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How did you perceive the lifestyle changes caused by the COVID-19 pandemic?

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This study did five surveys between April 2020 and March 2021 to look at how lifestyle changes during the pandemic affected well-being. These surveys covered all of Japan and were done both before and after the state of emergency was lifted. Applying the fixed-effects method to the panel data acquired in this manner, the analysis focused on subjective well-being and behavior during the COVID-19 pandemic. The results showed that teleworking during the pandemic may have increased life satisfaction, especially among young people. Although self-restraint behavior reduced well-being among young people, it tended to increase well-being among elderly individuals. On the other hand, self-restraint behavior by partners was found to lead to a decline in well-being among elderly individuals. In addition, it was observed that both the declaration of a state of emergency and the infection status had minimal impact on life satisfaction and happiness across all generational groups. Thus, the results show that lifestyle changes during the pandemic did not necessarily harm well-being, suggesting that the positive or negative impacts of factors differ from generation to generation.

Introduction

After a case of COVID-19 was reported in Wuhan, China in December 2019, COVID-19 quickly spread worldwide. The World Health Organization (WHO) declared a Public Health Emergency of International Concern (PHEIC) on January 30, 2020, indicating a particular need for an international response; this was followed by an assessment on March 11 that determined that COVID-19 could be characterized as a pandemic (World Health Organization, 2020a, b). Many countries implemented travel restrictions, curfews, and other measures to control infections, requiring drastic changes in people's daily lives. These movement restrictions included not only cross-border movement but also movement between cities within a country.

On April 7, 2020, a state of emergency was declared in certain prefectures in Japan, and on April 16, the state of emergency was extended to all the prefectures of Japan (Ministry of Health Labour and Welfare, Japan, 2021). Unlike many other countries, the state of emergency declaration in Japan was not legally binding on the public; instead, people were urged to refrain from going out 'voluntarily.' This weak stay-at-home order sparked some critical opinions about its effectiveness (e.g., Ookita, 2022). However, Mizuno (2020) estimated that the 'self-restraint rate,' indicating the

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extent to which people refrained from going out, reached 40-50% in most prefectures after the issuance of the state of emergency declaration. This suggests that the declaration was sufficiently effective, even without legal binding force. Then, what effect did this unenforced stay-at-home order have on subjective well-being? Our study aims to investigate the impact of the state of emergency declaration on people's subjective well-being, taking into account these characteristics. In particular, it is not fully clear whether they are caused solely by the stay-at-home order or by changes in one's life due to actual voluntary refraining from going out[1]. Therefore, this study seeks to answer these questions by investigating how people's subjective well-being changed based on their actions under the declared state of emergency.

Addressing this issue involves an initial focus on the factors of subjective well-being. Many studies have shown that subjective well-being is related to various factors other than individual attributes (e.g., gender, age, marriage, and income). For example, The Gallup Organization proposes five components of well-being: the career, social, financial, physical, and community aspects (Helliwell et al. 2021). The OECD has proposed a well-being index called the Better Life Index, which includes 11 indices: housing, income, jobs, community, education, environment, civic engagement, health, life satisfaction, safety, and work-life balance (OECD, 2022). However, the way in which subjective well-being is perceived is not always consistent across countries and regions, which makes it difficult to conduct a unified evaluation. For example, cultural differences have been shown to influence subjective well-being. In Asia, people's happiness level has been shown to increase with other factors, such as appreciation toward others and harmony with nature, whereas the satisfaction of a person's own ego has been shown to enhance well-being in the West (Uchida and Kitayama, 2009; Uchida et al., 2004).

In addition, in contrast to other countries, it has been reported in Japan that the level of a person's well-being does not increase much even in his or her old age (Commission on Measuring Well-being, 2011). The Japanese government has also shown interest in subjective well-being in recent years, and the Cabinet Office of the Government of Japan has been leading discussions on this topic since 2010 (Commission on Measuring Well-being, 2011). A report proposed three domains of well-being in Japan: socioeconomic conditions, health, and relatedness. As these three factors were significantly impacted by the COVID-19 pandemic, they are indispensable in examining the subjective well-being during this unprecedented disaster.

While public health measures such as ensuring social distancing and self-isolation are considered essential to contain a virus and thus control the spread of infection (Anderson et al., 2020), it has been pointed out that such measures may have negative impacts on mental health. For example, in China, it has been pointed out that measures such as self-isolation cause various psychological problems, although the degree of impact differs depending on gender, age, and social status (Qiu et al., 2020; Zhang et al., 2020). Several studies have also reported on the psychological effects of the COVID-19 pandemic, including effects on the relationship between self-isolation requests and health anxiety, financial worry, and loneliness (Brooks et al., 2020; Clair et al., 2021; Reger et al., 2020; Tull et al., 2020). Even if a person is not actually infected, these psychological effects may be closely related to his or her satisfaction and happiness with his or her daily life. Trzebiński et al. (2020) found in their mediation analysis that basic hope supports meaning in life and life satisfaction, and increases in the latter two factors result in decreased anxiety and COVID-19 stress.

Zacher and Rudolph (2021) also conducted a subjective well-being survey in Germany from December 2019 to May 2020 and analyzed it using a latent growth curve model. They found that although individual differences in life satisfaction are related to controllable stress in oneself and others, the effects of stress appraisals on individual changes in life satisfaction were shown to be small and nonsignificant. Although many researchers are investigating the relationship between the COVID-19 pandemic and subjective well-being, the results of these studies have been reported to vary by region and survey method (Prati and Mancini, 2021). As pointed out by Zacher and Rudolph (2021), additional research will be essential in the future.

The COVID-19 pandemic not only directly affects mental health and subjective well-being, but also indirectly through factors such as relationships and socioeconomic status (Arenas-Arroyo et al., 2021; Reger et al., 2020; Schokkenbroek et al., 2021). While there have been reports on people's increased loneliness and troubles with intimate partners due to a reduction in opportunities to go out as a result of the pandemic, Galdiolo et al. (2022) investigated couples' satisfaction during the COVID-19 lockdowns and found that partners perceived the influence of these lockdowns on couples and family functioning to be increasingly positive over time. Randall et al. (2022) also suggest the possibility that perceived partner positive dyadic coping buffers the negative association between post-COVID-19 psychological distress and relationship quality. In addition, Zacher and Rudolph (2021) found from multiple surveys that not only life satisfaction and positive affect but also negative affect declined after March 2020, and they cited a decrease in affective experiences themselves as a possible explanation. In other words, it is clear that the unprecedented crisis of COVID-19 has had a negative impact on subjective well-being, but it is also suggested that the successful adaptation to the new situation may have had a positive impact as well.

Beck and Hensher (2020) mentioned reduced commuting time as an important positive effect of teleworking during the COVID-19 pandemic. Subsequent studies have indicated that the time gained from reduced commuting is spent on leisure and family time rather than paid work (Hensher and Beck, 2023; Hensher et al., 2022). It has also been pointed out that there is considerable heterogeneity across studies (Prati and Mancini, 2021), and cultural variation is considered to be a factor (Randall et al., 2022). The results of studies that focus on specific regions, such as the present study, are important in terms of examining the impact of the COVID-19 pandemic in an integrated manner.

Note that survey-based research is subject to certain limitations related to survey implementation. Even when data from multiple surveys are used, the effects of various events that occur between the surveys may be considered as if they were the effects of a single representative event. For this reason, few studies have been able to separate the impact of the government's stay-at-home order from the impact of actual behaviors. There are many possible reasons why people may have followed the government's request to refrain from going out. In addition to an avoidance of the risk of infection, external factors such as the shortened opening hours of restaurants may also be cited. Another possible reason, for instance, is the perceived stigma of going out. Under the state of emergency, going out was regarded as an antisocial behavior, as it was the social norm to refrain from going out. It has been pointed out that a fear of being recognized as having been outside the house was a concern under the state of emergency declaration (Katafuchi et al., 2021). These effects were caused by the declaration of the state of emergency and are different from the effects of actual self-restraint behaviors. In addition, although many related studies have been conducted, only a few have utilized longitudinal data during the COVID-19 pandemic. Therefore, while various factors have been identified, few studies have been able to address causal relationships. To overcome these shortcomings, some studies have analyzed the

