

Reductions in the Frequency of Going Out Due to the COVID-19 Pandemic Negatively Affect Patients with Spinal Disorders

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Abstract:

Introduction: The coronavirus disease 2019 (COVID-19) pandemic has greatly changed the lifestyles of individuals due to the need to prevent disease spread. Globally, governments have enforced various policies, including travel bans, quarantine, home confinement, and lockdowns, as safety measures. Consequently, the frequency of individuals going out has decreased. This survey aimed to assess how decreasing the frequency of going out due to the COVID-19 pandemic impacts patients with spinal disorders.

Methods: This multicenter cross-sectional questionnaire survey included patients who visited four private spine clinics for any symptoms. Participants completed questionnaires pre- and post-pandemic that assessed the following topics: frequency of leaving home, exercise habits, locomotive syndrome, and health-related quality of life (HRQOL). Patients were divided into decreased and non-decreased frequency of going out groups, according to observed changes in their frequencies of leaving home. Both groups were statistically compared using univariate and multivariate logistic regression analyses to identify factors associated with the frequency of going out.

Results: Among 855 patients, 160 (18.7%; the decreased group) reported that they went out less frequently, and 695 (81.3%; the non-decreased group) reported that they left home equally frequently post- versus pre-pandemic. Multivariate analyses showed that exercise habits significantly decreased (adjusted odds ratio (aOR) = 2.67, $p = 0.004$), the incidence of locomotive syndrome significantly increased (aOR = 2.86, $p = 0.012$), and HRQOL significantly deteriorated (aOR = 4.14, $p < 0.001$) in the decreased group compared to the non-decreased group.

Conclusions: Restrictions regarding leaving home due to the COVID-19 pandemic significantly decreased exercise frequency, increased the occurrence of locomotive syndrome, and were associated with deterioration of HRQOL in patients with spine disorders. It may be beneficial for spine surgeons to encourage patients with spinal disorders to leave home at a frequency similar to what they did pre-pandemic while avoiding crowded areas, despite the presence of the COVID-19 pandemic.

Keywords:

COVID-19, pandemic, spinal disorder, staying at home, frequency of going out, locomotive syndrome, exercise habit, quality of life

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Introduction

The coronavirus disease 2019 (COVID-19) pandemic has had a huge impact on both physical and mental global health¹⁾, and our lifestyles have greatly changed to prevent viral spread²⁾. Globally, governments have been enforcing various policies, such as travel bans, quarantine, home confinement, and lockdowns, to prevent viral spread. Though

viral spread temporally subsided due to minimizing opportunities to come in direct contact with others, policies, such as home confinement or lockdown measures, have the potential to enhance loneliness, anxiousness, and depression and reduce activity levels.

Throughout the COVID-19 pandemic, people have been prohibited from going out for nonessential purposes. Consequently, the frequency of which individuals tend to go out

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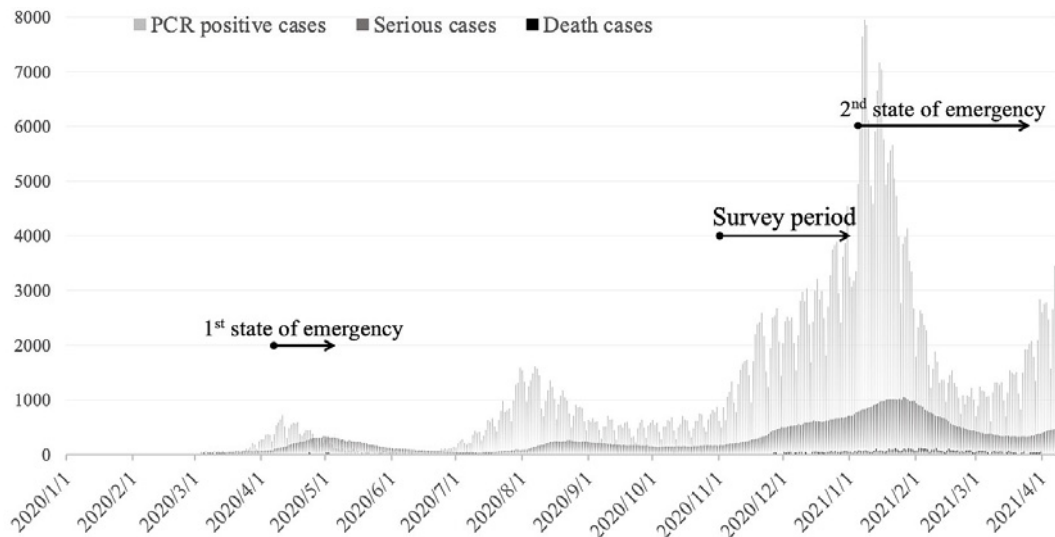


Figure 1. Description of the coronavirus disease pandemic in Japan during the survey period.

