



HOKKAIDO UNIVERSITY

Title	Are patients with mental disorders more vulnerable to loneliness and social isolation during the COVID-19 pandemic? – Findings from the Japan COVID-19 and Society Internet Survey
Author(s)	Goh, Keng Wee; Ishikawa, Shuhei; Okubo, Ryo et al.
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Table 1. Participant characteristics

	Values				
	Total (n=28175)	Loneliness		Social isolation	
		No to mild (n=13075)	Moderate-to-severe (n=15100)	Low (n=12108)	High (n=16067)
Sex, n (%)					
Male	14305 (50.8)	6290 (48.1)	8015 (53.1)	6609 (54.6)	7696 (47.9)
Age, n (%)					
Younger (<40 years)	8348 (29.6)	3651 (27.9)	4697 (31.1)	3917 (32.4)	4431 (27.6)
Middle-aged (40–60 years)	12473 (44.3)	5350 (40.9)	7123 (47.2)	4455 (36.8)	8018 (49.9)
Elder (>60 years)	7354 (26.1)	4074 (31.2)	3280 (21.7)	3736 (30.9)	3618 (22.5)
Occupation classification, n (%)					
Unemployed	9858 (35.0)	4552 (34.8)	5306 (35.1)	4270 (35.3)	5588 (34.8)
Self-employed	1904 (6.8)	922 (7.1)	982 (6.5)	823 (6.8)	1081 (6.7)
Non-regular employee	5701 (20.2)	2527 (19.3)	3174 (21.0)	2490 (20.6)	3211 (20.0)
Regular employee	10712 (38.0)	5074 (38.8)	5638 (37.3)	4525 (37.4)	6187 (38.5)
Number of household members, n (%)					
1	5910 (21.0)	2384 (18.2)	3526 (23.4)	2121 (17.5)	3789 (23.6)
2	9699 (34.4)	4781 (36.6)	4918 (32.6)	4042 (33.4)	5657 (35.2)
>2	12566 (44.6)	5910 (45.2)	6656 (44.1)	5945 (49.1)	6621 (41.2)
Spouse, yes: n (%)	16969 (60.2)	8598 (65.8)	8371 (55.4)	7811 (64.5)	9158 (57.0)
Having children, yes: n (%)					
Annual household income, n (%)					
< 2 million yen	2415 (8.6)	863 (6.6)	1552 (10.3)	725 (6.0)	1690 (10.5)
2–6 million yen	11091 (39.4)	5097 (39.0)	5994 (39.7)	4617 (38.1)	6474 (40.3)
> 6 million yen	8621 (30.6)	4339 (33.2)	4282 (28.4)	4185 (34.6)	4436 (27.6)
No response/unknown	6048 (21.5)	2776 (21.2)	3272 (21.7)	2581 (21.3)	3467 (21.6)
Educational level, n (%)					
High school educated or lower	7984 (28.3)	3656 (28.0)	4328 (28.7)	3296 (27.2)	4688 (29.2)
College educated or higher	20025 (71.1)	9348 (71.5)	10677 (70.7)	8763 (72.4)	11262 (70.1)
Other	166 (0.6)	71 (0.5)	95 (0.6)	49 (0.4)	117 (0.7)
Alcohol use, n (%)					
Never	11429 (40.6)	5143 (39.3)	6286 (41.6)	4695 (38.8)	6734 (41.9)
Ever	2150 (7.6)	825 (6.3)	1325 (8.8)	859 (7.1)	1291 (8.0)
Current	14596 (51.8)	7107 (54.4)	7489 (49.6)	6554 (54.1)	8042 (50.1)
Smoking status, n (%)					
Never	17534 (62.2)	8180 (62.6)	9354 (61.9)	7769 (64.2)	9765 (60.8)
Ever	5477 (19.4)	2602 (19.9)	2875 (19.0)	2220 (18.3)	3257 (20.3)
Current	5164 (18.3)	2293 (17.5)	2871 (19.0)	2119 (17.5)	3045 (19.0)
COVID-19 infection status in residential areas, n (%)					
Lowest quartiles	2915 (10.3)	1377 (10.5)	1538 (10.2)	1274 (10.5)	1641 (10.2)
Second quartiles	2902 (10.3)	1295 (9.9)	1607 (10.6)	1253 (10.3)	1649 (10.3)
Third quartiles	4917 (17.5)	2237 (17.1)	2680 (17.7)	2150 (17.8)	2767 (17.2)
Highest quartiles	17441 (61.9)	8166 (62.5)	9275 (61.4)	7431 (61.4)	10010 (62.3)
Diseases, yes: n (%)					
Diabetes	1999 (7.1)	932 (7.1)	1067 (7.1)	851 (7.0)	1148 (7.1)
Myocardial infarction and angina	724 (2.6)	267 (2.0)	457 (3.0)	323 (2.7)	401 (2.5)
Stroke	426 (1.5)	122 (0.9)	304 (2.0)	180 (1.5)	246 (1.5)
Cancer	685 (2.4)	263 (2.0)	422 (2.8)	294 (2.4)	391 (2.4)
Mental disorders	2021 (7.2)	346 (2.6)	1675 (11.1)	532 (4.4)	1489 (9.3)
Dementia	124 (0.4)	21 (0.2)	103 (0.7)	50 (0.4)	74 (0.5)
Schizophrenia	267 (0.9)	45 (0.3)	222 (1.5)	83 (0.7)	184 (1.1)
Bipolar disorder	381 (1.4)	69 (0.5)	312 (2.1)	120 (1.0)	261 (1.6)
Depression	1124 (4.0)	177 (1.4)	947 (6.3)	270 (2.2)	854 (5.3)
Anxiety disorder	703 (2.5)	98 (0.7)	605 (4.0)	197 (1.6)	506 (3.1)
Obsessive-compulsive disorder	277 (1.0)	41 (0.3)	236 (1.6)	93 (0.8)	184 (1.1)
Eating disorder	244 (0.9)	36 (0.3)	208 (1.4)	87 (0.7)	157 (1.0)

