Did Depression, Schizophrenia, and Alcohol Use Increase During the COVID-19 Pandemic Even in Low-Risk Regions? An Analysis of the 2017–2020 National Health Insurance Data in Tottori Prefecture

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ABSTRACT

Background This study aimed to determine whether the COVID-19 pandemic increased the number of medical consultations for depression, schizophrenia, and alcohol dependence in low-risk regions.

Methods National Health Insurance enrolments from March 2017 to March 2021 in Tottori Prefecture, Japan, where there were minimal COVID-19 cases in 2020, were included in this study. The all-cause mortality and proportion of National Health Insurance members with depression, schizophrenia, and alcohol dependence in the financial years (FY) 2017, 2018, 2019, and 2020 were calculated. The proportion in FY 2020 was compared with the average proportion from FY2017 to FY2019 and the proportion in FY2019.

Results The all-cause mortality for men aged 80–99 years and women aged 70–89 years decreased in FY2020. The proportion of men aged 20–29 years with depression increased to 4.1% in FY2020 compared with 3.0% in FY2019, while the proportion of women aged 20–29 years with depression was 4.4% in FY2017, 4.8% in FY2018, 4.8% in FY2019, and 5.5% in FY2020, confirming an increasing trend from before the COVID-19 pandemic. The proportion of men aged 30–39 years and 60–69 years with schizophrenia increased and that of women aged 40–49 years, 60–69 years, and 90–99 years with schizophrenia also increased, even before the pandemic. The proportion of people with alcohol use disorder has not changed significantly since FY2017.

Conclusion The pandemic has led to an increased proportion of men aged 20–29 years with depression, even in low-risk regions.

Key words alcohol use disorder; COVID-19; depression; medical fee claims; schizophrenia

The COVID-19 pandemic has negatively affected people's mental health. Studies show that the prevalence of psychological disorders, such as anxiety and depression, has increased with the spread of COVID-19.[1–4] In China, an increase in the prevalence of schizophrenia was reported from January to March 2020, which is likely associated with the spread of COVID-19.[5] Alcohol use also increased during the pandemic, and researchers have expressed concerns regarding an increase in alcohol use disorders worldwide.[6] However, these studies focused on areas with COVID-19 outbreaks, and the impact of the pandemic on mental health in low-risk regions remains unclear. To control the spread of COVID-19, even in low-risk regions, the Japanese government implemented lockdowns, forcing people to stay at home. The situation during COVID-19 outbreaks was communicated to the public via television and social networking sites. Therefore, even in low-risk regions, the pandemic may have affected people's mental health. A study reported that higher risk perception of COVID-19 is related to negative emotions and deterioration of mental health.[7] However, knowledge about the pandemic's effects on the general population's mental health in low-risk regions is limited, prompting this study to address this gap.

The cumulative number of COVID-19 cases in the Tottori Prefecture up to March 31, 2021 was 241, or 43.7 cases per 100,000 people, with two deaths, while the cumulative number of COVID-19 cases in Japan was 472,366, or 374.2 cases per 100,000 people, with 9,159 deaths.[8] Therefore, considering Tottori Prefecture as a low-risk region where COVID-19 did not spread widely, the current study was conducted to clarify the change in frequency of mental health disorders in low-risk regions during the COVID-19 pandemic.

MATERIALS AND METHODS
Study design and data sources
This was a descriptive epidemiological study using the medical fee claims submitted to the National Health Insurance (NHI) or the Association of Medical Care Services for Older Senior Citizens (MCSOSC) in the

Tottori Prefecture, Japan. Participants were people who had been enrolled in the NHI or the MCSOSC in Tottori Prefecture between April 2017 and March 2021. The NHI is a program for employees of small businesses, as well as self-employed and unemployed citizens. A total of 28.3% of the population under the age of 74 years in the Tottori Prefecture are enrolled in the Tottori NHI, while all prefectural residents aged 75 years and over are members of the Tottori MCSOSC.[9] Of these, those aged 0–99 years were included in the analysis. Anonymized data were obtained from the Tottori NHI and Tottori MCSOSC. The study protocol was approved by the Certified Review Board, Tottori University Hospital (approval number: 21A199).

Measures

In Japan, when a patient visits a medical institution, the medical institution submits a medical fee claim to the insurer. The insurer then pays the medical fee to the medical institution based on the medical fee claim,[9] which contains the name of the disease with which the patient has been diagnosed during a visit. The number of subscribers with F32: depressive episode (depression), F20: schizophrenia, or F10: mental and behavioral disorders due to alcohol use (AUD), as per the list of International Statistical Classification of Diseases and Related Health Problems - Tenth Edition (ICD-10), on their medical claims were counted.[10] The period of April 2017 to March 2018 was designated as financial year (FY) 2017, April 2018 to March 2019 as FY 2018, April 2019 to March 2020 as FY 2019, and April 2020 to March 2021 as FY 2020. The occurrence of deaths from all causes among subscribers of the Tottori NHI or Tottori MCSOSC was determined based on the data in the insured person registers available with the municipalities.

