Research Square

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Effects of COVID-19 social restrictions on prevalence of age-related disorders and risk factor analyses: Evidence from a two-stage study

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Abstract

Background:

The coronavirus disease 2019 (COVID-19) pandemic and associated social restrictions have profoundly altered daily life, particularly among older adults. However, their effect on the prevalence of age-related disorders and associated risk factors remains unclear. This study aimed to investigate the impact of these restrictions on the prevalence of age-related disorders and to identify the risk factors associated with insomnia, depressive symptoms, and falls. These conditions have been associated with physical activity and increased social isolation, both a result of pandemic-related restrictions.

Methods:

We conducted a two-stage hybrid observational study to examine changes in disorder prevalence and associated risk factors during the pandemic (2020–2022) compared to the pre-pandemic period (2017–2019). First, a retrospective electronic medical record (EMR) analysis at Shonai Amarume Hospital in Japan assessed the annual prevalence of hypertension, dyslipidemia, osteoporosis, hip fractures, and insomnia using chi-square analysis. Second, a cross-sectional questionnaire (supplementary file) was conducted to evaluate lifestyle, psychological, and sociodemographic factors associated with insomnia, depressive symptoms, and falls. Multivariate logistic regression analyses were performed to identify independent risk factors.

Results:

The EMR analysis showed a significant increase in insomnia and hip fractures and a decrease in dyslipidemia during the pandemic period ($P < 0.05$), whereas the prevalence of hypertension and osteoporosis remained unchanged. In the questionnaire, insomnia was observed in 18.1% of the participants and was independently associated with decreased physical activity and psychiatric disorders. Depressive symptoms (29.1%) were associated with female sex, decreased physical activity, decreased social interaction, and psychiatric disorders. Falls (16.9%) were associated with older age, decreased physical activity, dyslipidemia, and orthopedic disorders.

Conclusions:

COVID-19-related social restrictions are associated with higher rates of insomnia and hip fractures, and a lower prevalence of dyslipidemia. Reduced physical activity emerged as a key modifiable risk factor for multiple adverse health outcomes. Public health strategies during pandemics should prioritize physical activity and social engagement to mitigate adverse health consequences, particularly in older adults.

Background

The coronavirus disease 2019 (COVID-19) pandemic has led to unprecedented global public health measures, including lockdowns, social distancing, “stay-at-home” orders, and reduced mobility. Although these interventions are essential for controlling viral transmission, they inadvertently have caused significant shifts in human behavior, including reduced physical activity, limited social interaction, and changes in healthcare-seeking patterns, particularly in older adults [1, 2]. For older populations, these changes pose a heightened risk of "secondary health damage," such as the exacerbation of chronic conditions and the emergence of psychological distress [3].

Recent studies have highlighted social isolation as a potent risk factor for cognitive decline, depression, and physical frailty [4]. Emerging evidence suggests that pandemic-related restrictions contribute to decreased physical activity, increased social isolation, and worsened mental health [5, 6]. These changes may have significant downstream effects on age-related disorders. For example, reduced mobility has been associated with an increased risk of frailty, falls, and fractures [7], while social isolation has been linked to insomnia and depression [8]. Conversely, changes in healthcare access and health-seeking behaviors during the pandemic may have also influenced the apparent prevalence of chronic conditions such as hypertension and dyslipidemia [9]. However, the specific longitudinal impact of the pandemic on the prevalence of clinical diagnoses such as hip fractures and insomnia, combined with a detailed analysis of individual lifestyle risk factors, remains unclear. Despite the growing body of literature on the indirect health impacts of COVID-19, few studies have simultaneously evaluated changes in disease prevalence and their underlying behavioral and psychosocial determinants using both clinical and patient-reported data. Understanding these relationships is crucial for developing targeted interventions to mitigate the unintended consequences of public health restrictions.

Therefore, this study aimed to: (1) assess changes in the prevalence of selected age-related disorders using electronic medical records (EMR) and (2) identify lifestyle and psychosocial risk factors associated with insomnia, depressive symptoms, and falls using a questionnaire survey. By integrating these two approaches, we sought to generate hypotheses on the mechanisms linking pandemic-related lifestyle changes to health outcomes.

