

# The Impact of the COVID-19 Pandemic on Mothers' Quality of Life: A Longitudinal Analysis of Ibaraki Cohort Project

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## Abstract:

The spread of the 2019 novel coronavirus (COVID-19), which was confirmed at the end of 2019, has transformed our lives. Childcare was also impacted. Schools and childcare facilities were closed, and children were required to stay at home. This study aimed to determine the impact of COVID-19 on the quality of life (QOL) of mothers through a longitudinal study. Study 1 compared mothers' QOL before the COVID-19 pandemic with mothers' QOL during the pandemic and found that mothers during the pandemic had lower QOL in the "social relationships" category. In particular, significant score differences were found among mothers raising children aged 6 and 12 months. Study 2 compared mothers in 2021 and 2022 to determine whether the request to refrain from going out as a measure to prevent COVID-19 infection affected their QOL. Although QOL average scores were higher in 2022 when there was no request for self-restraint on going out, some participants' QOL increased from 2021 to 2022, while others experienced a decline in QOL. A common feature of these two studies was a significant change in "social relationships" scores. Thus, in the event of a pandemic such as COVID-19, supportive measures are needed to ensure that parents, especially those raising children, are not isolated.

**Keywords:** *COVID-19, mothers, QOL, childcare support*

## 1. Introduction

After the novel coronavirus (hereafter, COVID-19) was confirmed at the end of 2019, it spread worldwide. The first infected person in Japan was confirmed in January 2020, after which the infection spread. On March 11, 2020, the World Health Organization (WHO) declared the spread of the COVID-19 pandemic. Infection control measures were implemented in Japan. In April of the same year, a state of emergency was declared under the Act on Special Measures against Novel Influenza

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(H1N1) as an infection control measure. Following this measure, infection countermeasures (e.g., self-restraint on outings and recommending working from home) were carried out, and people's lives were changed completely. In this changed lifestyle, Sugiyama et al. (2021) longitudinally examined the impact of requests for refraining from unnecessary outings on the psychological state of people ranging from their 20s to 60s. During the study period, feelings of loneliness gradually increased, while anxiety showed a decreasing trend, although not statistically significant, and the quality of sleep remained unchanged (Sugiyama et al. 2021). This is considered a result of reduced interactions with others due to the requests to refrain from non-essential outings as a measure against infection. In addition, the changes in lifestyle during the COVID-19 pandemic have also had adverse psychological (Li and Wang 2020) and social effects (Killgore et al. 2020) on individuals.

Such changes in the life environment have inevitably affected people involved in childcare under the influence of COVID-19. In recent years, amid concerns about child-rearing in isolation, some consider that interactions with others were further reduced owing to the infection control measures. In fact, the coronavirus infection control measures had several impacts, including a reduction in the scale of child-rearing support services and a decrease in participation opportunities due to limited use. These changes in the child-rearing environment affected mothers' mental health. Maruyama et al. (2022) demonstrated the relationship between changes in mothers' work status due to infection control measures and the sense of burden caused by constraints on child-rearing during the COVID-19 pandemic. Specifically, their findings suggest the difficulty of balancing work and child-rearing in the same space by working from home. Ishikawa et al. (2022) also pointed out that the closed environment caused by the COVID-19 pandemic and the decrease in opportunities to go outside and meet people exacerbated child-rearing mothers' sense of isolation and burden. Such social isolation may lead to increased contact with online media and being influenced by the feelings of others online. It has been suggested that higher parental online sensitivity to the feelings of others may increase burnout (Prikkhidko et al. 2020). Therefore, requests for refraining from going out as a preventive measure against infectious diseases during the COVID-19 pandemic have been reported to promote social isolation among people, leading to feelings of confinement and burden in childcare, as well as potential burnout due to emotional contagion by online media. From reports of such negative impacts on caregivers, concerns arise about the decline in quality of life (QOL), namely satisfaction with daily life, when requests for refraining from going out are issued during the COVID-19 pandemic. It has been reported that the QOL of mothers during pregnancy and while raising children changes with the age of the child. Hama (2010) showed that the physical health aspect of pregnant women's QOL declines as pregnancy progresses. Nohara and Nakada (2019) also conducted a longitudinal study targeting mothers at 1 month, 6 months, and 12 months postpartum. They found that at 12 months postpartum, mothers with lower QOL exhibited higher levels of parenting anxiety. This suggests that a mother's QOL may be related to the child's gestational period, age in months, and parenting stress. Furthermore, regarding changes in the psychological aspect of mothers, Ando and Muto (2008) indicated that those who were still in a depressive state one year postpartum had already been depressed during pregnancy or by the fifth week postpartum. They also demonstrated that the third month postpartum is a crucial period for recovery from depression. By examining the impact of changes in the life environment due to the pandemic, in addition to the age of the child, recommendations for future childcare support measures are expected.