Statistical analyses

The number of deaths or the number of people with depression, schizophrenia, or AUD listed on the medical fee claims for each year was used as the numerator, and the number of subscribers for each year was used as the denominator to calculate mortality and the proportion of people with depression, schizophrenia, and AUD, by gender and age. A three-year average proportion by gender and age group was calculated using the total number of subscribers for each year as the denominator, with the number of deaths and the number of people with depression, schizophrenia, and AUD listed for FY 2017–2019 as the numerator. A chi-square test was conducted to test the difference between the percentage in FY 2020 and the average percentage in FY 2017–2019 or the percentage in FY 2019. The significance level was set at <0.05. Statistical analyses were conducted using Excel 2019 for Windows (Microsoft, Redmond, WA, 2019).

RESULTS

The numbers of participants included in the analysis were 237,808 in FY 2017, 233,193 in FY 2018, 229,917 in FY 2019 and 225,660 in FY 2020. Table 1 shows the number of participants in the current study by gender and age group, as well as the mortality from FY 2017 to FY 2020 and the average mortality for the three-year period from FY 2017 to FY 2019. The all-cause mortality for men aged 80–99 years and women aged 70–89 years decreased in FY 2020. Men aged 60–69 years showed a decrease in mortality in FY 2020 compared to FY 2019. Mortality for the other gender and age groups remained unchanged.

Table 2 shows the changes by year in the proportion of people with depression, schizophrenia, and AUD by age and gender. In FY 2020, the proportion of men and women aged 20–29 years and men aged 60–69 years with depression increased compared to the average proportions in FY 2017–2019. For men aged 20–29 years, the FY 2020 proportion increased compared to that in FY 2019. However, for women aged 70–79 years, the FY 2020 proportion decreased compared to the FY 2017–2019 average proportion. The proportion men aged 30–39 years, women aged 40–49 years, women aged 90–99 years, and men and women aged 60–69 years with schizophrenia increased in FY 2020 compared to the FY 2017–2019 average proportion. The proportion of people with AUD did not change.

Figure 1 shows the proportion of men and women aged 20–29 years with depression from FY 2017 to FY 2020. For men aged 20–29 years, there was no change up to and including FY 2019, while the proportion of men with depression increased in FY 2020. However, for women aged 20–29 years, the proportion increased from FY 2017 to FY 2020. There were differences between men and women with regard to changes in the proportion of people with depression.

DISCUSSION

This study examined the impact of the COVID-19 pandemic on mental health in a low-risk region and found an increase in the proportion of men aged 20–29 years with depression from FY 2019 to FY 2020. The proportion of women aged 20–29 years with depression and those with schizophrenia in several age and gender groups increased prior to the COVID-19 pandemic.

