

## Article

# Pandemic Fatigue in Japan: Factors Affecting the Declining COVID-19 Preventive Measures

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**Abstract:** Pandemic fatigue has threatened the efforts to contain the coronavirus disease 2019 (COVID-19) worldwide; thus, government-mandated preventive measures have declined. The Japanese government has implemented several methods to address COVID-19's spread, including hand hygiene, mask requirements, and social distancing. This study is the first to examine the socioeconomic factors affecting Japan's decline in COVID-19 prevention measures. It utilized the Preference Parameters Study of the Osaka University Institute of Social and Economic Research data of the 2021 and 2022 waves. With approximately 1580 observations, we detected a 10%, 4%, and 13% decline in hand hygiene practice, mask-wearing, and social distancing, respectively, between January 2021 and January 2022. Men were more likely to dislike the hand hygiene practice and mask-wearing and were also more reluctant to maintain social distancing. Moreover, financially satisfied individuals were positively associated with a decrease in the hand hygiene practice, while those with greater assets were more likely to dislike maintaining social distancing. People who exercised regularly were less likely to abandon the hand hygiene practices. Our results highlighted the significance of selective prevention programs targeting specific groups to promote compliance and lead to more effective pandemic management and less fatigue or discontentment.

**Keywords:** preventive measures; hand sanitization; medical mask; social distancing; hygiene; pandemic fatigue; COVID-19; Japan



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## 1. Introduction

Pandemic fatigue poses a global threat to the containment of the current coronavirus disease 2019 (COVID-19) [1]. The government-mandated preventive measures, such as hand hygiene, mask use, and social distancing, have declined [1]. The pandemic and its strict prevention measures have exhausted people, resulting in pandemic fatigue. Recent research has revealed that compliance fatigue appears to be increasing in the other parts of the world [2–4]. However, these studies have focused on pandemic fatigue regarding specific guidelines for the preventive measures or personality traits. Therefore, insufficient information is available about the socioeconomic factors that influence fatigue in individuals during the ongoing COVID-19 prevention efforts. Accordingly, it is important to examine how the changes in these factors affect pandemic fatigue. Such an analysis suggests that the people's inability to cope with restrictions is caused by more active forms of dissatisfaction, rather than passive submission to strong authorities. Furthermore, this type of research would help to strengthen the causal interpretation of these results using panel data, suggesting that pandemic fatigue exerts a causal effect on the changing socioeconomic backgrounds and psychological conditions. Therefore, this study examined how individual socioeconomic factors influenced Japan's decline in the COVID-19 preventive measures.

Pandemic fatigue is an ongoing reaction, wherein a decreased adherence to preventive measures facilitates the spread of viral infections [5,6]. This reduces the number of infection

precautions [1,6,7]. The COVID-19 pandemic fatigue is common, with the same pattern observed during the 1918 Spanish flu pandemic [8]. During both the pandemics, the public cooperation with the preventive measures declined with each successive wave of flu [9,10]. In addition, many cities have urged the authorities to ease the COVID-19 restrictions and resume their normal lives despite the widespread infection [11,12]. Despite vaccination and anti-coronavirus medications [13,14], new variants are likely to occur [15–17]. Therefore, integrating the preventive measures into the everyday life will help reduce the future infection rates [18]. Although this leads to a higher risk of pandemic fatigue as a side effect, it may help to decrease the risk of future epidemics.

Abundant literature has reported an association between socioeconomic factors and compliance or non-compliance behaviors regarding the COVID-19 prevention interventions. Non-compliance tendencies are associated with the perception that social distancing is unnecessary and ineffective [19,20] and that wearing a medical mask could affect the cardiorespiratory system [21] and muscle activity [22]. Moreover, face mask usage could affect basic psychological attributes and generate psychological resistance [23,24]. Non-compliance is particularly observed among the younger populations [2,7,25,26] and people with a higher social status [27,28]. Some studies have suggested non-adherence to preventive measures to be more common among men [20,27], while others have indicated a higher frequency among women [29]. Despite the well-established association between personal characteristics and compliance or non-compliance with COVID-19 precautionary measures, inadequate information is available about how the social and psychological risk factors are related to pandemic fatigue and, specifically, how to prevent the decline of compliance behaviors.

Emerging evidence has suggested that the reduced incentives to adhere to preventive measures may be related to several variables, including the perceived reduction in the COVID-19 risk and prevalence as people have become increasingly accustomed to the virus [7,30]. The pandemic-related economic losses, work-from-home office challenges, and social isolation can hamper the preventive measures [1,31]. A study in China has found that people who experienced the negative impact of the pandemic on employment and anxiety were more likely to suffer from pandemic fatigue, whereas those in better health were less likely to experience this [30]. The concept of pandemic fatigue and its association with its potential drivers have been addressed to a certain extent in some countries, such as China, Turkey, and the United States, considering the compliance behavior's dependence on the sociocultural contexts [32]. In Japan, a collectivist society that values relationships, pandemic fatigue is especially concerning.

The studies on pandemic fatigue in Japan are insufficient. Some have focused on the sociodemographic status and personal characteristics to cross-sectionally explain the compliance with preventive measures [33–35]; however, the others have examined the mental health aspects associated with a reduced engagement in the preventive behaviors [36–38]. The public health literature has highlighted the essence of political trust in pandemic resilience [39,40]; nevertheless, this factor does not play a significant role in influencing the behavior of the Japanese citizens toward the government's COVID-19-related recommendations [41]. Furthermore, several drivers of public compliance during the pandemic, such as psychological factors, health status, and individual changing contexts, are other determinants of the citizens' compliance with the public health measures [27,41]. Therefore, given the lack of studies on pandemic fatigue in Japan and its progression, as well as the continuous changes in the prevention and control measures, this research aimed to assess pandemic fatigue in Japan and its influencing factors using panel survey data from 2021 and 2022.

In the context of a lack of evidence on the decline in the practice of health safety measures in Japan, this study examines how individual socioeconomic factors influenced Japan's decline in the COVID-19 preventive measures. Our study contributes to the literature in at least two ways: first, we identified the changing effects of the sociodemographic attributes regarding the compliance behavior over time in Japan from January 2021 to

January 2022. Second, we examined the relationship between the declining compliance with the COVID-19 prevention measures and the socioeconomic and psychological factors during the same period. These findings are expected to help implement strategies to alleviate public pandemic fatigue in the ongoing fight against the pandemic and improve the efficiency of the infection prevention and control measures. Furthermore, this study will be helpful in understanding sustainable health behavior, which is an essential component of sustainable healthcare provision in a country. The increasing fatigue and the declining trend of maintaining health and safety measures would increase the chance of a resurgence of the virus that could dramatically affect healthcare costs during this recessive economy. Therefore, exploring the reasons for pandemic fatigue and applying proper interventions are necessary to create a sustainable health system in a country.

## 2. Data and Methods

### 2.1. Data

This research used the information from the Preference Parameters Study (PPS) of the Osaka University Institute of Social and Economic Research. The PPS is a nationwide panel survey that asks people about their socioeconomic background and preferences. This study employed the data from the 2021 and 2022 waves that happened in Japan at the beginning of each year during the COVID-19 pandemic (January 2021 and January 2022). The respondents were asked about the ways to avoid COVID-19, such as hand hygiene, wearing masks, and social distancing. The latest survey data are from 2022; therefore, we combined the two datasets to determine whether there was a trend. The 2021 and 2022 datasets consisted of 2046 and 1990 observations, respectively. Therefore, we combined the two datasets and excluded some observations because they had missing values for the demographic, socioeconomic, and behavioral variables. Overall, we obtained 1580 observations.

### 2.2. Variable Definitions

This study's dependent variables (hand hygiene, mask-wearing, and social distancing) were measured in relation to their respective years, using specific questions such as "I frequently wash and sanitize my hands," "I always wear a mask when I go out," and "I keep ample distance when I talk to people." The possible answers to these questions ranged from 1 = "Does not apply at all" to 5 = "Applies exactly," which were the same for both the 2021 and 2022 datasets. Therefore, we observed the ordinal measures, where the variables such as hand hygiene (2021, 2022), mask-wearing (2021, 2022), and social distancing (2021, 2022) were obtained. Subsequently, we monitored the decline by creating binary responses (decline in the three variables). We rated the respondents' decline in hand hygiene as "1" if they practiced hand hygiene in 2021, however, not in 2022, and as "0" if they did otherwise. We followed the same process for the other two variables as well. From both of the datasets we obtained the demographic characteristics of the respondents, such as gender and having children, as the explanatory variables. We also included socioeconomic variables, such as age, marital status, living status, employment status, and financial status. Additionally, we also incorporated the subjective ratings of health-related factors, such as health status and depression, as well as other variables, such as future anxiety, financial satisfaction, risk preference, and risky behaviors, such as smoking and alcohol use. Table 1 presents the detailed definitions of the main variables.