Table 2. Association between participant characteristics and loneliness or social isolation

	Moderate-to-severe loneliness		High social isolation	
	OR	(95% CI)	OR	(95% CI)
Sex, reference: male	1.21	(1.14 - 1.28)	0.66	(0.62 - 0.70)
Age				
Younger (15-39)	0.88	(0.83 - 0.94)	0.58	(0.54 - 0.62)
Middle-aged (40-64)		reference		reference
Older (65-79)	0.54	(0.50 - 0.58)	0.41	(0.38 - 0.45)
Occupation classification				
Unemployed		reference		reference
Self-employed	0.76	(0.68 - 0.85)	0.75	(0.67 - 0.83)
Non-regular employee	0.82	(0.76 - 0.88)	0.82	(0.76 - 0.88)
Regular employee	0.78	(0.72 - 0.84)	0.81	(0.75 - 0.87)
Number of household members				
1		reference		reference
2	0.94	(0.86 - 1.03)	1.06	(0.97 - 1.16)
≥ 3	1.01	(0.93 - 1.11)	0.72	(0.66 - 0.79)
Spouse, reference: no	0.79	(0.73 - 0.85)	0.81	(0.75 - 0.87)
Having children, reference: no	0.88	(0.81 - 0.96)	1.08	(0.99 - 1.17)
Annual household income				
< 2 million yen	1.19	(1.08 - 1.32)	1.41	(1.28 - 1.56)
2-6 million yen		reference		reference
> 6 million yen	0.83	(0.78 - 0.88)	0.73	(0.69 - 0.78)
No response/unknown	0.89	(0.83 - 0.95)	0.93	(0.87 - 1.00)
Educational level				
High school educated or lower		reference		reference
College educated or higher	1.00	(0.95 - 1.06)	0.91	(0.86 - 0.97)
Other	0.90	(0.64 - 1.24)	1.47	(1.04 - 2.08)
Alcohol use				
Never		reference		reference
Ever	1.28	(1.16 - 1.41)	0.98	(0.89 - 1.09)
Current	0.96	(0.91 - 1.01)	0.82	(0.78 - 0.86)
Smoking status				
Never		reference		reference
Ever	1.15	(1.08 - 1.23)	1.11	(1.03 - 1.18)
Current	1.10	(1.02 - 1.18)	0.94	(0.87 - 1.00)
COVID-19 infection status				
Lowest quartiles		reference		reference
Second quartiles	1.10	(0.99 - 1.23)	1.00	(0.90 - 1.11)
Third quartiles	1.07	(0.97 - 1.17)	0.99	(0.90 - 1.09)
Highest quartiles	1.01	(0.93 - 1.09)	1.06	(0.98 - 1.15)
Diseases, reference: no				
Diabetes	1.00	(0.90 - 1.10)	0.96	(0.87 - 1.07)