Methods and materials

Study Design

This was a two-step hybrid observational study designed to explore the factors underlying disorder trends during the COVID-19 pandemic in a hypothesis-generating manner. The study periods were divided into a 3-y pre-pandemic period (January 2017–December 2019) and a 3-y pandemic period (January 2020–December 2022).

1. Electronic medical record survey

First, we conducted a preliminary EMR review to identify disorders that showed significant fluctuations in incidence during the pandemic compared with the pre-pandemic period. In the second step, we conducted a cross-sectional questionnaire among outpatients to analyze risk factors, including lifestyle behaviors, psychological status, and sociodemographic factors, for selected disorders, including insomnia, depressive symptoms, and falls.

Prior to the questionnaire, we examined the prevalence of common and important disorders (hypertension, dyslipidemia, osteoporosis, hip fracture, and insomnia) using the EMR of data from Shonai Amarume Hospital in Japan. This study aimed to assess whether pandemic-related behavioral shifts and changes in healthcare-seeking patterns influenced disorder prevalence.

We extracted cases of each disorder from the EMR database, where the target disorders were recorded as diagnoses. For each year, we aggregated the total number of patients per condition to capture the annual prevalence (patients were not considered unique across years).

2. Questionnaire

Participants and Procedures

The survey was conducted among outpatients and inpatients (aged ≥ 20 years) at Shonai Amarume Hospital. The participants responded via paper-based forms or a web-based interface (Google Forms). To mitigate recall bias and ensure ethical standards, we clearly stated that participation was voluntary and that all responses were anonymous.

Survey Items

The following data were collected:

- Sociodemographic data: Sex, age, working status, and medical history (hypertension, diabetes, dyslipidemia, and orthopedic and psychiatric disorders).
- Lifestyle changes: Changes in physical activity, social interactions, and out-of-home activity were assessed using a 3-point Likert scale ("increased," "unchanged," and "decreased").
- Subjective health status: Insomnia and depressed mood were assessed. Changes in sleep quality were rated on a 4-point scale, with symptom frequency categorized as "often," "sometimes," "rarely," and "never."
- Falls: The occurrence of at least one fall was noted.

Outcome Definitions

Insomnia and depressive symptoms were defined as subjective symptoms rather than clinical diagnoses. In the questionnaire survey, participants who responded "often" or "sometimes" to the relevant items were classified as symptomatic. "Falls" were defined as experiencing at least one fall during the study period.

Statistical Analysis

Categorical and ordinal variables were presented as counts and percentages. Group comparisons were performed using the chi-square test or Fisher's exact test. Chi-square analysis was employed to analyze changes in disorder prevalence. Multivariate logistic regression analyses were conducted to identify the factors independently associated with insomnia, depressive symptoms, and falls. The models were adjusted for age, sex, living arrangements, employment status, comorbidities, and lifestyle changes. The results are presented as adjusted odds ratios (aORs) with 95% confidence intervals (CIs). Statistical significance was defined as a two-sided $P < 0.05$. All analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

Medical Record Study

The retrospective analyses using the EMR of Shonai Amarume Hospital revealed that insomnia and hip fractures significantly increased during the pandemic restriction period (2020–2022) compared with the pre-pandemic period (2017–2019) ($P < 0.05$), whereas dyslipidemia decreased significantly according to chi-square analysis (*$P < 0.05$) (Figure. 1). However, neither hypertension nor osteoporosis showed a significant difference between the pre-pandemic and pandemic restriction periods.

Participant Characteristics

Table 1 summarizes the demographics of the survey respondents; the study population was predominantly older adults, with the majority aged ≥ 70 y. The proportion of female participants was higher than that of male participants, although the difference was not statistically significant. Most respondents lived with others, and approximately half were still working.

Table 1
Patient demographics

Age (years)	**Number**	**%**
20–29	5	1
30–39	18	3.6
40–49	58	11.6
50–59	82	16.4
60–69	104	20.8
70–79	143	28.6
≥ 80	88	17.6
Total	498	100
Sex		
Male/Female	231/285	
Social background		
	Number	%
Working	251	50.2
Living alone	21	4.2

Table 1. Demographics of the patients who participated in the survey.

