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# Association between precautionary behaviors against coronavirus disease and psychosocial factors in outpatients with a pre-existing disease and their attendants

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## Abstract

**Aim:** The spread of the novel coronavirus infection (coronavirus disease 2019 [COVID-19]) has caused behavioral changes and mental illness in patients and their attendants during its early phase. The present study aimed to examine the association between precautionary behaviors against COVID-19 and psychosocial factors in outpatients with pre-existing disease and their attendants.

**Methods:** We conducted a cross-sectional paper-based questionnaire survey in Chiba University Hospital on 1019 patients and 513 attendants, and a web-based questionnaire survey in Japan on 3981 individuals from the general population. We evaluated the participants' anxiety about COVID-19, depression, health anxiety, and precautionary behaviors.

**Results:** Regarding knowledge and anxiety about COVID-19, the protective factors for the high precautionary behaviors group were knowledge of COVID-19 (odds ratio [OR] = 1.178, 95% confidence interval [CI]: 1.099–1.263), anxiety about the spread of COVID-19 (OR = 1.348, 95% CI: 1.243–1.461), and anxiety about infecting someone with COVID-19 (OR = 1.135, 95% CI: 1.039–0.239). Regarding psychosocial factors, the protective factors for the high precautionary behaviors group were patients (OR = 1.759, 95% CI: 1.056–2.929), their attendants (OR = 3.892, 95% CI: 1.416–10.700), health anxiety (OR = 2.005, 95% CI: 1.451–2.772), and nondepression states (OR = 1.368, 95% CI: 1.004–1.864).

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**Conclusion:** Our findings suggest that patients and their attendants may perform high precautionary behaviors. Health anxiety and nondepression states may be associated with high precautionary behaviors.

**KEYWORDS**
attendant, COVID-19, depression, health anxiety, precautionary behavior

## INTRODUCTION

The coronavirus disease 2019 (COVID-19) spreads from person to person via droplet infections. It is a highly contagious respiratory illness that has high mortality rates among the elderly and patients with comorbidities.[1] COVID-19 has an impact on psychiatric diseases and increases the prevalence of depression.[2] As revealed in previous studies, the prevalence of anxiety and depression was higher among patients with pre-existing diseases, including psychiatric diseases (56%) and COVID-19 infections (55%), compared with the general population, caregivers, and health workers.[3] Families and caregivers of patients with pre-existing diseases may have high anxiety about being infected with COVID-19; however, to our knowledge, this has not been empirically investigated.

Currently, several treatment options have become available for COVID-19, including antivirals, neutralizing antibodies, and steroids; however, few specific treatments were developed at the time of the survey by Luo et al.,[3] which necessitated the concern for precautionary measures against the infection. To prevent the spread of infection, the World Health Organization has recommended several precautionary behaviors, including maintaining social distancing, wearing face masks, being hygienic, and avoiding interactions with people who have a fever or respiratory symptoms.[4] The frequency of citizens' precautionary behaviors varies based on their sociodemographic characteristics, such as age, gender, and knowledge level. As per past studies, a high-risk perception of the pandemic was associated with an increased precautionary behavior,[5,6] while low levels of knowledge about COVID-19 were associated with a low frequency of precautionary behaviors.[7]

Sociodemographic characteristics also affected individuals' psychological states during the pandemic. The prevalence of depression and anxiety during the pandemic was 33% and 28% of the total population, respectively, with the patient group having a higher prevalence of such conditions than the general population, caregivers, and health workers.[3] Worrying about contracting COVID-19 was negatively associated with the five-level European Quality of Life Five Dimension (EQ-5D-5L) scores regarding the usual activities, pain/discomfort, and anxiety/depression dimensions.[8] Risk factors for experiencing greater psychological distress included being a woman, having lower socioeconomic status, and spending more time watching COVID-19-related news. Protective factors against psychological distress involved obtaining accurate health information, having high confidence in doctors, and taking precautionary measures.[9]

"Health anxiety" refers to one's construction of excessive anxiety focused on one's present and future health, caused by a catastrophic misinterpretation of sensations and symptoms. In health anxiety, excessive safety behaviors are considered undesirable, although they are coping behaviors against threats to individuals' health.[10] Moreover, a past study showed that a fearful image about contracting COVID-19 was associated with health anxiety.[11] Online research showed that 45.1% ($n = 155$) of the general population above 18 years old living in Turkey during COVID-19 had health anxiety.[12] In Germany, health anxiety has significantly increased since the COVID-19 outbreak.[13] In a regression analysis, the female gender, having accompanying chronic diseases, and a previous psychiatric history were risk factors for health anxiety.[12] People with high anxiety tend to engage in inappropriate safety behaviors, such as excessive handwashing, social withdrawal, and panic purchasing.[14] However, to our knowledge, the association between precautionary behaviors against COVID-19 and psychological state is unclear.