Furthermore, the conditions of child-rearing support also changed during the COVID-19 crisis. Sonoda (2023) reported a decrease in child-rearing support from close friends, medical workers (e.g.,

family doctors), and childcare support center staff. On the other hand, support from partners, teachers of day-care centers, kindergartens, and schools for mothers grew. Thus, during the COVID-19 pandemic, not all support for child-rearing decreased; the evidence suggests both an increase and decrease in support opportunities due to the effect of staying home. Regarding the increase in support from family, Hirai and Watanabe (2021) showed that fathers' involvement in the family increased owing to working from home, which affected their well-being and job satisfaction.

Additionally, they highlighted that an increase in working from home was observed in some men who worked at a desk, had a high level of education, and had a high income. Negative aspects of working from home for husbands were also reported. Hirai (2022) expressed positive opinions about her husband's entry into domestic childcare by working from home, such as "it has become easier," while others expressed dissatisfaction with their husbands' lives at home. In addition, regarding the support provided by childcare support centers during the COVID-19 pandemic, the decrease in the number of exchanges, consultations, and playgrounds for children at childcare support centers caused anxiety and burdens for both parents and children (Okamoto and Okada 2022).

As described above, the impact of COVID-19 on maternal mental health and childcare has been reported in Japan and overseas. However, many studies analyze cross-sectional data, and there are cases of data that recall life before the pandemic and even compare life before and after the pandemic. Therefore, it is rare to find research that illustrates the change in mother's quality of life (QOL) from the longitudinal data for mothers raising infants from before the pandemic to its outbreak. Accordingly, we conducted a longitudinal study entitled the "Ibaraki Cohort Project" (hereinafter "Ibaraki Cohort") from 2017. In this project, we conducted a longitudinal study of mothers and children from the first trimester of pregnancy using multifaceted methods, including physiological indices, questionnaire surveys, behavioral observations, and interviews. In addition, in 2020, we added a questionnaire survey on COVID-19. Throughout this project, we have collected longitudinal data on mothers raising infants from before to during the COVID-19 pandemic.

In the present study, we aim to clarify the impact of COVID-19 on the QOL of mothers raising children in the Ibaraki Cohort of participants and to consider support measures that do not result in loss of function during emergencies. Our research consists of two studies: Study 1 clarifies changes in maternal QOL before and during COVID-19, and Study 2 aims to demonstrate the impact of behavioral control, one of the measures against COVID-19, on maternal QOL.

## 2. Study 1

### (1) Purpose

Study 1 aimed to clarify changes in maternal QOL during the COVID-19 pandemic by comparing maternal QOL before and during the pandemic. In this study, we defined the before-COVID-19 and COVID-19 pandemic periods based on whether they were before or after April 7, 2020, respectively, when requests and instructions based on the Special Measures Law were implemented for the first time and an emergency declaration was issued. Additionally, previous studies have reported the relationship between maternal QOL and childcare anxiety based on pregnancy periods (Hama 2010) and children's ages (Nohara and Nakada 2019). Therefore, in this study, besides the period of COVID-19, children's ages were also considered as factors that may influence maternal QOL and were set as independent variables.

## (2) Methods

### 1) Participants

In this study, participants numbered 105 (mean age 35.31,  $SD = 4.57$ ) when their children were 3 months old, 127 (mean age 35.79,  $SD = 4.56$ ) when their children were 6 months old, and 117 (mean age 37.7,  $SD = 4.42$ ) when their children were 12 months old.

### 2) Questionnaire Survey

For the measurement of maternal QOL, we used a QOL scale that was partially modified from the QOL scale for women in pregnancy by Sun et al. (2022) and made available during the child-rearing period. This scale consists of a total of 21 items with five subscales—psychological health, physical health, social relationships, life environment, and welfare environment. The answer method was a self-evaluation with four items: “I strongly disagree,” “I disagree,” “I agree,” and “I strongly agree.”

### (3) Statistical Analysis

SPSS version 25 was used for the analysis. A two-way analysis of variance (*ANOVA*) was conducted to examine the differences in QOL scores by survey period (before-COVID-19, COVID-19 pandemic) and child age (3, 6, and 12 months).

