

RESEARCH

Open Access

related to workplace productivity. In Japan, the economic costs of alcohol consumption were about 1,000 billion yen (6.8 billion USD) in direct healthcare costs and up to 5,300 billion yen (36 billion USD) in indirect costs [5]. In Japan, 16.7% of the general population regularly smokes tobacco, and 20.5% have habitual drinking of alcohol consumption (3 or more times weekly and 20 g or more of

and health-related characteristics, tobacco product use status, nicotine dependence, and hazardous alcohol use according to the frequency of remote work, and reported with p -values for a chi-square test. Further, the associations of remote work frequency with tobacco dependency

Table 1 Basic characteristics of study participants per frequency of remote work

	Frequency of remote work						p-value
	0 day/week		< 1 day/week		≥ 1 day/week		
	N	(%)	N	(%)	N	(%)	
Total	4690	(56.6)	823	(9.9)	2779	(33.5)	
Sex							< 0.001
Men	2741	(58.4)	592	(71.9)	1827	(65.7)	
Women	1949	(41.6)	231	(28.1)	952	(34.3)	
Age group							< 0.001
10 s and 20 s	922	(19.7)	205	(24.9)	622	(22.4)	
30 s	1121	(23.9)	212	(25.8)	730	(26.3)	
40 s	1189	(25.4)	220	(26.7)	685	(24.6)	
50 s	1036	(22.1)	139	(16.9)	528	(19.0)	
60 s	422	(9.0)	47	(5.7)	214	(7.7)	
Educational attainment							< 0.001
High school or lower	933	(19.9)	106	(12.9)	319	(11.5)	
College	812	(17.3)	82	(10.0)	380	(13.7)	
University or higher	2945	(62.8)	635	(77.2)	2080	(74.8)	
Marital status							< 0.001
Married	2515	(53.6)	527	(64.0)	1495	(53.8)	
Single	1843	(39.3)	254	(30.9)	1144	(41.2)	
Widowed/Divorced	332	(7.1)	42	(5.1)	140	(5.0)	
Equivalent household income							< 0.001
Very low	412	(8.8)	47	(5.7)	211	(7.6)	
Low	798	(17.0)	92	(11.2)	344	(12.4)	
High	1276	(27.2)	219	(26.6)	640	(23.0)	
Very high	1435	(30.6)	377	(45.8)	1183	(42.6)	
No answer	769	(16.4)	88	(10.7)	401	(14.4)	
Average working hour per day							< 0.001
7 h	1299	(27.7)	241	(29.3)	1349	(48.5)	
8–9 h	2678	(57.1)	398	(48.4)	1079	(38.8)	
10 h	713	(15.2)	184	(22.4)	351	(12.6)	
Self-rated health							0.031
Excellent	995	(21.2)	184	(22.4)	621	(22.3)	
Very good	1518	(32.4)	303	(36.8)	914	(32.9)	
Good	1534	(32.7)	247	(30.0)	871	(31.3)	
Fair	503	(10.7)	60	(7.3)	279	(10.0)	
Poor	140	(3.0)	29	(3.5)	94	(3.4)	
Chronic diseases							0.008
No	3932	(83.8)	667	(81.0)	2259	(81.3)	
Yes	758	(16.2)	156	(19.0)	520	(18.7)	
Mental illness							< 0.001
No	4474	(95.4)	779	(94.7)	2576	(92.7)	
Yes	216	(4.6)	44	(5.3)	203	(7.3)	
Regions of residence							< 0.001
Hokkaido/Tohoku	560	(11.9)	50	(6.1)	161	(5.8)	
Kanto	1578	(33.6)	352	(42.8)	1632	(58.7)	
Hokuriku/Koshinetsu	283	(6.0)	51	(6.2)	60	(2.2)	
Tokai	582	(12.4)	109	(13.2)	230	(8.3)	
Kansai	761	(16.2)	141	(17.1)	429	(15.4)	
Chugoku	302	(6.4)	42	(5.1)	81	(2.9)	