We thus hypothesized that depression and anxiety states in patients with some pre-existing diseases and their attendants may be associated with decreased precautionary behaviors against COVID-19. This study aimed to examine the association between precautionary behaviors against COVID-19 and psychosocial factors in outpatients with some pre-existing diseases and their attendants during the early phase of the pandemic.

## METHODS

### Study design

We employed a cross-sectional, exploratory, paper-based questionnaire survey at Chiba University Hospital and a web-based questionnaire survey in Japan. Both questionnaire surveys were conducted between March 23 and 28, 2020.

The study was approved by the Ethics Committees of Chiba University Graduate School of Medicine (ID:3684).

### Participants

All participants were aged 20 years or more. The following exclusion criteria were applied: a diagnosis of COVID-19; a current worker at Chiba University Hospital; having relatives working at Chiba University Hospital; and those who gave invalid answers, such as not filling a screening question or giving a score of "1" on all 30 items of the main questions.

We recruited patients (PTs) and attendants of these patients (ATs) at the Chiba University Hospital. PT groups consisted of outpatients at Chiba University Hospital and included those with psychiatric disorders. AT groups included families, friends, or care workers of these patients.

We distributed the questionnaire to 2048 people at Chiba University and received valid responses from 1532 participants (response rate, 74.8%). Additionally, we asked Cross Marketing Inc. to recruit 4000 people from the general population (GP). Cross Marketing Inc. sent an invitation email to potential participants who had registered themselves in Cross-Marketing Inc. before the survey started. People who were willing to participate spontaneously visited the website to answer the questionnaire on a first-in-first-served basis. Completers were rewarded with cashable coupons. Duplicate answers were blocked by checking the unique ID of each participant.

The conditions of the web survey for the GP groups are described in detail according to the Checklist for Reporting Results of Internet E-Surveys.[7] GP groups were not excluded from the possibility of having pre-existing diseases. Of the 4000 individuals from the GP, 19 (0.48%) were excluded due to invalid answers. The study's final population consisted of 3981 participants in the GP group, 1019 in the PT group, and 513 in the AT group.

In both the paper-based and web-based questionnaire surveys, we did not collect participants' personal information through the anonymous surveys. Therefore, returning the questionnaire was deemed as agreement for participation and the written informed consent for participants was waived. Participants were informed of the research details and that their participation was voluntary. Consent to participate in the research was determined for all the participants if they completed all the answers and returned the questionnaire.

## The contents of the questionnaire

We adopted the questions used in a previous report,[5] but included new questions about anxiety levels regarding symptomatic aggravation and virus transmission to others. There were four parts in the questionnaire following the screening section, which checked whether the participants had experienced a diagnosis of COVID-19 or currently worked/had family working at the Chiba University Hospital.

The first part of the questionnaire focused on the degree of recognition and level of anxiety about COVID-19; that is, becoming infected and worsening conditions, spreading the infection, or the infection situation. Each question was assessed on a nine-point ordinal scale, with the terms “none” through “intermediate” to “very strong.”

The second part focused on participants’ anxiety regarding COVID-19, diabetes, HIV infection, severe injury, heart disease, avian influenza infection, or seasonal influenza infection that is threatening to health. Each question was asked on a five-point ordinal scale, with the terms “very low” through “intermediate” to “very high.”

The third part focused on participants' frequency regarding their information collection method about COVID-19; namely, public announcement, social network service, networking media, radio, television, handout from school/office, oral communication with family and friends or medical workers, and their reliability. Each question was asked on a five-point ordinal scale, with the terms “almost none/almost not reliable” through “intermediate” to “very often/reliable.”

Finally, the fourth part focused on participants' frequency of precautionary behaviors against COVID-19. They were asked about their frequency of precautionary behaviors; that is, avoiding people who cough/sneeze, avoiding large gatherings, avoiding people who are in contact with infected people, avoiding public transportation, avoiding school/work, avoiding traveling to infected areas, handwashing, using a disinfectant, and wearing a face mask. Each question was asked on a nine-point ordinal scale, with the terms “none” through “intermediate” to “very often/avoiding very often.”

