Is fear of COVID-19 higher in individuals residing in more deprived areas? A nationwide study

Woorim Kim[1], Soon Young Lee[2], Yeong Jun Ju[2]

[1]Division of Cancer Control & Policy, National Cancer Center, National Cancer Control Institute, Goyang-si, Gyeonggi-do 10408, Republic of Korea
[2]Department of Preventive Medicine and Public Health, Ajou University School of Medicine, Suwon-si, Gyeonggi-do 16499, Republic of Korea
Address correspondence to Yeong Jun Ju, E-mail: joomeon@ajou.ac.kr

ABSTRACT

Background This study investigated the association between various types of coronavirus disease 2019 (COVID-19)-related fear and the level of area deprivation in Korea.

Methods Different types of COVID-19-related fear were examined, namely fear of infection, fear of dying from infection, fear of public criticism, fear of a family member getting infected and fear of economic loss. The level of area deprivation was measured based on the Area Deprivation Index, which was calculated based on population census data. The association between various types of COVID-19-related fear and the level of area deprivation was analyzed using multivariable logistic regression analysis.

Results This study included 199 859 individuals from the 253 administrative divisions in South Korea. Findings indicated that fear was most common in individuals residing in the most deprived areas, followed by those in the mediocre and least deprived areas (fear of infection: odds ratio (OR) 1.05, 95% confidence interval (CI) 1.01–1.09; fear of dying from infection: OR 1.23, 95% CI 1.19–1.28; fear of public criticism: OR 1.20, 95% CI 1.15–1.24; fear of a family member getting infected: OR 1.12, 95% CI 1.07–1.18).

Conclusions The findings suggest the need to monitor and account for area deprivation in managing the psychological health effects of the COVID-19 crisis.

Keywords area deprivation, COVID-19, fear of COVID-19, mental health, South Korea

Introduction

Since the coronavirus disease 2019 (COVID-19) emerged as a global pandemic, it has infected tens of millions of individuals worldwide, causing substantial morbidity and mortality.[1] The pandemic has incurred unparalleled fear and uncertainty in numerous countries, which is unsurprising considering that fear is often activated in times of infectious disease outbreaks.[2,3] Fear related to the pandemic can be viewed as a mental health disorder, often accompanied by various psychological symptoms, including anxiety, stress and depression.[4] Various types of fear can be induced, including fear of infection, family well-being and possible criticism in the case of not conforming to the general consensus.[5] Although COVID-19-related fear may provide some consciousness, such as improved personal hygiene, extreme or lingering fear can have a negative impact on individuals' mental health and quality of life.[6,7] Hence, there is a need to appropriately manage fear in the general population as the pandemic continues.

Area deprivation level has been identified as a contributor to health disparities, as populations residing in marginalized areas, characterized by lower socioeconomic status and poorer living conditions, often exhibit a higher risk of adverse health outcomes, including mental health outcomes.[8,9] Investigating the relationship between COVID-19-related fear and area deprivation is particularly important because this outbreak has had immense implications regarding health inequalities.[10] As lockdown and social distancing measures have been implemented by many governments to contain the spread of the disease, existing spatially related health inequalities may have been aggravated during the outbreak.[11] Many people have been confined to their geographical areas of residence, which can amplify the impact of the environment on the

Woorim Kim, PhD, Associate Researcher

Soon Young Lee, MD, PhD, Professor

Yeong Jun Ju, PhD, Research Professor

mental health of an individual.[12] This tendency requires attention because individuals living in deprived areas have less access to healthcare, and disadvantaged neighborhoods have been linked to more health risk behaviors, decreased social cohesion and overcrowding, which are important social determinants of health.[9] The level of perceived fear can also be impacted by the fact that individuals with better socioeconomic resources are generally equipped with better coping strategies and resources.[13]

Despite the potential importance of examining the association between COVID-19-related fear and area deprivation level, this subject has been rarely studied. Furthermore, various types of fear, such as fear of infection and fear of death due to COVID-19, have not been taken into account. Therefore, this study aimed to investigate the association between various types of COVID-19-related fear and the level of area deprivation in South Korea. The hypothesis was that fear of COVID-19 will be higher in individuals residing in more deprived areas.