**Table 1.** Description and definition of the variables.

| Variable                         | Definition                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Dependent Variable</b>        |                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Hand Hygiene (2021 or 2022)      | Ordinal measure, ranging from 1–5, where 1 = does not apply at all and 5 = applies exactly to the statement “I frequently wash and sanitize my hands.”                                                                                                                                                                                                                                                               |
| Wearing a Mask (2021 or 2022)    | Ordinal measure, ranging from 1–5, where 1 = does not apply at all and 5 = applies exactly to the statement “I always wear a mask when I go out.”                                                                                                                                                                                                                                                                    |
| Social Distancing (2021 or 2022) | Ordinal measure, ranging from 1–5, where 1 = does not apply at all and 5 = applies exactly to the statement “I keep ample distance when I talk to people.”                                                                                                                                                                                                                                                           |
| Decline in Hand Hygiene          | Binary = 1, if the respondents practiced hand hygiene in 2021 and not in 2022, otherwise 0.                                                                                                                                                                                                                                                                                                                          |
| Decline in Wearing a Mask        | Binary = 1, if the respondents wore a nose mask in 2021 and not in 2022, otherwise 0.                                                                                                                                                                                                                                                                                                                                |
| Decline in Social Distancing     | Binary = 1, if the respondents practiced social distancing in 2021, and not in 2022, otherwise 0.                                                                                                                                                                                                                                                                                                                    |
| <b>Independent Variables</b>     |                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Male                             | Binary variable: 1 = male and 0 = female                                                                                                                                                                                                                                                                                                                                                                             |
| Age                              | Continuous variable: the respondents’ age in years in the specific year of the study                                                                                                                                                                                                                                                                                                                                 |
| Age Squared                      | Age squared in years                                                                                                                                                                                                                                                                                                                                                                                                 |
| Spouse                           | Binary variable: 1 = currently having a spouse or married and 0 = otherwise                                                                                                                                                                                                                                                                                                                                          |
| Divorced                         | Binary variable: 1 = divorced or separated and 0 = otherwise                                                                                                                                                                                                                                                                                                                                                         |
| Living Alone                     | Binary variable: 1 = living alone and 0 = otherwise                                                                                                                                                                                                                                                                                                                                                                  |
| Household Size                   | Continuous variable: the number of people currently living in the household                                                                                                                                                                                                                                                                                                                                          |
| Child(ren)                       | Binary variable: 1 = have at least one child and 0 = otherwise                                                                                                                                                                                                                                                                                                                                                       |
| Full-time Employment             | Binary variable: 1 = having a full-time job, 0 = otherwise                                                                                                                                                                                                                                                                                                                                                           |
| Household Income                 | Continuous variable: annual earned income before taxes and with bonuses of the entire household (unit: JPY)                                                                                                                                                                                                                                                                                                          |
| Log Household Income             | Log of the household income                                                                                                                                                                                                                                                                                                                                                                                          |
| Household Asset                  | Continuous variable: a balance of the financial assets (savings, stock, insurance, etc.) of the entire household (unit: JPY)                                                                                                                                                                                                                                                                                         |
| Log Asset                        | Log of the household assets                                                                                                                                                                                                                                                                                                                                                                                          |
| Depression                       | Ordinal variable for the statement, “I have been feeling depressed lately.” 1 = it does not hold true at all for you, 2 = it is not so true for you, 3 = neither true nor false, 4 = it is rather true for you, 5 = it is particularly true for you                                                                                                                                                                  |
| Future Anxiety                   | Ordinal variable for the statements, “I have anxieties about life after 65 years of age” and “I have anxieties about life in the future” for individuals less than 65 years old and for those who were aged 65 years or above, respectively. 1 = it does not hold true at all for you, 2 = it is not so true for you, 3 = neither true nor false, 4 = it is rather true for you, 5 = it is particularly true for you |
| Happiness                        | Continuous variable: the percentage score from the question “Overall, how happy would you say you are currently?”                                                                                                                                                                                                                                                                                                    |
| Financial Satisfaction           | Ordinal variable for the statement “How satisfied are you with the current financial situation of your household?” using a scale of 1 = unsatisfied to 5 = satisfied.                                                                                                                                                                                                                                                |
| Subjective Health Status         | Ordinal variable for the statement “How would you describe your current health status: Is it 5 = excellent, 4 = very good, 3 = good, 2 = fair, or 1 = poor?”                                                                                                                                                                                                                                                         |
| Risk Rain Preference             | Continuous variable: the percentage score from the question “How high does the chance of rain have to be for you to carry an umbrella with you when you go out?”                                                                                                                                                                                                                                                     |
| Smoking Behavior                 | Binary variable: 1 = current smoker (at least sometimes—more than two packs daily) and 0 = non-smoker (does not smoke at all, has quit, or hardly smokes)                                                                                                                                                                                                                                                            |
| Regular Exercise                 | Binary variable: 1 = regular exercise (exercises at least weekly or more) and 0 = otherwise                                                                                                                                                                                                                                                                                                                          |
| Alcohol Drinker                  | Binary variable: 1 = current drinker (drinks at least sometimes—five cans of beer daily) and 0 = otherwise                                                                                                                                                                                                                                                                                                           |
| Gambling Addiction               | Binary variable: 1 = frequent gambler (gambles at least weekly or more) and 0 = otherwise                                                                                                                                                                                                                                                                                                                            |

### 2.3. Methods

We evaluated the association between the use of the COVID-19 preventive measures and explanatory variables for the 2021 and 2022 datasets using the following Equations (1)–(3). The

relationship between the decline in these measures and the explanatory variables was further investigated.

$$Y_{21i} = f(X_{1i}, \epsilon_{1i}) \quad (1)$$

$$Y_{22i} = f(X_{2i}, \epsilon_{2i}) \quad (2)$$

$$Y_{Di} = f(X_{2i}, \epsilon_{2i}) \quad (3)$$

Here,  $Y_{21}$  represents the preventive measures for the year 2021,  $Y_{22}$  for the year 2022, and  $Y_D$  is the study's decline in preventive measures. A vector of the demographic, socio-economic, and behavioral variables for 2021 has been denoted in  $X_1$ , while a similar vector of variables has been shown in  $X_2$ . In Equation (3), the dependent variables are binary measures; therefore, the probit model was used. However, in Equations (1) and (2), the dependent variables are ordinal measures; hence, the ordered probit model was employed. We also performed a multicollinearity test because we believed that a multicollinearity problem could change the results of our regression (reports are available upon request). Based on our findings, the variables that explain this phenomenon have variance inflation factors of less than 10. Therefore, it is unlikely that our regressions demonstrated multicollinearity. Equations (1)–(3) have the following full model specifications: Equations (4)–(9) for Equations (1) and (2), and Equations (10)–(12) for Equation (3).

*Hand Hygiene(2021)*

$$\begin{aligned} &= \beta_0 + \beta_1 \text{Male}_i + \beta_2 \text{Age}_i + \beta_3 \text{Agesquared}_i + \beta_4 \text{Spouse}_i \\ &+ \beta_5 \text{Divorced}_i + \beta_6 \text{Living Alone}_i + \beta_7 \text{householdmemebers}_i \\ &+ \beta_8 \text{Child(ren)}_i + \beta_9 \text{Fulltime}_i + \beta_{10} \text{Log(HHincome)}_i \\ &+ \beta_{11} \log(\text{Asset})_i + \beta_{12} \text{Depression}_i + \beta_{13} \text{Anxiety}_i \\ &+ \beta_{14} \text{Happiness}_i + \beta_{15} \text{Fin satisfaction}_i \\ &+ \beta_{16} \text{SubjectiveHealth status}_i + \beta_{17} \text{RiskPreference}_i \\ &+ \beta_{18} \text{smoker}_i + \beta_{19} \text{Exercise}_i + \beta_{20} \text{AlcoholDrinker}_i \\ &+ \beta_{21} \text{Gambleaddiction}_i + \epsilon_i \dots\dots\dots \end{aligned} \quad (4)$$

*Wear Mask(2021)*

$$\begin{aligned} &= \beta_0 + \beta_1 \text{Male}_i + \beta_2 \text{Age}_i + \beta_3 \text{Agesquared}_i + \beta_4 \text{Spouse}_i \\ &+ \beta_5 \text{Divorced}_i + \beta_6 \text{Living Alone}_i + \beta_7 \text{householdmemebers}_i \\ &+ \beta_8 \text{Child(ren)}_i + \beta_9 \text{Fulltime}_i + \beta_{10} \text{Log(HHincome)}_i \\ &+ \beta_{11} \log(\text{Asset})_i + \beta_{12} \text{Depression}_i + \beta_{13} \text{Anxiety}_i \\ &+ \beta_{14} \text{Happiness}_i + \beta_{15} \text{Fin satisfaction}_i \\ &+ \beta_{16} \text{SubjectiveHealth status}_i + \beta_{17} \text{RiskPreference}_i \\ &+ \beta_{18} \text{smoker}_i + \beta_{19} \text{Exercise}_i + \beta_{20} \text{AlcoholDrinker}_i \\ &+ \beta_{21} \text{Gambleaddiction}_i + \epsilon_i \dots\dots\dots \end{aligned} \quad (5)$$