Myocardial infarction	1.22 (1.03 - 1.45)	0.82 (0.70 - 0.97)
Stroke	1.29 (1.01 - 1.63)	0.79 (0.63 - 0.99)
Cancer	1.07 (0.90 - 1.27)	0.96 (0.81 - 1.13)
Mental disorders	3.67 (3.25 - 4.14)	2.01 (1.80 - 2.25)

Table 3. Association between mental disorders and loneliness or social isolation.

	Moderate-to-severe loneliness		High social isolation	
	OR	(95% CI)	OR	(95% CI)
Mental disorders, reference: no				
Dementia	0.44	(0.23 - 0.87)	0.76	(0.45 - 1.30)
Schizophrenia	1.30	(0.87 - 1.93)	1.17	(0.82 - 1.66)
Bipolar disorder	1.02	(0.74 - 1.41)	0.93	(0.70 - 1.24)
Depression	2.78	(2.31 - 3.35)	1.99	(1.68 - 2.37)
Anxiety disorder	2.32	(1.80 - 2.98)	1.27	(1.02 - 1.57)
Obsessive-compulsive disorder	1.12	(0.73 - 1.72)	0.87	(0.61 - 1.23)
Eating disorder	1.27	(0.81 - 1.98)	0.83	(0.58 - 1.18)

Table 4. The impact of loneliness on psychiatric symptoms in patients with mental disorders.

	Serious psychological distress		Suicidal ideation		Exacerbation of psychiatric symptoms	
	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)
Moderate-to-severe loneliness, reference: no to mild loneliness						
Mental disorders	13.4	(8.20 - 21.9)	2.90	(1.49 - 5.66)	2.66	(1.83 - 3.88)
Dementia	5.28	(0.90 - 31.1)	0.30	(0.01 - 8.76)	3.40	(0.69 - 16.8)
Schizophrenia	9.23	(2.99 - 28.5)	4.23	(0.78 - 23.0)	2.91	(1.09 - 7.79)
Bipolar disorder	6.11	(2.70 - 13.8)	2.68	(0.84 - 8.56)	1.68	(0.84 - 3.35)
Depression	10.4	(5.70 - 18.9)	3.42	(1.30 - 8.98)	2.79	(1.68 - 4.63)
Anxiety disorder	10.0	(4.85 - 20.8)	1.83	(0.68 - 4.87)	2.07	(1.17 - 3.69)
Obsessive-compulsive disorder	9.07	(3.23 - 25.5)	1.81	(0.39 - 8.32)	2.44	(0.99 - 6.02)
Eating disorder	3.16	(1.23 - 8.08)	1.52	(0.29 - 8.07)	1.99	(0.77 - 5.19)

Table 5 . The impact of social isolation on psychiatric symptoms in patients with mental disorders.

	Serious psychological distress		Suicidal ideation		Exacerbation of psychiatric symptoms	
	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)
High social isolation, reference: low social isolation						
Mental disorders	1.56	(1.22 - 2.00)	1.20	(0.77 - 1.87)	1.30	(1.00 - 1.70)
Dementia	0.47	(0.14 - 1.54)	0.27	(0.03 - 2.94)	3.13	(1.03 - 9.54)
Schizophrenia	1.33	(0.67 - 2.63)	0.59	(0.21 - 1.61)	2.52	(1.21 - 5.24)
Bipolar disorder	1.56	(0.92 - 2.66)	0.84	(0.37 - 1.92)	2.48	(1.38 - 4.45)
Depression	1.79	(1.27 - 2.53)	0.81	(0.44 - 1.48)	1.50	(1.04 - 2.18)
Anxiety disorder	1.65	(1.12 - 2.44)	0.90	(0.47 - 1.73)	1.25	(0.84 - 1.87)
Obsessive-compulsive disorder	1.53	(0.81 - 2.90)	0.72	(0.23 - 2.25)	2.02	(1.05 - 3.88)
Eating disorder	1.82	(0.95 - 3.49)	0.44	(0.14 - 1.34)	1.66	(0.85 - 3.25)