative change	149 (7.5)
No change	1,239 (62.0)
Positive change	612 (30.6)
Drinking	
Negative change	347 (17.4)
No change	892 (44.6)
Positive change	761 (38.1)
Diet	
Negative change	553 (27.7)
No change	984 (49.2)
Positive change	463 (23.2)
Exercise	
Negative change	731 (36.6)
No change	634 (31.7)
Positive change	635 (31.8)
Stress	
Negative change	1,052 (52.6)
No change	721 (36.1)
Positive change	227 (11.4)
Health care service use	
Negative change	396 (19.8)
No change	1,141 (57.1)
Positive change	463 (23.2)



Fig. 1. Changes in cardiovascular disease-related behaviors during the COVID-19 pandemic. (A) Overall. (B) Without cardiometabolic disease. (C) With cardiometabolic disease.

Associations between negative changes and sociodemographic factors

The unadjusted risks of negative changes after COVID-19 according to socioeconomic factors are presented in Fig. 2 and Table S1. Younger age was associated with the highest risk of a negative change in diet, and participants in their 40s had the highest risks of negative changes in drinking, stress, and healthcare service use. Men were likely to exhibit negative changes in smoking and drinking, whereas women had greater risks in diet, exercise, stress, and healthcare service use. Marital status only showed a significant association with smoking behaviors. Compared to married individuals, the odds ratios (ORs) for negative changes were greater among those who were not married: 1.58 (95% confidence interval [CI], 1.11–2.23) for single persons and 2.62 (95% CI, 1.39–4.97) for those who were bereaved, separated, or divorced. Higher educational attainment was associated with negative changes in diet and exercise-related behav-

iors, but without statistical significance. Lower household income was related to a negative change in smoking. Furthermore, the unadjusted risk of having a poorer diet was lower in cardiometabolic disease patients (OR, 0.81; 95% CI, 0.66–0.99) than in participants without those diseases.

These findings were persistent when simultaneously adjusted for all sociodemographic factors (Fig. 3, Table S2). It is notable that bereaved, separated, or divorced individuals had a significantly higher likelihood of showing negative changes, whereas married or single respondents had similarly low risk. Furthermore, after adjustment for all sociodemographic factors, cardiometabolic disease patients showed higher risks for negative changes in diet, exercise, stress, and healthcare service use than those without cardiometabolic disease.

