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Sex Differences in COVID-19 Infection Fear in a Community Sample of Korean Adults Using Quantile Regression

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ABSTRACT

This study aims to explore the impact of distributional changes in coronavirus disease 2019 (COVID-19) infection fear with sex differences. A quota sampling strategy was followed and 483 Korean adults were surveyed in a community sample. Self-report questionnaires were used to assess COVID-19 infection fear, depressive symptoms, and general characteristics. Quantile regression was used to explore the regression relationship of COVID-19 infection fear and an individual's sex. There was a significant difference in COVID-19 infection fear (P = 0.001) and depression (P = 0.008) between the sexes - male and female. The differences between sexes at the 20th and 30th percentiles were significant (β = 2.04, P = 0.006; β = 1.5, P = 0.004, respectively). The results demonstrate that sex significantly predicts COVID-19 infection fear and women had significantly greater fear than men in the mild-level of COVID-19 infection fear.

Keywords: COVID-19; Fear; Sex; Depression; Quantile Regression

The coronavirus disease 2019 (COVID-19) was declared a pandemic in January 2020 by the World Health Organization. The pandemic spread worldwide over the past two years.[1] To prevent infection and viral spread, a social distancing and quarantine policy was implemented. However, as the pandemic prolonged, the widening disease burden forced people to adapt to a completely new way of life; daily lives changed instantaneously and interpersonal and community interactions were limited.[2] People feared contracting COVID-19 and restricted their daily activities, including meeting family and friends, exercising, and visiting hospitals.

COVID-19 infection fear is a type of health anxiety, defined as worrying about one's health.[3] Nearly everyone experiences COVID-19 infection fear to some degree, and its degrees may influence potential health-related behaviors. Those with high levels of infection fear can perceive bodily sensations or changes as symptoms of infection, but those signs are not limited to infectious disease.[4] Infection-protective behaviors can differ depending on the level of COVID-19 infection fear.[4]

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Disclosure
The authors have no potential conflicts of interest to disclose.

Author Contributions
Conceptualization: Bahk WM. Data curation: Jung YE, Kim MD. Formal analysis: Na HJ, Jung YE, Park C. Writing - original draft: Na HJ, Jung YE, Lee C. Writing - review & editing: Bahk WM, Jung YE, Na HJ, Kim MD, Park C, Lee C.

During pandemics, psychological factors are known to play an important role in successful public health management, including awareness of early signs of viral infection, promoting healthy behaviors, and knowledge of protective treatments. Among psychological problems, sex differences are prominent in anxiety disorders characterized by similar fear symptoms.[4,5] Women are more likely to have twice the lifetime rates for most anxiety disorders than men. Additionally, their symptoms are different.[6] Women with anxiety disorders reported somatic discomfort due to excessive worrying, while men were more likely to have trouble with interpersonal relationships.[7] Although sex differences and comorbid symptoms are reported in psychological problems, the difference in COVID-19 infection fear remains uncertain.

A quantile regression model allows assessment of the distribution of COVID-19 infection fear. It explicitly informs whether risk factors are associated differentially across its distribution. People with high levels of fear have trouble in health-related behaviors and social interaction. Thus, it is necessary to know the risk group for COVID-19 infection fear and provide early intervention. This study aims to explore in-depth the inferences of distribution changes of COVID-19 infection fear with sex differences and provide evidence to assist in policymaking for COVID-19 public management.

The present study analyzed the dataset of the survey of COVID-19 related to negative psychological states (i.e., infection fear, depression, and functional impairment), conducted by the Jeju mental health welfare center in Jeju, Korea. Data were collected from June to July 2021, and this was a period when the COVID-19 pandemic, where the 4th wave began to thrive, and the high-intensity social distancing policy continued for several months. A quota sampling strategy was used to collect data, and the sampling was considered appropriate for ensuring proportionality in terms of age and sex. The study sample comprised 500 community-dwelling adults, aged 20–69 years, living in Jeju, Korea. Informed consent was obtained from all of the participants included in the study. Surveys missing responses to any sociodemographic questions or with no responses to over half of the questionnaire items were excluded; thus, 483 participants were included in the final analysis.