Methods

Data and study population

The Area Deprivation Index (ADI) was measured using data from the 2015 Population and Housing Census, which consists of a representative sample of 2% of the national population. Individual and household-level variables were extracted to measure the ADI of the 253 administrative divisions in Korea. Data from the 2020 Korea Community Health Survey (KCHS) were used for all other variables. The KCHS is conducted by the Korea Disease Control and Prevention Agency. It is a cross-sectional survey, with a study population drawn from multistage, stratified area probability samples of civilian, non-institutionalized Korean households categorized according to geographic area, age and sex. The survey is conducted annually and data are collected through in-person (one-on-one) interviews. As the samples used in the current study were extracted from national survey data, they are considered representative of the Korean population.[14]

This study included individuals aged ≥19 years. From an initial total of 218 501 potential participants, respondents without data on the relevant variables were excluded. Finally, 199 859 individuals were included in this study.

Dependent variable

The dependent variable in this study was fear of COVID-19, which included fear of infection, fear of dying from infection, fear of public criticism, fear of a family member getting infected and fear of economic loss. Each item was measured by responding to the following statements: 'I fear that I will get infected with the COVID-19', 'I fear that I might die if I get infected', 'I fear that I may be criticized if I get infected', 'I fear that my family members vulnerable to poor health may get infected' and 'I fear that the outbreak may cause economic loss to me or my family'. Each item was considered separately using different models in this study. The fear of COVID-19 was successfully evaluated using these questions and has also been validated in a previous study.[15] Regarding internal consistency, the Cronbach's alpha coefficient was 0.73. The Pearson's correlation between each of the components included ranged from 0.31 to 0.48. These correlation values infer reasonable internal consistency and internal homogeneity of the scale used to measure COVID-19-related fear.[15]

Interesting variable

The independent variable of interest in this study was the level of area deprivation, measured using the ADI. The ADI was calculated based on a Korean version of the ADI developed and utilized in previous studies.[16,17] Low socioeconomic status (population aged between 15 and 64 years employed in agriculture or fishery, simple laborers who are self-employed, or temporary and day laborers),[18] adverse living conditions, low educational level, car ownership, marital status (divorced or widowed), single-person household status, female householder status, older-aged population and residence status (non-apartment residence) of the 253 administrative divisions of Korea were assessed and totaled into a composite index after normalization and standardization. The measured ADI was then classified into terciles, with T1 representing the most deprived areas and T3 representing the least deprived areas.

Covariates

The study analysis included various sociodemographic, economic and health-related covariates. The variables were sex (male or female), age (19–29 years, 30–39 years, 40–49 years, 50–59 years, 60–69 years or 70 years and above), educational level (none, elementary school, middle school, high school, college and above), income (quartiles), job classification (professional or administrative position, office work, sales and service, agriculture and fishery, blue collar work or simple labor, or unemployed), region (rural or urban), smoking status (no or yes), monthly drinking (no or yes), depressive symptoms (no or yes), perceived stress (no or yes) and subjective health status (fair or poor). Depressive symptoms were measured using the Patient Health Questionnaire-9 (PHQ-9), which is commonly used to screen for depression. The validity and reliability of the Korean version of the PHQ-9 have been verified.[19]

Table 1 General characteristics of the study population

Variables	Total	
	N	%
Area deprivation level		
T1 (most deprived)	70 374	35.2
T2 (mediocre)	66 821	33.4
T3 (least deprived)	62 664	31.4
Sex		
Male	90 412	45.2
Female	109 447	54.8
Age		
19–29	22 103	11.1
30–39	22 421	11.2
40–49	31 554	15.8
50–59	37 641	18.8
60–69	39 265	19.7
70+	46 875	23.5
Educational level		
Uneducated	18 390	9.2
Elementary school	29 800	14.9
Middle school	21 906	11.0
High school	67 114	33.6
College and above	62 649	31.4
Income		
Q1 (low)	32 723	16.4
Q2	63 387	31.7
Q3	49 007	24.5
Q4 (high)	54 742	27.4
Job classification		
Professional or administrative position	20 099	10.1
Office work	17 342	8.7
Sales and service	25 182	12.6
Agriculture and fishery	20 039	10.0
Blue collar work or simple labor	37 238	18.6
Unemployed	79 959	40.0
Region		
Urban	111 915	56.0
Rural	87 944	44.0
Smoking		
No	168 098	84.1
Yes	31 761	15.9
Monthly drinking		
No	111 106	55.6
Yes	88 753	44.4
Depressive symptoms (PHQ-9 ≥ 10)		
No	194 248	97.2
Yes	5611	2.8