Studies from countries where COVID-19 was

Table 1. Annual changes in all-cause mortality rates by gender and age

	2017		2018		2019		2017–2019 average	2020	
	Number of partici-pants	Proportion (95% C.I.) (%)	Number of partici-pants	Proportion (95% C.I.) (%)	Number of partici-pants	Proportion (95% C.I.) (%)	Proportion (95% C.I.) (%)	Number of partici-pants	Proportion (95% C.I.) (%)
Men Age 0–9	3281	0.0 (0.0–0.1)	3021	0.0 (0.0–0.0)	2894	0.0 (0.0–0.0)	0.0 (0.0–0.0)	2575	0.0 (0.0–0.0)
Age 10–19	3860	0.1 (0.0–0.1)	3653	0.0 (0.0–0.1)	3552	0.0 (0.0–0.1)	0.0 (0.0–0.0)	3337	0.0 (0.0–0.1)
Age 20–29	4176	0.1 (0.0–0.2)	3948	0.1 (0.0–0.2)	3808	0.0 (0.0–0.1)	0.1 (0.0–0.1)	3567	0.0 (0.0–0.1)
Age 30–39	6315	0.1 (0.0–0.2)	5796	0.2 (0.1–0.3)	5394	0.1 (0.0–0.3)	0.1 (0.1–0.2)	5135	0.2 (0.1–0.3)
Age 40–49	7517	0.4 (0.2–0.5)	7226	0.2 (0.1–0.3)	7133	0.2 (0.1–0.3)	0.3 (0.2–0.3)	6967	0.4 (0.2–0.5)
Age 50–59	7330	0.7 (0.5–0.9)	6915	0.7 (0.5–0.9)	6834	0.6 (0.5–0.8)	0.7 (0.6–0.8)	6825	0.7 (0.5–0.9)
Age 60–69	23313	1.4 (1.2–1.5)	21302	1.2 (1.1–1.4)	19423	1.6 (1.4–1.7)	1.4 (1.3–1.5)	17896	1.3 (1.1–1.5)†
Age 70–79	27062	2.4 (2.2–2.6)	28820	2.3 (2.2–2.5)	30155	2.3 (2.2–2.5)	2.4 (2.2–2.5)	30715	2.3 (2.1–2.4)
Age 80–89	18330	7.2 (6.8–7.6)	18005	7.0 (6.6–7.4)	17859	7.0 (6.6–7.4)	7.1 (6.9–7.3)	18036	6.5 (6.2–6.9)*
Age 90–99	3911	18.3 (17.0–19.5)	4145	18.2 (17.0–19.4)	4330	18.1 (16.9–19.2)	18.2 (17.5–18.8)	4519	16.2 (15.2–17.3)*†
Women Age 0–9	3067	0.0 (0.0–0.0)	2860	0.0 (0.0–0.1)	2665	0.0 (0.0–0.0)	0.0 (0.0–0.0)	2409	0.1 (0.0–0.2)
Age 10–19	3722	0.0 (0.0–0.1)	3451	0.0 (0.0–0.1)	3363	0.0 (0.0–0.0)	0.0 (0.0–0.0)	3186	0.0 (0.0–0.0)
Age 20–29	4532	0.0 (0.0–0.1)	4312	0.0 (0.0–0.1)	4191	0.0 (0.0–0.1)	0.0 (0.0–0.1)	3756	0.1 (0.0–0.1)
Age 30–39	5524	0.1 (0.0–0.2)	5287	0.0 (0.0–0.1)	5038	0.1 (0.0–0.2)	0.1 (0.0–0.1)	4770	0.0 (0.0–0.1)
Age 40–49	6402	0.2 (0.1–0.3)	6150	0.2 (0.1–0.3)	6064	0.2 (0.1–0.4)	0.2 (0.2–0.3)	5770	0.1 (0.0–0.2)
Age 50–59	7111	0.4 (0.2–0.5)	6599	0.3 (0.1–0.4)	6370	0.3 (0.2–0.5)	0.3 (0.2–0.4)	6235	0.3 (0.2–0.5)
Age 60–69	26025	0.5 (0.4–0.6)	24137	0.5 (0.4–0.6)	22101	0.5 (0.4–0.6)	0.5 (0.4–0.5)	20556	0.5 (0.4–0.6)
Age 70–79	32430	1.0 (0.9–1.1)	33850	1.1 (1.0–1.2)	35114	1.0 (0.9–1.1)	1.0 (1.0–1.1)	35470	0.8 (0.7–0.9)*†
Age 80–89	31507	3.8 (3.6–4.0)	30797	3.7 (3.5–3.9)	30260	3.7 (3.5–4.0)	3.8 (3.6–3.9)	30057	3.4 (3.2–3.6)*†
Age 90–99	12393	13.0 (12.4–13.6)	12919	12.5 (11.9–13.1)	13369	12.7 (12.1–13.2)	12.7 (12.4–13.0)	13879	12.2 (11.6–12.7)†

*$P < 0.05$ when the proportion of 2020 is compared to the proportion of 2017–2019 average. †$P < 0.05$ when the proportion of 2020 is compared to that of 2019.

prevalent reported that young adults were more suscep-tible to mental distress caused by the pandemic.[2–4, 11] On the contrary, older adults reportedly had a more op-timistic outlook and better mental status.[12] COVID-19 has been detrimental to mental health owing to "fear and anxiety about the COVID-19 pandemic," "economic and psychological distress due to restrictions on behav-ioral and economic activities," and "constant exposure

Table 2. Annual changes in proportion of people with depression, schizophrenia, and alcohol use disorder by age and gender