## Clinical assessment

Depression symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9).[15,16] The cut-off score of PHQ-9 for clinically significant symptoms of depression is 10. General anxiety was assessed using the Japanese version of the Generalized Anxiety Disorder-7 (GAD-7).[17] The cut-off score of GAD-7 for clinically significant symptoms of general anxiety is 10. Health anxiety symptoms were assessed using the Japanese version of the Short Health Anxiety Inventory (SHAI).[18,19] The cut-off score of SHAI for clinically significant symptoms of health anxiety is 18. Health-related quality of life was assessed using the EQ-5D-5L.[20,21]

## Statistical analysis

For comparisons among the three groups, a $\chi^2$ test was employed for categorical variables, and the Mann–Whitney $U$ test or Kruskal–Wallis test with post-hoc Bonferroni correction was employed for continuous variables. An exploratory factor analysis (EFA) with Promax rotation was used for the precautionary behaviors regarding COVID-19; Cronbach's $\alpha$ was also calculated for each component. Based on factor loadings, factor scores were calculated through regression. A confirmatory factor analysis was performed to test the consistency of the construct measure and identify the model fitness. A two-step cluster analysis was performed for exploring the natural groups in a dataset using a procedure to automatically select the optimal number of groups based on factor scores. We defined one group as a highly protective group of COVID-19 with high scores of avoidance and active precautionary behaviors, and the other group as the low protective group with low scores of protective behaviors and active precautionary behaviors.

Binominal logistic regression analyses were conducted to examine the effects of each variable on high protective groups

against COVID-19 to identify variables that may be useful in promoting precautionary behaviors. The odds ratio (OR) was used as a measure of the strength association. To identify possible confounders mediating the association between the low protective group and clinical variables, several analyses were performed in a stepwise manner. The clinical rating scale was dichotomized with the cutoff values already shown and put into the variables. First, we assessed associations between the high protective group and sociological variables. Second, in addition to sociological variables, we included knowledge and anxiety about COVID-19. Third, in addition to sociological variables, we included the following covariates: psychological variables, the frequency and credibility of each information source, and their interaction with the sources. Finally, we included significant variables as candidate covariates (sex, age, educational background, EQ-5D-5L scores, depression, health anxiety, frequency of watching television, and credibility of the specialist). Statistical significance was set at $p < 0.05$. The statistical analyses were performed using SPSS 25.0J and Amos 26 software (IBM).

## RESULTS

### Participants' characteristics

The sociological characteristics of the analyzed participants are shown in Table 1. Table 2 shows the participants' psychological characteristics. The EQ-5D-5L scores in the PT groups were lower than those in the GP and AT groups. The proportion of depression in the GP (18.4%) and PT (16.3%) groups was greater than that in the AT group (8.7%). The proportion of health anxiety in the PT group (52.2%) was greater than that in the GP (33.0%) and AT (29.9%) groups. The proportion of general anxiety in the GP group (11.5%) was greater than that in the AT group (5.7%).

**TABLE 1** Participants' sociological characteristics.

| | All $n = 5513$ | GP $n = 3981$ | PT $n = 1019$ | AT $n = 513$ |
|---|---|---|---|---|
| Gender | | | | |
| Male | 2531 (45.9) | 1984 (49.8) | 422 (41.4) | 125 (24.4) |
| Female | 2937 (53.3) | 1997 (50.2) | 567 (55.6) | 373 (72.7) |
| Unknown | 5 (0.1) | 0 (0) | 4 (0.4) | 1 (0.2) |
| Age, years | | | | |
| 20s | 862 (15.6) | 791 (19.9) | 55 (5.4) | 16 (3.1) |
| 30s | 951 (17.3) | 793 (19.9) | 82 (8.0) | 76 (14.8) |
| 40s | 1102 (20.0) | 800 (20.1) | 149 (14.6) | 153 (29.8) |
| 50s | 1087 (19.7) | 799 (20.1) | 192 (18.8) | 96 (18.7) |
| 60s | 866 (15.7) | 583 (14.6) | 205 (20.1) | 78 (15.2) |
| 70s | 548 (9.9) | 194 (4.9) | 268 (26.3) | 86 (16.8) |
| 80s | 92 (1.7) | 21 (0.5) | 64 (6.3) | 7 (1.4) |
| Unknown | 45 (0.8) | 0 (0) | 30 (2.9) | 15 (2.9) |
| Educational background | | | | |
| Secondary school | 214 (3.9) | 106 (2.7) | 77 (7.6) | 31 (6.0) |
| High school | 1812 (32.9) | 1223 (30.7) | 396 (38.9) | 193 (37.6) |
| Diploma course or vocational school | 1243 (22.5) | 876 (22.0) | 213 (20.9) | 154 (30.0) |
| University graduate | 2226 (40.4) | 1776 (44.6) | 317 (31.1) | 133 (25.9) |
| Unknown | 18 (0.3) | 0 (0) | 16 (1.6) | 2 (0.4) |
| Infected family members | | | | |
| Yes | 18 (0.3) | 17 (0.4) | 1 (0.1) | 0 (0) |
| No | 5219 (94.7) | 3787 (95.1) | 957 (93.9) | 475 (92.6) |
| Not sure | 276 (5.0) | 177 (4.4) | 61 (6.0) | 38 (7.4) |
| Unknown | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Infected acquaintances | | | | |
| Yes | 55 (1.0) | 45 (1.1) | 5 (0.5) | 5 (1.0) |
| No | 5129 (93.0) | 3744 (94) | 921 (90.4) | 464 (90.4) |
| Not sure | 313 (5.7) | 192 (4.8) | 82 (8.0) | 39 (7.6) |
| Unknown | 16 (0.3) | 0 (0) | 11 (1.1) | 5 (1.0) |