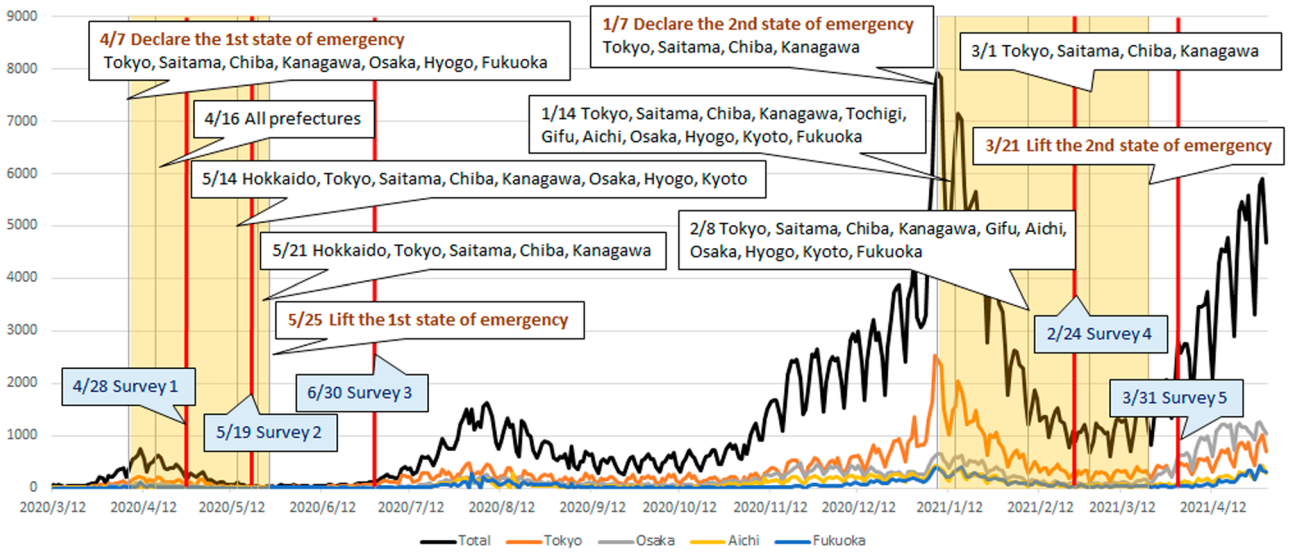

Fig. 1 Number of new infections and emergency declarations issued. This figure shows the number of new infections in Japan and the timing of emergency declarations issued and lifted in each prefecture.

impact of lockdowns based on data such as those on Google trends or the number of counseling sessions conducted (Armbruster and Klotzbücher, 2020; Brodeur et al., 2021; Foa et al., 2022). In these studies, mental effects are inferred from actual behaviors (e.g., performing a search, or making a phone call). However, it is difficult to directly relate an individual's behavior to general indicators such as his or her life satisfaction (Banks et al., 2021).

Building upon the aforementioned, this study aims to address three issues: (1) How did teleworking and self-restraint behaviors impact subjective well-being? (2) How was subjective well-being influenced by partner behavior? and (3) Did the declaration of a state of emergency in Japan affect subjective well-being? To achieve this objective, a total of five surveys were conducted across Japan over approximately one year starting in April 2020 when COVID-19 began spreading rapidly. The paper is structured as follows: "Methodology" provides details on the data and methodologies used in the analysis, "Results" presents the analysis results, followed by a discussion in "Discussion", and the paper concludes in "Conclusion".

Methodology

Dataset and variables. Figure 1 shows the number of newly infected patients and the periods of state of emergency declarations in Japan from the early stages of the spread of COVID-19 infection to April 2021. The number of newly infected patients increased rapidly around late March 2020, especially in Tokyo and other urban areas. Although the spread of the disease was milder than it was in Europe, a state of emergency was declared on April 7 due to a shortage of medical care. The measures implemented in accordance with this declaration covered the seven prefectures of Tokyo, Kanagawa, Saitama, Chiba, Osaka, Hyogo, and Fukuoka and were expanded to cover the entire country on April 16, 2020[2]. Subsequently, the government reduced the number of target areas based on the infection situation and other factors, and the state of emergency was lifted nationwide on May 25, 2020 (Ministry of Health Labour and Welfare, Japan, 2021).

After the spread of COVID-19 appeared to be under control, the number of infected people began to gradually increase again in late June of the same year, and voluntary self-restraint was again recommended. However, during this so-called second wave, the number of new infections peaked in early August and gradually declined, although a state of emergency was not declared[3]. Although it was hoped that the disease would be eradicated, it was not, and the number of newly infected people began to increase again around November of the same year. This third wave coincided with the year-end and New Year holidays, which is when travel increases, and infection spread rapidly in the Tokyo metropolitan area as well as the Kansai and Chukyo areas. The number of newly infected people was extremely high compared to the previous cases; thus, the government declared a state of emergency for the second time on January 7, 2021 for the Tokyo, Saitama, Chiba, and Kanagawa prefectures, and one week later, on January 14, 2021, Tochigi, Gifu, Aichi, Osaka, Hyogo, Kyoto, and Fukuoka were added to the coverage area. The scope of the declaration was subsequently reduced as the number of newly infected cases decreased, and the emergency measures implemented for the third wave were finally lifted on March 21 of the same year.

This study conducted a questionnaire survey on life during the COVID-19 pandemic, covering factors such as life satisfaction. The survey encompassed targeted all of Japan during the period between the first and third waves of COVID-19. The survey was conducted online by a professional survey company[4]. As shown in Fig. 1, the first survey was conducted on April 26, 2020, and the next four surveys were conducted on May 19, 2020; June 30, 2020; February 24, 2021; and March 31, 2021. The survey dates corresponded to the periods when the emergency measures were put into place and after they were lifted to account for the infection situation and the implementation of the emergency measures. In particular, the first, second, and fourth surveys were conducted when emergency measures were being put into place and the number of new patients was decreasing after the declaration of the state of emergency was issued. The first survey was conducted when the entire country was under the declaration, and the second survey was conducted when only some areas were under it. The third and fifth surveys were conducted after the declarations were lifted and when the number of newly infected patients had begun to increase.

This survey targeted men and women over the age of 18 who were registered with a professional survey company. They provided the survey company with demographic information

such as age, gender, occupation, and annual income in advance, and this information was also used in this analysis. Initially, 1149 respondents completed the first survey, and the second and subsequent questionnaires were administered to individuals who had responded to the previous survey. Therefore, the numbers of respondents corresponding to the second survey and the surveys thereafter were 992, 912, 762, and 728, respectively. In other words, 728 respondents responded to all five surveys, and 421 respondents abandoned their responses midway through the survey. The aim is to assess the subjective well-being of the entire population of 100 million people excluding those under 17 years old in Japan. With a confidence level of 99% and a margin of error of 5%, this sample size is deemed acceptable.

The attributes of the respondents are described in Table 1. In addition to providing the aggregate results regarding all the respondent attributes, Table 1 includes the aggregate results regarding the attributes of individuals with complete and incomplete responses (hereafter, the complete and incomplete respondents, respectively). Focusing first on age, the average age of all the respondents was 52.4 years, while the average age of the complete respondents was slightly higher at 53.5 years. The complete respondents were somewhat older than the incomplete respondents ($p < 0.01$). On the other hand, the results of a χ^2 test of gender, marital status, and the presence of children did not reveal any significant differences between the complete and incomplete respondents. The sample was roughly evenly split between men and women; moreover, over 60% of the respondents were married and almost 50% had children. The results regarding annual income were significant, and the annual income of the complete respondents was slightly higher than that of the incomplete respondents ($p = 0.063$). Approximately 40% of the respondents had annual income in the range of 2 to 6 million yen. In this analysis, the average value of the selected category (e.g., 1.5 million for the range of 1 million-1.99 million) was used as each respondent's annual household income. The respondents' education was categorized as follows: junior high school graduate or lower, high school graduate, junior college/technical school graduate, university graduate, graduate school graduate or higher, and others. The "others" category included those who answered "not educated" or "do not know." Respondents who had graduated from high school, junior college/technical school, or university accounted for approximately 90% of the total. There was a significant difference between the complete and incomplete respondents at the 5% level in the χ^2 test ($p = 0.044$).

From these respondents, responses on happiness, life satisfaction, health, community, and income change were obtained in all five surveys. In the fourth and fifth surveys, responses on teleworking status and staying at home were also obtained to complement the series of surveys. The other variables used in this analysis were a variable denoting the state of emergency declarations and a variable denoting the number of new cases.

Happiness: Happiness was rated on a five-point scale, namely, 1-completely unhappy, 2-slightly unhappy, 3-neither, 4-slightly happy, and 5-completely happy, in response to the question, "All in all, how happy are you?"

Life satisfaction: Life satisfaction was rated on a five-point scale, namely, 1-completely dissatisfied, 2-slightly dissatisfied, 3-neither, 4-slightly satisfied, and 5-completely satisfied, in response to the question, "All in all, how satisfied are you with your life?"

These were done to give positive situations a higher score.