Year	Depression (%)					Schizophrenia (%)		
	2017	2018	2019	2017–2019 average	2020	2017	2018	2019
Men Age 0–9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(0.0–0.1)	(0.0–0.0)	(0.0–0.1)	(0.0–0.1)	(0.0–0.1)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)
Age 10–19	0.7	0.8	0.6	0.7	0.8	1.7	1.7	1.3
	(0.5–1.0)	(0.5–1.1)	(0.3–0.8)	(0.5–0.9)	(0.5–1.1)	(1.3–2.1)	(1.3–2.1)	(0.9–1.7)
Age 20–29	3.0	3.1	3.0	3.1	4.1	2.9	2.5	2.7
	(2.5–3.5)	(2.6–3.7)	(2.5–3.6)	(2.7–3.4)	(3.4–4.7)*†	(2.4–3.4)	(2.0–3.0)	(2.2–3.2)
Age 30–39	4.9	5.1	6.0	5.3	6.0	6.2	6.3	6.9
	(4.4–5.5)	(4.5–5.7)	(5.4–6.6)	(5.0–5.6)	(5.4–6.7)	(5.6–6.8)	(5.7–7.0)	(6.2–7.6)
Age 40–49	5.7	5.3	5.5	5.5	5.9	8.2	8.2	8.0
	(5.1–6.2)	(4.8–5.8)	(5.0–6.1)	(5.2–5.8)	(5.3–6.4)	(7.5–8.8)	(7.6–8.8)	(7.4–8.6)
Age 50–59	5.5	5.8	6.0	5.7	6.2	7.6	8.1	8.5
	(5.0–6.1)	(5.2–6.3)	(5.4–6.5)	(5.4–6.1)	(5.6–6.7)	(7.0–8.2)	(7.4–8.7)	(7.9–9.2)
Age 60–69	3.3	3.6	3.7	3.5	3.8	3.7	4.0	4.1
	(3.0–3.5)	(3.4–3.9)	(3.4–4.0)	(3.4–3.7)	(3.6–4.1)*	(3.5–4.0)	(3.7–4.2)	(3.8–4.4)
Age 70–79	4.1	4.1	4.0	4.1	4.0	3.1	3.2	3.3
	(3.9–4.4)	(3.8–4.3)	(3.8–4.3)	(3.9–4.2)	(3.8–4.2)	(2.9–3.3)	(3.0–3.4)	(3.1–3.5)
Age 80–89	6.0	6.0	6.0	6.0	5.9	5.1	5.1	5.1
	(5.7–6.4)	(5.7–6.4)	(5.7–6.4)	(5.8–6.2)	(5.6–6.3)	(4.8–5.4)	(4.8–5.5)	(4.7–5.4)
Age 90–99	6.1	5.8	6.3	6.0	5.5	8.0	8.1	8.8
	(5.3–6.8)	(5.1–6.5)	(5.6–7.0)	(5.6–6.5)	(4.9–6.2)	(7.2–8.9)	(7.3–8.9)	(7.9–9.6)
Women Age 0–9	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0
	(0.0–0.2)	(0.0–0.0)	(0.0–0.2)	(0.0–0.1)	(0.0–0.1)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)
Age 10–19	1.3	1.4	1.2	1.3	1.1	0.9	1.0	0.8
	(1.0–1.7)	(1.0–1.8)	(0.8–1.5)	(1.1–1.5)	(0.7–1.4)	(0.6–1.2)	(0.7–1.4)	(0.5–1.1)
Age 20–29	4.4	4.8	4.8	4.7	5.5	2.8	2.9	3.3
	(3.8–5.0)	(4.2–5.5)	(4.2–5.5)	(4.3–5.0)	(4.8–6.2)*	(2.3–3.8)	(2.4–3.4)	(2.8–3.8)
Age 30–39	6.8	7.4	7.5	7.2	8.1	7.1	7.0	7.2
	(6.1–7.5)	(6.7–8.1)	(6.8–8.2)	(6.8–7.6)	(7.3–8.8)	(6.4–7.7)	(6.3–7.7)	(6.5–7.9)
Age 40–49	7.9	8.1	8.3	8.1	8.8	8.0	8.5	9.0
	(7.2–8.6)	(7.4–8.7)	(7.6–9.0)	(7.7–8.5)	(8.1–9.5)	(7.3–8.7)	(7.8–9.2)	(8.3–9.8)
Age 50–59	5.8	6.3	6.5	6.2	6.8	6.0	7.1	7.4
	(5.2–6.3)	(5.8–6.9)	(5.9–7.1)	(5.9–6.5)	(6.2–7.5)	(5.5–6.6)	(6.5–7.7)	(6.8–8.1)
Age 60–69	4.8	4.7	4.6	4.7	4.5	3.2	3.1	3.4
	(4.6–5.1)	(4.4–4.9)	(4.4–4.9)	(4.6–4.9)	(4.2–4.7)	(3.0–3.4)	(2.9–3.4)	(3.2–3.7)
Age 70–79	7.3	6.9	6.6	6.9	6.4	3.0	2.9	2.9
	(7.0–7.6)	(6.6–7.1)	(6.4–6.9)	(6.8–7.1)	(6.1–6.7)*	(2.8–3.2)	(2.7–3.1)	(2.8–3.1)
Age 80–89	10.0	9.9	9.8	9.9	9.6	5.4	5.7	5.7
	(9.7–10.4)	(9.6–10.3)	(9.4–10.1)	(9.7–10.1)	(9.3–10.0)	(5.1–5.6)	(5.4–5.9)	(5.4–5.9)
Age 90–99	9.0	9.2	8.7	9.0	8.6	8.6	9.0	9.3
	(8.5–9.5)	(8.8–9.7)	(8.2–9.1)	(8.7–9.2)	(8.2–9.1)	(8.1–9.0)	(8.5–9.5)	(8.8–9.8)

Upper panel shows proportions; lower panel shows 95% confidence intervals. *$P < 0.05$ when the proportion of 2020 is compared to that of the 2017–2019 average. †$P < 0.05$ when the proportion of 2020 is compared to that of 2019.