## (4) Results

### 1) Comparison of Mothers' QOL Scores

The two-way ANOVA showed a significant main effect of measurement time on the subscale item of “social relationships” ( $F(1,343) = 11.23, p < .01, \eta_p^2 = .03$ ) (see Table 1). Multiple comparisons using the Holm method revealed that QOL scores were higher before COVID-19 than during COVID-19 ( $p < .01$ ). There was also a simple main effect of measurement time in each group (3 months:  $F(1,343) = 2.99, p < .01, \eta_p^2 = .03$ ; 6 months:  $F(1,343) = 4.17, p < .05, \eta_p^2 = .03$ ; 12 months:  $F(1,343) =$

**Table 1. Results of Analysis of Variance between Age in Months and Time of Measurement of Maternal QOL**

		3 months		6 months		12 months			<i>F</i>	<i>p</i>	$\eta_p^2$
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
Overall score	before-COVID-19	65.10	8.98	64.96	8.77	65.30	9.21	Main effect (measurement time)	.01	.91	.00
								Main effect (age)	.05	.95	.00
	COVID-19 pandemic	65.42	9.91	64.77	10.86	64.79	10.14	Interaction effect	.05	.95	.00
Subscale											
Psychological health	before-COVID-19	13.06	2.50	12.80	2.57	13.00	2.63	Main effect (measurement time)	.18	.67	.00
								Main effect (age)	.07	.93	.00
	COVID-19 pandemic	13.07	3.08	13.09	2.80	13.09	2.71	Interaction effect	.08	.92	.00
Physical health	before-COVID-19	12.21	2.30	12.01	2.45	12.17	2.45	Main effect (measurement time)	2.80	.09	.01
								Main effect (age)	.54	.58	.00
	COVID-19 pandemic	12.72	2.16	12.32	2.26	12.63	2.27	Interaction effect	.06	.94	.00
Social relationships	before-COVID-19	12.37	2.29	12.60	1.99	12.57	2.10	Main effect (measurement time)	11.23	.00**	.03
								Main effect (age)	.22	.80	.00
	COVID-19 pandemic	11.56	2.54	11.74	2.64	11.66	2.60	Interaction effect	.01	.99	.00
Life environment	before-COVID-19	9.42	1.80	9.56	1.57	9.68	1.70	Main effect (measurement time)	.17	.68	.00
								Main effect (age)	.11	.89	.00
	COVID-19 pandemic	9.63	2.36	9.70	2.17	9.59	2.01	Interaction effect	.19	.83	.00
Welfare environment	before-COVID-19	4.97	1.39	4.90	1.43	4.81	1.68	Main effect (measurement time)	1.08	.30	.00
								Main effect (age)	.23	.80	.00
	COVID-19 pandemic	5.12	1.43	5.07	1.70	5.00	1.42	Interaction effect	.01	.99	.00

\*\* $p < .01$

4.22,  $p < .05$ ,  $\eta_p^2 = .04$ ). Multiple comparisons using the Holm method revealed that there was no significant difference in QOL scores at 3 months of age. On the other hand, at 6 and 12 months of age, QOL scores were significantly higher in the “social relationships” category before COVID-19 than during COVID-19 ( $ps < .05$ ). In addition, there was no significant interaction and main effect of age in months and time of measurement on the overall score and other subscales of maternal QOL.

## **(2) Discussion**

The results of the analysis showed that the QOL score for “social relationships” during the COVID-19 pandemic was significantly lower than that before the COVID-19 pandemic. This item of “social relationships” consists of the contents of friendship exchange, relationships with others, marital relationship, and support from friends. Therefore, we considered that the activity restrictions of the infectious disease countermeasures (e.g., the emergency declaration of the COVID-19 pandemic) and the special measures (e.g., the prevention of the spread) decreased opportunities for having relationships with others and led to the lowering of QOL.

Regarding the significant difference between 6 and 12 months of age, since an increase in parenting stress was reported in this period (Kimura et al. 2020), the decrease in opportunities for receiving support from surrounding people (e.g., family and friends) may further lead to an increase in parenting stress. The restriction of social connections in an emergency situation may lead to a decrease in QOL. In addition, Kimura et al. (2022) suggested that the difficulty in obtaining social support during the COVID-19 pandemic may lead to the experience of parenting stress, indicating the need for uninterrupted positive support to reduce stress and anxiety during parenting.