The survey comprised self-report questionnaires. Sociodemographic data were collected, including age, sex, marital status, education, monthly income, and employment status. COVID-19 infection fear was assessed using the COVID-19 Infection Fear Scale (CIFS) developed by the Korean Society for Traumatic Stress Studies.[8] The CIFS scale consists of nine related items on a 4-point Likert scale, with scores ranging from 0 to 27. The Cronbach's alpha of the CIFS in this study is 0.91. Depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9),[9] a reliable and validated measure for examining depression severity over the previous two weeks. The PHQ-9 consists of nine related items on a 4-point Likert scale, with scores ranging from 0 to 27. The Cronbach's alpha of the PHQ-9 in this study is 0.86.

First, the χ^2 and Mann-Whitney *U* test were conducted for the difference comparison between COVID-19 infection fear and depressive symptoms by sex. Second, quantile regression was used to explore the regression relationship of COVID-19 infection fear and sex. Because the levels of COVID-19 infection fear have a non-normal distribution, quantile regression was used to estimate the median difference by sex and to quantify the percentile variation of the effect of sex on fear. Considering the factor distribution, the 10th to 90th percentile of conditional quantile points were described as the quantile regression analysis range. Each of the nine regression analyses were adjusted for depressive symptoms. Stata statistical software

v13.0 (StataCorp LLC, College Station, TX, USA) was used to analyze the data and a *P* value < 0.05 was considered significant.

Of the 483 participants included in the analysis, 241 (49.9%) were male and 242 (50.1%) were female. Among men, 129 (53.5%) were 20–49 years old, and 112 (46.5%) were 50 years old or above. Among women, 126 (52.1%) were 20–49 years old, and 116 (47.9%) were 50 years old or above. Employment status significantly differed by sex ($P < 0.001$), while the remaining general characteristics were not statistically significant by sex, including age, marital status, household income, and education.

The median score of CIFS in men was 17 out of 27 (interquartile range: 13–21) and that in women was 18 out of 27 (interquartile range: 16–22). There was a significant difference in the CIFS between the sexes ($P = 0.001$) (**Table 1**). The median score of depressive symptoms in men was 1 out of 27 (interquartile range: 0–4.5), and that in women was 2 out of 27 (interquartile range: 1–6). There was a significant difference in depressive symptoms between the sexes ($P = 0.008$) (**Table 1**).

Fig. 1 shows the distribution of the CIFS by sex. Coefficient estimates and associated *P* values for each of the nine quantile regression models are described in **Table 2**. Each coefficient describes the increase in the given quantile of CIFS associated with sex difference. While the median CIFS differences between the sexes was not significant ($\beta = 0.71$, $P = 0.162$), differences at the 20th and 30th percentiles were significant ($\beta = 2.04$, $P = 0.006$; $\beta = 1.5$, $P = 0.004$, respectively). The results indicate that sex differences in the level of CIFS were substantially larger at the mild level. For the low level of the quantile regression model, women were more likely to experience COVID-19 infection fear compared to men.

The survey results indicated that the median level of COVID-19 infection fear was 17 out of 27 in men and 18 out of 27 in women. These moderately-high levels of CIFS scores were

Table 1. Sex differences of variables

Variables	Men (n = 241)		Women (n = 242)		χ^2 or U	*P*
	No. or Median	% or IQR	No. or Median	% or IQR		
Age					1.628	0.804
20s	45	18.7	42	17.4		
30s	34	14.1	36	14.9		
40s	50	20.7	48	19.8		
50s	52	21.6	45	18.6		
60s	60	24.9	71	29.3		
Marital status					1.486	0.223
Married	162	67.2	175	72.3		
Unmarried	79	32.8	67	27.7		
Monthly household income (US$)					1.977	0.160
< 1,000	37	15.4	49	20.2		
≥ 1,000	204	84.6	193	79.8		
Education, yr					2.580	0.108
≤ 12	99	41.1	117	48.3		
> 12	142	58.9	125	51.7		
Employment					15.711	< 0.001
Yes	195	80	157	64.9		
No	46	19.1	85	35.1		
Fear of COVID-19[a]	17	13.00–21.00	18	16.00–22.00	23,936.5	0.001
Depressive symptoms[a]	1	0.00–4.50	2	1.00–6.00	25,142.5	0.008

IQR = interquartile range, COVID-19 = coronavirus disease 2019.
[a]Mann-Whitney *U* test was conducted.