Continued

Variables	Total	
	N	%
Perceived stress		
No	155 771	77.9
Yes	44 088	22.1
Subjective health status		
Bad	104 342	52.2
Good	95 517	47.8
Total	199 859	100.0

Statistical analysis

The general characteristics of the study population were investigated using chi-square tests. The association between the different types of COVID-19-related fear and the level of area deprivation was analyzed using multivariable logistic regression analysis. Each type of fear was investigated separately using different models. All analyses were conducted after adjustment for confounding variables. Results are shown as odds ratios (ORs) and their 95 percent confidence intervals (95% CIs). All analyses were conducted using SAS software (version 9.4; SAS Institute, Cary, NC, USA). Statistical significance was set at $P < 0.05$.

Ethical approval

The Korea Community Health Survey (KCHS) data are openly published. Participants' data were fully anonymized prior to release. Our study was excluded from the review list pursuant to Article 2.2 of the Enforcement Rule of Bioethics and Safety Act in Korea, since the data were exempted from Institutional Review Board (IRB) review. All procedures performed in studies involving human participants were in accordance with the ethical standards of the national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Results

The general characteristics of the study population are shown in Tables 1 and 2. This study included 199 859 individuals, of which 70 374 (35.2%) resided in areas that were most deprived (T1), 66 821 (33.4%) lived in mediocre areas (T2) and 62 664 (31.4%) in resided areas that were least deprived (T3). COVID-19-related fear was relatively common among the study participants: 142 894 (71.5%) reported fear of infection, 92 566 (46.3%) reported fear of dying from infection, 152 881 (76.5%) experienced fear of public criticism, 172 730 (86.4%)

Table 2 Reasons for COVID-19-related fear in participants who reported having fear

| Variables | Reasons for having COVID-19-related fear | | | | Unit: N (%), P-value |
	Infection	Dying from infection	Public criticism	Infection of family member	Economic loss
Area deprivation level	***	***	***	***	***
T1 (most deprived)	51 420 (73.1)	37 769 (53.7)	56 338 (80.1)	62 154 (88.3)	58 271 (82.8)
T2 (mediocre)	47 523 (71.1)	30 147 (45.1)	50 937 (76.2)	57 609 (86.2)	53 267 (79.7)
T3 (least deprived)	43 951 (70.1)	24 650 (39.3)	45 606 (72.8)	52 967 (84.5)	47 648 (76.0)
Sex	***	***	***	***	***
Male	59 112 (65.4)	36 640 (40.5)	65 655 (72.6)	76 107 (84.2)	69 956 (77.4)
Female	83 782 (76.6)	55 926 (51.1)	87 226 (79.7)	96 623 (88.3)	89 230 (81.5)