During the COVID-19 pandemic, while scores for “social relationships” decreased, no significant differences were observed in other QOL domains. In the “psychological health” and “physical health” domains, respondents were asked about their sense of fulfillment and purpose in parenting, and their self-assessment of current health status, as well as aspects of diet and sleep. It is considered that responses to these items were not affected by the requests to refrain from going out during the pandemic. During the survey period of this study, there were no closures of schools or similar measures for preventing infection spread. Therefore, the specific childcare environment during the survey period of this study was likely characterized mainly by reduced opportunities for interactions with others, with no change in feelings about childcare compared to before the pandemic. Additionally, no significant differences were found in “life environment” and “welfare environment” scores. These responses involved assessing satisfaction with current living conditions, and the survey area may have maintained a high standard of living compared to other municipalities, indicating no change in the living environment. In the “welfare environment,” there were periods during the survey period when public facilities were closed during the declaration of a state of emergency and periods when they were open with infection control measures in place, so no change in scores was observed. Therefore, although this study focused on a pandemic situation when social activities are forced to be restricted, during future emergencies (e.g., natural disasters) support measures focusing on the fulfillment of social relationships will be required.

## **3. Study 2**

### **(1) Purpose**

Study 1 showed changes in maternal QOL before and during COVID-19 and focused on

behavioral restrictions among administrative infection control measures during COVID-19. The purpose of Study 2 was to clarify changes in the QOL of mothers who raise children and related factors from a survey conducted at two points in June 2021, when the state of emergency was declared, and in August 2022, when behavioral restrictions were relaxed.

## (2) Methods

### 1) Participants

A total of 104 individuals participated in this study (June 2021: mean age 34.1 years,  $SD = 4.49$ ) and 91 (August 2022: mean age 35.5,  $SD = 4.60$ ) mothers participated in the Ibaraki Cohort. Of these, 78 (August 2022: mean age 35.8,  $SD = 4.58$ ) participated in both surveys. Among the children, 48 were boys and 30 were girls (August 2022: mean age 2.89,  $SD = 0.88$ ).

### 2) Questionnaire Survey

Similar to Study 1, the questionnaire survey measured the basic information of the study participants and their mothers' QOL during the parenting period. The basic information included age, occupation, annual income, and questions about COVID-19.

To measure maternal QOL, we used a QOL scale that was partially modified from Sun et al.'s (2022) QOL scale for women during pregnancy and made available during the child-rearing period.

In addition, the parenting stress scale (Kimura et al. 2022) was added from the survey in 2022. This scale consists of 14 items and four subscales: "Feeling of burden in parenting," "Opportunities for support from others," "Understanding from family," and "Husband's cooperation." The responses were self-rated using four responses: "not applicable at all," "not applicable," "slightly applicable," and "applicable."

## (3) Results

### 1) Participant Attributes

Table 2 shows participants' age, occupation, annual income, the number and sex of children, and answers to questions about COVID-19 in this study.

### 2) Relationship between Maternal QOL and Parenting Stress

The correlation coefficients between maternal QOL and parenting stress in the 2022 survey are shown in Table 3. As can be seen, there was a negative correlation between the overall QOL score, feeling of the burden of parenting, and understanding from family (in order  $r = -.333, p < .01$ ;  $r = -.357, p < .01$ ). There was a positive correlation between the overall QOL score, the opportunity for support from others, and husband's cooperation (in order,  $r = .358, p < .01$ ;  $r = .254, p < .05$ ).

The association between the sub-scales of QOL and parenting stress showed a negative correlation between "Psychological health" aspects and feeling of burden in parenting ( $r = -.322, p < .01$ ), and a positive correlation between opportunities for support from others ( $r = .213, p < .05$ ). There was a negative correlation between feeling of burden of parenting and understanding from family (in order,  $r = -.266, p < .05$ ;  $r = -.365, p < .01$ ) and a positive correlation between opportunities for support from others and husband's cooperation (in order,  $r = .260, p < .05$ ;  $r = .279, p < .01$ ). There was a positive correlation between social relationships and opportunities for support from others ( $r = .459, p < .01$ ) and a negative correlation between feeling of burden of parenting and understanding from family, ( $r = -.291, p < .01$ ;  $r = -.245, p < .05$ ). Life environment was negatively

correlated with understanding from family ( $r = -.254, p < .05$ ) and positively correlated with cooperation with husband's cooperation ( $r = .209, p < .05$ ). Finally, "welfare environment" was negatively correlated with understanding from family ( $r = -.250, p < .05$ ).