Health: This indicator was used only to determine the respondents' health status at the time of the survey, and the respondents were asked, "How is your overall health?" Therefore, COVID-19 was not mentioned in this question. Responses were given on a 5-point scale as follows: 1 - very bad, 2 - a little bad, 3 - undecided, 4 - a little good, and 5 - very good.

Community: To measure their level of attachment to the communities in which they lived, the respondents were asked, "How attached are you to the community in which you live?" A 5-point scale was used: 1-no attachment at all, 2-not much attachment, 3-neither, 4-somewhat attached, 5-very attached.

Change in income: In the second and subsequent surveys, the respondents were asked about any changes in household income during the previous two months (Fig. 2). The following eight options were offered in response to the question, "Was there any difference in your household income during X (e.g., March) compared to your income before the coronavirus began to spread? ": decreased by ~50–100%, decreased by ~10–50%, decreased by a few percent to ~10%, no change, increased by a few percent to ~10%, increased by ~10–50%, increased by ~50–100%, increased by more than 100%. The second survey (initiated on May 19, 2020) covered March and April 2020, the third survey (initiated on June 30, 2020) covered May and June 2020, and the fourth survey (initiated on February 24, 2021) covered December 2020 and January 2021. Because all the surveys, including the first one, were conducted at the end of the respective month, this study used the responses corresponding to the month in which the survey began to construct the variable for income change in each survey. In addition, since 60–70% of the respondents indicated that their income was no different from their income before the COVID-19 pandemic, the data were tabulated into three groups: those whose household income had decreased (*inc_decrease*), those whose income had remained approximately the same, and those whose income had increased (*inc_increase*). A corresponding dummy variable was created.

Although there are many factors that influence happiness and life satisfaction, the Commission on Measuring Well-being (2011) identified "socioeconomic conditions," "health," and "relatedness" as the three main axes in the Japanese subjective well-being survey. Since it has been pointed out that perceptions of happiness are highly dependent on national characteristics (Uchida and Kitayama, 2009; Ura et al., 2012) and since this survey was conducted in Japan, changes in health, community, and income were used as the three key variables of this study.

Working from home and self-restraint: Questions on teleworking and self-restraint were included in the fourth and fifth surveys. The respondents were asked to report on their teleworking and self-restraint status, as well as that of their partners, for each month of the past year. Since it was necessary to go back about one year, to make it as easy as possible for respondents to answer, the survey asked them to "Select all the months since last year in which more than half of your or your partner's work has been transferred to teleworking. Additionally, please select all the months in which you think you were more cautious about going out than you were before the COVID-19 pandemic." In the fifth survey, a similar question was asked about March 2021. As with the "change in income" question, for these items, the responses corresponding to the month in which the survey was conducted were coded as dummy variables (1 if selected and 0 otherwise). Figure 3 shows the changes in the respondents' teleworking and self-restraint status. The vertical axis shows the percentage of respondents who answered "yes" to the above question; those who answered "no" include the respondents who indicated that they did not have a partner.

The percentages of respondents teleworking and practicing self-restraint increased around March and April 2020 but then declined slightly, and these percentages increased again around November 2020. These results are generally consistent with the number of people infected and the state of emergency declarations.

State of emergency: As shown in Fig. 1, the periods during which a state of emergency was declared differed by prefecture.

Table 1 Sample characteristics.

Characteristic	Overall (*N* = 1149)	Complete (*N* = 728)	Incomplete (*N* = 421)	*p*
Age (years)				
M (SD)	52.4 (14.1)	53.5 (13.0)	50.4 (15.7)	< 0.001
Mdn [min, max]	52 [18, 90]	53 [19, 90]	51 [18, 80]	
Gender				
Male	595 (51.8)	384 (52.7)	211 (50.1)	0.390
Female	554 (48.2)	344 (47.3)	210 (49.9)	
Annual household income (mil. Yen)				
0–0.99	90 (7.8)	58 (8.0)	32 (7.6)	0.063
1–1.99	96 (8.4)	63 (8.7)	33 (7.8)	
2–2.99	140 (12.2)	80 (11)	60 (14.3)	
3–3.99	160 (13.9)	89 (12.2)	71 (16.9)	
4–4.99	156 (13.6)	111 (15.2)	45 (10.7)	
5–5.99	118 (10.3)	75 (10.3)	43 (10.2)	
6–6.99	89 (7.7)	63 (8.7)	26 (6.2)	
7–7.99	80 (7.0)	49 (6.7)	31 (7.4)	
8–8.99	45 (3.9)	28 (3.8)	17 (4.0)	
9–9.99	56 (4.9)	28 (3.8)	28 (6.7)	
10–11.99	45 (3.9)	33 (4.5)	12 (2.9)	
12–14.99	35 (3)	26 (3.6)	9 (2.1)	
15–17.99	10 (0.9)	8 (1.1)	2 (0.5)	
18–19.99	6 (0.5)	4 (0.5)	2 (0.5)	
20-	23 (2.0)	13 (1.8)	10 (2.4)	
Married				
Yes	727 (63.3)	461 (63.3)	266 (63.2)	0.962
No	422 (36.7)	267 (36.7)	155 (36.8)	
Child				
Yes	578 (50.3)	364 (50.0)	214 (50.8)	0.785
No	571 (49.7)	364 (50.0)	207 (49.2)	
Education				
Less than junior high school graduate	27 (2.3)	12 (1.6)	15 (3.6)	0.044
High school	353 (30.7)	243 (33.4)	110 (26.1)	
Junior college or technical college	256 (22.3)	154 (21.2)	102 (24.2)	
University	436 (37.9)	276 (37.9)	160 (38.0)	
Graduated school	56 (4.9)	33 (4.5)	23 (5.5)	
Others (no education or I don't know)	21 (1.8)	11 (1.5)	10 (2.4)	
Happiness				
1-completely unhappy	75 (6.5)	52 (7.1)	23 (5.5)	< 0.001
2-slightly unhappy	289 (25.2)	125 (17.2)	164 (39.0)	
3-neither	299 (26.0)	191 (26.2)	108 (25.7)	
4-slightly happy	523 (45.5)	323 (44.4)	200 (47.5)	
5-completely happy	63 (5.5)	37 (5.1)	26 (6.2)	
Life satisfaction				
1-completely dissatisfied	113 (9.8)	73 (10.0)	40 (9.5)	0.271
2-slightly dissatisfied	239 (20.8)	142 (19.5)	97 (23.0)	
3-neither	287 (25.0)	193 (26.5)	94 (22.3)	
4-slightly satisfied	464 (40.4)	295 (40.5)	169 (40.1)	
5-completely satisfied	46 (4.0)	25 (3.4)	21 (5.0)	

Data are presented as *n* (%) unless otherwise noted. The *p* value reflects comparison between complete and incomplete respondents.

Therefore, a dummy variable was used; this variable equaled 1 for prefectures that had declared a state of emergency at the time the focal survey was initiated and 0 for prefectures that had not.

Infection status: Two variables were prepared to denote infection status using relevant data at the prefecture level provided by Sapporo Medical University[5]. The first variable was the number of new infections in the week immediately prior to the start of the survey (*num_patients* [1000 people]); the second was a dummy variable denoting the trend of increasing infections, and it was set to 1 if the number of new infections in the week immediately prior to the survey exceeded the number of new infections two weeks prior to the survey and 0 otherwise (*dmy_patients*).