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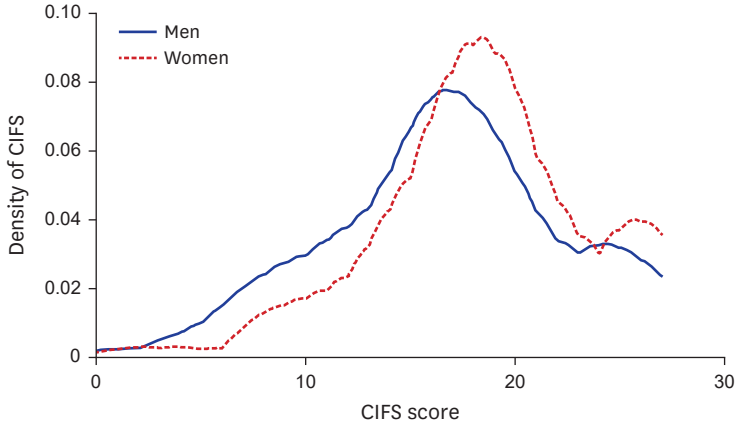

Fig. 1. Distribution of COVID-19 infection fear by sex.
COVID-19 = coronavirus disease 2019, CIFS = Coronavirus Disease 2019 Infection Fear Scale.

Table 2. Regression coefficients and *P* values for the nine quantile regression models

Variables (sex: female)	COVID-19 infection fear quantile models								
	10th	20th	30th	40th	50th	60th	70th	80th	90th
Coefficient	1.311	2.042	1.500	0.868	0.714	0.768	1.247	0.989	0.556
P	0.218	0.006	0.004	0.077	0.162	0.144	0.040	0.158	0.493

Controlled for depressive symptoms.
COVID-19 = coronavirus disease 2019.

higher than those assessed in the previous year (2020) in Korea with the same measurement (mean score 12.14). Moreover, this study's participants reported much higher levels of fear than those surveyed in the same region in the previous year (mean score 12.0).[8] In other countries too, respondents were fearful; a study conducted in the United States reported an average score of nearly 7 on a scale of 10.[10] Respondents in Eastern Europe and Spain used the worldwide validated Fear of COVID-19 Scale, and their fear score was moderate, with mean values of 17.2 and 16.8 out of 35, respectively.[11,12] It is difficult to directly compare the infection fear level in this study with that of other studies as different instruments were used. The prolonged and extraordinary situation of the COVID-19 pandemic can induce fear among people, likely due to continued social distancing policies and increased prevalence of infections in this period.

The quantile regression results confirmed that sex is a significant predictor of COVID-19 infection fear. An individual's sex may have had a disproportionately stronger effect at the mild levels of COVID-19 infection fear. Women experience greater impact of COVID-19 infection fear than men at a low quantile indicating a mild level of fear. These results were consistent with the findings of previous studies on infection fear.[13-16] Given the risk of infection fear among women, further research in this context is needed.

Although this study focuses only on sex differences in COVID-19 infection fear, previous research found that infection preventive behaviors, including adopting preventive hygiene and social distancing, differed depending on sex.[17] Furthermore, more educated and well-informed people experience less COVID-19 infection fear.[15] These results emphasize the importance of providing women with correct COVID-19 health information to reduce fear and promote infection protective behaviors.

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The present study has several limitations. First, a cross-sectional research design was used, limiting the inference of causality among the variables. Second, when measuring the COVID-19 infection fear, the timing and location of the investigation may have decisive influences. This study was limited to people in a community setting, thus limiting generalizability for those in other regions. Third, self-report questionnaires were used, which may risk response bias as it was not yet verified.