*Social Distance(2021)*

$$\begin{aligned} &= \beta_0 + \beta_1 \text{Male}_i + \beta_2 \text{Age}_i + \beta_3 \text{Agesquared}_i + \beta_4 \text{Spouse}_i \\ &+ \beta_5 \text{Divorced}_i + \beta_6 \text{Living Alone}_i + \beta_7 \text{householdmemebers}_i \\ &+ \beta_8 \text{Child(ren)}_i + \beta_9 \text{Fulltime}_i + \beta_{10} \text{Log(HHincome)}_i \\ &+ \beta_{11} \log(\text{Asset})_i + \beta_{12} \text{Depression}_i + \beta_{13} \text{Anxiety}_i \\ &+ \beta_{14} \text{Happiness}_i + \beta_{15} \text{Fin satisfaction}_i \\ &+ \beta_{16} \text{SubjectiveHealth status}_i + \beta_{17} \text{RiskPreference}_i \\ &+ \beta_{18} \text{smoker}_i + \beta_{19} \text{Exercise}_i + \beta_{20} \text{AlcoholDrinker}_i \\ &+ \beta_{21} \text{Gambleaddiction}_i + \epsilon_i \dots\dots\dots \end{aligned} \quad (6)$$

*Hand Hygiene(2022)*

$$\begin{aligned}
&= \beta_0 + \beta_1 \text{Male}_i + \beta_2 \text{Age}_i + \beta_3 \text{Agesquared}_i + \beta_4 \text{Spouse}_i \\
&+ \beta_5 \text{Divorced}_i + \beta_6 \text{Living Alone}_i + \beta_7 \text{householdmemebers}_i \\
&+ \beta_8 \text{Child(ren)}_i + \beta_9 \text{Fulltime}_i + \beta_{10} \text{Log(HHincome)}_i \\
&+ \beta_{11} \log(\text{Asset})_i + \beta_{12} \text{Depression}_i + \beta_{13} \text{Anxiety}_i \\
&+ \beta_{14} \text{Happiness}_i + \beta_{15} \text{Fin satisfaction}_i \\
&+ \beta_{16} \text{SubjectiveHealth status}_i + \beta_{17} \text{RiskPreference}_i \\
&+ \beta_{18} \text{smoker}_i + \beta_{19} \text{Exercise}_i + \beta_{20} \text{AlcoholDrinker}_i \\
&+ \beta_{21} \text{Gambleaddiction}_i + \epsilon_i \dots\dots\dots
\end{aligned} \tag{7}$$

*Wear Mask(2022)*

$$\begin{aligned}
&= \beta_0 + \beta_1 \text{Male}_i + \beta_2 \text{Age}_i + \beta_3 \text{Agesquared}_i + \beta_4 \text{Spouse}_i \\
&+ \beta_5 \text{Divorced}_i + \beta_6 \text{Living Alone}_i + \beta_7 \text{householdmemebers}_i \\
&+ \beta_8 \text{Child(ren)}_i + \beta_9 \text{Fulltime}_i + \beta_{10} \text{Log(HHincome)}_i \\
&+ \beta_{11} \log(\text{Asset})_i + \beta_{12} \text{Depression}_i + \beta_{13} \text{Anxiety}_i \\
&+ \beta_{14} \text{Happiness}_i + \beta_{15} \text{Fin satisfaction}_i \\
&+ \beta_{16} \text{SubjectiveHealth status}_i + \beta_{17} \text{RiskPreference}_i \\
&+ \beta_{18} \text{smoker}_i + \beta_{19} \text{Exercise}_i + \beta_{20} \text{AlcoholDrinker}_i \\
&+ \beta_{21} \text{Gambleaddiction}_i + \epsilon_i \dots\dots\dots
\end{aligned} \tag{8}$$

*Social Distance(2022)*

$$\begin{aligned}
&= \beta_0 + \beta_1 \text{Male}_i + \beta_2 \text{Age}_i + \beta_3 \text{Agesquared}_i + \beta_4 \text{Spouse}_i \\
&+ \beta_5 \text{Divorced}_i + \beta_6 \text{Living Alone}_i + \beta_7 \text{householdmemebers}_i \\
&+ \beta_8 \text{Child(ren)}_i + \beta_9 \text{Fulltime}_i + \beta_{10} \text{Log(HHincome)}_i \\
&+ \beta_{11} \log(\text{Asset})_i + \beta_{12} \text{Depression}_i + \beta_{13} \text{Anxiety}_i \\
&+ \beta_{14} \text{Happiness}_i + \beta_{15} \text{Fin satisfaction}_i \\
&+ \beta_{16} \text{SubjectiveHealth status}_i + \beta_{17} \text{RiskPreference}_i \\
&+ \beta_{18} \text{smoker}_i + \beta_{19} \text{Exercise}_i + \beta_{20} \text{AlcoholDrinker}_i \\
&+ \beta_{21} \text{Gambleaddiction}_i + \epsilon_i \dots\dots\dots
\end{aligned} \tag{9}$$

*Probability of Decline Hand Hygiene*

$$\begin{aligned}
&= \Phi(\beta_0 + \beta_1 \text{Male}_i + \beta_2 \text{Age}_i + \beta_3 \text{Agesquared}_i + \beta_4 \text{Spouse}_i \\
&+ \beta_5 \text{Divorced}_i + \beta_6 \text{Living Alone}_i + \beta_7 \text{householdmemebers}_i \\
&+ \beta_8 \text{Child(ren)}_i + \beta_9 \text{Fulltime}_i + \beta_{10} \text{Log(HHincome)}_i \\
&+ \beta_{11} \log(\text{Asset})_i + \beta_{12} \text{Depression}_i + \beta_{13} \text{Anxiety}_i \\
&+ \beta_{14} \text{Happiness}_i + \beta_{15} \text{Fin satisfaction}_i \\
&+ \beta_{16} \text{SubjectiveHealth status}_i + \beta_{17} \text{RiskPreference}_i \\
&+ \beta_{18} \text{smoker}_i + \beta_{19} \text{Exercise}_i + \beta_{20} \text{AlcoholDrinker}_i \\
&+ \beta_{21} \text{Gambleaddiction}_i) \dots\dots\dots
\end{aligned} \tag{10}$$

*Probabilty of Decline Wear Mask*

$$\begin{aligned}
&= \Phi(\beta_0 + \beta_1 \text{Male}_i + \beta_2 \text{Age}_i + \beta_3 \text{Agesquared}_i + \beta_4 \text{Spouse}_i \\
&+ \beta_5 \text{Divorced}_i + \beta_6 \text{Living Alone}_i + \beta_7 \text{householdmemebers}_i \\
&+ \beta_8 \text{Child(ren)}_i + \beta_9 \text{Fulltime}_i + \beta_{10} \text{Log(HHincome)}_i \\
&+ \beta_{11} \log(\text{Asset})_i + \beta_{12} \text{Depression}_i + \beta_{13} \text{Anxiety}_i \\
&+ \beta_{14} \text{Happiness}_i + \beta_{15} \text{Fin satisfaction}_i \\
&+ \beta_{16} \text{SubjectiveHealth status}_i + \beta_{17} \text{RiskPreference}_i \\
&+ \beta_{18} \text{smoker}_i + \beta_{19} \text{Exercise}_i + \beta_{20} \text{AlcoholDrinker}_i \\
&+ \beta_{21} \text{Gambleaddiction}_i) \dots\dots\dots
\end{aligned} \tag{11}$$

### Probabilty of Decline Social Distance

$$\begin{aligned}
 = & \Phi(\beta_0 + \beta_1 \text{Male}_i + \beta_2 \text{Age}_i + \beta_3 \text{Agesquared}_i + \beta_4 \text{Spouse}_i \\
 & + \beta_5 \text{Divorced}_i + \beta_6 \text{Living Alone}_i + \beta_7 \text{householdmemebers}_i \\
 & + \beta_8 \text{Child(ren)}_i + \beta_9 \text{Fulltime}_i + \beta_{10} \text{Log(HHincome)}_i \\
 & + \beta_{11} \log(\text{Asset})_i + \beta_{12} \text{Depression}_i + \beta_{13} \text{Anxiety}_i \\
 & + \beta_{14} \text{Happiness}_i + \beta_{15} \text{Fin satisfaction}_i \\
 & + \beta_{16} \text{SubjectiveHealth status}_i + \beta_{17} \text{RiskPreference}_i \\
 & + \beta_{18} \text{smoker}_i + \beta_{19} \text{Exercise}_i + \beta_{20} \text{AlcoholDrinker}_i \\
 & + \beta_{21} \text{Gambleaddiction}_i) \dots\dots\dots
 \end{aligned} \tag{12}$$

## 3. Results

### 3.1. Descriptive Statistics

Table 2 presents the descriptive statistics. In 2021 and 2022, hygiene practice scored 4.6/5 and 4.3/5, respectively. In addition, regarding mask-wearing, a score of 4.8/5 was reported in 2021; however, it decreased to 4.7/5 in 2022. For social distancing, we found a score of 4.3/5 and 4.1/5 in 2021 and 2022, respectively. There was a 10%, 4%, and 13% decline in hand hygiene, wearing masks, and social distancing, respectively, by 2022. This revelation requires immediate attention, especially in Japan where compliance is highly valued. In the demographic structure, about 47% represented the male population in both the years; however, the median age in 2021 was 61 years that increased to 62 years in 2022. Approximately 81% had a spouse in 2021, which decreased to 80% by 2022. The divorce rate surged from approximately 4% in 2021 to approximately 5% in 2022. In addition, the number of people living alone also increased to 8.4% in 2022 from 8% in 2021. Regarding the household structure, we observed a decrease in the average number of households from 2.9/5 in 2021 to around 2.8/5 in 2022. The respondents with children remained constant in both years (87%). Regarding the income levels, we found a reduction in full-time employment in 2022, from approximately 32% to 31% in 2021 and 2022, respectively. This could be due to the impact of COVID-19 that has affected the economies and employment sectors. Contrariwise, household income indicated an average increase from 6 million yen in 2021 to about 6.2 million yen in 2022; the same was observed for the household assets, averaging 13 million yen in 2021 to about 13.4 million yen in 2022. Considering the subjective measurements, we found that while depression remains a concern, a minimal decrease was reported in the depression scores from 2.8/5 in 2021 to approximately 2.7/5 in 2022. Moreover, people were also additionally anxious, with a score of approximately 3.3/5 in both years. In addition, their level of happiness remained constant over the years, with an average score of approximately 0.66. The study found that the respondents thought they were financially satisfied, with an average score of about 3.2/5 for both years. Subjectively, people's health has been declining; although we reached a score of 3.3/5 in 2021, it reduced to about 3.2/5 in 2022, indicating that over the years, people have experienced deterioration in their health. In addition, the risk preference of the respondents was an average of 0.45 for both years; thus, the population is largely risk-neutral, especially during COVID-19. Finally, regarding the healthy lifestyle activities and risky behaviors, in 2021, approximately 47% exercised regularly, which increased to 48% in 2022. Interestingly, there was a decrease from 14% to 13% for smoking and 43% to 41% for alcohol consumption in 2021 and 2022, respectively; however, gambling increased from 27% in 2021 to 30% in 2022.