*Note*: Values are presented as a number (frequency %).
Abbreviations: AT, attendants; GP, general population; PT, patients.

### Respondents' knowledge and anxiety about COVID-19

Supporting Information: Table S1 shows participants' knowledge and anxiety about COVID-19. The knowledge of COVID-19 in the PT group was lower than that in the GP group ($p < 0.001$). Anxiety about the spread of COVID-19, being infected with COVID-19, and the severity of COVID-19 infection in the PT and AT groups was higher than that in the GP group. Anxiety about infecting someone with COVID-19 in the AT group was higher than that in the GP and PT groups ($p < 0.05$, $p < 0.01$, respectively).

### Precautionary behaviors against COVID-19

Figure 1 shows the frequency of precautionary behaviors against COVID-19. The frequency of avoiding people who cough or sneeze in the PT group was higher than that in the GP group. The frequency of performing some precautionary behaviors in the AT group was higher than that in the GP and PT groups. The frequency of other precautionary behaviors in the PT and AT groups was higher than that in the GP group. However, the frequency of avoiding school or work in the GP and PT groups was higher than that in the AT group.

**TABLE 2** Participants' psychological characteristics.

| | All ($n$ = 5513) | GP ($n$ = 3981) | PT ($n$ = 1019) | AT ($n$ = 513) | $p$[a] | Post hoc |
|---|---|---|---|---|---|---|
| EQ-5D-5L | | | | | | |
| Mean ± SD | 0.908 ± 0.146 | 0.919 ± 0.145 | 0.855 ± 0.159 | 0.933 ± 0.096 | | PT vs. GP*** |
| Median [IQR] | 1.000 [0.867–1.000] | 1.000 [0.867–1.000] | 0.895 [0.808–1.000] | 1.000 [0.867–1.000] | <0.001 | PT vs. AT*** |
| PHQ-9 scores | | | | | | |
| Mean ± SD | 4.96 ± 5.63 | 5.09 ± 5.91 | 4.91 ± 4.89 | 3.87 ± 4.09 | | PT vs. GP** |
| Median [IQR] | 3 [1–8] | 3 [0–8] | 3 [1–7] | 3 [1–5] | 0.001 | PT vs. AT* |
| Depression | | | | | | |
| Yes | 916 (16.6) | 732 (18.4) | 142 (16.3) | 39 (8.7) | | |
| No | 4394 (79.7) | 3249 (81.6) | 730 (71.6) | 410 (79.9) | | PT vs. AT*** |
| Unknown | 211 (3.8) | 0 (0) | 147 (14.4) | 64 (12.5) | <0.001 | GP vs. AT*** |
| SHAI scores | | | | | | |
| Mean ± SD | 15.33 ± 9.432 | 14.56 ± 9.68 | 18.95 ± 8.58 | 14.79 ± 6.63 | | PT vs. GP*** |
| Median [IQR] | 15 [9–20] | 14 [8–19] | 18 [13–23] | 14 [10–18] | <0.001 | PT vs. AT*** |
| Health anxiety | | | | | | |
| Yes | 1915 (34.7) | 1312 (33.0) | 462 (52.2) | 135 (29.9) | | |
| No | 3409 (61.8) | 2669 (67.0) | 423 (41.5) | 316 (61.6) | | PT vs. GP*** |
| Unknown | 196 (3.6) | 0 (0) | 134 (13.2) | 62 (12.1) | <0.001 | PT vs. AT*** |
| GAD scores | | | | | | |
| Mean ± SD | 3.34 ± 4.49 | 3.38 ± 4.67 | 3.35 ± 4.1 | 2.86 ± 3.39 | | |
| Median [IQR] | 1 [0–5] | 1 [0–5] | 2 [0–5] | 2 [0–4] | 0.012 | PT vs. GP* |
| General anxiety | | | | | | |
| Yes | 565 (10.2) | 456 (11.5) | 82 (9.2) | 26 (5.7) | | |
| No | 4765 (86.4) | 3525 (88.5) | 806 (79.1) | 427 (83.2) | | |
| Unknown | 191 (3.5) | 0 (0) | 131 (12.9) | 60 (11.7) | <0.001 | GP vs. AT*** |
| The scores of precautionary behaviors | | | | | | |
| Avoidance score | | | | | | |
| Mean ± SD | 0.000 ± 0.937 | −0.068 ± 0.991 | 0.182 ± 0.741 | 0.225 ± 0.687 | <0.001 | PT vs. GP*** |
| Median [IQR] | 0.168 [−0.578, 0.727] | 0.100 [−0.683, 0.698] | 0.315 [−0.267, 0.780] | 0.368 [−0.179, 0.755] | <0.001 | AT vs. GP*** |
| Active score | | | | | | |
| Mean ± SD | 0.000 ± 0.904 | −0.064 ± 0.947 | 0.142 ± 0.759 | 0.270 ± 0.673 | <0.001 | AT vs. GP*** |
| Median [IQR] | 0.191 [−0.522, 0.715] | 0.120 [−0.618, 0.693] | 0.293 [−0.285, 0.727] | 0.415 [−0.101, 0.788] | <0.001 | AT vs. PT* |
| | | | | | | PT vs. GP*** |