To prevent COVID-19 fear, we must know the risk factors of those who are overly fearful of COVID-19. Further research is necessary to examine whether potential risk factors can influence COVID-19 infection fear. Additionally, health professionals can help reduce COVID-19 infection fear in adults through interventions, including targeted education.

Ethics statement

All protocols were approved by the Institutional Review Board of Jeju National University Hospital and the requirement for informed consent was waived (IRB No. JEJUNUH 2022-07-006).

REFERENCES

1. Wu YC, Chen CS, Chan YJ. The outbreak of COVID-19: an overview. *J Chin Med Assoc* 2020;83(3):217-20.
PUBMED | CROSSREF
2. Qian M, Jiang J. COVID-19 and social distancing. *Z Gesundh Wiss* 2022;30:259-61.
PUBMED | CROSSREF
3. NHS Foundation Trust. Health anxiety https://www.nhs.uk/mental-health/conditions/health-anxiety/. Updated 2020. Accessed April 7, 2020.
4. Asmundson GJ, Taylor S. How health anxiety influences responses to viral outbreaks like COVID-19: what all decision-makers, health authorities, and health care professionals need to know. *J Anxiety Disord* 2020;71:102211.
PUBMED | CROSSREF
5. Wu Q, Zhuo L, Li H, Zheng L, Ma G, Tao H. Factors associated with the mental health of back-to-Wuhan university students based on quantile regression model during the COVID-19 period. *BMC Psychiatry* 2022;22(1):284.
PUBMED | CROSSREF
6. Altemus M, Sarvaiya N, Neill Epperson C. Sex differences in anxiety and depression clinical perspectives. *Front Neuroendocrinol* 2014;35(3):320-30.
PUBMED | CROSSREF
7. Vesga-López O, Schneier FR, Wang S, Heimberg RG, Liu SM, Hasin DS, et al. Gender differences in generalized anxiety disorder: results from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). *J Clin Psychiatry* 2008;69(10):1606-16.
PUBMED | CROSSREF
8. Korean Society for Traumatic Stress Studies. Coronavirus disease-19 1st National Mental Health Survey 2020. http://kstss.kr/?p=1370. Updated 2020. Accessed April 7, 2020.
9. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001;16(9):606-13.
PUBMED | CROSSREF
10. Fitzpatrick KM, Harris C, Drawve G. Fear of COVID-19 and the mental health consequences in America. *Psychol Trauma* 2020;12:S17-21.
PUBMED | CROSSREF
11. Martínez-Lorca M, Martínez-Lorca A, Criado-Álvarez JJ, Armesilla MD, Latorre JM. The fear of COVID-19 scale: validation in Spanish university students. *Psychiatry Res* 2020;293:113350.
PUBMED | CROSSREF

12. Reznik A, Gritsenko V, Konstantinov V, Khamenka N, Isralowitz R. COVID-19 fear in Eastern Europe: validation of the fear of COVID-19 scale. *Int J Ment Health Addict* 2021;19(5):1903-8.
PUBMED | CROSSREF
13. Lee D, Kim Y, Lee D, Hwang H, Nam S, Kim J. The influence of public fear, and psycho-social experiences during the coronavirus disease 2019 (COVID-19) pandemic on depression and anxiety in South Korea. *Korean J Couns Psychother* 2020;32:2119-56.
14. Jung AR, Hong EJ. A study on anxiety, knowledge, infection possibility, preventive possibility and preventive behavior level of COVID-19 in general public. *J Converg Inf Technol* 2020;10:87-98.
15. Cerda AA, García LY. Factors explaining the fear of being infected with COVID-19. *Health Expect* 2022;25(2):506-12.
PUBMED | CROSSREF
16. Uz B, Savaşan E, Soğancı D. Anxiety, depression and burnout levels of Turkish healthcare workers at the end of the first period of COVID-19 pandemic in Turkey. *Clin Psychopharmacol Neurosci* 2022;20(1):97-108.
PUBMED | CROSSREF
17. Bronfman N, Repetto P, Cordón P, Castañeda J, Cisternas P. Gender differences on psychosocial factors affecting COVID-19 preventive behaviors. *Sustainability (Basel)* 2021;13(11):6148.
CROSSREF