Source: Ministry of Health, Labour and Welfare website (<https://www.mhlw.go.jp/stf/covid-19/open-data.html>)³³⁾

has decreased. It has been reported that the frequency of going out impacts physical health³⁾ and that depression has increased due to the COVID-19 pandemic, especially among the elderly, who were greatly affected by COVID-19-related restrictions⁴⁾. Moreover, a previous report demonstrated that negative emotions, including depression, significantly impact health-related quality of life (HRQOL)⁵⁾. In particular, decreases in the frequency of going out due to the COVID-19 pandemic have the potential to cause the deterioration of physical or mental health. To the best of our knowledge, no reports assessing the relationship between decreases in the frequency of going out and physical or mental health parameters have been published.

However, a previous report demonstrated that reductions in physical activity due to the COVID-19 pandemic may lead to accelerated sarcopenia progression and muscle loss⁶⁾. This indicates that patients who suffer from locomotive syndrome may also be negatively affected by self-restriction, including decreasing one's frequency of going out. Since locomotive syndrome is strongly associated with spinal disorders, including intervertebral disc diseases, lumbar spinal stenosis, spinopelvic malalignment, and spinal osteoporosis⁷⁻⁹⁾, it is especially important to understand the impact of self-restriction on changes in the incidence of locomotive syndrome in patients with spinal disorders.

To enhance our understanding of the effects of restrictions put in place to minimize the spread of COVID-19 on patients with spinal diseases, this study assessed the effects of reducing the frequency of leaving home by evaluating patients pre- and post-pandemic. We hypothesized that COVID-19-related restrictions on going out may negatively affect the physical functioning or HRQOL of patients with spinal disorders. Therefore, this cross-sectional survey aimed to verify how changes in the frequency of going out impacted patients with spinal disorders after the COVID-19

pandemic.

Materials and Methods

In this multicenter cross-sectional study, all patients who visited four private spine clinics for any symptoms were asked to participate in a survey. Patients who provided informed consent were enrolled in the study. Enrolled participants had an appointment at one of the four clinics, either visiting for the first time or at a return visit. The survey was conducted between November 1, 2020, and December 31, 2020, in Osaka, Japan. In Japan, the third COVID-19 pandemic wave occurred during the study period. The first and second waves of the pandemic occurred in April and August, respectively (Fig. 1).

Questionnaire

At the time of the survey, all Japanese were considered to have already experienced the first and second waves of the COVID-19 pandemic, and enrolled participants were asked to complete several questionnaires at the following two time points: pre-pandemic and post-second wave (current).

General information

Questions included the age, sex, first or return visit, and whether they hesitated to visit the hospital (if they hesitated or had not hesitated).

Changes after the second wave of the COVID-19 pandemic

Questions also assessed whether patients observed changes in their symptoms (deteriorated, stable, improved, or newly occurred after the pandemic), exercise habits (stable, increased, decreased, or no exercise habit), locomotive syndrome (newly developed, no changes, or improvements), and frequency of going out (everyday, 4-5 times/week, 1-2

times/week, 1-2 times/2 weeks, 1-2 times/month, or did not leave home).

Diagnosis of locomotive syndrome

The physical function of subjects was evaluated based on the presence or absence of the locomotive syndrome since a previous report demonstrated an association between physical functioning and the syndrome¹⁰. The diagnosis of locomotive syndrome was based on patient responses to a loco-check, consisting of the following seven statements: (1) You cannot put on a pair of socks while standing on one leg; (2) You stumble or slip in your house; (3) You need to use a handrail when going upstairs; (4) You cannot get across the road at a crossing before the traffic light changes; (5) You have difficulty walking continuously for 15 min; (6) You find it difficult to walk home carrying a shopping bag weighing about 2 kg; (7) You find it difficult to do housework requiring physical strength. Anyone who positively responds to any of the above statements may have locomotive syndrome. Several studies have verified the usefulness of the loco-check to detect early-stage locomotive syndrome^{11,12}, and participants with one or more positive responses to the statements were considered to have locomotive syndrome in this study.