**Table 2. Participants' Demographic Data**

2021 (N=104)			2022 (N=91)		
Age	M	SD	Age	M	SD
	34.1	4.49		35.5	4.60
Number of children		n	Number of children		n
	one child	43		one child	24
	Two	44		Two	45
	Three	11		Three	16
	Four	5		Four	4
	Five	1		Five	2
		n %			n %
	Less than 3.5 million yen	4 4.4			
	3.5 million ~ 4.5 million yen	5 5.5			
	4.5 million ~ 5.5 million yen	6 6.6			
	5.5 million ~ 6.5 million yen	10 11.0			
	6.5 million ~ 7.5 million yen	16 17.6			
	7.5 million ~ 8.5 million yen	14 15.4			83 91.2
Income	Annual income		Decline in family income due to the coronavirus	No	
	8.5 million ~ 9.5 million yen	12 13.2		Yes	4 4.4
	9.5 million ~ 10 million yen	2 2.2		I don't want to answer.	3 3.3
	10 million ~ 12 million yen	4 4.4		missing value	1 1.1
	12 million ~ 14 million yen	6 6.6			
	14 million ~ 16 million yen	3 3.3			
	18 million ~ 20 million yen	1 1.1			
	20 million or more	1 1.1			
	Not answered	6 6.6			
		n %			n %
	Unemployed	33 36.3		Manufacturing Industry	23 25.3
	Medical and Welfare	12 13.2		Information and Communications industry	10 11.0
	Manufacturing Industry	9 9.9		Civil Servant	9 9.9
	Wholesale and Retail trade	7 7.7		Wholesale and Retail trade	8 8.8
	Civil Servant	7 7.7		Medical and Welfare	7 7.7
	Electricity, Gas, Heat Supply and Water supply	3 3.3		Education and Learning support industry	7 7.7
Occupation	Mother		Father	Electricity, Gas, Heat supply and Water supply	6 6.6
	Restaurants and Lodging	3 3.3		Building Industry	5 5.5
	Education and Learning support industry	3 3.3		Transportation Business	4 4.4
	Information and Communications industry	2 2.2		Finance, Insurance and Real Estate	4 4.4
	Finance, Insurance and Real Estate	2 2.2		Restaurants and Lodging	1 1.1
	Other services (Cooperatives, other than post offices)	6 6.6		Other services (Cooperatives, other than post offices)	4 4.4
	Others (specifically)	4 4.4		Others (specifically)	3 3.3

Note) Income and occupation as of 2022

**Table 3. Correlation Coefficients between Maternal QOL and Parenting Stress**

QOL	Parenting stress				
	Overall score	Feeling of burden in parenting	Opportunities for support from others	Understanding from family	Husband's cooperation
Overall score	-.095	-.333**	.358**	-.357**	.254*
Psychological health	-.128	-.322**	.213*	-.205	.200
Physical health	-.104	-.266*	.260*	-.365**	.279**
Social relationships	.006	-.291**	.459**	-.245*	.113
Life environment	-.074	-.082	.053	-.254*	.209*
Welfare environment	.039	-.025	.189	-.250*	.148

N=91 ; \*\*: $p < .01$ , \*: $p < .05$

### 3) Changes in Maternal QOL

To clarify the changes in maternal QOL during the survey period, we compared the QOL scores at two points (2021 and 2022) (see Table 4). A paired *t*-test showed that maternal QOL significantly increased in the overall score and that of the subscale “life environment” ( $ps < .05$ ).

Maternal QOL was also divided into two groups: an increase group ( $N = 48$ ) and a decrease group ( $N = 30$ ) at two points. To clarify the relationship between the time of measurement and the QOL score of both groups, we conducted a two-way mixed ANOVA with the QOL score as the dependent variable, the time of measurement (2021, 2022), the within-participant factor, and the group (increase group and decrease group) (see Table 5). In the overall QOL score, there was an interaction between the time of measurement and the group ( $F(1,76) = 108.21, p < .01, \eta_p^2 = .59$ ). Since there was an interaction, we performed a simple main effect test and found there was a simple main effect of group at each measurement time ( $F(1,152) = 5.98, p < .05, \eta_p^2 = .73$ ). As a result of multiple comparisons using the Holm method, the score of the decrease group was higher in 2021 ( $p < .05$ ). In contrast, in 2022, the score of the increase group was higher ( $p < .05$ ). There was also a simple main effect of measurement time in each group (increase group:  $F(1,76) = 86.56, p < .01, \eta_p^2 = .65$ , decrease group:  $F(1,76) = 34.87, p < .01, \eta_p^2 = .55$ ). As a result of multiple comparisons using the Holm method, the increase group had a higher score in 2022, and the decrease group had a lower score in 2022 ( $ps < .01$ ).