Age	***	***	***	***	***
19–29	13 893 (62.9)	69 59 (31.5)	14 837 (67.1)	17 477 (79.1)	15 745 (71.2)
30–39	15 729 (70.2)	79 84 (35.6)	16 459 (73.4)	19 779 (88.2)	16 732 (74.6)
40–49	21 453 (68.0)	11 357 (36.0)	23 052 (73.1)	27 229 (86.3)	24 170 (76.6)
50–59	26 826 (71.3)	16 395 (43.6)	28 892 (76.8)	31 925 (84.8)	30 420 (80.8)
60–69	29 554 (75.3)	21 422 (54.6)	31 504 (80.2)	34 406 (87.6)	32 930 (83.9)
70+	35 439 (75.6)	28 449 (60.7)	38 137 (81.4)	41 914 (89.4)	39 189 (83.6)
Educational level	***	***	***	***	***
Uneducated	14 221 (77.3)	11 623 (63.2)	15 275 (83.1)	16 668 (90.6)	15 890 (86.4)
Elementary school	23 159 (77.7)	18 234 (61.2)	24 652 (82.7)	26 867 (90.2)	25 811 (86.6)
Middle school	16 568 (75.6)	12 256 (56.0)	17 639 (80.5)	19 318 (88.2)	18 719 (85.5)
High school	46 587 (69.4)	28 782 (42.9)	49 550 (73.8)	56 910 (84.8)	53 814 (80.2)
College and above	42 359 (67.6)	21 671 (34.6)	45 765 (73.1)	52 967 (84.6)	44 952 (71.8)
Income	***	***	***	***	***
Q1 (low)	24 166 (73.9)	18 930 (57.9)	25 793 (78.8)	28 720 (87.8)	27 472 (84.0)
Q2	46 114 (72.8)	32 629 (51.5)	49 255 (77.7)	55 440 (87.5)	52 737 (83.2)
Q3	34 698 (70.8)	20 934 (42.7)	36 886 (75.3)	42 127 (86.0)	39 124 (79.8)
Q4 (high)	37 916 (69.3)	20 073 (36.7)	40 947 (74.8)	46 443 (84.8)	39 853 (72.8)
Job classification	***	***	***	***	***
Professional or administrative position	13 697 (68.2)	6549 (32.6)	14 835 (73.8)	16 844 (83.8)	14 259 (70.9)
Office work	11 833 (68.2)	5715 (33.0)	12 996 (74.9)	14 838 (85.6)	11 986 (69.1)
Sales and service	18 103 (71.9)	10 672 (42.4)	19 259 (76.5)	21 608 (85.8)	21 264 (84.4)
Agriculture and fishery	14 773 (73.7)	11 471 (57.2)	16 458 (82.1)	17 965 (89.7)	17 165 (85.7)
Blue collar work or simple labor	25 989 (69.8)	16 604 (44.6)	28 153 (75.6)	32 180 (86.4)	30 991 (83.2)
Unemployed	58 499 (73.2)	41 555 (52.0)	61 180 (76.5)	69 295 (86.7)	63 521 (79.4)
Region	***	***	***	***	***
Urban	78 864 (70.5)	46 451 (41.5)	82 559 (73.8)	95 016 (84.9)	86 656 (77.4)
Rural	64 030 (72.8)	46 115 (52.4)	70 322 (80.0)	77 714 (88.4)	72 530 (82.5)
Smoking	***	***	***	***	*
No	12 2738 (73.0)	80 436 (47.9)	13 0487 (77.6)	14 5998 (86.9)	13 4052 (79.8)
Yes	20 156 (63.5)	12 130 (38.2)	22 394 (70.5)	26 732 (84.2)	25 134 (79.1)
Monthly drinking	***	***	***	***	***
No	82 087 (73.9)	57 678 (51.9)	86 465 (77.8)	96 925 (87.2)	90 146 (81.1)
Yes	60 807 (68.5)	34 888 (39.3)	66 416 (74.8)	75 805 (85.4)	69 040 (77.8)
Depressive symptoms (PHQ-9 ≥ 10)	***	***	NS	***	***
No	13 8700 (71.4)	89 571 (46.1)	14 8567 (76.5)	16 7762 (86.4)	15 4495 (79.5)
Yes	4194 (74.8)	2995 (53.4)	4314 (76.9)	4968 (88.5)	4691 (83.6)