*Note*: Values are presented as mean ± SD, median [IQR] or number (frequency %).

Abbreviations: AT, attendants; EQ-5D-5L, Five-Level European Quality of Life Five Dimension; GAD-7, Generalized Anxiety Disorder-7; GP, general population; IQR, interquartile range; PHQ-9, Patient Health Questionnaire-9; PT, patients; SD, standard deviation; SHAI, Short Health Anxiety Inventory.

[a]$\chi^2$ test or Kruskal–Wallis test with post-hoc Bonferroni correction.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

## Factor analysis of the precautionary behaviors

An EFA was conducted to explore the potential factors related to nine items of precautionary behaviors. A maximum likelihood estimation procedure was used with a Promax rotation. Supporting Information: Table S2 presents the items and their factor loadings. These analyses returned a two-factor solution that explained 50.9% of the variance. The first factor explained 42.8% of the variance,

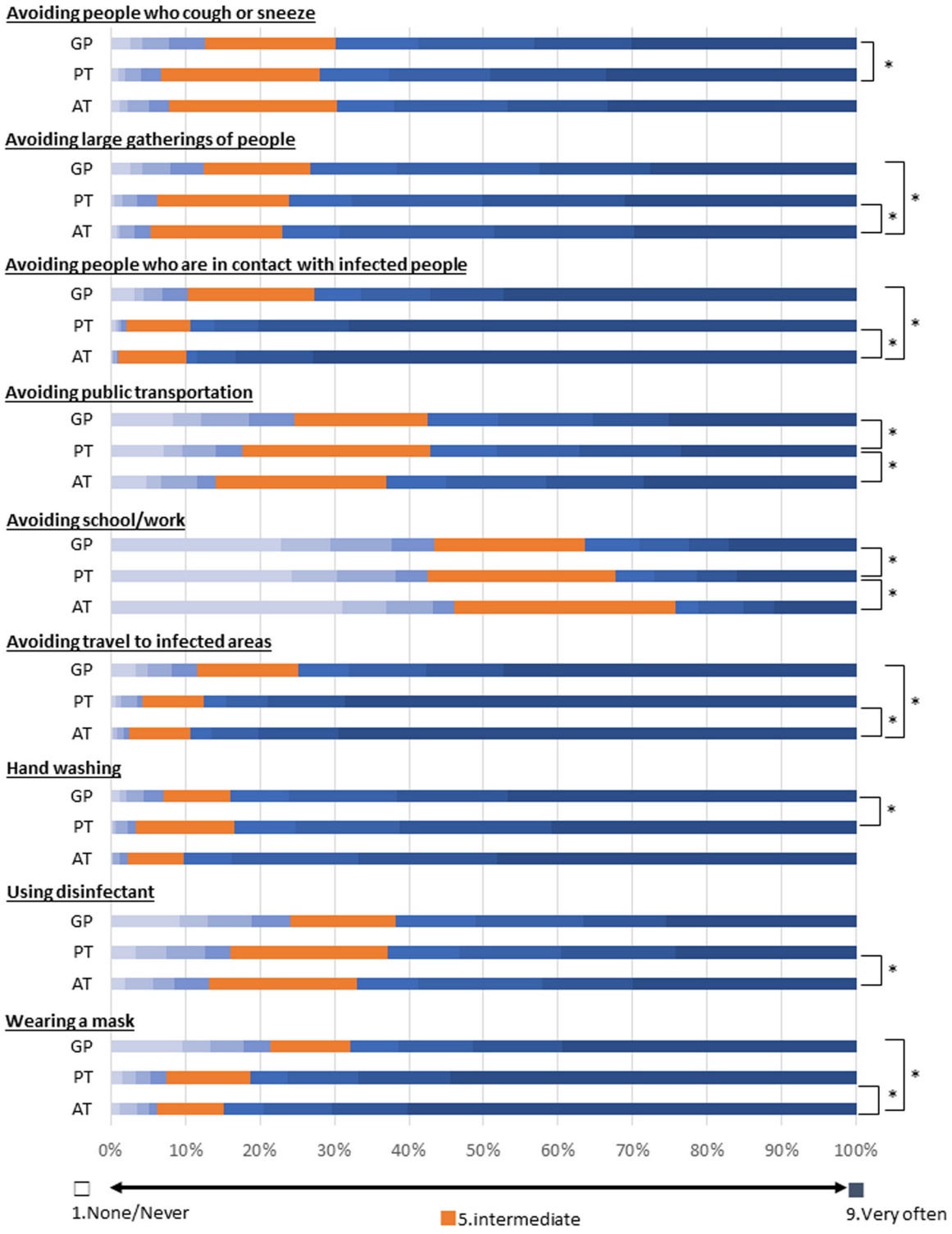


**FIGURE 1** The frequency of precautionary behaviors against coronavirus disease 2019 (COVID-19). Comparison among three groups by precautionary behaviors. For the greater part of precautionary behaviors, the frequency in patients (PT) and their attendants (AT) was higher than that in the general population (GP). *$p < 0.05$.

reflecting avoidance of precautionary behaviors against COVID-19 ($\alpha = 0.85$). The second factor explained 8.2% of the variance, corresponding to active precautionary behaviors against COVID-19 ($\alpha = 0.75$). Based on the factor loadings, factor scores of the avoidance and active precautionary behaviors were calculated with the regression method. The model fit indices of confirmatory factor analysis were: $\chi^2 = 1522.22$, $df = 26$, root-mean-square error of approximation (RMSEA) = 0.102, and comparative fit index

(CFI) = 0.925. RMSEA values >0.10 indicate poor fit, while CFI values >0.90 are acceptable.[22]