HRQOL index

The HRQOL of study participants at the two time points (pre-pandemic and post-second wave) were assessed using EuroQoL-5 dimensions 5-level (EQ-5D-5L), which was previously described in a survey cross-sectionally¹³. EQ-5D-5L measures health-related HRQOL using a 1-5 severity scale to assess five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The Japanese version of the EQ-5D 5-level test was used in this survey¹⁴. Domain scores were converted to index values via the methodology proposed in a previous report¹⁵. To evaluate the impact on HRQOL, the change in the total index of EQ-5D-5L was categorized into stable/improved and deteriorated.

Study design and statistical analysis

Patients who did not fill out questions regarding the frequency of their going out were excluded from the statistical analyses. Patients were then divided into two groups, i.e., a decreased frequency of going out and a non-decreased frequency of going, according to the change in frequency of going out reported. The decreased frequency of going out group included those who went out less frequently after the second wave versus pre-pandemic. The non-decreased group included those whose frequency of going out either increased or remained constant after the second wave versus pre-pandemic. The change in total EQ-5D 5-level index values of the groups, which were determined pre- and post-second wave of the pandemic, was compared using a mixed-effects model. Subsequently, in univariate analyses, effects of age, sex, hesitation to visit the hospital, symptom severity changes, exercise habits, locomotive syndrome incidence,

and HRQOL calculated from EQ-5D-5L were compared between the groups using the Mann-Whitney U test to evaluate continuous values and a Chi-squared test to assess categorical variables. Finally, variables with a significance <0.05 in the univariate analysis were included in a multivariate logistic regression model as explanatory variables. In the analysis, the decreased group was set as an objective variable. The adjusted odds ratio (aOR) and 95% confidence intervals (95% CI) of dependent variables were calculated. Furthermore, in a subgroup analysis, patients who were included in the decreased group were further divided into mildly and severely decreased activity level groups. The mildly decreased frequency of going out group included patients who were restricted from going out by one rank pre- versus post-second wave. For example, patients in this category may have gone out at a frequency of 4-5 times/week pre-pandemic and 1-2 times/week post-second wave. The severely decreased group included patients who went out at levels two or more ranks lower post-second wave than they did pre-pandemic. For example, a patient who went out 4-5 times/week pre-pandemic and that who went out 1-2 times/month post-second wave may be included in the group. In the subgroup analysis, the change in total EQ-5D 5-level index values of the groups from pre-pandemic and post-second wave of the pandemic was compared using a mixed-effects model, and each domain of the mildly decreased and severely decreased groups was compared using univariate analysis. All analyses were performed using SPSS software (version 27; SPSS, Chicago, IL, USA). Values of $p < 0.05$ were considered statistically significant.

Results

Among the 1,193 patients with spinal disorders who participated in this survey, 308 patients were excluded since they did not answer questions regarding the frequency of going out. Consequently, we included 855 patients in the analysis. The average age of the patients was 59.2 ± 18.7 years, and 409 women and 430 men (16 patients did not provide this information) were included in the analysis. Table 1 presents the overall data of answers to each question.

Grouping based on the change in frequency of going out

Among 855 patients, 160 (18.7%) reported that their frequency of going out after the COVID-19 pandemic decreased. These patients were classified into the decreased frequency of going out group. In addition, 695 patients (81.3%) reported that their frequency of going out post- versus pre-pandemic either increased or remained the same. These patients were classified into the non-decreased frequency of going out group (the same frequency, 683 patients; increased frequency, 12 patients) (Table 2).

Impact on the HRQOL

Fig. 2 shows the change in each EQ-5D-5L domain of both groups, post- versus pre-pandemic. In a mixed-effects

Table 1. Overall Answers of the Questionnaire.