Apart from the overall score, we also performed a two-way mixed ANOVA on the subscales. For psychology, there was an interaction between measurement time and group ( $F(1,76) = 21.56, p < .01, \eta_p^2 = .22$ ). Since there was an interaction, we performed a simple main effect test. The results showed that the simple main effect of measurement time in each group was significant (increase group:  $F(1,76) = 9.62, p < .01, \eta_p^2 = .17$ , decrease group:  $F(1,76) = 12.02, p < .01, \eta_p^2 = .29$ ). As a result of multiple comparisons using the Holm method, the score in 2022 was higher in the increase group, and the score in 2021 was higher in the decrease group ( $ps < .001$ ). There was also a simple main effect of the decrease group in 2021 ( $F(1,152) = 4.78, p < .05, \eta_p^2 = .06$ ). As a result of multiple comparisons using the Holm method, the score of the decrease group was higher in 2021 ( $p < .05$ ).

There was also an interaction between the time of measurement and group in Physical health ( $F(1,76) = 13.45, p < .01, \eta_p^2 = .15$ ). Since there was an interaction, a simple main effect test was performed. The results showed a simple main effect of measurement time in each group (Increase group:  $F(1,76) = 9.64, p < .01, \eta_p^2 = .17$ , decrease group:  $F(1,76) = 4.93, p < .05, \eta_p^2 = .15$ ). As a result of multiple comparisons using the Holm method, the increase group had a higher score in 2022 ( $p < .01$ ), and the decrease group had a lower score in 2022 ( $p < .05$ ). There was also a simple main effect

**Table 4. Comparison of Maternal QOL**

	2021		2022		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
	61.99	9.71	63.78	9.43	-2.35	.02*
Psychological health	12.62	2.70	12.68	2.81	-.25	.80
Physical health	12.51	2.55	12.77	2.37	-.98	.33
Social relationships	11.47	2.56	11.81	2.46	-1.60	.11
Life environment	9.13	2.00	9.53	1.74	-2.25	.03*
Welfare environment	4.83	1.33	4.74	1.46	.56	.57

$N=78$ ; \*:  $p < .05$



of group in 2021 ( $F(1,152) = 4.68, p < .05, \eta_p^2 = .06$ ). As a result of multiple comparisons using the Holm method, the score of the decrease group was higher in 2021 ( $p < .05$ ).

Next, there was an interaction between the time of measurement and the group in “social relationships” ( $F(1,76) = 32.82, p < .01, \eta_p^2 = .30$ ). Since there was an interaction, we performed a simple main effect test. The results showed a simple main effect of measurement time in each group (increase group:  $F(1,76) = 25.29, p < .01, \eta_p^2 = .35$ , decrease group:  $F(1,76) = 10.97, p < .01, \eta_p^2 = .27$ ). As a result of multiple comparisons using the Holm method, the increase group had a higher score in 2022, and the decrease group had a lower score in 2022 ( $ps < .01$ ). There was also a simple main effect of group in 2022 ( $F(1,152) = 5.66, p < .05, \eta_p^2 = .07$ ). Multiple comparisons using the Holm method showed that in 2022, the score of the increase group was higher ( $p < .05$ ).

In addition, there was an interaction between measurement time and group in the life environment ( $F(1,76) = 8.81, p < .01, \eta_p^2 = .10$ ). Since there was an interaction, we performed a simple main effect test. The results showed a simple main effect of measurement time in the increase group ( $F(1,76) = 13.67, p < .01, \eta_p^2 = .23$ ). As a result of multiple comparisons using the Holm method, the score in 2022 was high ( $p < .01$ ).

Moreover, there was an interaction between measurement time and group in the “welfare environment” ( $F(1,76) = 4.33, p < .05, \eta_p^2 = .05$ ). Since there was an interaction, we performed a simple main effect test, and the results indicated there was no simple main effect of measurement time and group.

Finally, to clarify the characteristics of each increase group and decrease group, we compared the basic information of each group and the parenting stress score. Next, a group comparison of parenting stress (total score and subscale), which showed a significant positive correlation from the correlation analysis, was carried out, and there was no significant difference in either. Furthermore, there was no