Table 2 shows that the scores of avoidance precautionary behaviors in the PT (0.182 ± 0.741) and AT groups (0.225 ± 0.687) were higher than those in the GP group (−0.068 ± 0.991). Similarly, the scores of active precautionary behaviors in the AT group (0.270 ± 0.673) were higher than those in the GP (−0.064 ± 0.947) and PT groups (0.142 ± 0.759), with scores in the PT group being higher than those in the GP group.

Supporting Information: Table S3 shows the scores of avoidance and active precautionary behaviors stratified by depression, health anxiety, and general anxiety. The scores of avoidance and active precautionary behaviors in all participants with depression were lower than those in individuals without depression, especially in the AT group. Similarly, the scores of avoidance and active precautionary behaviors in all participants with health anxiety were higher than those in participants without health anxiety. In particular, the scores of avoidance precautionary behaviors in the PT group with health anxiety were higher than those in the PT group without health anxiety ($p = 0.034$).

## Cluster analysis of factors

Based on the two-step cluster analysis using the Euclidean distance measure with scores of the first and second factors, the participants were classified into two clusters based on their protective behaviors. A total of 5017 participants (93.8%) were included in Cluster 1, defined as a high protective group with high scores of avoidance and active precautionary behaviors (0.141 ± 0.764, 0.137 ± 0.732, respectively). Similarly, 332 participants (6.2%) were included in Cluster 2, defined as the low protective group with low scores of avoidance and active precautionary behaviors (−2.138 ± 0.678, −2.077 ± 0.675, respectively).

## Association of the protective group with knowledge and anxiety about COVID-19

We performed a logistic regression analysis to evaluate the association between knowledge and anxiety about COVID-19 and the high-defense group. The binominal logistic regression analysis revealed that protective factors for the high protective group were knowledge of COVID-19 (OR = 1.178, 95% CI: 1.099–1.263, $p < 0.001$), anxiety about the spread of COVID-19 (OR = 1.348, 95% CI: 1.243–1.461, $p < 0.001$) and anxiety about infecting someone with COVID-19 (OR = 1.135, 95% CI: 1.039–0.239, $p = 0.005$) (Table 3).