The entire study sample was divided into subsamples according to sex. Table 3 show that the hand hygiene, mask-wearing, and social distancing practices varied by gender at a 99% significance level for the 2021 measures, while Table 4 display the same for the 2022 measures. Furthermore, Table 5 shows that the decline in the hand hygiene, mask-wearing, and social distancing practices varied by gender, with a level of significance of 99%.

**Table 2.** Descriptive statistics.

| Variable                     | 2021           |                | 2022           |                | Decline Practices |           |
|------------------------------|----------------|----------------|----------------|----------------|-------------------|-----------|
|                              | Mean           | Std. Dev.      | Mean           | Std. Dev.      | Mean              | Std. Dev. |
| <b>Dependent Variables</b>   |                |                |                |                |                   |           |
| Hand Hygiene                 | 4.626          | 0.678          | 4.322          | 0.931          | 0.109             | 0.312     |
| Wearing a Mask               | 4.866          | 0.500          | 4.754          | 0.779          | 0.044             | 0.206     |
| Social Distancing            | 4.379          | 0.790          | 4.125          | 0.932          | 0.136             | 0.343     |
| <b>Explanatory Variables</b> |                |                |                |                |                   |           |
| Male                         | 0.475          | 0.500          | 0.475          | 0.500          |                   |           |
| Age                          | 61.651         | 11.406         | 62.651         | 11.406         |                   |           |
| Age Squared                  | 3930.813       | 1385.620       | 4055.114       | 1408.295       |                   |           |
| Spouse                       | 0.812          | 0.391          | 0.806          | 0.395          |                   |           |
| Divorced                     | 0.048          | 0.214          | 0.051          | 0.219          |                   |           |
| Living Alone                 | 0.08           | 0.271          | 0.084          | 0.277          |                   |           |
| Household Size               | 2.947          | 1.307          | 2.892          | 1.289          |                   |           |
| Child(ren)                   | 0.872          | 0.334          | 0.87           | 0.336          |                   |           |
| Full-time Employment         | 0.320          | 0.467          | 0.310          | 0.463          |                   |           |
| Household Income             | 6,087,974.700  | 3,886,309.500  | 6,204,113.900  | 4,085,565.000  |                   |           |
| Log Household Income         | 15.42          | 0.659          | 15.429         | 0.671          |                   |           |
| Household Asset              | 13,000,000.000 | 12,401,017.000 | 13,437,500.000 | 12,132,349.000 |                   |           |
| Log Asset                    | 16.072         | 0.770          | 16.111         | 0.772          |                   |           |
| Depression                   | 2.808          | 1.134          | 2.741          | 1.118          |                   |           |
| Future Anxiety               | 3.398          | 1.090          | 3.359          | 1.093          |                   |           |
| Happiness                    | 0.668          | 0.172          | 0.662          | 0.177          |                   |           |
| Financial Satisfaction       | 3.204          | 1.032          | 3.213          | 1.049          |                   |           |
| Subjective Health Status     | 3.315          | 0.926          | 3.238          | 0.922          |                   |           |
| Risk Rain Preference         | 0.456          | 0.192          | 0.454          | 0.196          |                   |           |
| Smoking Behavior             | 0.144          | 0.352          | 0.139          | 0.346          |                   |           |
| Regular Exercise             | 0.470          | 0.499          | 0.482          | 0.500          |                   |           |
| Alcohol Drinker              | 0.430          | 0.495          | 0.419          | 0.494          |                   |           |
| Gambling Addiction           | 0.278          | 0.448          | 0.301          | 0.459          |                   |           |

Observation (N) = 1580.

**Table 3.** (a). Gender and hand hygiene practice (ordinal measure 2021). (b). Gender and wearing a mask (ordinal measure 2021). (c). Gender and social distancing (ordinal measure 2021).

| (a)             |                   |        |        |        |        |        |
|-----------------|-------------------|--------|--------|--------|--------|--------|
| Gender          | Hand Hygiene 2021 |        |        |        |        | Total  |
|                 | 1                 | 2      | 3      | 4      | 5      |        |
| Female          | 3                 | 3      | 20     | 137    | 666    | 829    |
| %               | 33.330            | 15     | 31.250 | 37.330 | 59.460 | 52.470 |
| Male            | 6                 | 17     | 44     | 230    | 454    | 751    |
| %               | 66.670            | 85     | 68.750 | 62.670 | 40.540 | 47.530 |
| Total           | 9                 | 20     | 64     | 367    | 1120   | 1580   |
| %               | 100               | 100    | 100    | 100    | 100    | 100    |
| Mean Difference | F = 72.49 ***     |        |        |        |        |        |
| (b)             |                   |        |        |        |        |        |
| Gender          | Wearing of Mask   |        |        |        |        | Total  |
|                 | 1                 | 2      | 3      | 4      | 5      |        |
| Female          | 4                 | 1      | 0      | 20     | 804    | 829    |
| %               | 44.440            | 7.690  | 0      | 18.180 | 56.030 | 52.470 |
| Male            | 5                 | 12     | 13     | 90     | 631    | 751    |
| %               | 55.560            | 92.310 | 100    | 81.820 | 43.970 | 47.530 |
| Total           | 9                 | 13     | 13     | 110    | 1435   | 1580   |
| %               | 100               | 100    | 100    | 100    | 100    | 100    |
| Mean Difference | F = 53.94 ***     |        |        |        |        |        |
| (c)             |                   |        |        |        |        |        |
| Gender          | Social Distancing |        |        |        |        | Total  |
|                 | 1                 | 2      | 3      | 4      | 5      |        |
| Female          | 4                 | 10     | 49     | 253    | 513    | 829    |
| %               | 50                | 28.570 | 31.820 | 47.200 | 60.570 | 52.470 |
| Male            | 4                 | 25     | 105    | 283    | 334    | 751    |
| %               | 50                | 71.430 | 68.180 | 52.800 | 39.430 | 47.530 |
| Total           | 8                 | 35     | 154    | 536    | 847    | 1580   |
| %               | 100               | 100    | 100    | 100    | 100    | 100    |
| Mean Difference | F = 58.37 ***     |        |        |        |        |        |

\*\*\*  $p < 0.01$ .



**Table 4.** (a). Gender and hand hygiene practice (ordinal measure 2022). (b). Gender and wearing a mask (ordinal measure 2022). (c). Gender and social distancing (ordinal measure 2022).

| (a)             |                        |        |        |        |        |        |
|-----------------|------------------------|--------|--------|--------|--------|--------|
| Gender          | Hand Hygiene 2022      |        |        |        |        | Total  |
|                 | 1                      | 2      | 3      | 4      | 5      |        |
| Female          | 16                     | 12     | 54     | 217    | 530    | 829    |
| %               | 43.240                 | 25.530 | 36.240 | 44.740 | 61.480 | 52.470 |
| Male            | 21                     | 35     | 95     | 268    | 332    | 751    |
| %               | 56.760                 | 74.470 | 63.760 | 55.260 | 38.520 | 47.530 |
| Total           | 37                     | 47     | 149    | 485    | 862    | 1580   |
| %               | 100                    | 100    | 100    | 100    | 100    | 100    |
| Mean Difference | F = 57.30 ***          |        |        |        |        |        |
| (b)             |                        |        |        |        |        |        |
| Gender          | Wearing a Mask 2022    |        |        |        |        | Total  |
|                 | 1                      | 2      | 3      | 4      | 5      |        |
| Female          | 15                     | 2      | 4      | 33     | 775    | 829    |
| %               | 34.880                 | 13.330 | 13.790 | 28.950 | 56.200 | 52.470 |
| Male            | 28                     | 13     | 25     | 81     | 604    | 751    |
| %               | 65.120                 | 86.670 | 86.210 | 71.050 | 43.800 | 47.530 |
| Total           | 43                     | 15     | 29     | 114    | 1379   | 1580   |
| %               | 100                    | 100    | 100    | 100    | 100    | 100    |
| Mean Difference | F = 40.46 ***          |        |        |        |        |        |
| (c)             |                        |        |        |        |        |        |
| Gender          | Social Distancing 2022 |        |        |        |        | Total  |
|                 | 1                      | 2      | 3      | 4      | 5      |        |
| Female          | 16                     | 13     | 92     | 320    | 388    | 829    |
| %               | 45.710                 | 25.000 | 39.320 | 51.700 | 60.620 | 52.470 |
| Male            | 19                     | 39     | 142    | 299    | 252    | 751    |
| %               | 54.290                 | 75.000 | 60.680 | 48.300 | 39.380 | 47.530 |
| Total           | 35                     | 52     | 234    | 619    | 640    | 1580   |
| %               | 100                    | 100    | 100    | 100    | 100    | 100    |
| Mean Difference | F = 42.17 ***          |        |        |        |        |        |