Table 2 Continued

| | Reasons for having COVID-19-related fear | | | | Unit: N (%), P-value |
Variables	Infection	Dying from infection	Public criticism	Infection of family member	Economic loss
Perceived stress	***	NS	***	***	***
No	10 9817 (70.5)	72 013 (46.2)	118 341 (76.0)	133 588 (85.8)	122 619 (78.7)
Yes	33 077 (75.0)	20 553 (46.6)	34 540 (78.3)	39 142 (88.8)	36 567 (82.9)
Subjective health status	***	***	***	***	***
Bad	77 260 (74.0)	53 544 (51.3)	81 148 (77.8)	91 841 (88.0)	85 134 (81.6)
Good	65 634 (68.7)	39 022 (40.9)	71 733 (75.1)	80 889 (84.7)	74 052 (77.5)
Total	142 894 (71.5)	92 566 (46.3)	152 881 (76.5)	172 730 (86.4)	142 718 (71.4)

Note: ***$P < 0.0001$, *$P < 0.05$, NS P-value not significant.

reported fear of a family member getting infected and 142 718 (71.4%) experienced fear of economic loss. Fear was most commonly found among individuals residing in areas with the highest level of area deprivation, followed by those living in the mediocre and least deprived areas.

The results of the multivariable logistic regression analysis investigating the association between COVID-19-related fear and the level of area deprivation are presented in Fig. 1. Compared to individuals belonging to the least deprived area group, those categorized into the mediocre group were more likely to show fear of dying from infection (OR 1.10, 95% CI 1.07–1.13), fear of public criticism (OR 1.12, 95% CI 1.08–1.15), fear of a family member getting infected (OR 1.08, 95% CI 1.04–1.12) and fear of economic loss (OR 1.09, 95% CI 1.05–1.12). Similarly, individuals in the most deprived areas showed a statistically significantly higher likelihood of fear of infection (OR 1.05, 95% CI 1.01–1.09), fear of dying from infection (OR 1.23, 95% CI 1.19–1.28), fear of public criticism (OR 1.20, 95% CI 1.15–1.24) and fear of a family member getting infected (OR 1.12, 95% CI 1.07–1.18) than those in the least deprived group.
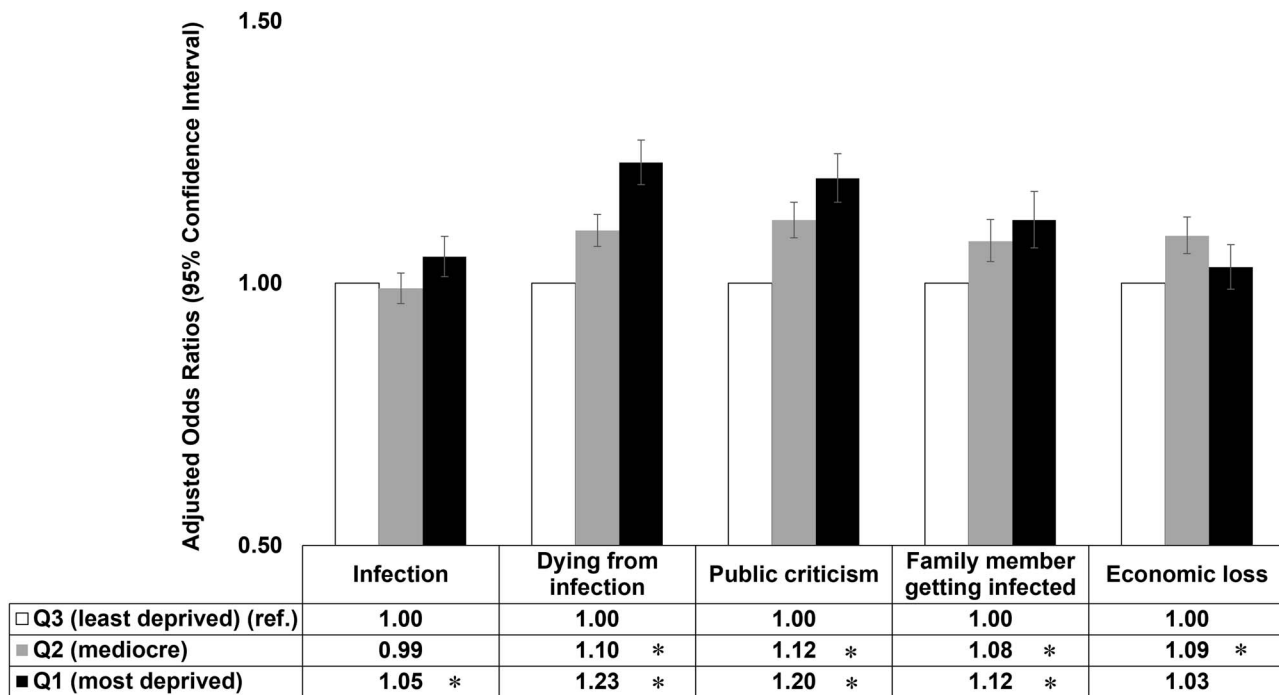
Discussion

This study revealed a significant association between COVID-19-related fear and the level of area deprivation in the general population of South Korea. Individuals residing in the more deprived areas generally had a higher likelihood of expressing various types of fear related to the pandemic, including fear of infection, fear of dying from infection, fear of public criticism, fear of a family member getting infected and fear of economic loss. These findings suggest that area deprivation may be an important factor that influences the level

of fear experienced by individuals during the COVID-19 outbreak.

Investigating fear during a pandemic is important because it is linked to risk perception, which requires understanding in order to implement effective risk communication and management during a public health crisis caused by an infectious disease.[2] Constant worry and psychological distress can also negatively affect the general health of individuals, such as by resulting in insomnia.[20] Increased levels of fear caused by COVID-19 have been identified in previous studies, in which many individuals report experiencing deterioration in mental health due to the unexpected outbreak.[21] Specifically, fear has been found to arise due to the rapid spread and death rate of the disease, social isolation caused by the implementation of quarantine and distancing policies, economic difficulties and difficulties in accessing medical services.[22] Therefore, there is a need to identify factors that may be associated with perceived levels of COVID-19-related fear.