Other variables: This study also controlled for personal attributes that are associated with happiness, life satisfaction, and stress in our analysis. Several previous studies have pointed out the impacts of demographics (Banks et al., 2021; Bruine de Bruin, 2021; Dowd et al., 2020; Klaiber et al., 2021; Qiu et al., 2020; Schokkenbroek et al., 2021; Wenham et al., 2020). In particular, the relationship between age and happiness is said to be a U-shaped curve. Although the increase in happiness observed in old age is lower in Japan than in other countries, the analysis attempted to incorporate the square of the age term, in line with existing studies (Commission on Measuring Well-being, 2011; Tsurumi et al., 2019). In addition, the respondents were categorized into five family composition groups, namely, one person, couple, two generations, three or

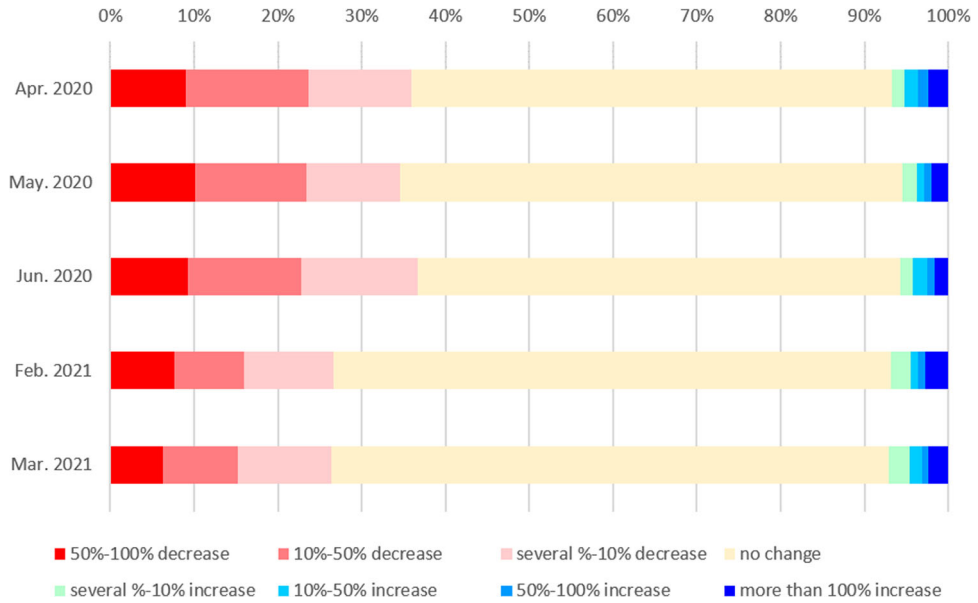

Fig. 2 Change in income compared to before the COVID-19 pandemic. This figure shows the extent to which respondents' monthly income has changed over the five survey periods compared to the pre-pandemic period.

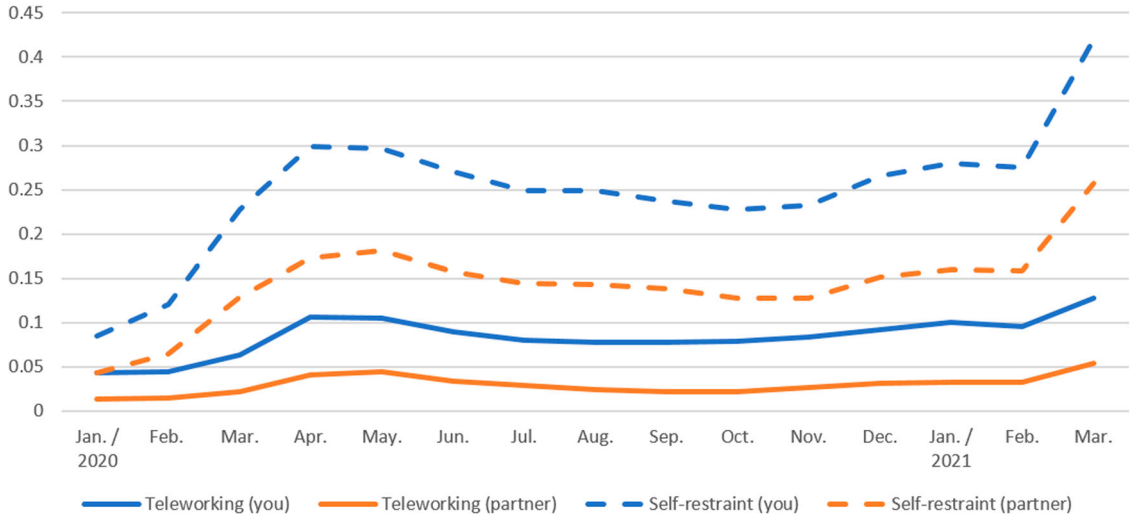

Fig. 3 Monthly teleworking and self-restraint status. This figure shows the teleworking and self-restraint status of respondents and respondents' partners by month.

more generations, and other (dormitory, shared house, etc.), and these were added as dummy variables (one person was used as the standard). This item was added as a variable because of concerns that it might reflect the effects of the COVID-19 disaster. The increase in time spent at home during the pandemic increased the amount of time spent sharing the same space with family members or roommates. Therefore, control for family composition was necessary in the analysis of the effects of teleworking and self-restraint. In addition, we controlled for the respondents' prefectures of residence and occupation types. There were many regional differences in the status of COVID-19 infections; for example, explosive increases in the number of infections were accelerated in large cities such as Tokyo and tourist destinations such as Okinawa (Abiko, 2021). With regard to occupation, it is easy to imagine that people's risk of infection and changes in work patterns during the pandemic differed depending on their type of occupation. The respondents were classified into 47 prefecture groups according to their place of residence and into 11 occupation categories: full-time employees, contract employees, managers, civil servants, self-employed individuals, freelance workers, medical professionals, homemakers, students, part-time employees, and unemployed individuals.

Figure 4 depicts life satisfaction and happiness by prefecture in the first survey. The *x*-axis represents the population size of each prefecture, with larger prefectures (such as Tokyo, Osaka, Aichi, and Kanagawa) located towards the right. Smaller prefectures show greater variation in life satisfaction and happiness, while no significant regional differences are observed in prefectures with more than 2 million people, where there are more than several dozen samples available. Figure 5 displays trends in life satisfaction and happiness based on occupation. While many occupations remained unchanged throughout the survey period, medical professionals' life satisfaction and happiness exhibited at downward trend, possibly due to the prolonged duration of the pandemic increasing their burden. Additionally, the figure

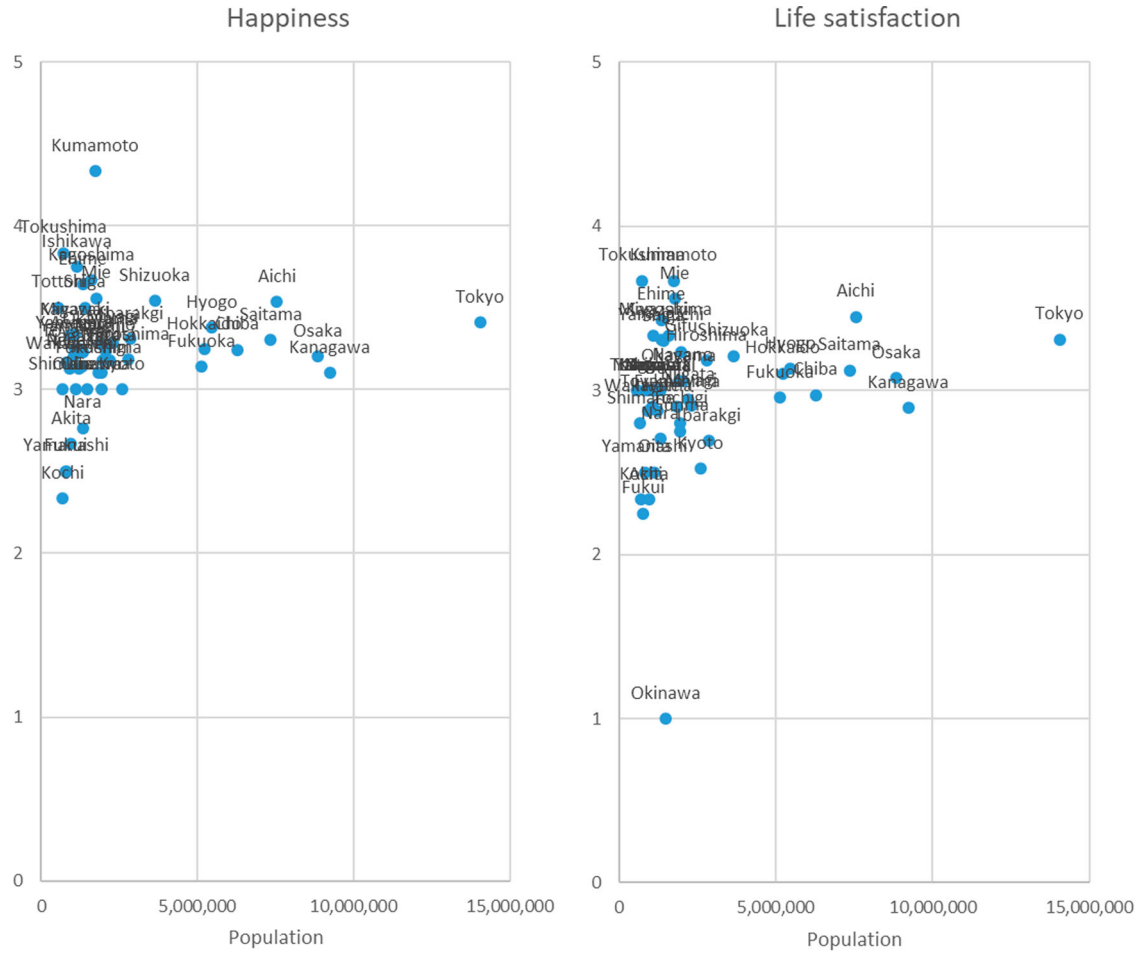

Fig. 4 Life satisfaction/Happiness and population size by prefecture. This figure shows the relationship between the size of the respondent's place of residence and subjective well-being.

indicates that students experience relatively high levels of subjective well-being.