\*\*\*  $p < 0.01$ .**Table 5.** Statistical distribution of gender by decline in hand hygiene, wearing of mask, and social distancing.

| Gender          | Decline Hand Hygiene |        | Decline Wearing of Mask |        | Decline Social Distancing |        |
|-----------------|----------------------|--------|-------------------------|--------|---------------------------|--------|
|                 | No                   | Yes    | No                      | Yes    | No                        | Yes    |
| Female          | 764                  | 65     | 809                     | 20     | 734                       | 95     |
| %               | 54.300               | 37.570 | 53.580                  | 28.570 | 53.770                    | 44.190 |
| Male            | 643                  | 108    | 701                     | 50     | 631                       | 120    |
| %               | 45.700               | 62.430 | 46.420                  | 71.430 | 46.230                    | 55.810 |
| Total           | 1407                 | 173    | 1510                    | 70     | 1365                      | 215    |
| %               | 100                  | 100    | 100                     | 100    | 100                       | 100    |
| Mean Difference | t = −4.1778 ***      |        | t = −4.1147 ***         |        | t = −2.6204 ***           |        |

\*\*\*  $p < 0.01$ .

### 3.2. Observing the COVID-19 Preventive Measures in 2021 and 2022

Table 6 lists the regression results for the maintenance of the preventive measures for each year. Regarding the hand hygiene practices, we found that men and people who smoke were negatively associated, indicating that they were less likely to practice hand hygiene in 2021; additionally, the people with spouses, anxiety, happiness, and those who exercised regularly were positively associated with hand hygiene in 2021. In addition, regarding 2022, we found that men were negatively associated with hand hygiene, while happiness and exercise were positively related. Regarding wearing a mask, for the 2021 analysis, men and household size were negatively associated with mask-wearing. The people with spouses, divorced status, household income, and depression were also positively associated with wearing a mask. Furthermore, for 2022, males, age (years) was negatively related with

wearing a mask, while only the age squared variable was positively associated with it. In addition to observing social distancing as a measure, in 2021, men and regular gamblers were negatively associated with social distancing, whereas happiness and exercise were positively associated with it. In 2022, we found that men, the log of assets, and smokers were negatively related to the preventive measures.

**Table 6.** Ordered probit results of preventive measures for the 2021 and 2022.

| Variables                | Full Sample           |                       | Full Sample           |                       | Full Sample           |                       |
|--------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                          | Hand Hygiene          |                       | Wearing a Mask        |                       | Social Distancing     |                       |
|                          | 2021                  | 2022                  | 2021                  | 2022                  | 2021                  | 2022                  |
| Male                     | −0.514 ***<br>(0.079) | −0.442 ***<br>(0.071) | −0.887 ***<br>(0.123) | −0.594 ***<br>(0.099) | −0.441 ***<br>(0.069) | −0.363 ***<br>(0.065) |
| Age (in years)           | 0.00945<br>(0.027)    | −0.0206<br>(0.024)    | 0.000784<br>(0.039)   | −0.0691 **<br>(0.032) | 0.0300<br>(0.027)     | 0.0102<br>(0.023)     |
| Age Squared              | 0.000<br>(0.000)      | 0.000<br>(0.000)      | 0.000<br>(0.000)      | 0.001 *<br>(0.000)    | 0.000<br>(0.000)      | 0.000<br>(0.000)      |
| Spouse                   | 0.277 **<br>(0.129)   | 0.082<br>(0.124)      | 0.657 ***<br>(0.186)  | 0.122<br>(0.167)      | 0.146<br>(0.120)      | −0.091<br>(0.114)     |
| Divorced                 | 0.264<br>(0.195)      | 0.194<br>(0.180)      | 0.708 **<br>(0.311)   | 0.265<br>(0.274)      | −0.116<br>(0.171)     | −0.073<br>(0.160)     |
| Living Alone             | 0.027<br>(0.159)      | −0.065<br>(0.138)     | 0.025<br>(0.208)      | −0.030<br>(0.186)     | 0.007<br>(0.146)      | −0.058<br>(0.139)     |
| Household Sizes          | 0.003<br>(0.031)      | −0.004<br>(0.028)     | −0.075 *<br>(0.043)   | −0.063<br>(0.039)     | 0.004<br>(0.028)      | 0.025<br>(0.026)      |
| Child(ren)               | −0.033<br>(0.120)     | −0.017<br>(0.108)     | −0.025<br>(0.155)     | 0.205<br>(0.140)      | 0.042<br>(0.099)      | 0.057<br>(0.095)      |
| Full-time Employment     | −0.020<br>(0.084)     | −0.010<br>(0.079)     | −0.067<br>(0.124)     | −0.026<br>(0.107)     | 0.013<br>(0.076)      | 0.071<br>(0.074)      |
| Log Household Income     | 0.027<br>(0.062)      | 0.033<br>(0.057)      | 0.156 *<br>(0.088)    | 0.080<br>(0.080)      | −0.036<br>(0.056)     | 0.012<br>(0.053)      |
| Log Asset                | 0.002<br>(0.044)      | −0.043<br>(0.038)     | 0.021<br>(0.061)      | 0.008<br>(0.055)      | 0.020<br>(0.040)      | −0.142 ***<br>(0.038) |
| Depression               | 0.0357<br>(0.034)     | 0.010<br>(0.034)      | 0.089 *<br>(0.047)    | −0.011<br>(0.045)     | 0.042<br>(0.031)      | −0.025<br>(0.032)     |
| Anxiety                  | 0.114 ***<br>(0.039)  | 0.050<br>(0.033)      | 0.067<br>(0.050)      | 0.051<br>(0.043)      | −0.004<br>(0.035)     | 0.039<br>(0.033)      |
| Happiness                | 0.617 **<br>(0.247)   | 0.438 *<br>(0.229)    | 0.477<br>(0.363)      | 0.381<br>(0.326)      | 0.393 *<br>(0.229)    | 0.324<br>(0.216)      |
| Financial Satisfaction   | 0.004<br>(0.042)      | −0.0207<br>(0.037)    | 0.006<br>(0.059)      | −0.033<br>(0.052)     | 0.021<br>(0.039)      | 0.030<br>(0.036)      |
| Subjective Health Status | 0.015<br>(0.040)      | 0.044<br>(0.037)      | 0.063<br>(0.060)      | −0.036<br>(0.052)     | −0.038<br>(0.035)     | −0.010<br>(0.035)     |
| Risk Rain Preference     | −0.084<br>(0.174)     | −0.200<br>(0.153)     | 0.040<br>(0.249)      | −0.031<br>(0.203)     | −0.236<br>(0.157)     | −0.143<br>(0.147)     |
| Smoker                   | −0.227 **<br>(0.093)  | −0.0565<br>(0.089)    | −0.086<br>(0.129)     | −0.074<br>(0.117)     | −0.139<br>(0.086)     | −0.171 *<br>(0.089)   |
| Exercise                 | 0.166 **<br>(0.069)   | 0.168 ***<br>(0.059)  | −0.108<br>(0.097)     | 0.046<br>(0.083)      | 0.167 ***<br>(0.061)  | 0.069<br>(0.058)      |
| Alcohol Drinker          | −0.042<br>(0.068)     | −0.085<br>(0.062)     | 0.057<br>(0.097)      | −0.033<br>(0.086)     | 0.010<br>(0.061)      | −0.031<br>(0.059)     |
| Gambling Addiction       | −0.020<br>(0.072)     | 0.052<br>(0.065)      | −0.021<br>(0.097)     | 0.061<br>(0.090)      | −0.129**<br>(0.065)   | 0.008<br>(0.063)      |
| /cut1                    | −1.008<br>(1.413)     | −2.457 **<br>(1.237)  | 0.606<br>(2.022)      | −3.025 *<br>(1.726)   | −1.689<br>(1.299)     | −3.353 ***<br>(1.148) |
| /cut2                    | −0.547<br>(1.412)     | −2.078 *<br>(1.236)   | 0.972<br>(1.984)      | −2.889 *<br>(1.723)   | −1.012<br>(1.297)     | −2.933 **<br>(1.145)  |
| /cut3                    | 0.005<br>(1.403)      | −1.491<br>(1.235)     | 1.183<br>(1.978)      | −2.688<br>(1.725)     | −0.191<br>(1.290)     | −2.138 *<br>(1.146)   |
| /cut4                    | 1.082<br>(1.401)      | −0.520<br>(1.235)     | 1.952<br>(1.977)      | −2.201<br>(1.726)     | 0.927<br>(1.288)      | −1.029<br>(1.145)     |
| Observations             | 1580                  | 1580                  | 1580                  | 1580                  | 1580                  | 1580                  |
| Log likelihood           | −1201                 | −1705                 | −539.100              | −790.100              | −1584                 | −1874                 |
| Chi-square               | 130.500               | 88.480                | 108.7                 | 67.49                 | 104.600               | 82.100                |
| p-value                  | 0.000                 | 0.000                 | 0.000                 | 0.000                 | 0.000                 | 0.000                 |