Questionnaire items	
<i>Did you hesitate to visit the hospital due to the COVID-19 pandemic? (n, %)</i>	
Hesitated	292 (34.1)
Did not hesitate	552 (64.6)
Not answered	11 (1.3)
<i>Has your symptom improved as a result of self-quarantine due to the COVID-19 pandemic? (n, %)</i>	
Stable/improved	445 (52.1)
Deteriorated	107 (12.5)
Not answered	303 (35.4)
<i>How has your exercise habit changed as a result of the COVID-19 pandemic? (n, %)</i>	
Stable/increased	419 (49.0)
Decreased	307 (35.9)
No exercise habit	124 (14.5)
Not answered	5 (0.6)
<i>EQ-5D-5L total index</i>	0.88±0.14 0.82±0.17
<i>HRQOL (n, %)</i>	
Stable/improved	388 (45.4)
Deteriorated	222 (26.0)
Unable to evaluate	245 (28.6)
<i>The number of participants who answered “yes” in the loco-check (n, %)</i>	
	<i>Pre</i> <i>Post</i>
You cannot put on a pair of socks while standing on one leg	208 (24.3) 281 (32.9)
You stumble or slip in your house	107 (12.5) 154 (18.0)
You need to use a handrail when going upstairs	208 (24.3) 287 (33.6)
You cannot get across the road before the traffic light changes	158 (18.5) 260 (30.4)
You have difficulty walking continuously for 15 min	98 (11.5) 160 (18.7)
You find it difficult to walk home carrying a shopping bag	85 (9.9) 150 (17.5)
You find it difficult to do housework requiring physical strength	33 (3.9) 49 (5.7)
<i>Locomotive syndrome severity (n, %)</i>	
Stable/improved	669 (78.2)
Newly developed	182 (21.3)
Unable to evaluate	4 (0.5)

Abbreviations: EQ-5D-5L, EuroQoL-5 dimensions 5-level; HRQOL, health-related quality of life

Table 2. Data for Frequency of Going out Pre- and Post-pandemic and Data for How the Level of Frequency of Going out Changes Post-pandemic.

	Pre-pandemic (n)	Post-pandemic (n)
<i>Frequency of going out</i>		
Everyday	499	416
4–5 times/week	200	209
1–2 times/week	98	146
1–2 times/2 weeks	32	43
1–2 times/month or did not leave home	26	41
<i>The change in the level of frequency of going out</i>		
One or more level up		12
No change		683
1 level down		116
2 levels down		35
3 levels down		4
4 levels down		5

model, patients of the decreased frequency of going out group showed significantly larger decreases in total EQ-5D-5L index than those of the non-decreased frequency of going out group, post- versus pre-pandemic (p < 0.001, Fig.

3).