## Association of protective group with clinical variables

We performed logistic regression to evaluate the association of sociological variables, psychological variables, and attitudes toward information with the high-defense group. The binominal logistic regression analysis revealed that protective factors for the high protective group were older age (every 10 years; OR = 1.178, 95% CI: 1.083–1.282, $p < 0.001$), being a female (OR = 1.923, 95% CI: 1.491–2.482, $p < 0.001$), and being a high school graduate (OR = 2.236, 95% CI: 1.293–3.869, $p = 0.004$). Compared with the GP group, the PT and AT groups involved protective factors for the high protective group (PT: OR = 1.759, 95% CI: 1.056–2.929, $p = 0.030$; AT: OR = 3.892, 95% CI: 1.416–10.700, $p = 0.008$). Additionally, high EQ-5D-5L scores (OR = 7.607, 95% CI: 3.622–15.975, $p < 0.001$), the current health anxiety state (OR = 2.005, 95% CI: 1.451–2.772, $p < 0.001$), and current nondepressive state (OR = 1.368, 95% CI: 1.004–1.864, $p = 0.047$) were protective factors for the high protective group. Similarly, a high frequency of watching television (OR = 1.546, 95% CI: 1.395–1.713, $p < 0.001$) and high credibility of the specialist (OR = 1.544, 95% CI: 1.384–1.723, $p < 0.001$) were seen as protective factors (Table 4).

**TABLE 3** Odds ratios for the high protective group against COVID-19.

| | OR | 95% CI | p |
|---|---|---|---|
| Protective factors | | | |
| Older age (every 10 years) | 1.189 | 1.091–1.295 | <0.001 |
| Female | 1.842 | 1.417–2.394 | <0.001 |
| High school graduate[a] | 2.236 | 1.293–3.869 | 0.004 |
| Attendants[b] | 4.060 | 1.478–11.15 | 0.007 |
| Knowledge of COVID-19 | 1.178 | 1.099–1.263 | <0.001 |
| Anxiety about infecting someone with COVID-19 | 1.135 | 1.039–1.239 | 0.005 |
| Anxiety about the spread of COVID-19 | 1.348 | 1.243–1.461 | <0.001 |

Abbreviations: COVID-19, coronavirus disease 2019; EQ-5D-5L, Five-Level European Quality of Life Five Dimension; OR, odds ratio.
[a]Compared to secondary school.
[b]Compared to the general population.

## DISCUSSION

This study demonstrated that the PT and AT groups were frequently taking precautionary behaviors against COVID-19 compared with the GP group. Additionally, protective factors for the high-defense group against COVID-19 involved belonging to the PT and AT groups compared with the GP group, good quality of life, current health anxiety states, and nondepression states, regardless of the confounding factors. To the best of our knowledge, this is the first study to demonstrate an association between the high-defense group against COVID-19 and psychological status in outpatients with a pre-existing disease, as well as their attendants, during the early phase of the pandemic.

The present finding showed that scores of avoidance and active precautionary behaviors in the PT and AT groups were higher than those in the GP group. Anxiety about COVID-19 in the PT and AT

**TABLE 4** Odds ratios for the high protective group against COVID-19.

| | OR | 95% CI | *p* |
|---|---|---|---|
| **Protective factors** | | | |
| Older age (every 10 years) | 1.178 | 1.083–1.282 | <0.001 |
| Female | 1.923 | 1.491–2.482 | <0.001 |
| High school graduate[a] | 2.236 | 1.293–3.869 | 0.004 |
| Patients[b] | 1.759 | 1.056–2.929 | 0.030 |
| Attendants[b] | 3.892 | 1.416–10.700 | 0.008 |
| High EQ-5D-5L scores | 7.607 | 3.622–15.975 | <0.001 |
| Health anxiety state | 2.005 | 1.451–2.772 | <0.001 |
| Nondepression state | 1.368 | 1.004–1.864 | 0.047 |
| High frequency of using television | 1.546 | 1.395–1.713 | <0.001 |
| High credibility of specialist | 1.544 | 1.384–1.723 | <0.001 |

Abbreviations: CI, confidence interval; COVID-19, coronavirus disease 2019; EQ-5D-5L, Five-Level European Quality of Life Five Dimension; OR, odds ratio.

[a]Compared to secondary school.

[b]Compared to the general population.

groups was higher than that in the GP group, especially anxiety about the severity of infection in the PT group and anxiety about infecting someone with COVID-19 in the AT group. More precautionary behaviors may be performed due to the risk of severe illness in the PT group and the anxiety of infecting someone in the AT group. Additionally, the PT and AT groups, in comparison with the GP group, were protective factors for the high-defense group, regardless of depression and health anxiety. These results suggest that AT groups may be more careful with precautionary behaviors against COVID-19 than the GP group, regardless of their psychological status. A previous study reported that the caregiving intensity and psychological and physical burdens of caregivers with mild cognitive dementia greatly increased during the pandemic.[23] Caregivers who increased the frequency of providing personal care had felt depressed and anxious more often since the outbreak of COVID-19.[24] Our study showed higher levels of health and lower levels of depression and health anxiety among the attendants, but it is possible that this was early on in the pandemic, and the burden of caregiving did not increase. Thus, we consider that a prolonged duration of the pandemic may cause burnout among the attendants. Longitudinal studies are needed to confirm this.