Robust standard errors in parentheses, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

We evaluated the association between the socioeconomic variables and preventive measures in 2021 and 2022 by sex (Table 7). Age, household size, depression, anxiety, happiness, and exercise were positively related to hand hygiene in the 2021 female subsample, whereas age squared and smoking were negatively related to it. In the male subsample, spouse and happiness were positively correlated to it. Furthermore, in the 2022 female subsample, the log of assets was negatively associated with hand hygiene, whereas anxiety and exercise were positively associated with it. Regarding the 2022 male subsample, we

found that age, risk preference, age squared, divorce, spouse, and exercise behavior were positively associated with hand hygiene. Furthermore, smoking was negatively associated with mask-wearing in 2021 in the female subsample; in addition, marriage and depression were positively associated with mask-wearing. For the male subsample, household size and exercise were negatively associated with wearing a mask, whereas spouse, divorced status, and subjective health status were positively related to wearing a mask. In 2022, age was negatively associated with wearing a mask. In contrast, age squared was positively associated with it in the female subsample. However, household size was negatively related to wearing a mask during divorce, while happiness was positively associated with it for the male subsample. Regarding social distancing, for the female subsample in 2021, we found that the subjective health status and frequent gamblers were negatively associated, while exercise behavior was positively related to it. Risk preference was negatively associated for the male subsample for the same measure in 2021, however, spouses and happiness were positively associated with social distancing practices. Finally, for the 2022 sample, the spouse and log of assets in the female subsample were negatively associated with the social distancing practices, whereas the household size was positively related to it for the female subsample. In the male subsample, risk preference and smoking were negatively associated with the social distancing measures, while spouses were positively associated with it.

**Table 7.** Ordered probit results of the subsample analysis of preventive measures for the 2021 and 2022.

|                          | Sub-Sample   |      |          |           |                |           |           |          |                   |            |      |           |            |      |            |
|--------------------------|--------------|------|----------|-----------|----------------|-----------|-----------|----------|-------------------|------------|------|-----------|------------|------|------------|
|                          | Hand Hygiene |      |          |           | Wearing a Mask |           |           |          | Social Distancing |            |      |           |            |      |            |
| Variables                | Female       | 2021 | Male     | Female    | 2022           | Male      | Female    | 2021     | Male              | Female     | 2022 | Male      | Female     | 2022 | Male       |
| Age (in years)           | 0.078 *      |      | −0.025   | 0.024     | −0.062 *       | 0.078     | −0.018    | −0.119 * | −0.061            | 0.060      |      | 0.009     | 0.052      |      | −0.021     |
|                          | (0.044)      |      | (0.037)  | (0.036)   | (0.032)        | (0.087)   | (0.044)   | (0.065)  | (0.039)           | (0.040)    |      | (0.038)   | (0.035)    |      | (0.032)    |
| Age Squared              | −0.000 *     |      | 0.000    | −0.000    | 0.000 **       | −0.000    | 0.000     | 0.000 *  | 0.000             | −0.000     |      | 0.000     | −0.000     |      | 0.000      |
|                          | (0.000)      |      | (0.000)  | (0.000)   | (0.000)        | (0.000)   | (0.000)   | (0.000)  | (0.000)           | (0.000)    |      | (0.000)   | (0.000)    |      | (0.000)    |
| Spouse                   | 0.097        |      | 0.411 ** | −0.133    | 0.440 **       | 0.516 **  | 0.682 **  | −0.120   | 0.389             | −0.025     |      | 0.326 *   | −0.346 **  |      | 0.415 **   |
|                          | (0.177)      |      | (0.194)  | (0.157)   | (0.211)        | (0.248)   | (0.275)   | (0.240)  | (0.253)           | (0.159)    |      | (0.187)   | (0.147)    |      | (0.196)    |
| Divorced                 | 0.233        |      | 0.325    | 0.000     | 0.649 **       | 0.429     | 1.122 **  | −0.176   | 1.170 **          | −0.317     |      | 0.186     | −0.163     |      | 0.188      |
|                          | (0.253)      |      | (0.329)  | (0.217)   | (0.305)        | (0.333)   | (0.544)   | (0.324)  | (0.489)           | (0.208)    |      | (0.309)   | (0.198)    |      | (0.274)    |
| Living Alone             | 0.142        |      | 0.040    | −0.0757   | 0.043          | 0.183     | 0.0491    | −0.042   | −0.015            | −0.004     |      | 0.057     | −0.017     |      | −0.007     |
|                          | (0.216)      |      | (0.231)  | (0.176)   | (0.220)        | (0.294)   | (0.281)   | (0.266)  | (0.274)           | (0.194)    |      | (0.224)   | (0.177)    |      | (0.232)    |
| Household Sizes          | 0.091 *      |      | −0.038   | 0.0277    | −0.0235        | 0.111     | −0.106 ** | −0.003   | −0.088 *          | 0.006      |      | 0.018     | 0.076 **   |      | −0.018     |
|                          | (0.051)      |      | (0.042)  | (0.038)   | (0.042)        | (0.099)   | (0.051)   | (0.059)  | (0.051)           | (0.040)    |      | (0.040)   | (0.036)    |      | (0.041)    |
| Child(ren)               | −0.041       |      | −0.033   | 0.109     | −0.222         | 0.052     | −0.025    | 0.293    | 0.033             | 0.015      |      | 0.023     | 0.115      |      | −0.129     |
|                          | (0.182)      |      | (0.162)  | (0.159)   | (0.154)        | (0.238)   | (0.204)   | (0.218)  | (0.188)           | (0.150)    |      | (0.132)   | (0.139)    |      | (0.137)    |
| Full-time Employment     | −0.103       |      | 0.063    | −0.109    | 0.116          | −0.186    | 0.028     | −0.239   | 0.082             | −0.018     |      | 0.053     | −0.030     |      | 0.108      |
|                          | (0.133)      |      | (0.120)  | (0.123)   | (0.111)        | (0.237)   | (0.149)   | (0.170)  | (0.133)           | (0.114)    |      | (0.112)   | (0.116)    |      | (0.102)    |
| Log Household Income     | 0.149        |      | −0.036   | 0.0869    | −0.029         | 0.146     | 0.139     | 0.169    | 0.025             | −0.002     |      | −0.065    | 0.064      |      | −0.050     |
|                          | (0.091)      |      | (0.088)  | (0.081)   | (0.081)        | (0.151)   | (0.113)   | (0.134)  | (0.098)           | (0.078)    |      | (0.084)   | (0.075)    |      | (0.074)    |
| Log Asset                | −0.045       |      | 0.055    | −0.137 ** | 0.077          | 0.062     | 0.0155    | −0.086   | 0.064             | 0.017      |      | 0.040     | −0.174 *** |      | −0.077     |
|                          | (0.069)      |      | (0.058)  | (0.054)   | (0.056)        | (0.123)   | (0.070)   | (0.085)  | (0.073)           | (0.060)    |      | (0.055)   | (0.054)    |      | (0.055)    |
| Depression               | 0.172 ***    |      | −0.055   | 0.021     | 0.007          | 0.214 **  | 0.060     | −0.044   | 0.003             | 0.034      |      | 0.053     | −0.042     |      | −0.005     |
|                          | (0.053)      |      | (0.046)  | (0.048)   | (0.049)        | (0.086)   | (0.058)   | (0.073)  | (0.057)           | (0.046)    |      | (0.044)   | (0.045)    |      | (0.046)    |
| Anxiety                  | 0.211 ***    |      | 0.054    | 0.112 **  | −0.009         | 0.063     | 0.059     | 0.116    | 0.010             | 0.019      |      | −0.026    | 0.055      |      | 0.026      |
|                          | (0.060)      |      | (0.051)  | (0.048)   | (0.046)        | (0.085)   | (0.059)   | (0.075)  | (0.053)           | (0.051)    |      | (0.050)   | (0.050)    |      | (0.047)    |
| Happiness                | 0.719 *      |      | 0.632 *  | 0.444     | 0.449          | 0.512     | 0.465     | −0.172   | 0.703 *           | 0.173      |      | 0.638 *   | 0.415      |      | 0.225      |
|                          | (0.368)      |      | (0.346)  | (0.326)   | (0.330)        | (0.642)   | (0.447)   | (0.571)  | (0.378)           | (0.316)    |      | (0.338)   | (0.296)    |      | (0.314)    |
| Financial Satisfaction   | 0.076        |      | −0.070   | 0.036     | −0.071         | −0.001    | 0.028     | −0.021   | −0.034            | 0.069      |      | −0.040    | 0.065      |      | 0.0039     |
|                          | (0.062)      |      | (0.058)  | (0.052)   | (0.054)        | (0.089)   | (0.075)   | (0.083)  | (0.067)           | (0.052)    |      | (0.058)   | (0.052)    |      | (0.051)    |
| Subjective Health Status | −0.009       |      | 0.055    | 0.071     | 0.022          | −0.057    | 0.129 *   | 0.034    | −0.074            | −0.134 *** |      | 0.053     | −0.065     |      | 0.046      |
|                          | (0.062)      |      | (0.054)  | (0.053)   | (0.052)        | (0.110)   | (0.071)   | (0.084)  | (0.065)           | (0.050)    |      | (0.051)   | (0.051)    |      | (0.050)    |
| Risk Rain Preference     | 0.134        |      | −0.224   | −0.061    | −0.356 *       | 0.158     | 0.068     | −0.216   | −0.0314           | 0.085      |      | −0.547 ** | 0.315      |      | −0.580 *** |
|                          | (0.271)      |      | (0.236)  | (0.224)   | (0.215)        | (0.440)   | (0.301)   | (0.314)  | (0.264)           | (0.231)    |      | (0.211)   | (0.211)    |      | (0.208)    |
| Smoker                   | −0.601 ***   |      | −0.086   | 0.078     | −0.107         | −0.607 ** | 0.015     | 0.057    | −0.126            | −0.151     |      | −0.110    | 0.085      |      | −0.262 **  |
|                          | (0.190)      |      | (0.105)  | (0.191)   | (0.105)        | (0.292)   | (0.135)   | (0.277)  | (0.134)           | (0.168)    |      | (0.102)   | (0.178)    |      | (0.106)    |
| Exercise                 | 0.303 ***    |      | 0.083    | 0.149 *   | 0.201 **       | 0.059     | −0.193 *  | 0.015    | 0.067             | 0.278 ***  |      | 0.062     | 0.064      |      | 0.088      |
|                          | (0.110)      |      | (0.093)  | (0.087)   | (0.083)        | (0.203)   | (0.113)   | (0.130)  | (0.106)           | (0.090)    |      | (0.086)   | (0.081)    |      | (0.082)    |
| Alcohol Drinker          | 0.030        |      | −0.065   | −0.099    | −0.098         | 0.115     | 0.073     | −0.032   | −0.044            | 0.066      |      | −0.041    | 0.020      |      | −0.106     |
|                          | (0.113)      |      | (0.089)  | (0.094)   | (0.085)        | (0.201)   | (0.110)   | (0.145)  | (0.107)           | (0.091)    |      | (0.083)   | (0.087)    |      | (0.083)    |
| Gambling Addiction       | −0.054       |      | 0.002    | 0.033     | 0.089          | 0.168     | −0.041    | −0.012   | 0.098             | −0.243 **  |      | −0.027    | 0.011      |      | 0.030      |
|                          | (0.125)      |      | (0.091)  | (0.103)   | (0.086)        | (0.244)   | (0.113)   | (0.167)  | (0.109)           | (0.101)    |      | (0.087)   | (0.099)    |      | (0.083)    |
| /cut1                    | 3.395        |      | −2.345   | −1.019    | −2.751         | 4.192     | 0.619     | −4.389   | −2.273            | −0.487     |      | −1.795    | −1.308     |      | −4.229 *** |
|                          | (2.136)      |      | (1.973)  | (1.796)   | (1.706)        | (4.341)   | (2.441)   | (3.130)  | (2.031)           | (1.865)    |      | (1.887)   | (1.691)    |      | (1.587)    |
| /cut2                    | 3.676 *      |      | −1.797   | −0.775    | −2.266         | 4.290     | 1.141     | −4.338   | −2.086            | −0.0110    |      | −0.941    | −1.049     |      | −3.684 **  |
|                          | (2.137)      |      | (1.977)  | (1.799)   | (1.705)        | (4.321)   | (2.384)   | (3.124)  | (2.027)           | (1.869)    |      | (1.884)   | (1.685)    |      | (1.588)    |
| /cut3                    | 4.328 **     |      | −1.267   | −0.227    | −1.647         | 5.016     | 1.410     | −4.249   | −1.832            | 0.712      |      | −0.0410   | −0.277     |      | −2.858 *   |
|                          | (2.118)      |      | (1.964)  | (1.797)   | (1.705)        | (4.302)   | (2.377)   | (3.133)  | (2.030)           | (1.849)    |      | (1.881)   | (1.689)    |      | (1.587)    |
| /cut4                    | 5.416 **     |      | −0.165   | 0.723     | −0.641         | 2.203     | −3.799    | −1.320   | 1.886             | 1.060      |      | 0.893     | −1.777     |      |            |
|                          | (2.111)      |      | (1.963)  | (1.797)   | (1.705)        | (2.380)   | (3.137)   | (2.030)  | (1.843)           | (1.880)    |      | (1.689)   | (1.585)    |      |            |
| Observations             | 829          |      | 751      | 829       | 751            | 829       | 751       | 829      | 751               | 829        |      | 751       | 829        |      | 751        |
| Log likelihood           | −470.800     |      | −705.800 | −778      | −911.200       | −112.600  | −410.700  | −245.900 | −530              | −731.900   |      | −836      | −898.800   |      | −953.800   |
| Chi-square               | 56.770       |      | 27.580   | 27.930    | 29.130         | 50.120    | 35.270    | 20.810   | 26.860            | 41.180     |      | 44.990    | 40.330     |      | 37.900     |
| p-value                  | 0.000        |      | 0.120    | 0.111     | 0.085          | 0.000     | 0.018     | 0.409    | 0.139             | 0.003      |      | 0.001     | 0.004      |      | 0.009      |