Primary univariate and multivariate comparisons

Univariate analyses of groups considered revealed signifi-

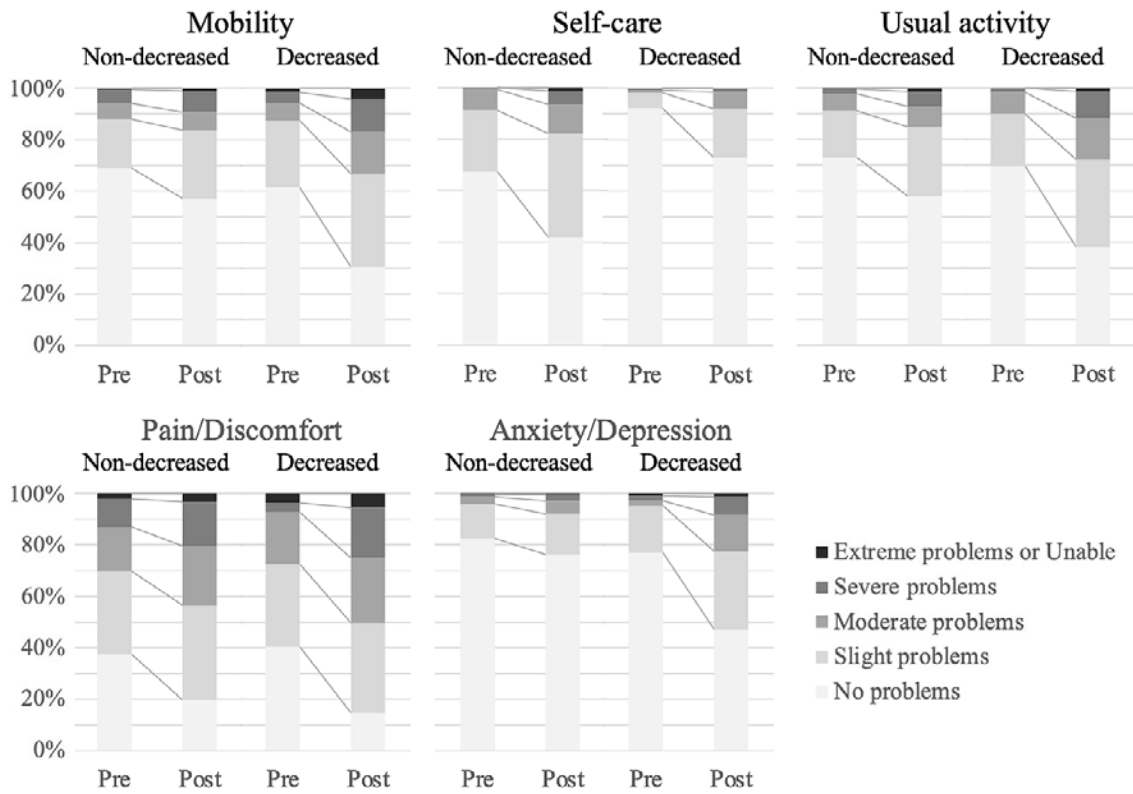


Figure 2. Comparison of EQ-5D-5L in each domain of patients within the non-decreased and decreased frequency of going out groups.

Abbreviations: EQ-5D-5L, EuroQoL-5 dimensions 5-level; Pre, pre-pandemic; Post, post-pandemic

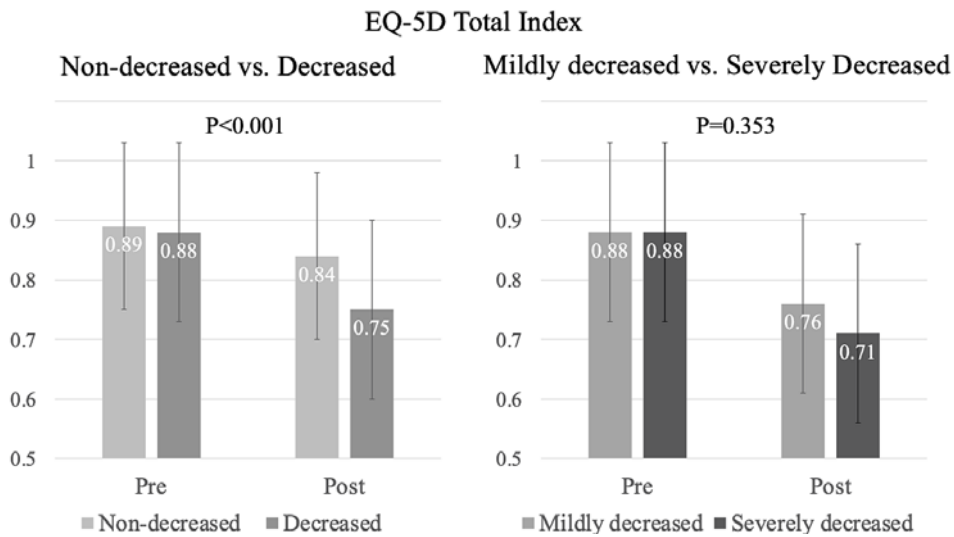


Figure 3. Comparison of total index of EQ-5D-5L between the non-decreased and decreased groups and between the mildly decreased and severely decreased groups.

Patients in the decreased frequency of going out group showed significantly larger decreases in total index of EQ-5D-5L than patients in the non-decreased group. Meanwhile, no significant difference in total index of EQ-5D-5L was observed between patients who mildly and strictly avoided going out. Statistical analysis: mixed-effect model; statistically significant: $p < 0.05$.