1. Insomnia

Valid responses to the insomnia questionnaire were obtained from 497 participants (Table 2). Ninety one respondents (18.1%) were classified as having insomnia symptoms ("often" or "sometimes") (Table 2). No significant associations were found between insomnia and age, sex, living arrangements, or working status.

Table 2
Questionnaire survey results

Often	**Number**	**Ratio (%)**
	21	**4**
Sometimes	70	14.1
Rarely	270	54.3
Never	122	24.5
Do not remember	14	2.8
	497	100
Insomnia		
	Number	Ratio (%)
Often	20	4.1
Sometimes	117	24.1
Rarely	236	48.7
Never	97	20
Do not remember	15	3.1
Total	485	100
Depressive symptoms		
	Number	Ratio (%)
Fall without fracture	62	12.9
Fall with any fracture	19	4
No fall or fracture	399	83.1
Total	480	100
Falls		

Table 2. Results of the questionnaire for insomnia, depressive symptoms, and falls. In the multivariable logistic regression model adjusting for background factors and comorbidities, “decreased physical activity,” and “psychiatric disorders” remained associated with insomnia (Table 3).

Table 3
Multivariable logistic regression analysis for insomnia

Variables	Adjusted OR	95% CI	*P* value
Age	1.07	0.85–1.35	0.571
Sex (female)	1.45	0.87–2.44	0.158
Not working	0.76	0.40–1.46	0.413
Decreased physical activity	2.22	1.33–3.72	**0.002**
Decreased social interaction	1.59	0.81–3.13	0.178
Decreased out-of-home activity	1.76	0.89–3.48	0.106
Hypertension	0.99	0.52–1.81	0.917
Diabetes	1.05	1.04–2.96	0.862
Dyslipidemia	1.21	0.81–6.15	0.089
Orthopedic disorders	0.48	0.20–1.14	0.135
Psychiatric disorders	2.12	0.93–41.52	**0.033**

Table 3. Multivariable logistic regression analyses for insomnia. “Decreased physical activity” and “psychiatric disorders” were independently associated with insomnia.

2. Depressive symptoms

Of the 500 respondents, 485 provided valid responses for depressive symptoms (Q9), with 137 (29.1%) classified as symptomatic (Table 2). Multivariate analysis showed that “female,” “decreased physical activity,” “decreased social interaction,” and “psychiatric disorders” were independently associated with depressive symptoms (Table 4).

Table 4
Multivariable logistic regression analysis for depressive symptoms

Variables	Adjusted OR	95% CI	*P* value
Age	0.96	0.78–1.18	0.688
Sex (female)	1.66	1.05–2.61	**0.032**
Not working	1.44	0.80–2.61	0.226
Decreased physical activity	0.5	0.36–0.70	**< 0.001**
Decreased social interaction	0.68	0.48–0.97	**0.031**
Decreased out-of-home activity	1.02	0.73–1.44	0.896
Hypertension	0.97	0.54–1.74	0.911
Diabetes	1.26	0.49–3.24	0.638
Dyslipidemia	2.21	0.81–6.03	0.123
Orthopedic disorders	0.48	0.20–1.14	0.095
Psychiatric disorders	6.2	0.95–40.56	**0.047**

Table 4. Multivariable logistic regression analyses for depressive symptoms. “Female sex,” “decreased physical activity,” “decreased social interaction,” and “psychiatric disorders” were independently associated with insomnia.

3. Falls

Valid responses regarding falls were obtained from 480 participants. Since the start of the pandemic, 81 (16.9%) participants had experienced at least one fall, including 19 (4.0%) who sustained fractures (Table 2). Those who had experienced falls were significantly older than those who had not. In the multivariate model, “older age,” “decreased physical activity,” “dyslipidemia,” and “orthopedic disorders” were independently associated with falls (Table 5).