DISCUSSION

We examined self-reported changes in CVD-related health

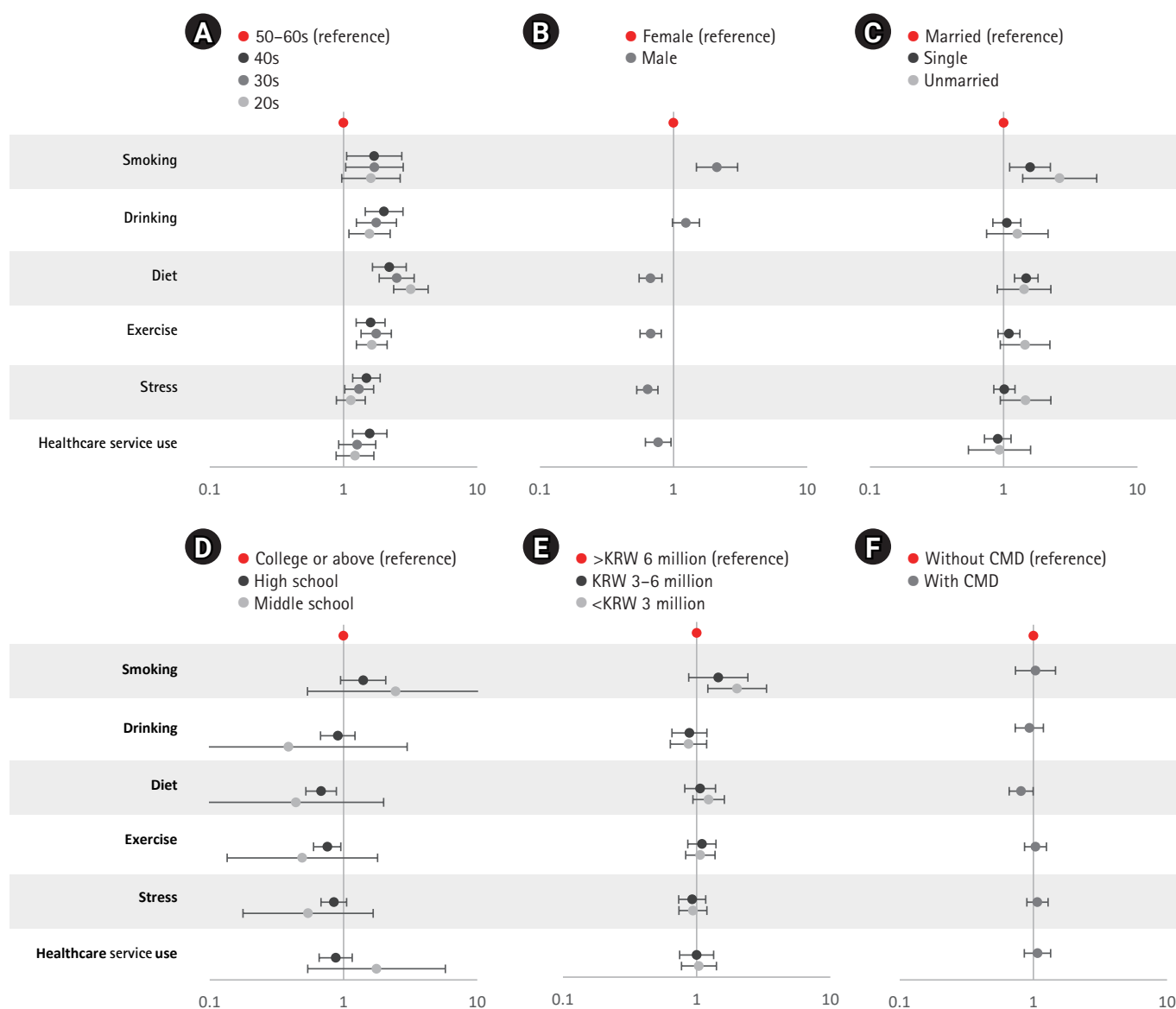


Fig. 2. The unadjusted risks of negative changes in cardiovascular disease-related behaviors during the COVID-19 pandemic. Confidence intervals outside of arbitrary limits were truncated for the applying a consistent scale. (A) Age. (B) Sex. (C) Marital status (unmarried refers to bereavement, separation, and divorce). (D) Education (in terms of educational attainment). (E) Household monthly income. (F) The presence of cardiometabolic disease (CMD).

behaviors during the COVID-19 pandemic. Favorable changes were mainly observed in smoking, drinking, and healthcare service use, while unfavorable changes were predominant in diet, exercise, and stress. These negative changes during the pandemic were also significantly associated with age, sex, marital status, and the presence of cardiometabolic disease after adjustment for all socioeconomic factors.

As the world manages the imminent health challenges, COVID-19 has brought about substantial changes in the diagnosis, treatment, and prevention of other diseases such as CVD [1,11]. In particular, growing public interest in health appears to be linked to individual efforts to improve health-related behaviors [12,13]. A study in the United States analyzed online search interest for CVD-related lifestyle factors based on Google Trends and Google Shopping