Models. Using the data described above, this study constructs a panel data regression analysis model with subjective well-being as the explained variable. First, as a base model, the consideration involves the following ordinary least squares (OLS) model consisting of a minimum number of variables:

$$SWB_{it} = \beta_0 + \beta_1 state\_of\_emergemcy_{it} + \beta_2 num\_patients_{it} + \beta_3 dmy\_patients_{it} + \beta_4 num\_patients_{it} \times dmy\_patients_{it} + \beta_5 health_{it} + \beta_6 community_{it} + \gamma Z_i + \theta_t + \varepsilon_{it} \quad (1)$$

where $i = 1, 2, \ldots, N$ and $t = 1, 2, \ldots, T$. Here, N denotes the total number of respondents, and T represents the total number of survey rounds. The error term, ε_{it}, accounts for the residual variations in the model. The explained variable, SWB_{it}, is an index of subjective well-being, specifically, happiness or life satisfaction. Z_i is a vector of individual socio-demographic variables, including logarithmic income, presence of children, marital status, age, sex, education level, family composition, occupation, and residential area (prefectures). The variable θ_t represents time effects, capturing any time-specific influences on subjective well-being.

Next, a model is considered in which variables related to the economic changes that occurred during the COVID-19 pandemic(*inc_decrease* and *inc_increase*) and the actions taken at that time (self-restraint (*SR*) and the working-from-home (*WFH*) are added to equation (1).

$$SWB_{it} = \beta_0 + \beta_1 state\_of\_emergemcy_{it} + \beta_2 num\_patients_{it} + \beta_3 dmy\_patients_{it} + \beta_4 num\_patients_{it} \times dmy\_patients_{it} + \beta_5 health_{it} + \beta_6 community_{it} + \beta_7 inc\_decrease + \beta_8 inc\_increase + \beta_9 WFH(self)_{it} + \beta_{10} WFH(partner)_{it} + \beta_{11} SR(self)_{it} + \beta_{12} SR(partner)_{it} + \gamma Z_i + \theta_t + \varepsilon_{it}. \quad (2)$$

The model includes changes in factors that, although self-reported, would have affected subjective well-being, which is precisely what was greatly affected by the pandemic.

Finally, a fixed-effects (FE) model is suggested.

$$SWB_{it} = \alpha_i + \beta_1 state\_of\_emergemcy_{it} + \beta_2 num\_patients_{it} + \beta_3 dmy\_patients_{it} + \beta_4 num\_patients_{it} \times dmy\_patients_{it} + \beta_5 health_{it} + \beta_6 community_{it} + \beta_7 inc\_decrease + \beta_8 inc\_increase + \beta_9 WFH(self)_{it} + \beta_{10} WFH(partner)_{it} + \beta_{11} SR(self)_{it} + \beta_{12} SR(partner)_{it} + \theta_t + \epsilon_{it}. \quad (3)$$

While previous models relied on socio-demographic variables to capture differences among respondents, they may not fully account for all the factors influencing individual responses. For example, psychological traits can significantly vary among respondents, leading them to perceive and respond differently to the same phenomenon. These traits are not adequately reflected in the previous models, as they are treated as part of the error term in the OLS model. This can introduce bias in the estimated coefficients, as the error term may be correlated with the independent variables. In contrast, the fixed effects model introduces dummy variables, α_i, to represent the time-invariant characteristics of each respondent. By doing so, it effectively

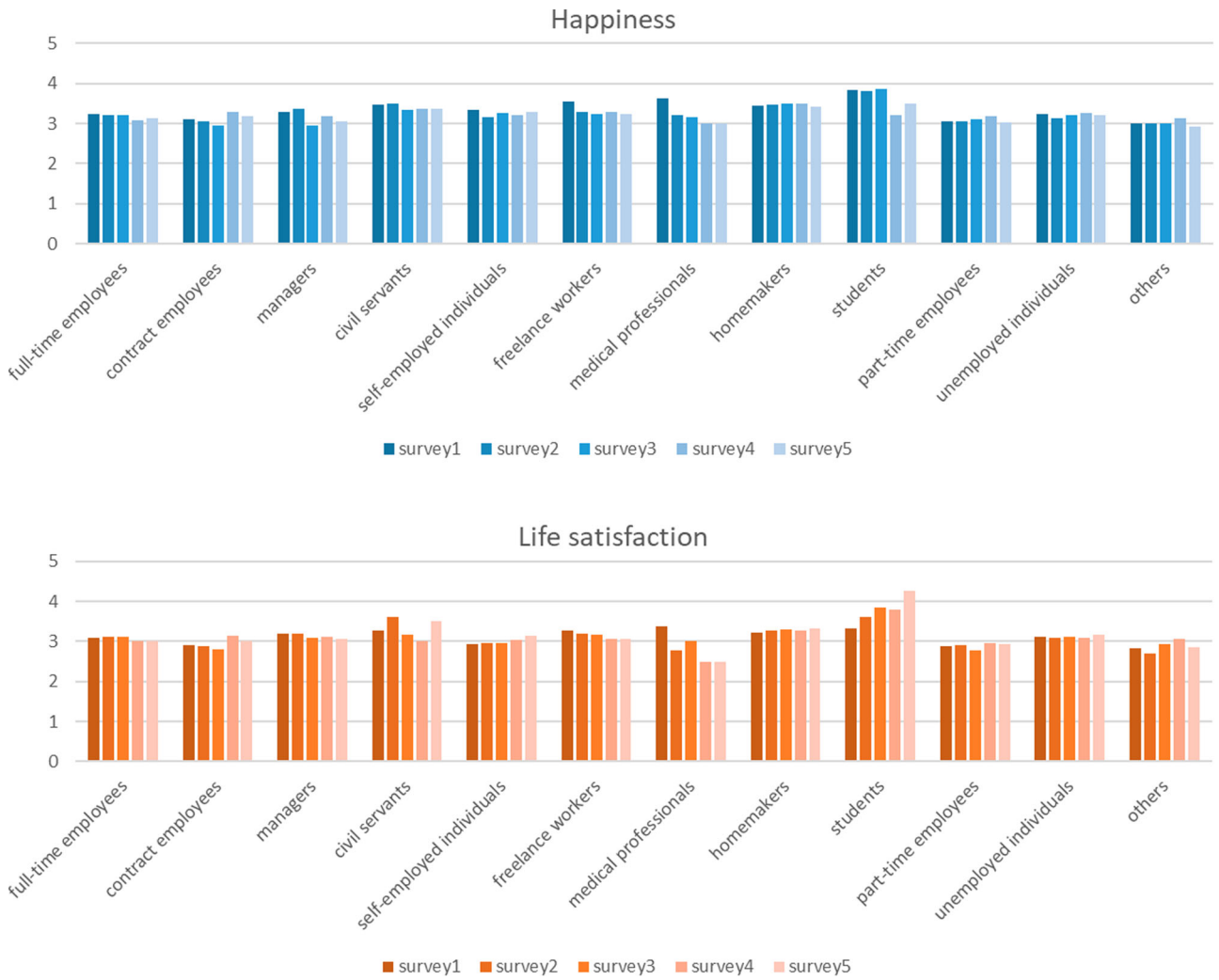

Fig. 5 Time-series changes in life satisfaction and happiness by occupation. This figure shows how the subjective well-being of respondents by occupation changed over the course of the five surveys.

controls for the unobservable heterogeneity among respondents that remains constant over time. This separation of unobservable respondent characteristics from the error term reduces bias in the coefficient estimates and enhances the model's reliability for identifying causal relationships between the independent and dependent variables (Let ϵ_{it} be the error term from which the time-invariant respondent characteristics are separated).

This study employs fixed effects methods to account for unobserved time-invariant confounding factors. For unveiling more intricate causal relationships, G-estimation methods would be necessary.

Results

Baseline estimation. Table 2 shows the results of the analysis when life satisfaction (Columns 1–3) and happiness (Columns 4–6) are the explained variables for the respondents as a whole. Only the variables of interest are highlighted in the tables. (Detailed estimation results are in Tables A and B of the Online Appendix in the separate supplemental material file).