Abbreviations: EQ-5D-5L, EuroQoL-5 dimensions 5-level; Pre, pre-pandemic; Post, post-pandemic

cant differences with regard to age ($p = 0.001$), sex ($p < 0.001$), degree of hesitation to visit the hospital ($p = 0.016$),

changes in locomotive syndrome incidence ($p < 0.001$), and changes in HRQOL ($p < 0.001$) (Table 3). The multivariate logistic regression

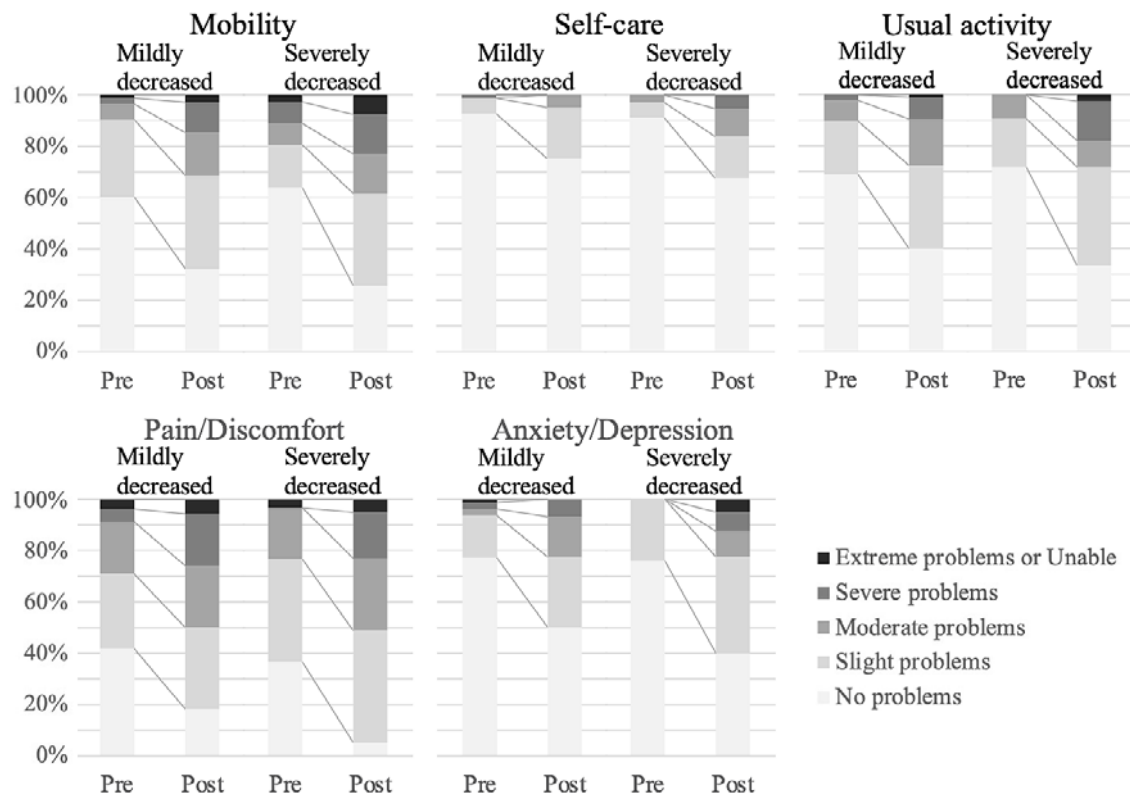


Figure 4. Comparison of EQ-5D-5L in each domain of patients who did not avoid, avoided, and strictly avoided going out.

Abbreviations: EQ-5D-5L, EuroQoL-5 dimensions 5-level; Pre, pre-pandemic; Post, post-pandemic

Table 3. Univariate Comparison Between Patients within the Non-decreased and Decreased Frequency of Going out Groups.