**Table 5. Results of Analysis of Variance between Groups and Time of Measurement in Maternal QOL**

	Year	Increase group		Decrease group			<i>F</i>	<i>p</i>	$\eta_p^2$
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
Overall score	2021	59.96	8.99	65.23	9.77	Main effect (group)	.00	1.00	.00
						Main effect (measurement time)	1.29	.26	.02
	2022	65.81	8.15	60.53	10.23	Interaction effect	108.21	.00**	.59
Subscale									
Psychological health	2021	12.08	2.52	13.47	2.73	Main effect (group)	.26	.61	.00
						Main effect (measurement time)	.63	.43	.01
	2022	12.98	2.48	12.20	3.17	Interaction effect	21.56	.00**	.22
Physical health	2021	12.04	2.65	13.27	2.13	Main effect (group)	.38	.54	.00
						Main effect (measurement time)	.03	.85	.00
	2022	13.00	2.27	12.40	2.43	Interaction effect	13.45	.00**	.15
Social relationships	2021	11.21	2.49	11.90	2.56	Main effect (group)	.38	.54	.01
						Main effect (measurement time)	.28	.60	.00
	2022	12.33	2.08	10.97	2.73	Interaction effect	32.82	.00**	.30
Life environment	2021	9.00	1.99	9.33	1.96	Main effect (group)	.20	.65	.00
						Main effect (measurement time)	2.61	.11	.03
	2022	9.79	1.78	9.10	1.56	Interaction effect	8.81	.00**	.10
Welfare environment	2021	4.71	1.26	5.03	1.40	Main effect (group)	.00	.98	.00
						Main effect (measurement time)	1.08	.30	.01
	2022	4.88	1.41	4.53	1.50	Interaction effect	4.33	.04*	.05

\*\* $p < .01$  \* $p < .05$

significant difference in the result of the  $\chi^2$  tests of the answers to the question, “Has your family income decreased because of the coronavirus?” between the groups.

#### (4) Discussion

The comparison between June 2021 (the emergency declaration period) and August 2022 (the 7th wave of the spread of the infection at two points when the behavioral restrictions were relaxed) showed an increase in maternal QOL. Despite the ongoing spread of infection, the QOL scores were higher during the period when restrictions on activities were eased. Therefore, it is possible that the restrictions, which were intended as measures to prevent infection spread, may have decreased the QOL of mothers. In addition, there was a significant increase in the score of “life environment” in the QOL, and its subscales, which included items on housing and economic situation. Therefore, the results indicate that living conditions improved compared with 2021 because, in August 2022, which was considered to be the 7th wave of the infection, there were no measures such as behavioral restrictions as there were before, and signs of gradually returning to daily life before the coronavirus were observed. However, this study revealed the presence of both an increase group and a decrease group in QOL scores among participants. Therefore, the results of the t-tests in this study need to be interpreted with caution. In this study, it is more important to consider the changes in scores within each group rather than comparing overall scores.

Regarding the relationship between QOL and parenting stress, there was no significant correlation with the overall score of parenting stress, but there was a significant correlation with each subscale, suggesting a relationship between QOL and parenting stress. Regarding parenting stress during the COVID-19 pandemic, India, Malaysia, Japan, and the United States reported an increase in parenting stress during the COVID-19 pandemic compared to prior to the COVID-19 behavioral restrictions (Kurata et al. 2021). For the investigation in 2020, this study was conducted during the period when behavioral restrictions (e.g., the declaration of a state of emergency) were implemented in Japan. As a factor for the increase in child-rearing stress due to the COVID-19 pandemic, both parents pointed out that they could not take breaks as well as before (Sonoda et al. 2023).

While the results showed that mothers’ QOL overall increased from 2021 to 2022, it was also revealed that participants’ QOL was divided into an increase group and a decrease group. Furthermore, the relationship between the group differences in QOL scores changed from 2021 to 2022, suggesting that there was a large change in QOL between the two groups. There is suggestive evidence of significant changes in QOL between both groups. Attempts were made to identify the factors contributing to these changes from the perspective of participants’ childcare stress and changes in income, but no significant differences were found between the increase and decrease groups. The main difference in infection control measures during the study period was primarily the request to refrain from going out. This request was made to residents of the relevant area and was not limited to specific individuals or groups, including the study participants. In this situation, individual characteristics may have contributed to differences in the changes in QOL. It has been reported that individual personality traits are associated with the measurement of QOL (Yamaoka et al. 1996). Additionally, during the survey period in June 2021, it was the third declaration of a state of emergency, and there may have been a sense of familiarity compared to the first declaration of a state of emergency. However, in August 2022, there was an increase in the number of infected individuals. The survey area was no exception, and it experienced an increase in infected individuals similar to the trend observed in Osaka Prefecture as a whole. During the period when there were more infected individuals than in June 2021,

there were no requests for refraining from going out, and it was a time when people's attitudes toward going out may have varied.

#### 4. Conclusion

In this study, we showed that maternal QOL scores were lower during the COVID-19 pandemic than before the pandemic. We also showed that maternal QOL scores were higher during the COVID-19 pandemic in 2022 than in 2021 when the request to refrain from going out was made. In this study, we also showed the negative impact of COVID-19 on childcare from the perspective of maternal QOL, confirming previous studies showing that COVID-19 makes the childcare environment difficult. As for the negative impact of COVID-19 on parents, it has been shown that corona-related stress worsens mental health conditions such as anxiety and depression in parents (Heuvel et al. 2022). It has also been shown that mothers experience more stress than fathers (Heuvel et al. 2022; Abidin et al. 2022). Previous studies have used maternal health and parenting stress as indicators to examine the effects of COVID-19. In this study, it was possible to clarify not only the physical and mental health condition of the mother, such as "psychology," "physical health," "social relations," "life environment," and "welfare environment," but also the change of the condition of the mother over a comparatively wide range including the environmental factor, because the QOL of the mother was used as an index.