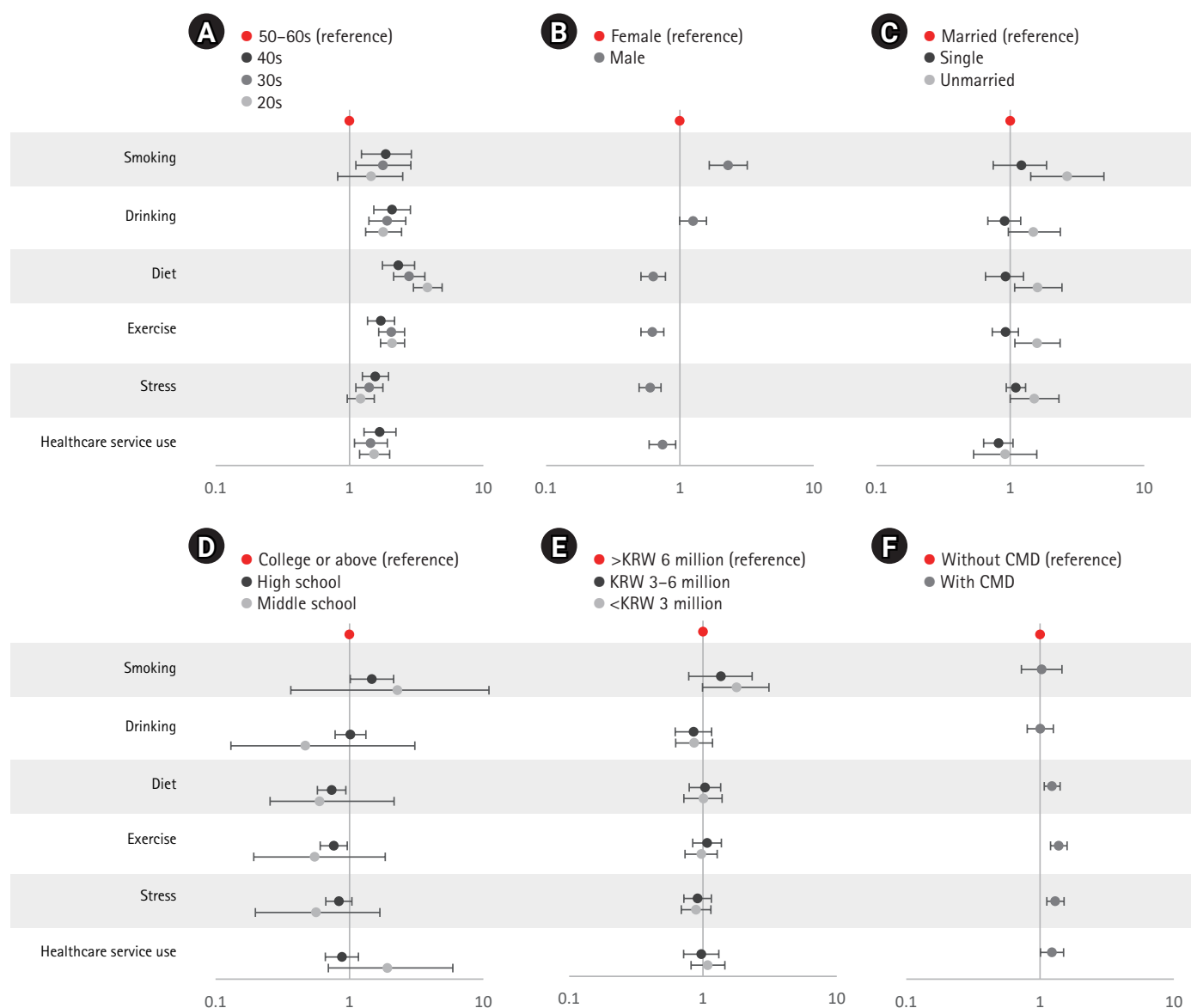


Fig. 3. The adjusted risks of negative changes in cardiovascular disease-related behaviors during the COVID-19 pandemic. (A) Age, (B) sex, (C) marital status (unmarried refers to bereavement, separation, and divorce), (D) educational attainment (in terms of educational attainment), (E) household monthly income, and (F) the presence of cardiometabolic disease (CMD) were simultaneously adjusted for each model of behaviors. Confidence intervals outside of arbitrary limits were truncated for the applying a consistent scale.

Insights in 2020 [12]. During the pandemic, search terms relating to a healthier diet and physical exercise increased, but searches for smoking-related terms decreased [12]. Our study also documented collateral benefits for healthier lifestyles. Many respondents reported improvements in their smoking and drinking habits during the pandemic (30.6% and 38.1%, respectively). It seems that the decline in smoking and drinking was at least partly due to the restrictions of

social gatherings [13]. Earlier reports on COVID-19 also suggested that smoking is a risk factor for the development of more severe cases after being infected [14]. The fear of this novel viral disease seems to have brought about positive changes in health behaviors. However, in dietary habits and physical activity, more people reported negative changes than those who showed positive changes. One possible explanation is that indoor fitness centers were closed, result-

ing in reduced physical activity, especially in urban settings [15]. Sedentary lifestyles may also have increased as people worked from home and were reluctant to go out [15]. The growing consumption of nonperishable food and delivery food may have led to increased food insecurity and poorer dietary quality after the outbreak of COVID-19 [2,16]. In a survey of college students in Korea, 65% of the respondents answered that they ordered delivery food at least one to two times a week, while reporting a gain of body weight in the past 6 months [16]. Above all, it is alarming that most of the respondents (52.6%) rated their stress as aggravated.