	Non-decreased (n=695)	Decreased (n=160)	p-value
Age (years)	58.2±18.9	63.8±17.5	0.001#
Sex (female/male)	312/372	97/58	<0.001*
Hesitated to visit the hospital			0.016*
Hesitated	224	68	
Did not hesitate	461	91	
Symptom severity			<0.001*
Stable/improved	375	70	
Deteriorated	69	38	
Frequency of exercise			<0.001*
Stable/increased	380	39	
Decreased	211	96	
No exercise habit	100	24	
Locomotive syndrome severity			<0.001*
Stable/improved	582	87	
Newly developed	110	72	
HRQOL			<0.001*
Stable/improved	349	39	
Deteriorated	159	63	

#Mann-Whitney U test

*Fisher's exact test/Chi-squared test

Statistically significant: p<0.05

Abbreviation: HRQOL, health-related quality of life

model showed that patients who reported that they left home less frequently post-pandemic than pre-pandemic were significantly more likely to exercise less (aOR = 2.67, p = 0.004), experience locomotive syndrome (aOR = 2.86, p =

Table 4. Multivariate Logistic Regression Analysis to Determine the Association of Explanatory Variables with the Frequency of Going Out.

Explanatory variables		Reference	aOR	p-value	95% CI
Age		Continuous	1.01	0.433	0.99–1.03
Sex	Male	Female	0.54	0.068	0.28–1.05
Hesitated to visit the hospital	Did not hesitate	Hesitated	0.57	0.091	0.29–1.10
Symptom severity	Deteriorated	Stable/improved	1.25	0.549	0.60–2.62
Frequency of regular exercise	Decreased	Stable/increased	2.67	0.004	1.36–5.23
Locomotive syndrome severity	Newly developed	Stable/improved	2.86	0.012	1.23–6.45
HRQOL	Deteriorated	Stable/improved	4.14	<0.001	2.01–8.52

Statistically significant: p<0.05

Abbreviations: HRQOL, health-related quality of life; aOR, adjusted odds ratio; CI, confidence interval

Table 5. Univariate Comparison Between Mildly Decreased and Severely Decreased Frequency of Going out Groups.

	Mildly decreased (n=116)	Severely decreased (n=44)	p-value
Age (years)	62.3±18.1	68.0±14.8	0.128 [#]
Sex (female/male)	78/36	19/22	0.012*
Hesitated to visit the hospital			0.672*
Hesitated	48	20	
Did not hesitate	67	24	
Symptom severity			0.578*
Stable/improved	48	22	
Deteriorated	28	10	
Frequency of exercise			0.240*
Stable/increased	30	9	
Decreased	64	32	
No exercise habit	21	3	
Locomotive syndrome severity			0.273*
Stable/improved	66	21	
Newly developed	49	23	
HRQOL			0.460*
Stable/improved	31	8	
Deteriorated	46	17	

[#]Mann–Whitney U test

*Chi-squared test

Statistically significant: p<0.05

Abbreviations: HRQOL, health-related quality of life

0.012), and have HRQOL deterioration (aOR = 4.14, p < 0.001) than patients who went out at a similar frequency pre- and post-pandemic (Table 4).

Subgroup analysis

In the subgroup analysis of 160 patients who went out less frequently, post- versus pre-pandemic, 116 patients were included in the mildly decreased frequency of going out group, and 44 patients were included in the severely decreased frequency of going out group (Table 2). Fig. 4 shows the change in each EQ-5D-5L domain of both groups, post- versus pre-pandemic. In the mixed-effect model, no significant differences in the total EQ-5D-5L index pre- and post-pandemic were observed between patients who mildly and strictly avoided going out (Fig. 3). Univariate

analysis also showed that there were no significant differences between the two groups, except with regard to sex (Table 5).

Discussion

In this study, restricting going out due to the COVID-19 pandemic was associated with the deterioration of total index of EQ-5D-5L. Additionally, multivariate analysis demonstrated that restricting going out was significantly associated with decreased exercise frequency, locomotive syndrome development, and HRQOL deterioration in a manner that is independent of age, sex, hesitation to visit the hospital, symptom severity, and each other. However, results of the subgroup analysis revealed that the degree of the de-

crease reported regarding the frequency of going out was not associated with changes in exercise habits, locomotive syndrome incidence, or HRQOL deterioration.

Frequent exercise has various advantages with regard to the prevention or improvement of cardiovascular and metabolic diseases, diabetes mellitus, mental diseases like depression and anxiety, and musculoskeletal disorders, including spinal disorders¹⁶⁻²¹. Although home containment and lockdowns are important to prevent the spread of COVID-19, our findings indicate that measures which promote staying home may decrease exercise frequency in patients with spinal disorders. Consequently, these measures may promote the mental or physical deterioration of patients with spinal disorders.