Table 2. *Contiuned*

Year	Schizophrenia (%)		Alcohol use disorder (%)				
	2017–2019 average	2020	2017	2018	2019	2017–2019 average	2020
Men Age 0–9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)
Age 10–19	1.6	1.0	0.0	0.0	0.0	0.0	0.0
	(1.3–1.8)	(0.7–1.3)	(0.0–0.1)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)	(0.0–0.1)
Age 20–29	2.7	3.1	0.3	0.3	0.2	0.3	0.2
	(2.4–3.0)	(2.5–3.7)	(0.1–0.4)	(0.2–0.5)	(0.0–0.3)	(0.2–0.3)	(0.1–0.4)
Age 30–39	6.5	7.3	0.3	0.3	0.5	0.3	0.4
	(6.1–6.8)	(6.6–8.0)*	(0.2–0.4)	(0.1–0.4)	(0.3–0.6)	(0.3–0.4)	(0.2–0.5)
Age 40–49	8.1	8.2	0.9	0.7	0.6	0.7	0.7
	(7.8–8.5)	(7.6–8.9)	(0.6–1.1)	(0.5–0.8)	(0.5–0.8)	(0.6–0.8)	(0.5–0.9)
Age 50–59	8.1	8.5	1.3	1.1	1.3	1.2	1.4
	(7.7–8.4)	(7.8–9.1)	(1.0–1.5)	(0.9–1.4)	(1.0–1.6)	(1.1–1.4)	(1.1–1.7)
Age 60–69	3.9	4.3	0.7	0.8	0.9	0.8	1.0
	(3.8–4.1)	(4.0–4.6)*	(0.6–0.9)	(0.7–0.9)	(0.8–1.0)	(0.7–0.9)	(0.8–1.1)
Age 70–79	3.2	3.2	0.8	0.8	0.7	0.8	0.7
	(3.1–3.3)	(3.0–3.4)	(0.7–0.9)	(0.7–0.9)	(0.6–0.8)	(0.7–0.8)	(0.6–0.8)
Age 80–89	5.1	5.1	0.5	0.5	0.6	0.6	0.5
	(4.9–5.3)	(4.8–5.5)	(0.4–0.7)	(0.4–0.6)	(0.5–0.7)	(0.5–0.6)	(0.4–0.6)
Age 90–99	8.3	8.8	0.2	0.2	0.2	0.2	0.2
	(7.8–8.8)	(8.0–9.6)	(0.1–0.3)	(0.1–0.4)	(0.1–0.3)	(0.1–0.3)	(0.1–0.3)
Women Age 0–9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)
Age 10–19	0.9	0.7	0.0	0.0	0.0	0.0	0.0
	(0.7–1.1)	(0.4–1.0)	(0.0–0.0)	(0.0–0.0)	(0.0–0.1)	(0.0–0.0)	(0.0–0.0)
Age 20–29	3.0	3.7	0.1	0.4	0.4	0.3	0.3
	(2.7–3.3)	(3.1–4.3)	(0.0–0.2)	(0.2–0.6)	(0.2–0.6)	(0.2–0.4)	(0.1–0.5)
Age 30–39	7.1	7.7	0.3	0.2	0.2	0.2	0.2
	(6.7–7.5)	(6.9–8.4)	(0.1–0.4)	(0.1–0.4)	(0.1–0.3)	(0.2–0.3)	(0.1–0.3)
Age 40–49	8.5	9.5	0.3	0.3	0.4	0.3	0.4
	(8.1–8.9)	(8.8–10.3)*	(0.2–0.5)	(0.1–0.4)	(0.3–0.6)	(0.3–0.4)	(0.2–0.5)
Age 50–59	6.8	7.5	0.2	0.2	0.2	0.2	0.4
	(6.5–7.2)	(6.8–8.1)	(0.1–0.3)	(0.1–0.4)	(0.1–0.3)	(0.2–0.3)	(0.2–0.5)
Age 60–69	3.2	3.5	0.1	0.1	0.1	0.1	0.1
	(3.1–3.4)	(3.3–3.8)*	(0.1–0.1)	(0.0–0.1)	(0.1–0.2)	(0.1–0.1)	(0.1–0.2)
Age 70–79	2.9	3.0	0.1	0.1	0.1	0.1	0.1
	(2.8–3.0)	(2.8–3.2)	(0.1–0.1)	(0.1–0.1)	(0.1–0.1)	(0.1–0.1)	(0.1–0.1)
Age 80–89	5.6	5.8	0.1	0.1	0.1	0.1	0.0
	(5.4–5.7)	(5.5–6.0)	(0.0–0.1)	(0.0–0.1)	(0.0–0.1)	(0.0–0.1)	(0.0–0.1)
Age 90–99	9.0	9.7	0.0	0.0	0.0	0.0	0.0
	(8.7–9.3)	(9.2–10.2)*	(0.0–0.1)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)	(0.0–0.0)