Table 2 shows the results regarding the notable variables. The effects of the stay-at-home order and the infection status were considered here by adding as variables the state of emergency declaration status at the time of each survey, the number of new patients in the previous week, a dummy denoting whether the number of new patients had increased over that of the previous two weeks, and their cross terms, which were not significant and had small estimates in most estimations[6]. In Models (a1) and (a4), the only variable related to the stay-at-home order was the state of emergency declaration, and self-restraint behaviors and teleworking were not taken into account separately. However, significant effects of the state of emergency declaration itself or the infection situation were not observed. Similarly, in Models (a2) and (a5), which were estimated by OLS, the variables denoting changes in income since the beginning of the pandemic and the self-restraint and teleworking of the respondents and their partners were added, but the estimated coefficients of the state of emergency declaration and the infection situation were small and not significant. The same was true of Models (a3) and (a6), which were the fixed effects models. In other words, neither the declaration of a state of emergency nor familiar infection conditions changed life satisfaction or happiness much, and causal relationships could not be identified.

In contrast, focusing on Models (a2) and (a3), which used life satisfaction as the explained variable, the respondents' own teleworking was positively significant, with coefficients estimated at 0.0929 (s.e. 0.0532) and 0.1297 (s.e. 0.0647), respectively. Additionally, the respondents' self-restraint behavior was

Table 2 The relevant results of the OLS and FE analysis of all the data.

Dep. Variable	Life satisfaction			Happiness		
	(a1)	(a2)	(a3)	(a4)	(a5)	(a6)
	OLS	OLS	FE	OLS	OLS	FE
No. Observations	4543	3742	3742	4543	3742	3742
R-Squared (Within)	-	-	0.0348	-	-	0.0284
R-Squared (Between)	-	-	0.1740	-	-	0.1254
R-Squared (Overall)	0.3775	0.3990	0.1432	0.3989	0.4288	0.1078
inc_decrease		−0.2605***	−0.0670**		−0.2200***	−0.0359
		(0.0327)	(0.0331)		(0.0307)	(0.0288)
inc_increase		−0.0550	0.0028		−0.0192	0.0800*
		(0.0625)	(0.0524)		(0.0587)	(0.0455)
log(income)	0.1622***	0.1513***		0.1327***	0.1086***	
	(0.0221)	(0.0248)		(0.0208)	(0.0233)	
WFH(self)		0.0929*	0.1297**		0.0497	−0.0416
		(0.0532)	(0.0647)		(0.0499)	(0.0562)
WFH(partner)		−0.0274	−0.0081		−0.0918	−0.0819
		(0.0766)	(0.0953)		(0.0720)	(0.0828)
SR(self)		−0.0706	−0.1039**		0.0220	−0.0050
		(0.0461)	(0.0504)		(0.0433)	(0.0438)
SR(partner)		0.1974***	0.1075*		0.1424***	0.0412
		(0.0563)	(0.0618)		(0.0529)	(0.0537)
state of emergency	0.0152	−0.0049	0.0069	0.029	0.0264	0.0353
	(0.0547)	(0.0597)	(0.0389)	(0.0514)	(0.0561)	(0.0338)
num_patients	−0.0342	−0.0161	−0.0102	−0.0328	−0.0196	−0.0106
	(0.0543)	(0.0562)	(0.03672)	(0.0510)	(0.05278)	(0.03192)
dmy_patients	0.0121	−0.0018	0.0084	−0.0019	−0.0067	0.0022
	(0.0397)	(0.0432)	(0.0282)	(0.0373)	(0.0406)	(0.0245)
*num_patients * dmy_patients*	−0.0859	−0.0237	−0.024	0.0261	−0.0187	−0.0192
	(0.0548)	(0.056)	(0.0365)	(0.0515)	(0.0526)	(0.0317)

*: < 0.1, **: < 0.05, ***: < 0.01. Std. Errors reported in parentheses.

negatively significant in only Model (a3), and the coefficient was −0.1039 (s.e. 0.0504). These results indicate that teleworking generally increases life satisfaction, whereas self-restraint decreases life satisfaction. In addition, it is estimated that the behavior of an individual's partner also affects his or her life satisfaction. The estimated values for partners' teleworking were small and not significant, but those for partners' self-restraint behavior were equal to 0.1974 (s.e. 0.0563) for (a2) and 0.1075 (s.e. 0.0618) for (a3), both of which were found to be significant. The results suggest that people's life satisfaction increased when their partners refrained from going out. In terms of income, the coefficient of the income decrease dummy was −0.2605 (s.e. 0.0327) and −0.0670 (s.e. 0.0331) in Models (a2) and (a3), and these were both negative and significant results. The income increase dummy was nonsignificant in relation to life satisfaction.

Next, focusing on the model with happiness as the explained variable, we find that neither the respondent's own self-restraint behavior (teleworking and self-restraint) nor that of his or her partner is significant for happiness. Model (a5) was the only model in which partner self-restraint was positively significant (0.1424; s.e. 0.0529), indicating that the respondents whose partners refrained from going out were slightly happier than those whose partners did not. Regarding changes in income, Model (a6) reveals a trend in which happiness increases with an increase in income, albeit at the 10% level of significance (0.0800; s.e. 0.0455).

Generational differences. Next, an attempt was made to analyze the differences in effects across generations by creating subgroups for each generation. In the previous analysis, the inclusion of age and its square term as variables was done to account for age differences. However, previous studies have pointed out that perceptions of the effects of the pandemic vary greatly depending on age. Klaiber et al. (2021) also found that during the pandemic, young and middle-aged people faced more interpersonal conflicts and work- and family-related daily stressors. On the other hand, older adults were less concerned about the threat of COVID-19 and had better affective well-being. Bruine de Bruin (2021) also reported that elderly people have a more optimistic outlook on COVID-19. Therefore, the data was divided into three groups according to the respondents' ages to examine these differences in the studied effects. Here, the respondents were categorized into three groups (young, middle-aged, and elderly), namely, under 40 years old, between 40 and 59 years old, and over 60 years old, with sample sizes of 545 (222 respondents), 1901 (544 respondents), and 1296 (383 respondents), respectively.

Graphs depicting the average life satisfaction and happiness of each group are shown in Fig. 6. These figures clearly show that the scores of the elderly group were higher than those of the other groups. In addition, the youngest group showed greater variation across the surveys than the other groups. Helliwell et al. (2021) also surveyed people's level of well-being during the pandemic by generation, and similar to the present study, a high level of well-being was observed among elderly individuals. However, the survey showed that the youngest group exhibited little variation over the survey period, while the middle-aged and elderly groups showed similar levels of variation. This may be due to the influence of the survey area and the timing of the survey, but there are commonly large differences across generations; moreover, the relatively similar patterns of variation of the middle-

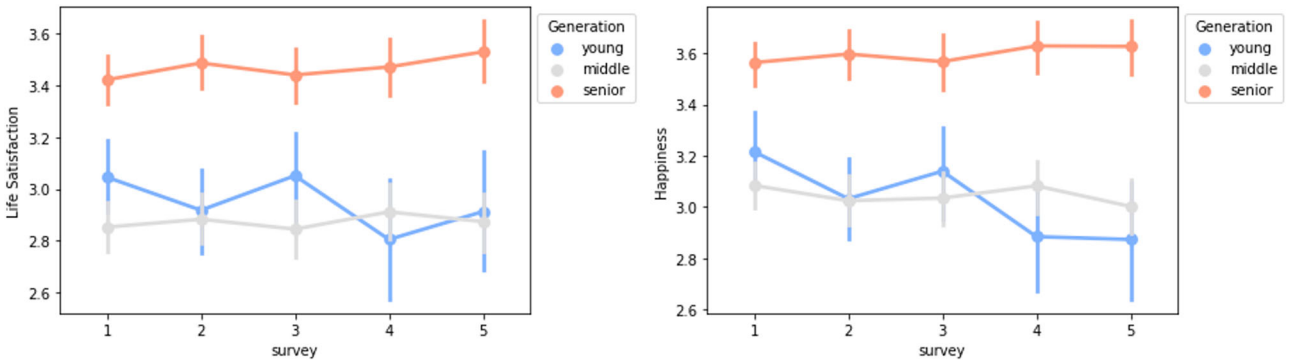

Fig. 6 Differences in life satisfaction and happiness by generation. This figure shows how respondents' subjective well-being by generation changed over the course of the five surveys.

aged and elderly groups may be a common feature of the two groups.