Previous studies have suggested that socioeconomic factors may affect the level of perceived fear related to COVID-19, including fear of illness and social distancing.[23] In addition to individual socioeconomic status, including lower education levels, being associated with greater fear, findings have revealed that people in more deprived areas may be particularly vulnerable to the psychological distress caused by the pandemic.[5,24] In fact, mental health during the COVID-19 crisis was found to be worse in more deprived areas.[12] Such tendencies are unsurprising considering that the physical environment is a well-established factor known to affect the mental health of individuals, with those residing in areas with higher levels of socioeconomic deprivation generally reporting poorer subjective well-being.[11,25] Area deprivation was also found to correlate with subjective health in a Korean study.[26]

	Infection	Dying from infection	Public criticism	Family member getting infected	Economic loss
☐ Q3 (least deprived) (ref.)	1.00	1.00	1.00	1.00	1.00
▨ Q2 (mediocre)	0.99	1.10 ∗	1.12 ∗	1.08 ∗	1.09 ∗
■ Q1 (most deprived)	1.05 ∗	1.23 ∗	1.20 ∗	1.12 ∗	1.03

Fig. 1 The association between having COVID-19-related fear and area deprivation level. Adjusted ORs were calculated using multivariable logistic regression analysis and adjusted for sex, age, educational level, income, job classification, region, smoking, monthly drinking, depressive symptoms, perceived stress and subjective health status. Asterisk indicates a value of $P < 0.05$.

The findings of this study suggest that area deprivation may be an important factor related to the level of fear perceived by individuals during a pandemic. This may partially be explained by the fact that different characteristics of the built environment and neighborhood, including housing quality, overcrowding, neighborhood problems, the quality of the surrounding environment and opportunities for social participation, are known to impact mental health.[27] This relationship may have been reinforced by the spread of the pandemic as social isolation and quarantine measures implemented during the crisis have limited the movement of individuals, binding them more strongly to the characteristics of their residential neighborhoods and intensifying existing spatial inequalities.[11] Furthermore, because area deprivation correlates with decreased self-efficacy, those residing in more deprived areas may experience higher levels of worry about their ability to manage their own lives in times of a crisis.[28] This study highlights that COVID-19-related fear was more common in individuals living in more deprived areas, implying the need to reduce related disparities, which may have intensified during the pandemic.

This study has certain limitations. First, causal inferences based on the study results should be made with caution because this study was cross-sectional in design. Second, the 2015 census data were used to measure ADI because

Statistics Korea releases census data every 5 years. Third, COVID-19-related fear was measured based on self-reports. Nevertheless, this variable was studied in a relatively composite manner because the KCHS collects data on five different aspects of COVID-19-related fear. Fourth, due to the unprecedented pandemic situation, scales to evaluate the impact of the COVID-19 were rapidly developed in many countries, tailored to the needs and characteristics of each country. The scale used to measure COVID-19-related fear and disruptions in daily activities due to the pandemic in this study was developed by the Korea Disease Control and Prevention Agency to investigate the effect of the COVID-19 in Korea. Such rapid development and utilization have led to inevitable limitations in testing the reliability and validity of these scales, particularly in studies targeting the general population. Although there were limitations in evaluating the validity and reliability of these measures at the researcher level, these scales are important and meaningful in that they can be used to investigate the effect of the COVID-19 in the general population. Finally, although this study accounted for different covariates, the possibility of residual confounding cannot be completely ruled out. However, despite the limitations stated above, this study offers important insights because it is the first to investigate the relationship between various aspects of COVID-19-related fear and

the level of area deprivation using nationally representative data.

Conclusion

Various types of COVID-19-related fear were associated with the level of area deprivation. Compared to individuals residing in the least deprived areas, those living in more deprived areas were more likely to report fear of infection, fear of dying from infection, fear of public criticism, fear of a family member getting infected and fear of economic loss during the outbreak. The findings suggest the need to monitor and account for area deprivation in managing the psychological health effects of the COVID-19 crisis.

Informed consent

The Korea Community Health Survey 2020 database does not contain private information and is openly available to researchers in de-identified format. We did not have to address ethical concerns regarding informed consent.

Availability of data and material

Data will be made available on request. The dataset is available on the Korea Community Health Survey website (https://chs.cdc.go.kr/chs/rdr/rdrInfoProcessMain.do).

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Conflict of Interest

The authors declares no conflict of interest.

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