Upper panel shows proportions; lower panel shows 95% confidence intervals. *$P < 0.05$ when the proportion of 2020 is compared to that of the 2017–2019 average. †$P < 0.05$ when the proportion of 2020 is compared to that of 2019.
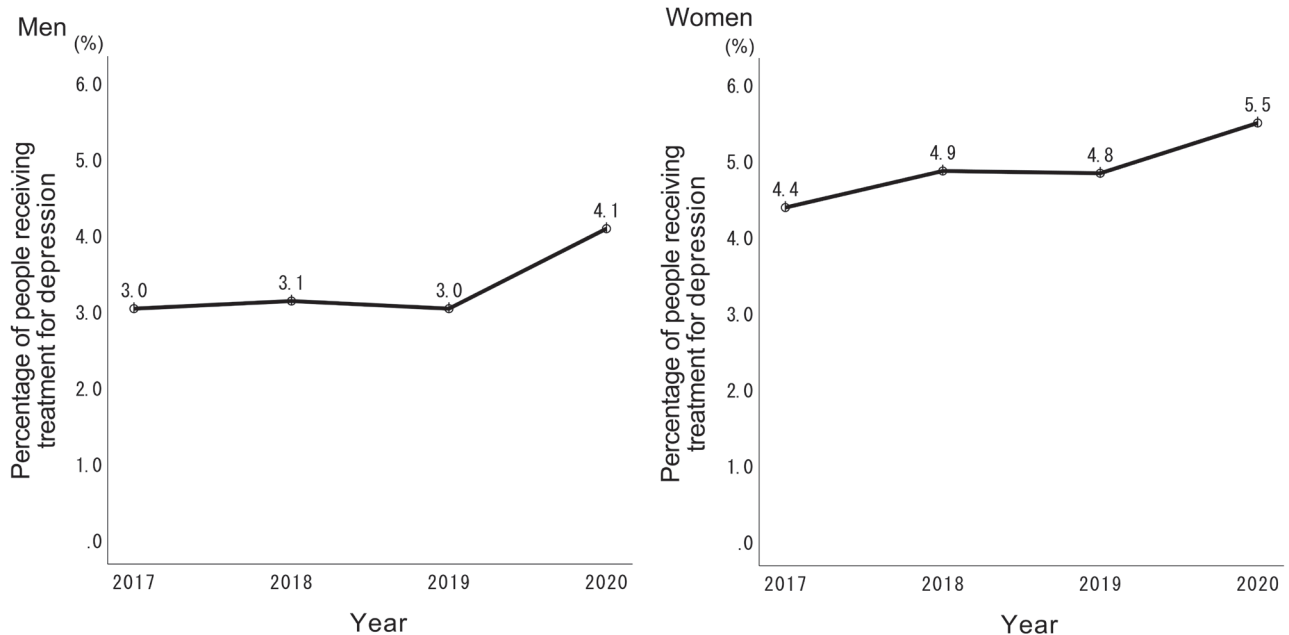
Fig. 1. Trends in the proportion of people with depression aged 20–29 years.

to COVID-19-related news from the media and social platforms."[13, 14] Young adults are more likely to use social networking platforms than older adults and the stay-at-home policy mandated by the Japanese government during COVID-19 severely restricted the activities in which young adults could engage, including gathering with their peers.[15, 16] Since young adults also financially support their families, the decrease in income due to restrictions on economic activities likely caused emotional distress. The current study's results indicate that the proportion of young adults with depression in FY 2020 increased, even in low-risk regions. This may have been because the increased use of social networking platforms and activity restrictions mentioned above had the same effect in low-risk areas as well. This study primarily investigated NHI members under 74 years; among them, over 60% were in the 20–29 age group and employed professionals.[17] Furthermore, NHI-enrolled employees were microenterprise employees for whom the reduction in income due to restrictions on economic activity was greater than that of large enterprise employees. Additionally, the per capita income of NHI enrollees aged 20–29 years is 670,000 yen, which is lower than that of NHI enrollees aged 30 years and older.[17] In COVID-19-affected areas, lower income indicates a stronger degree of psychological distress.[13, 18, 19] Therefore, economic deprivation may have caused mental distress in low-risk areas as well as in COVID-19-affected areas due to restrictions on economic activities.