Subsequently, OLS and FE analyses were conducted for each of the subgroups. The life satisfaction and happiness estimates are shown in Table 3. These results show that the estimated values and their significance differ considerably by generation. As was the case with our analysis of all the data, both the declaration of a state of emergency and the infection status had little effect on life satisfaction and happiness across all the generation groups. Models (b1) through (b6) use life satisfaction as the explained variable. When focusing on the respondents' teleworking in these models, the estimated values are the highest in the young group (0.3923, s.e. 0.1691) analyzed with FE, and the estimated values decrease as age increases. Significance was found in only the model for the young group. Conversely, the estimated value of the respondents' self-restraint was −0.2575 (s.e. 0.1224) for the youngest group and −0.0931 (s.e. 0.0673) and 0.0237 (s.e. 0.1072) for the middle-aged and elderly groups, respectively; this result indicates a gradually decreasing effect. As was the case with teleworking, significance was confirmed for only the young group. The variables related to partner behavior were not significant according to our FE analysis. However, in the OLS models, partner self-restraint behavior was significant for all generations. In the young group, those whose partners exhibited self-restraint tended to be more satisfied with their lives, but this trend reversed with increasing age. Particularly in the older age groups, life satisfaction tended to be low not only among those whose partners were not going out but also among those whose partners were teleworking. The effect of changes in income observed in the overall analysis was not found to be significant in the FE analysis of the subgroups.

Next, turning to Models (b7) to (b12), happiness serves as the explained variable. In the OLS analysis, the coefficients of the self-restraint behavior of the respondents were −0.4470 (s.e. 0.1247), 0.0009 (s.e. 0.0572), and 0.3993 (s.e. 0.0911) for the young (b7), middle-aged (b9), and elderly groups (b11), respectively, while an effect of teleworking on the level of happiness was not observed. In other words, the level of happiness of the self-restraint group tends to be lower than that of the young group, but this difference disappears almost completely in the middle-aged group; moreover, in the elderly group, self-restraining individuals have a higher level of happiness. In contrast, the coefficients of the partners' self-restraint behavior were estimated to be 0.6373 (s.e., 0.1995), 0.1655 (s.e., 0.0712), and −0.2440 (s.e., 0.0994), indicating that the happiness level of those whose partners practice self-restraint is higher in the young group; however, this tendency is reversed in the elderly group. These results are consistent with those of the analysis of life satisfaction. In the FE analysis, significant differences were found in only the elderly group (b12), with the coefficient of self-restraint behavior estimated at 0.2051 (s.e. 0.0918) and that of partner self-restraint behavior at −0.1956 (s.e. 0.0953). With regard to the impact of the pandemic on income, in contrast to the results of the overall analysis, there was no increase in happiness due to increased income. The OLS analysis estimated a negative value for the effect of the decrease in income, and this effect was significant for the middle-aged and elderly groups. The young group was the only group where a negative causality was observed in the FE analysis.

Discussion

The above results suggest the following effects on well-being brought about by the COVID-19 pandemic in Japan. First, the state of emergency declaration itself had little effect on well-being, and the recent infection situation in the immediate area and the increase or decrease in the number of infected people are not considered to be factors that affect well-being. This lack of significance was observed across different generations, similar to the overall estimates. In Models (a1) and (a4), other factors related to the declaration of a state of emergency were not included among the variables. Therefore, the effect was estimated as the total impact of the emergency declaration rather than the impact of the emergency declaration itself. One possibility is that the positive and negative factors related to the declaration of a state of emergency could have canceled each other out. Our observation of both positive and negative factors in Models (a2) and (a5) supports the validity of this hypothesis. Banks et al. (2021) pointed out that mental health may have deteriorated before the lockdown and the stay-at-home order and that it may have stabilized after the lockdown. The results of this study are considered consistent with this opinion. In addition, there may be some effects unique to Japan. Although a state of emergency was declared, it was not legally binding. Additionally, surveys of private companies at the time showed a high percentage of support for the declaration of a state of emergency, suggesting that the public wanted a state of emergency to be declared[7]. However, although this study focused on teleworking, self-restraint behavior, and partner relationships, it cannot be said that the state of the emergency declaration itself had no effect since some factors could not be separated from the effects of the state of emergency declaration, such as exercise.

In terms of actual behavior, it could be suggested that subjective well-being may be affected by individuals' behavior and that of their partners. In particular, both an individual's behaviors and those of his or her partner are factors that affect life satisfaction, and their effects are not necessarily negative. The results of the overall

Table 3 The relevant results of the OLS and FE analyses of the subgrouped data.

Dep. Variable	Life satisfaction						Happiness					
	young (−39)		middle-aged (40-59)		elderly (60-)		young (−39)		middle-aged (40-59)		elderly (60-)	
	(b1)	(b2)	(b3)	(b4)	(b5)	(b6)	(b7)	(b8)	(b9)	(b10)	(b11)	(b12)
Estimator	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**
No. Observations	**545**	**545**	**1901**	**1901**	**1296**	**1296**	**545**	**545**	**1901**	**1901**	**1296**	**1296**
R-Squared (Within)		0.1113		0.0321		0.0322		0.0802		0.0348		0.0370
R-Squared (Between)		0.2598		0.1789		0.1274		0.1839		0.1224		0.0774
R-Squared (Overall)	0.6024	0.2251	0.4057	0.1448	0.4198	0.1047	0.6173	0.1633	0.4479	0.1076	0.4341	0.0681
inc_decrease	−0.0693	−0.0809	−0.2716***	−0.0607	−0.2800***	−0.0688	−0.1378	−0.1582*	−0.1827***	−0.0145	−0.2026***	0.0056
	(0.0927)	(0.0889)	(0.0450)	(0.0473)	(0.0555)	(0.0543)	(0.0919)	(0.0868)	(0.0419)	(0.0395)	(0.0505)	(0.0465)
inc_increase	0.1435	0.1276	−0.0207	−0.0375	−0.1253	0.0034	0.2494	0.2037	0.0130	0.0755	−0.0547	0.0248
	(0.1575)	(0.1417)	(0.0905)	(0.0776)	(0.0997)	(0.0808)	(0.1563)	(0.1382)	(0.0843)	(0.0649)	(0.0908)	(0.0692)
log(income)	−0.0978		0.2595***		0.1080***		0.0501		0.2251***		0.0075	
	(0.0840)		(0.0373)		(0.0396)		(0.0833)		(0.0347)		(0.0361)	
WFH(self)	0.2113	0.3923**	0.0350	0.1021	0.2216*	0.0452	0.0784	0.0227	−0.0212	−0.0524	0.1557	−0.0343
	(0.1641)	(0.1691)	(0.0668)	(0.0848)	(0.1136)	(0.1427)	(0.1628)	(0.1650)	(0.0622)	(0.0710)	(0.1034)	(0.1222)
WFH(partner)	0.0828	−0.4287	0.0686	0.0507	−0.4770***	0.1122	−0.1338	−0.4272	−0.0861	−0.0347	−0.2604	0.1491
	(0.2548)	(0.2802)	(0.0922)	(0.1107)	(0.1782)	(0.5603)	(0.2528)	(0.2734)	(0.0859)	(0.0926)	(0.1623)	(0.4799)
SR(self)	−0.5811***	−0.2575**	−0.1069*	−0.0931	0.3258***	0.0237	−0.4470***	−0.0709	0.0009	−0.0411	0.3993***	0.2051**
	(0.1257)	(0.1224)	(0.0614)	(0.0673)	(0.1001)	(0.1072)	(0.1247)	(0.1194)	(0.0572)	(0.0563)	(0.0911)	(0.0918)
SR(partner)	0.7163***	0.1710	0.1978***	0.1418	−0.1940*	−0.0341	0.6373***	0.2460	0.1655**	0.0976	−0.2440**	−0.1956**
	(0.2011)	(0.2118)	(0.0765)	(0.0868)	(0.1091)	(0.1112)	(0.1995)	(0.2066)	(0.0712)	(0.0726)	(0.0994)	(0.0953)
state of emergency	−0.1716	−0.1221	0.0119	0.0309	0.0010	0.0062	−0.0372	−0.0093	0.0583	0.0830*	−0.0344	−0.0268
	(0.1463)	(0.1132)	(0.0857)	(0.0584)	(0.0867)	(0.0580)	(0.1451)	(0.1104)	(0.0798)	(0.0489)	(0.0790)	(0.0497)
num_patients	−0.0802	−0.0688	0.0158	0.0262	−0.0753	−0.0501	0.0509	0.0596	−0.0225	−0.0031	−0.0749	−0.0523
	(0.1498)	(0.1158)	(0.076)	(0.0524)	(0.0834)	(0.0561)	(0.1486)	(0.113)	(0.0707)	(0.0439)	(0.0759)	(0.048)
dmy_patients	2.831e−05	0.0265	0.0122	0.0215	−0.0156	−0.0136	−0.0250	−0.0208	−0.0084	0.0129	0.0049	0.0096
	(0.1042)	(0.0808)	(0.0625)	(0.0425)	(0.0618)	(0.0413)	(0.1034)	(0.0788)	(0.0582)	(0.0356)	(0.0563)	(0.0354)
*num_patients * dmy_patients*	0.0162	0.061	−0.0439	−0.0501	−0.003	−0.0203	−0.058	−0.007	0.0156	0.0054	−0.0558	−0.0708
	(0.1503)	(0.1162)	(0.0761)	(0.0517)	(0.0845)	(0.0569)	(0.1491)	(0.1134)	(0.0709)	(0.0432)	(0.077)	(0.0487)
Control												
time	yes		yes		yes		yes		yes		yes	
prefecture	yes		yes		yes		yes		yes		yes	
job	yes		yes		yes		yes		yes		yes	