Approximately 20-30% of Japanese people aged 20-69 years have locomotive syndrome, according to its current definition²². Locomotive syndrome is strongly associated with chronic pain, poor quality of life²³, sarcopenia, and frailty²⁴. Moreover, locomotive syndrome stage 1 was likely to lead to significant deterioration with regard to future motor performance²⁵, and locomotive syndrome stage 2 and frailty independently influenced the dropout from cohort study due to deterioration in health status²⁶. In the current study, decreased frequency of going out was significantly associated with the development of locomotive syndrome. This result could suggest that maintenance of frequency of going out even during the COVID-19 pandemic is important for preventing the development of locomotive syndrome.

As COVID-19 spreads, governments globally will need to implement restrictions, including home containment and quarantine. However, these types of restrictions are strongly associated with worsening mental health condition²⁷⁻³⁰. In addition, another study reported that mental health deterioration occurs due to increased confinement at home³¹. Our results also showed that decreasing frequency of going out due to the COVID-19 pandemic was significantly associated with HRQOL, including mental health deterioration.

Decreased frequency of going out was also significantly associated with other negative outcomes, such as the development of locomotive syndrome, decreased frequency of exercise, and HRQOL. According to the results of our subgroup analysis, the degree of the decrease in the frequency of going out might not affect health outcomes. Therefore, we postulated that the decreasing frequency of going out itself, regardless of the degree of the decrease, may negatively affect patients with spinal disorders. Therefore, it is likely important for these patients to maintain their frequency of going out during the COVID-19 pandemic.

The mental and/or physical condition of people, especially patients with spinal disorders, has the potential to be maintained or improved via safely maintaining or increasing their frequency of going out. Since preventing the spread of COVID-19 requires that we avoid direct contact with each other, we suggest that patients may be able to maintain their frequency of going out if governments or spine surgeons encourage them to frequently visit places where they are un-

likely to come in contact with others, a type of activity that can be maintained even during the COVID-19 pandemic. Moreover, since our findings showed that decreases in the frequency of going out led to the development of locomotive syndrome, spine surgeons should be aware of the risk of locomotive syndrome development. Finally, spine surgeons should provide appropriate exercise guidance, allowing patients to avoid contact with other people since exercise frequency tends to decrease as the frequency of going out decreases.

Several limitations must be acknowledged in our cross-sectional study. First, the most significant limitation is recall bias since we did not collect data prior to the pandemic and have asked for retrospective reports with data collected before the pandemic. Further, negative emotions, such as fear or anger related to COVID-19, may have impacted our results. Second, the questionnaire did not comprise detailed information since it needed to be easy for elderly people to complete. Therefore, we could not collect details regarding the presence of comorbidities and spine disease status, which may be crucial for assessing patient status. Third, the results of this study might not be applicable to healthy subjects, as there were slight differences in evaluating locomotive syndrome and EQ-5D-5L in the subjects of this study between current values and those of reported Japanese healthy subjects^{11,32}. Fourth, this study design could have included selection bias. As we focused on patients who visited the hospital during the survey periods, all participants have some treatments for their symptoms. Consequently, the severity of their symptoms may not have been correctly assessed. Fifth, there were missing data for each question in this cross-sectional study. Despite these limitations, we believe that this study provided valuable insights, which were supported by data from a relatively large sample size. In particular, the present study is of value because it is likely the first report to describe the negative effects of decreasing frequency of going out due to the COVID-19 pandemic in patients with spinal disorders.

In conclusion, the requirement for individuals to stay home due to the COVID-19 pandemic was significantly related to decreased exercise habits, the development of locomotive syndrome, and the deterioration of HRQOL. The creation of an environment that allows people to go out safely during the COVID-19 pandemic by governments may be needed. Furthermore, governments and spine surgeons should encourage people, especially patients with spinal disorders, to maintain their frequency of going out while avoiding crowded places.

Conflicts of Interest: The authors declare that there are no relevant conflicts of interest.

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Ethical Approval: The study protocol was approved by the Institutional Review Board of Osaka City University (No. R02996). All information was handled in accordance with the standards for privacy of individually identifiable health information of Health Insurance Portability and Accountability Act in Japan.

Informed Consent: All study participants provided written informed consent.

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