Table 5
Multivariable logistic regression analysis for falls

Variables	Adjusted OR	95% CI	*P* value
Age	1.56	1.19–2.04	**0.001**
Sex (female)	1.38	0.80–2.37	0.246
Not working	0.8	0.41–1.57	0.515
Decreased physical activity	2.83	1.32–5.89	**0.042**
Decreased social interaction	1.11	0.81–1.48	0.922
Decreased out-of-home activity	0.6	0.36-1.00	0.052
Hypertension	0.9	0.57–1.81	0.978
Diabetes	1.56	0.55–3.35	0.867
Dyslipidemia	2.63	1.01–6.86	**0.048**
Orthopedic disorders	3.12	0.22–1.18	**0.024**
Psychiatric disorders	1.49	0.58–2.89	0.912

Table 5. Multivariable logistic regression analyses for falls. “Older age,” “decreased physical activity,” “dyslipidemia,” and “orthopedic disorders” were independently associated with falls.

Discussion

This study demonstrated that the COVID-19 pandemic was characterized by significant shifts in the prevalence of age-related disorders. Our medical record review revealed a significant increase in insomnia and hip fractures and a decrease in recorded dyslipidemia. These findings suggest that lifestyle restrictions have tangible effects on physical and mental health. In this two-stage hybrid study, we observed that the COVID-19 pandemic was associated with an increased prevalence of insomnia and hip fractures and a decrease in dyslipidemia. Decreased physical activity consistently emerged as a key risk factor for insomnia, depressive symptoms, and falls, highlighting its central role in mediating the health impact of pandemic-related restrictions.

The increase in insomnia observed in both the EMR data and questionnaire responses aligns with previous studies reporting widespread sleep disturbances during the pandemic [10, 11]. Psychological stress, disruption of daily routines, and reduced physical activity contribute to poor sleep quality [12]. Our findings extend this evidence by demonstrating that decreased physical activity and pre-existing psychiatric disorders independently contribute to the risk of insomnia.

Similarly, the prevalence of depressive symptoms in our cohort (29.1%) was consistent with meta-analytic estimates, indicating an increased mental health burden during COVID-19 [13]. The association

between decreased social interaction supports the well-established link between social isolation and depression [8]. The higher risk observed among women has also been reported in previous pandemic studies and may reflect sex differences in psychosocial stressors and coping mechanisms [14].

The increase in hip fractures and the association between falls and decreased physical activity are particularly noteworthy [15]. Reduced mobility during lockdowns likely contributed to a decline in muscle strength and balance, thereby increasing fall risk [2]. Additionally, restricted access to rehabilitation services and reduced outdoor activities may exacerbate physical deconditioning in older adults [16].

In contrast, the observed decrease in dyslipidemia prevalence may reflect reduced healthcare utilization or underdiagnosis rather than a true improvement. Previous studies have reported a decline in routine health screening during the pandemic [9], suggesting that caution is needed when interpreting these findings.

This study has several strengths. The integration of EMR-based prevalence data with patient-reported outcomes provides a comprehensive view of both clinical and behavioral factors. Additionally, the inclusion of multiple outcomes allows identification of shared risk factors such as physical inactivity [17].

However, this study also has some limitations. First, retrospective EMR analysis may be influenced by changes in healthcare-seeking behaviors. Second, the cross-sectional design of the questionnaire precludes causal inference. Third, self-reported measures may be subject to recall and reporting biases. Finally, the study was conducted at a single center, which may have limited generalizability.

Conclusions

In conclusion, our findings suggest that COVID-19-related social restrictions have a multifaceted impact on health, particularly among older adults [18]. Reduced physical activity appears to be a central modifiable factor linking pandemic conditions to adverse outcomes, including insomnia, depression, and falls [19]. Public health policies should incorporate strategies for maintaining physical activity and social connectivity during future pandemics and similar crises [20, 21].

Abbreviations

aOR
adjusted odds ratio
CI
confidence interval
COVID-19
coronavirus disease 2019
EMR: electronic medical records

Declarations

Ethics approval and consent to participate

This study was in accordance with the Declaration of Helsinki and was approved by the Ethics Committees of Tohoku Medical and Pharmaceutical University Hospital.This study was approved by the Ethics Committee for Life Science and Medical Research of Tohoku Medical and Pharmaceutical University. All participants provided an informed consent. An opt-out approach was adopted, and the participants were informed that non-participation would not result in any disadvantages.