Through Studies 1 and 2, the QOL was low in the item of "social relations" in the COVID-19 pandemic. Therefore, the connection with society is considered a more concrete effect of COVID-19 on the mother's QOL. Since this item consists of contents such as exchanges between friends, relationships with others, marital relationships, and support of friends, it seems to be affected by the decrease in interactions with people due to exercising self-restraint on going out during the COVID-19 pandemic. Regarding the effect of self-restraint on going out on the loneliness of Japanese people, Sugiyama et al. (2021) showed that loneliness increased over time during the self-restraint period and pointed out the effect of limiting going out on loneliness. In Study 1 of this research, the analysis was carried out before and after the declaration of the state of emergency, and in Study 2, the existence of the order to exercise self-restraint on going out as an infection control measure was analyzed as one of the factors of QOL change of mothers. In this study, since the QOL of mothers was consistently lower in the period when self-restraint on going out was requested during the COVID-19 pandemic, it is considered that this limitation on leaving the home affected the QOL of mothers, similar to Sugiyama (2021). This study has shown that COVID-19 may have affected the QOL of mothers. In particular, there was a negative effect of decreasing the QOL score in the social relationships item, which is related to human interaction. There was a decrease in the score related to social relationships during the period when infection prevention measures such as avoiding going out and avoiding close situations with people were taken. However, interaction by online media such as SNS was recommended even if it was not possible to go out, so even interaction with a person comparatively far away was possible. Thus, it can be said that human relations were not completely prevented by the COVID-19 crisis. Therefore, it was suggested that the restriction of actual physical face-to-face interaction, rather than online on-screen interaction, was a factor that lowered the QOL of mothers during parenting.

From the above, it is considered that the dilution of interpersonal relationships caused by emergency situations lowered the QOL of mothers raising infants. One of the factors that improved the

dilution of interpersonal relationships was the interaction between same-age children in child-rearing support centers, nurseries, and kindergartens. It has been reported that mothers felt that by visiting child-rearing support centers, they could meet other parents in the same situation as themselves, that their children could experience various kinds of play with their peers, and that they could consult about child-rearing (Noguchi et al. 2015). In addition, Teramura (2015) conducted a connection program (an exchange meeting for mothers with children under 6 months old) at a local child-rearing support center, and the participants showed a higher level of empowerment than non-participants. Thus, before COVID-19, child-rearing counseling and information exchanges were being conducted through meetings with other parents and staff at support centers. Reinelt et al. (2023) also reported that the availability of better information and expert support on child-rearing and COVID-19 was associated with less anxiety about childbirth and decreased maternal health during the pandemic. However, during the COVID-19 pandemic, support centers were closed, and some support was suspended (Okamoto and Okada 2022). As for the role of the childcare support center during the COVID-19 crisis, Okamoto and Okada mentioned that it functioned as a consultation partner for parents' troubles in times of peace and beyond, and that it provided a way for parents and children to play such as hand games, crafts, and cooking activities by distributing videos. For this purpose, they showed the necessity of an online consultation counter using SNS, etc., and a support method by providing information through video distribution. Therefore, childcare support that can provide a connection with the society is required even in an emergency.

On the other hand, some people receive support and others do not. In this regard, we should also consider support ability, which is the ability to accept and utilize support, as mentioned by Kimura et al. (2021). Even if support measures are developed, they will not be delivered unless there is a positive attitude towards accepting them. Therefore, it is necessary not only to unilaterally develop support measures for society but also to consider how to provide support that is acceptable to all the people who need it.

## 5. Limitations

This study analyzed data from a longitudinal study conducted before and during the COVID-19 pandemic. The longitudinal data showed that the need to refrain from going outside as a measure to prevent infection during the COVID-19 pandemic may limit child-rearing and reduce social interaction, which may contribute to a decline in maternal QOL. A comparison of QOL scores for mothers at two time points indicated the presence of individuals whose QOL had increased and those whose QOL had decreased. However, due to factors such as not taking into account mothers' different personalities, the reasons for the different characteristics of both groups could not be accurately determined. Thus, it was not possible to clarify the change process of maternal QOL between 3 and 12 months and the difference in child development before and during the COVID-19 pandemic.

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