The reduction in mortality among older adults during the COVID-19 pandemic has also been shown in the national data from Japan and confirmed in this study.[20] This may be a result of infection control measures against COVID-19, which also suppressed other infections. Consequently, the impact of COVID-19 on mental health may be more pronounced among the youth.

The pattern of depression percentage increase from FY 2017 to FY 2020 differed for men and women, with the previously unchanged proportion of men aged 20–29 years with depression increasing in FY 2020, presumably due to the pandemic. This study shows that the percentage of women aged 20–29 years with depression increased compared to the FY2017–2019 average, but was not higher than in the FY 2019 single year. Therefore, this increase is not only due to the pandemic but also existed before the pandemic. In Japan, suicides have increased since the pandemic began, especially among women and men below 30 years.[21–23] In this study, the proportion of women aged 20–29 with depression was found to increase before the pandemic, suggesting that women's lives were becoming increasingly difficult in Japanese society before COVID-19. Japan remains a country with a large gender gap in terms of salary and sharing of housework,[24] and measures are needed to address the difficulties women face in Japanese society that are unrelated to COVID-19.

This study has several limitations. First, it did not include individuals with mental distress who did not see

a doctor. Thus, the prevalence of mental illness reported in this study might be lower than that in a population-based study. However, the use of reliable data based on medical bills rather than self-reports is one of its strengths. Second, it considered only three ICD-10 codes. Therefore, future studies should include other codes related to depression and schizophrenia. Third, while the present data included all persons aged 75 years and older in the Tottori Prefecture, it included only 28.3% of residents aged 74 years and below. Most NHI subscribers are microenterprise employees followed by unemployed individuals, with an average household income of 1.36 million yen. This is lower than the average household income in Japan.[17] In other words, this study's results represent individuals with a lower socioeconomic status. This implies that the younger population was under-represented and other health insurance enrollees should be examined in future studies. Fourth, caution should be exercised in generalizing this study as the data are based on the NHI and MCSOSC in Tottori Prefecture alone. Nonetheless, the factors that may have contributed to psychological distress among young adults during the COVID-19 pandemic were common throughout Japan and may be similar in other lower-risk areas as well.

In conclusion, even in low-risk regions, the proportion of men aged 20–29 years with depression increased from FY 2019 to FY 2020, which was not observed in the preceding three years. Young adults were likely to experience a significant impact on their mental health due to the restriction in their activities or the constant exposure to COVID-19-related news even in a low-risk region.

The authors declare no conflict of interest.

REFERENCES

1　Breslau J, Finucane ML, Locker AR, Baird MD, Roth EA, Collins RL. A longitudinal study of psychological distress in the United States before and during the COVID-19 pandemic. Prev Med. 2021;143:106362. DOI: 10.1016/j.ypmed.2020.106362, PMID: 33388325

2　Coley RL, Baum CF. Trends in mental health symptoms, service use, and unmet need for services among US adults through the first 8 months of the COVID-19 pandemic. Transl Behav Med. 2022;12:273-83. DOI: 10.1093/tbm/ibab133, PMID: 34662427

3　Pierce M, Hope H, Ford T, Hatch S, Hotopf M, John A, et al. Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. Lancet Psychiatry. 2020;7:883-92. DOI: 10.1016/S2215-0366(20)30308-4, PMID: 32707037

4　Yamamoto T, Uchiumi C, Suzuki N, Yoshimoto J, Murillo-Rodriguez E. The psychological impact of 'mild lockdown' in Japan during the COVID-19 pandemic: A nationwide survey under a declared state of emergency. Int J Environ Res Public Health. 2020;17:9382. DOI: 10.3390/ijerph17249382, PMID: 33333893

5　Hu W, Su L, Li D, Zhou Y, Zhu J. Risk of first-episode schizophrenia in aged adults increased during COVID-19 outbreak. Int J Ment Health Addict. 2021 Oct 12;1-11. DOI: 10.1007/s11469-021-00671-3, PMID: 34658681

6　Peshkovskaya A. Letter to the editor: Other consequences. COVID-19 and underestimated public health crisis. J Psychiatr Res. 2021;144:320-2. PMID: 34715599

7　Han Q, Zheng B, Agostini M, Bélanger JJ, Gützkow B, Kreienkamp J, et al. Associations of risk perception of COVID-19 with emotion and mental health during the pandemic. J Affect Disord. 2021;284:247-55. DOI: 10.1016/j.jad.2021.01.049, PMID: 33602537