Robust standard errors in parentheses, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

### 3.3. Observing the Decline in the COVID-19 Preventive Measures

Table 8 presents a regression analysis using probit to better understand the socioeconomic factors that influence the decline in the use of the preventive interventions leading to pandemic fatigue. The male and financially satisfied respondents were positively associated with a decline in the hand hygiene practices. This indicated that men and people who were subjectively and financially satisfied were more likely to do without hand hygiene in the long run. Exercise behaviors were negatively related to a decline in hand hygiene, indicating that the people who participated in physical activity were less likely to refuse to practice hand hygiene during the COVID-19 period. Furthermore, men and household size were positively associated with a decline in mask-wearing; in addition, the former and log assets were positively associated with the social distancing practices.

**Table 8.** Probit results for the decline in the preventive measures (Full sample).

| Variables                | Decline Hand Hygiene<br>Model 4 | Decline Mask-Wearing<br>Model 4 | Decline Social Distancing<br>Model 4 |
|--------------------------|---------------------------------|---------------------------------|--------------------------------------|
| Male                     | 0.333 ***<br>(0.104)            | 0.471 ***<br>(0.140)            | 0.194 **<br>(0.096)                  |
| Age (in years)           | 0.038<br>(0.035)                | 0.079<br>(0.050)                | −0.021<br>(0.031)                    |
| Age Squared              | −0.000<br>(0.000)               | −0.000<br>(0.000)               | 0.000<br>(0.000)                     |
| Spouse                   | −0.099<br>(0.171)               | 0.034<br>(0.264)                | 0.021<br>(0.157)                     |
| Divorced                 | −0.400<br>(0.278)               | −0.101<br>(0.365)               | −0.215<br>(0.231)                    |
| Living Alone             | −0.157<br>(0.213)               | 0.292<br>(0.286)                | −0.210<br>(0.201)                    |
| Household Sizes          | 0.003<br>(0.041)                | 0.122 ***<br>(0.046)            | −0.061<br>(0.040)                    |
| Child(ren)               | 0.026<br>(0.151)                | −0.119<br>(0.206)               | 0.110<br>(0.143)                     |
| Full-time Employment     | 0.040<br>(0.113)                | −0.187<br>(0.153)               | −0.118<br>(0.107)                    |
| Log Household Income     | −0.059<br>(0.081)               | −0.104<br>(0.111)               | −0.026<br>(0.076)                    |
| Log Asset                | 0.043<br>(0.058)                | −0.127<br>(0.081)               | 0.101 *<br>(0.055)                   |
| Depression               | 0.058<br>(0.048)                | 0.013<br>(0.058)                | 0.051<br>(0.045)                     |
| Anxiety                  | −0.029<br>(0.045)               | −0.026<br>(0.059)               | −0.006<br>(0.045)                    |
| Happiness                | −0.091<br>(0.329)               | 0.296<br>(0.479)                | −0.013<br>(0.294)                    |
| Financial Satisfaction   | 0.142 ***<br>(0.055)            | 0.047<br>(0.075)                | −0.008<br>(0.051)                    |
| Subjective Health Status | −0.065<br>(0.055)               | −0.011<br>(0.071)               | 0.021<br>(0.050)                     |
| Risk Rain Preference     | 0.096<br>(0.216)                | −0.266<br>(0.273)               | −0.184<br>(0.200)                    |
| Smoker                   | 0.097<br>(0.120)                | 0.151<br>(0.150)                | 0.144<br>(0.114)                     |
| Exercise                 | −0.273 ***<br>(0.089)           | −0.082<br>(0.116)               | 0.002<br>(0.083)                     |
| Alcohol Drinker          | 0.013<br>(0.090)                | −0.008<br>(0.122)               | 0.093<br>(0.086)                     |
| Gambling Addiction       | −0.000<br>(0.094)               | 0.107<br>(0.122)                | 0.074<br>(0.088)                     |
| Constant                 | −2.491<br>(1.723)               | −1.414<br>(2.425)               | −1.484<br>(1.548)                    |
| Observations             | 1580                            | 1580                            | 1580                                 |
| Log likelihood           | −523.400                        | −269                            | −616.400                             |
| Chi-square               | 42.590                          | 34.540                          | 25.870                               |
| p-value                  | 0.003                           | 0.031                           | 0.211                                |

Robust standard errors in parentheses, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

We also examined the decline in the prevention interventions using gender subsampling (Table 9). Exercise and the log of assets were negatively and positively associated with a decrease in hand hygiene among the female population, respectively. In the male subsample, age squared, divorce, and exercise were negatively associated with a reduction in hand hygiene, whereas age and financial satisfaction were positively associated with it. We also found that the household size in the female subsample was positively associated

with a decline in mask-wearing. Furthermore, full-time employment and the log of assets were negatively related to a decrease in mask-wearing in the male subsample; however, the household size was positively associated with it. Furthermore, the household size and risk preferences were negatively related to a decrease in social distancing for the female subsample, while the log of assets was positively associated with it for the female population. Finally, we found that children and smokers were positively associated with a decline in social distancing in the male subsample.