Our result showed that the scores of avoidance and active precautionary factors in the GP and AT participants with depression were lower than those in each participant without depression. Additionally, nondepression states were associated with protective factors for the high-defense group against COVID-19, regardless of other factors. These results suggested that depression may prevent one from taking precautionary behaviors. A previous study reported a prevalence rate of 33% for depression during COVID-19.[3] Self-isolation during the COVID-19 pandemic was positively associated with the likelihood of high stress, anxiety, and depressive symptoms.[25] Depression symptoms, such as anhedonia and loss of energy, caused some functional impairments.[26] A previous study reported that both men and women with more severe depression were more likely to violate precautionary health behaviors as their depression worsened.[27] People with depressive symptoms would be unable to change their daily behaviors to precautionary measures during the pandemic. Our investigation suggested that treating depression may be important for preventing further spread of COVID-19 infection.

Our study demonstrated that the scores of avoidance or active precautionary behaviors in the GP and PT groups with health anxiety were higher than those in each participant without health anxiety. Additionally, health anxiety was a protective factor for the high-defense group against COVID-19, regardless of other factors. These results suggested that COVID-19 may increase health anxiety and affect individuals' behaviors to reduce the spread of infection. A previous study showed that people with high anxiety may engage in inappropriate safe behaviors, such as excessive handwashing, social withdrawal, panic purchasing, and avoiding the hospital and specialist clinics.[14] Another study reported that health anxiety negatively affected psychological health during COVID-19, which in turn decreased individuals' quality of life.[28] One possible explanation for this inconsistency in behaviors is that these acts of handwashing and social distancing may be considered adaptive behaviors during the early stages of a pandemic. However, increased health anxiety over a long period may reduce quality of life and increase exhaustion. Further studies are needed to clarify the appropriate and excessive safety behaviors for individuals.

This study has several limitations. First, this cross-sectional study was performed during the last week of March 2020, before the explosive outbreak of COVID-19. The COVID-19 pandemic was prolonged and could be distinct from the current situations among patients and their attendants. A longitudinal study is desirable to examine the association between precautionary behaviors and psychological state after being exposed to the prolonged stress of the COVID-19 pandemic. Second, we cannot exclude the possibility of selection bias among the participants. For the general public, we included participants willing to answer online questionnaires, and they were not excluded from the possibility of having pre-existing diseases. Third, we did not identify the individual disease types of each patient. A previous study reported that the risk of mortality by COVID-19 varied depending on some comorbidities, that is, cardiovascular diseases and respiratory diseases.[1] Behaviors and threats regarding COVID-19 may be influenced by the types of comorbidity.

## CONCLUSION

In conclusion, our findings suggest that patients with some pre-existing diseases and their attendants may take high precautionary behaviors against COVID-19. Additionally, health anxiety and nondepression states may be associated with high precautionary behaviors.

## AUTHOR CONTRIBUTIONS

*Conception and design of the study*: Keita Idemoto, Tomihisa Niitsu, Akihiro Shiina, Tasuku Hashimoto, Kensuke Yoshimura, Shoichi Ito, Michiko Nakazato, Yoshito Igarashi, Eiji Shimizu, and Masaomi Iyo. *Acquisition and analysis of data*: Keita Idemoto, Tomihisa Niitsu, Akihiro Shiina, Osamu Kobori, Misaki Onodera, Kiyomitsu Ota, Atsuhiro Miyazawa, Masumi Tachibana, Makoto Kimura, Ryota Seki, Tasuku Hashimoto, Kensuke Yoshimura, Shoichi Ito, Michiko Nakazato, Yoshito Igarashi, Eiji Shimizu, and Masaomi Iyo. *Drafting the manuscript or figures*: Keita Idemoto, Tomihisa Niitsu, Kiyomitsu Ota, and Masaomi Iyo. All authors contributed to and approved the final manuscript.

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## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

## DATA AVAILABILITY STATEMENT

All data generated or analyzed during this study are included in this published article.

## ETHICS APPROVAL STATEMENT

The study was approved by the Ethics Committees of Chiba University Graduate School of Medicine. Participants were informed that their participation was voluntary. Participants were rewarded according to the regulations of Cross Marketing Group Inc.

## PATIENT CONSENT STATEMENT

All participants provided their written informed consent for participation in this study.

## CLINICAL TRIAL REGISTRATION

N/A.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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