8　Ministry of Health. Labour and Welfare [Internet]. Visualizing the data: Information on COVID-19 infections. 2022 [cited 2022 Oct 21]. Available from: https://covid19.mhlw.go.jp/extensions/public/en/index.html

9　Japan Health Policy NOW [Internet]. Japan's Health Insurance System. Tokyo: Health and Global Policy Institute [cited 2022 Oct 21]. Available from: http://japanhpn.org/en/section-3-1/

10　World Health Organization [Internet]. ICD-10 version, 2016. [cited 2022 Oct 21]. Available from: https://icd.who.int/browse10/2016/en

11　Xiong J, Lipsitz O, Nasri F, Lui LMW, Gill H, Phan L, et al. Impact of COVID-19 pandemic on mental health in the general population: A systematic review. J Affect Disord. 2020;277:55-64. DOI: 10.1016/j.jad.2020.08.001, PMID: 32799105

12　Bruine de Bruin W. Age differences in COVID-19 risk perceptions and mental health: evidence from a national U.S. survey conducted in March 2020. J Gerontol B Psychol Sci Soc Sci. 2021;76:e24-9. DOI: 10.1093/geronb/gbaa074, PMID: 32470120

13　Kimhi S, Eshel Y, Marciano H, Adini B, Bonanno GA. Trajectories of depression and anxiety during COVID-19 associations with religion, income, and economic difficulties. J Psychiatr Res. 2021;144:389-96. DOI: 10.1016/j.jpsychires.2021.10.043, PMID: 34735842

14　Su Z, McDonnell D, Wen J, Kozak M, Abbas J, Šegalo S, et al. Mental health consequences of COVID-19 media coverage: the need for effective crisis communication practices. Global Health. 2021;17:4. DOI: 10.1186/s12992-020-00654-4, PMID: 33402169

15　Ministry of Internal Affairs and Communications [Internet].2021 White paper, Information and communications in Japan [cited 2022 Dec 12]. Available from: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2021/2021-index.html

16　COVID-19 Control Headquarters in Cabinet Secretariat. Basic policy countermeasures COVID-19 updated version on 16 April 2020. [cited 2022 Dec 12]. Available from: https://www.kantei.go.jp/jp/singi/novel_coronavirus/th_siryou/kihon_r_030416.pdf

17 Portal Site of Official Statistics of Japan website. Annual survey of National Health Insurance [cited 2022 Dec 12]. Available from: https://www.e-stat.go.jp/ Japanese.

18 Cai G, Lin Y, Lu Y, He F, Morita K, Yamamoto T, et al. Behavioural responses and anxiety symptoms during the coronavirus disease 2019 (COVID-19) pandemic in Japan: A large scale cross-sectional study. J Psychiatr Res. 2021;136:296-305. DOI: 10.1016/j.jpsychires.2021.02.008, PMID: 33631655

19 Nagasu M, Muto K, Yamamoto I. Impacts of anxiety and socioeconomic factors on mental health in the early phases of the COVID-19 pandemic in the general population in Japan: A web-based survey. PLoS One. 2021;16:e0247705. DOI: 10.1371/journal.pone.0247705, PMID: 33730044

20 Onozuka D, Tanoue Y, Nomura S, Kawashima T, Yoneoka D, Eguchi A, et al. Reduced mortality during the COVID-19 outbreak in Japan, 2020: a two-stage interrupted time-series design. Int J Epidemiol. 2022;51:75-84. DOI: 10.1093/ije/dyab216, PMID: 34718594

21 Nomura S, Kawashima T, Yoneoka D, Tanoue Y, Eguchi A, Gilmour S, et al. Trends in suicide in Japan by gender during the COVID-19 pandemic, up to September 2020. Psychiatry Res. 2021;295:113622. DOI: 10.1016/j.psychres.2020.113622, PMID: 33290942

22 Osaki Y, Otsuki H, Imamoto A, Kinjo A, Fujii M, Kuwabara Y, et al. Suicide rates during social crises: changes in the suicide rate in Japan after the Great East Japan earthquake and during the COVID-19 pandemic. J Psychiatr Res. 2021;140:39-44. DOI: 10.1016/j.jpsychires.2021.05.035, PMID: 34090102

23 Sakamoto H, Ishikane M, Ghaznavi C, Ueda P. Assessment of suicide in Japan during the COVID-19 pandemic vs previous years. JAMA Netw Open. 2021;4:e2037378. DOI: 10.1001/jamanetworkopen.2020.37378, PMID: 33528554

24 World Economic Forum. [Internet]. Global gender gap report 2021 [cited 2022 Oct 21]. Available from: https://www.weforum.org/reports/global-gender-gap-report-2021