*: < 0.1, **: < 0.05, ***: < 0.01. Std. errors are reported in parentheses.

estimates show that teleworking independently leads to an increase in life satisfaction. Although expectations regarding the potential benefits of teleworking were high before the pandemic, there were concerns about the physical and mental health effects (Buomprisco et al., 2021; Mann and Holdsworth, 2003; Song and Gao, 2020). In addition to the benefits of reduced commute time and increased free time, a benefit that may cause many people to consider working from home is the ability to reduce the risk of infection, which is an advantage in a pandemic. However, while teleworking improved life satisfaction in the overall estimation, positive significance was observed in only the young group in the generational analysis. According to the Cabinet Office (2020), 21.5% of people in Japan were teleworking as of December 2020, and more than half of them hoped that more than 50% of their work would consist of teleworking in the future. In addition, the results showed that a large percentage of young people changed their attitudes toward work-life balance, placing greater importance on their lives rather than on their jobs; indeed, compared to the period before the spread of the infectious disease, such attitudes tended to be stronger among young people. Moreover, the top two advantages of teleworking were shown to be the elimination of the need to commute and the effective use of spare time, which suggests that teleworking is favored by young people who wish to focus on their daily lives. The fact that young people are more likely to adapt to new approaches and situations may also be a factor in this causal relationship among young people. Another possible factor behind these results is their position in the business. Bloom et al. (2022) found significant differences in the evaluation of hybrid working from home between managers and non-managers. Non-managers viewed the introduction of hybrid WFH positively, while managers viewed it negatively. The consistent finding of the positive impact of WFH on subjective well-being among the younger generation, who are more likely to be in non-managerial positions, supports this notion.

Relationships with close partners may also be involved; Galdiolo et al. (2022) pointed out that opportunities for communication that arise during lockdown increase couples' well-being. Teleworking increases these opportunities by causing people to be at home. While self-restraint was shown to have a negative impact on life satisfaction, the results regarding partners' self-restraint were favorable, suggesting that the increase in time spent together at home during the pandemic was viewed positively by the respondents to this survey.

The characteristics of self-restraint behavior also varied significantly across generations. While self-restraint behavior tended to be associated with lower life satisfaction and happiness in the young group, the correlation was reversed as the respondents' ages increased. Causality was observed in only the young group in relation to life satisfaction and in the elderly group in relation to happiness. Klaiber et al. (2021) found that elderly individuals report more positive events in their daily diary data. These results suggest that elderly individuals may have been able to enjoy their self-restrained situation more, such as by finding new pleasure in their situations. In contrast, the opposite trend was observed in relation to partner self-restraint behavior. In the young group, life satisfaction and happiness were higher for those whose partners practiced self-restraint, whereas these factors were lower for the older group whose partners did so. Various possible explanations come to mind for this result. In a survey by the Cabinet Office (2020), more than 80% of the respondents who reported increased time spent with their families during the pandemic indicated that they would like to maintain this time with their families in the future. In addition, more than 40% of those who reported an increase in the husband's role in child-rearing and household chores and of those who reported an increase in both roles reported an improvement in their marital relationship, while less than 20% of those who reported an increase in the wife's role reported an improvement in their marital relationship. In the young group, the division of household chores and child-rearing was altered by the pandemic, which may have resulted in the improvement of relationships. Many of the couples in the elderly group had already finished child-rearing, and the burden of household chores may have been placed on only one of the spouses, but this study cannot indicate the reason for this.

Conclusion

In this study, a series of surveys was conducted covering ~1 year, starting in April 2020, when COVID-19 infections began to spread. By separating the teleworking and self-restraint behavior of the survey respondents and their partners during the pandemic from the effects of the state of emergency declaration, it was revealed that the lifestyle changes that arose during the pandemic did not necessarily harm well-being. It also became clear that the effects of these actions during the pandemic varied greatly across generations. For example, a causal relationship emerged in which teleworking increased life satisfaction in the young group of respondents; however, this effect was small, and causality was not observed in the middle-aged and elderly groups. In addition, while in the young group, there was a negative correlation between subjective well-being and self-restraint behavior and a positive correlation with the self-restraint behavior of partners, the opposite was true in the elderly group. The reason for these results is thought to stem from differences in how different generations perceive various behaviors adopted under the state of emergency declaration. The government's stay-at-home order may have been perceived by young people as a constraint. On the other hand, elderly people may have viewed it more optimistically, choosing to use their time in a meaningful way, as shown by Klaiber et al. (2021) and Bruine de Bruin (2021). Conversely, the effect of the self-restraint behavior of partners is presumably a reflection of relationships with family members or close partners and of factors such as life-work balance.

In addition, this study suggests that pandemic-induced lifestyle changes have both positive and negative effects on subjective well-being. Therefore, considering the impact of lockdowns or stay-at-home orders as a single overall impact would lead to variation across studies, as Prati and Mancini (2021) point out. In this study, the results show that the impact of the state of emergency declaration is almost negligible through a separation of the impact of teleworking and self-restraint behavior. This may be due in part to the fact that there has been a high level of support for the state of emergency declaration in Japan, but the limitation of this study should also be understood. Although the behavior of the respondents and their partners was considered in addition to the state of emergency declaration and the daily changes in the number of infected persons, not all the behavioral changes stemming from stay-at-home orders could be captured as variables. For example, the frequencys of exercise and shopping for daily necessities are possible factors, but they were not taken into account in this study. Since the timing of the emergency declaration and its lifting differ from prefecture to prefecture, the variables in our analysis represent simply whether a state of emergency had been declared in the focal area. Therefore, it is difficult to conduct a more detailed analysis focused on factors such as changes within the period when the state of emergency was in place. To better clarify such factors, a more advanced analysis, such as one that combines different approaches in addition to the questionnaire survey, is necessary.

Several years have passed since the pandemic occurred, but its aftermath is still ongoing. Continued investigation and the accumulation of knowledge are needed not only on the short-term effects of the pandemic on well-being but also on its long-term effects. In addition to differences in gender and age, differences in

the government response, national character, and culture have significant impacts. The accumulation of these findings will provide effective countermeasures against similar risks in the future.

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Notes

1 In this study, "self-restraint" is defined as voluntary refraining from going out, while 'self-isolation' is defined as refraining from going out, regardless of voluntariness.
2 The Cabinet Secretariat has published an archive of reports on its website, detailing the timing of emergency declarations and the corresponding covered areas: https://corona.go.jp/emergency/ Accessed 19 Jul 2022.
3 Although a state of emergency was not declared, some point out that the government's call for restaurants to shorten their hours and for people to refrain from going out was effective (The Asahi Shimbun, 2020).
4 A service called Freeasy from iBridge Corporation was utilized. This company owns a pool of 13 million potential respondents in Japan, from whom a random sample was selected. The selected respondents were required to be at least 18 years old.
5 These data can be downloaded from the following URL: https://web.sapmed.ac.jp/canmol/coronavirus/japan.html Accessed 19 Jul 2022.
6 We also analyzed models in which these variables were added independently but did not find significant changes in the estimation results.
7 For example, the following articles are available. Eighty-four percent of the respondents to a certain survey were in favor of the nationwide expansion of the first declaration of a state of emergency (The Chunichi Shimbun, 2020). A total of 72.5% were in favor of the second state of emergency declaration (NEXER inc., 2021b). A total of 43.3% of the respondents (27.1% in favor) were against the lifting of the second state of emergency declaration on March 21 (NEXER inc., 2021a).

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Author contributions

T.T. designed the study, the main conceptual ideas, and the proof outline. T.T., W.N., and A.K. designed the survey and collected the data. T.T., W.N., and A.K. aided in interpreting the results and worked on the manuscript. T.T. wrote the manuscript. T.T., W.N., and A.K. discussed the results and commented on the manuscript.

Competing interests

The authors declare no competing interests.

Ethical approval

The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

Informed consent

Informed consent has been obtained from all individuals included in this study.

Additional information

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