Deterioration of mental health during the COVID-19 pandemic has been frequently reported in previous studies. An analysis of 16 studies (113,285 individuals) illustrated a high prevalence of mental distress from December 2019 to June 2020 [17]. Depression was found in 20% of individuals, anxiety in 35%, and psychological stress in 53% [17]. A study in Australia investigated the association between changes in health-related behaviors and psychological distress [18]. Not only was there a high prevalence of negative changes in physical activity (48.9%), sleep (40.7%), drinking (26.6%), and cigarette smoking (6.9%) during the pandemic, but these deteriorations were also associated with greater risks of depression, anxiety, and stress symptoms [18]. Improving both mental health and other health-related behaviors can help reduce psychological distress.

We also confirmed that sociodemographic factors were related to negative changes during the pandemic. While those in their 40s and men were at high risk of deterioration in smoking and drinking, the risks for diet and exercise were higher among those in their 20s and women. This seemed to result from decreases in social smoking and drinking, which were relatively prevalent in middle-aged adults and men. Furthermore, as outdoor activities were canceled after the outbreak and participants spent more time indoors, dietary habits and physical activity may have changed in young adults and women. Educational attainment and monthly household income did not show significant associations with negative changes in health-related behaviors, except for smoking, where lower education and income level put individuals at a higher risk than their counterparts. This finding was not consistent with other studies that presented an association between higher income and engagement in self-protective behaviors during the COVID-19 pandemic [19]. Future studies should

investigate the possible effect of income and education on CVD-related health behaviors with a sufficient sample size. After adjusting for all sociodemographic factors in our study, cardiometabolic disease patients were more likely to show aggravation of lifestyle factors, except for smoking and drinking. Similarly, another study reported that patients with diabetes had a higher likelihood of experiencing food insecurity and drug shortages than individuals without diabetes. Patients with diabetes were also more concerned about COVID-19 and perceived the risk as higher, which may lead to greater psychological distress among those with comorbidities [20].

Our study examined changes in CVD-related behaviors that are difficult to investigate with a clinical approach but are nonetheless important for CVD prevention. Despite the possible implications of our study for public health, several limitations should be taken into consideration. First, our findings need to be reaffirmed in future studies with sufficient sample sizes. Although the Cardiovascular Disease Prevention Awareness Survey sought to reflect behavioral changes in the general population in Korea, and consisted of various individuals, the relatively small sample size may limit its implications. Second, our report was based on self-reported data, and the possibility should be considered that the findings resulted from subjective changes without objective indicators or figures. Last, there might have been meaningful differences in characteristics between respondents and nonrespondents. The survey was completed online or on mobile devices, which could result in non-responsiveness among digitally illiterate subpopulations, which are likely to have a lower socioeconomic status.

COVID-19 caused a reduction in hospital use for CVD patients and those with predisposing factors. This could lead to a higher CVD burden in the near future. Moreover, considerable studies reported more deaths and adverse events from COVID-19 in CVD patients. As the pandemic is prolonged, it is necessary to examine changes in CVD-related health behaviors and establish preventive strategies accordingly. CVD prevention, which has been somewhat postponed, should be further encouraged. Doing so would both relieve the CVD burden that is likely to overload the health system in the near future and reduce the harm from COVID-19.

SUPPLEMENTARY MATERIALS

Table S1. The unadjusted risks of negative changes after COVID-19 according to socioeconomic factors

Table S2. The adjusted risks of negative changes after COVID-19 according to socioeconomic factors

Supplementary materials are available from <https://doi.org/10.36011/cpp.2023.5.e2>.

ARTICLE INFORMATION

Ethical statements

Not applicable.

Conflicts of interest

The authors have no conflicts of interest to declare.

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Author contributions

Conceptualization: CHJ, DJK, SHK, HYL, KYL, DRK, SKR, WYL, EJR, HCK; Data curation: EK, EJR, HCK; Formal analysis: EK; Methodology: DRK, EJR, HCK; Project administration: WYL, EJR; Supervision: HCK; Validation: DJK, HYL, WYL; Visualization: EK; Writing-original draft: EK, HCK; Writing-review & editing: CHJ, DJK, SHK, HYL, KYL, DRK, SKR, WYL, EJR, HCK. All authors read and approved the final manuscript

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