Consent for publication

We have obtained consent from all participants.

Competing interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Author Contribution

TY, AK and KF conceived and designed the study. TY, YT, MN, and KK collected and analyzed data. TY and KF wrote the original draft. TY, MN, KK and AK received and edited the manuscript.

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Data Availability

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

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Figures

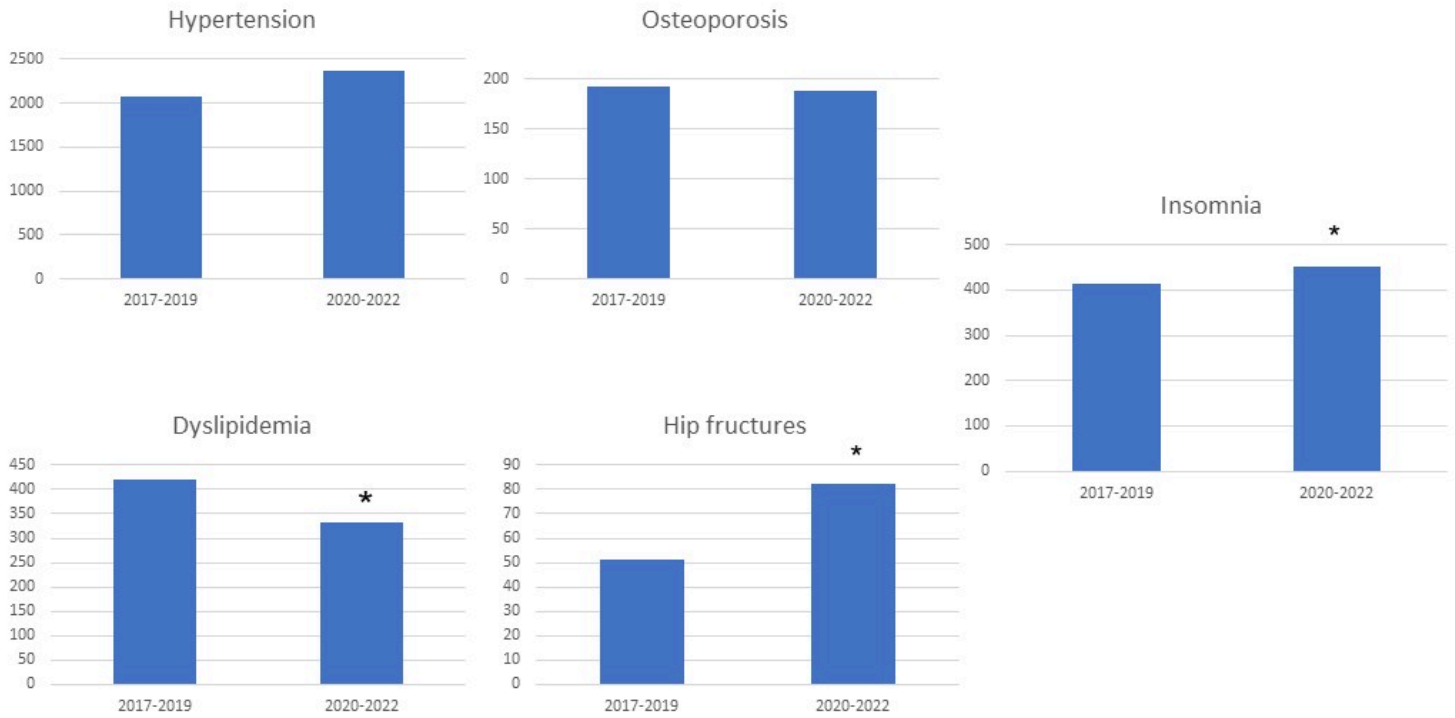


Figure 1

Comparisons of each prevalence between the pre-pandemic and pandemic restriction period. Comparisons between the pre-pandemic and pandemic restriction periods in the prevalence of hypertension, osteoporosis, dyslipidemia, hip fractures and insomnia are indicated. *P<0.05.

Supplementary Files

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- quesitonnaire01.docx