**Table 9.** Probit results for the decline in the preventive measures (subsample).

| Variables                | Decline Hand Hygiene<br>Model 4 | Decline Mask-Wearing<br>Model 4 | Decline Social Distancing<br>Model 4 |
|--------------------------|---------------------------------|---------------------------------|--------------------------------------|
| Male                     | 0.333 ***<br>(0.104)            | 0.471 ***<br>(0.140)            | 0.194 **<br>(0.096)                  |
| Age (in years)           | 0.038<br>(0.035)                | 0.079<br>(0.050)                | −0.021<br>(0.031)                    |
| Age Squared              | −0.000<br>(0.000)               | −0.000<br>(0.000)               | 0.000<br>(0.000)                     |
| Spouse                   | −0.099<br>(0.171)               | 0.034<br>(0.264)                | 0.021<br>(0.157)                     |
| Divorced                 | −0.400<br>(0.278)               | −0.101<br>(0.365)               | −0.215<br>(0.231)                    |
| Living Alone             | −0.157<br>(0.213)               | 0.292<br>(0.286)                | −0.210<br>(0.201)                    |
| Household Sizes          | 0.003<br>(0.041)                | 0.122 ***<br>(0.046)            | −0.061<br>(0.040)                    |
| Child(ren)               | 0.026<br>(0.151)                | −0.119<br>(0.206)               | 0.110<br>(0.143)                     |
| Full-time Employment     | 0.040<br>(0.113)                | −0.187<br>(0.153)               | −0.118<br>(0.107)                    |
| Log Household Income     | −0.059<br>(0.081)               | −0.104<br>(0.111)               | −0.026<br>(0.076)                    |
| Log Asset                | 0.043<br>(0.058)                | −0.127<br>(0.081)               | 0.101 *<br>(0.055)                   |
| Depression               | 0.058<br>(0.048)                | 0.013<br>(0.058)                | 0.051<br>(0.045)                     |
| Anxiety                  | −0.029<br>(0.045)               | −0.026<br>(0.059)               | −0.006<br>(0.045)                    |
| Happiness                | −0.091<br>(0.329)               | 0.296<br>(0.479)                | −0.013<br>(0.294)                    |
| Financial Satisfaction   | 0.142 ***<br>(0.055)            | 0.047<br>(0.075)                | −0.008<br>(0.051)                    |
| Subjective Health Status | −0.065<br>(0.055)               | −0.011<br>(0.071)               | 0.021<br>(0.050)                     |
| Risk Rain Preference     | 0.096<br>(0.216)                | −0.266<br>(0.273)               | −0.184<br>(0.200)                    |
| Smoker                   | 0.097<br>(0.120)                | 0.151<br>(0.150)                | 0.144<br>(0.114)                     |
| Exercise                 | −0.273 ***<br>(0.089)           | −0.082<br>(0.116)               | 0.002<br>(0.083)                     |
| Alcohol Drinker          | 0.013<br>(0.090)                | −0.008<br>(0.122)               | 0.093<br>(0.086)                     |
| Gambling Addiction       | −0.000<br>(0.094)               | 0.107<br>(0.122)                | 0.074<br>(0.088)                     |
| Constant                 | −2.491<br>(1.723)               | −1.414<br>(2.425)               | −1.484<br>(1.548)                    |
| Observations             | 1580                            | 1580                            | 1580                                 |
| Log likelihood           | −523.400                        | −269                            | −616.400                             |
| Chi-square               | 42.590                          | 34.540                          | 25.870                               |
| p-value                  | 0.003                           | 0.031                           | 0.211                                |

Robust standard errors in parentheses, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

#### 4. Discussion

##### *Decline in the COVID 19 Preventive Measures*

Our findings revealed that the socioeconomic factors have profoundly influenced the decline in the use of the preventive measures, signaling pandemic fatigue in Japan. Furthermore, males were more likely to deviate from hand hygiene and mask-wearing practices and would also be more reluctant to maintain social distancing over time. Our results are consistent with those of the previous studies Nivette et al. [27] and Smith et al. [20], suggesting that the non-adherence to preventive measures is more common among men. This indicates that women are more likely to follow the preventive practices than men. The results confirmed the common claim that women are more conscious than

their male counterparts. Otterbring and Festila [42] also showed that women were more likely to adhere to the public health behaviors because they were more conscientious and docile than men, who were perceived as risk-takers and, consequently, improvised their self-care practices. Undoubtedly, women's compliance is associated with positive interpersonal interactions and conflict avoidance [43] that may rationalize their normative behavior (e.g., compliance with the preventive behaviors). To support men's imprudent thoughts that could later be translated into practice, as compared to women, many of them believed that COVID-19 could be controlled, which could be the reason that their compliance level decreased considerably from the previous year [44].

The financially satisfied respondents were more likely to show a decline in hand hygiene practices as they may be engaged in activities that may restrict them from consistently practicing hand hygiene. Furthermore, the people with more assets were more likely to decline in social distancing practice. Our findings are consistent with prior studies [27,28], suggesting that non-compliance with social distancing stems from perceptions that it is unnecessary and ineffective, particularly among the affluent. Those who are financially comfortable and better off tend to be adamant when attending business meetings, especially if they have suffered economic losses owing to the pandemic. Those with better incomes could also engage in economic activities where maintaining social distancing and hand hygiene is a constraint. In addition, there is considerable evidence that the transmission of COVID-19 is closely related to an individual's socioeconomic position [45,46]. The income level largely influences the preventive measures [47]. For those engaged in investments or money-making ventures, taking preventive measures may appear tiresome, superfluous, or annoying; however, reassuring people about their household earnings during job absences appears necessary for the public health compliance [48].

In contrast, exercise behavior was negatively associated with a decrease in hand hygiene. Those who exercised were less likely to avoid hand hygiene during the COVID-19 pandemic. As physical exercise is important for health, all complementary disciplines should be conscientiously practiced [49]. Our results may indicate that people in Japan who exercise regularly are conscientious and concerned about their health and/or lives.

Finally, we found that the household size was more likely to reduce the mask-wearing practices. Household cohesion and lack of infection could encourage non-compliance. People may not wear masks because of their ironclad relationship with other family members within a household. The household size can downplay the prevalence of the pandemic, particularly when the household members have not been infected. Furthermore, the minor symptoms of COVID-19 can reinforce the view that the risk is overblown, thus increasing non-compliance.

## 5. Conclusions

Pandemic fatigue is increasing in many countries and has become a threat to the containment of COVID-19. Against the backdrop of a lack of credible evidence on pandemic fatigue in Japan, this study is the first to examine the socioeconomic factors that affect the decline in preventive measures of COVID-19. First, our results show a fatigue effect in maintaining preventive measures such as hand hygiene practice, mask-wearing, and social distancing in Japan. The main cause of maintenance fatigue is the prolonged duration of preventive measures that change human behavior and restrict movement. Although preventive measures received much support during the first two years of the pandemic, support and compliance with the measures decreased considerably during later periods. Second, the regression models show that men were more likely to dislike the practice of hand hygiene and wearing masks; they were also more reluctant to maintain social distancing. Financially satisfied individuals were also positively associated with a decrease in hand hygiene practice, while those with higher wealth were more likely to dislike maintaining social distancing. Furthermore, households with members were more likely to decline mask use. However, those who exercised regularly were less likely to avoid hand hygiene.

The findings of our study highlight the need for policymakers to implement targeted prevention programs based on factors such as demographics of the population and socioeconomic status to maximize the success of these initiatives and ultimately the public health outcomes. It is possible that this type of consideration, as opposed to a general campaign, could lead to a more effective pandemic management that could minimize fatigue or dissatisfaction.

Although the results are important and make a significant contribution to the existing literature, our study has some limitations. First, the items used to measure compliance with COVID-19 prevention measures were subjective and the responses were self-reported; nevertheless, this is a common limitation in such studies. Second, regarding the decline variables that were observed using the available dataset, we did not assess the other factors that might be related to non-compliance, such as medical conditions and recommendations. Third, in terms of timing, our panel data consisted of two waves that were collected when the prefectures' restrictions on the 'state of emergency declaration' were relaxed; thus, future studies can include more waves indicating non-compliance reasons. Future studies should minimize these limitations to provide more comprehensive international evidence on compliance fatigue.

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