Table 1 (continued)

	Frequency of remote work						p-value
	0 day/week		< 1 day/week		≥ 1 day/week		
	N	(%)	N	(%)	N	(%)	
Shikoku	140	(3.0)	11	(1.3)	32	(1.2)	
Kyushu/Okinawa	484	(10.3)	67	(8.1)	154	(5.5)	
Tobacco product use status							< 0.001
Non use	3642	(77.7)	591	(71.8)	2013	(72.4)	
Cigarette only use	526	(11.2)	71	(8.6)	255	(9.2)	
Heated tobacco only use	259	(5.5)	55	(6.7)	160	(5.8)	
Dual use	263	(5.6)	106	(12.9)	351	(12.6)	
TDS scores							< 0.001
4	4217	(89.9)	712	(86.5)	2423	(87.2)	
5	473	(10.1)	111	(13.5)	356	(12.8)	
AUDIT scores							< 0.001
7	4013	(85.6)	628	(76.3)	2166	(77.9)	
8	677	(14.4)	195	(23.7)	613	(22.1)	

AUDIT Alcohol use disorders identification test, TDS Tobacco dependence screener

Of note, while the previous study examined remote work 15 h or more per week, equivalent to two full days per week [9], our study showed that even working remotely once a week or less can contribute to the increased risk of tobacco dependence and hazardous alcohol use. This may be a unique health problem in the fourth year of COVID-19 pandemic.

There are two main potential reasons for the association of remote work with tobacco dependence and hazardous alcohol use. First, remote work, even less than once a week, could have increased access to tobacco and alcohol by being at home more often. In Japan, workplace bans on smoking during working hours are common, limiting access to cigarettes at workplace [21]. Greater freedom to smoke cigarettes during their remote works can contribute to more tobacco dependence. The habits formed at home through remote work might have persisted even after remote work ends. Second, remote work reduces face-to-face interaction with their colleagues, limiting work-related social support which plays a critical role in enhancing the well-being [22]. Due to the reduced social support, people might have utilized dysfunctional coping strategies, such as tobacco and alcohol use, to alleviate their stress [9].

In our study, those who have lower self-rated health conditions, chronic disease, or mental illness were more likely to have tobacco dependence and hazardous alcohol behaviors. While individuals aged 50 s to 60 s were more likely to have tobacco dependence, they were less likely to be hazardous alcohol drinkers. Similarly, previous studies reported that risk factors of smoking behavior included

male gender, older age group (55 years old or older), and living alone [10], and those for increased alcohol use included male gender, higher age, leadership position, and higher educational level [9].

There are several limitations in our study. First, our study could show only associations rather than causation, given the cross-sectional study design. Second, while we surveyed residents living in diverse regions, our studied pool may have been biased during the selection process.

Third, surveyed individuals might not correctly report or underreport their behavior of tobacco and alcohol use due to their recall or social desirability bias. In fact, some studies have shown that individuals tend to underreport their behaviors towards tobacco and alcohol [23–25]. Fourth, information on chronic diseases and mental illness was collected on a self-reported base, and may not necessarily match data from medical records. Despite these limitations, this study has established that those who work remotely even less than once per week are more likely to have tobacco dependence and hazardous alcohol use.

To the best of our knowledge, it is the first study to investigate the association of remote work with tobacco dependence and hazardous alcohol use three years after the beginning of the pandemic when its impact on daily work was mitigated. This finding can aid clinicians in identifying individuals at higher prevalence for developing tobacco use disorder and alcohol use disorder at an early phase. Based on the study’s findings, we recommend that employees who work remotely even once a week should be carefully reviewed for their tobacco and

Table 2 The association between remote work frequency and tobacco dependence (n = 8292)

	TDS scores ≤ 4		TDS scores ≥ 5		PR	(95%CI)
	N	(%)	N	(%)		
Total	7,352	(88.7)	940	(11.3)		
Frequency of remote work						
0 day/week	4,217	(89.9)	473	(10.1)	1.00	
< 1 day/week	712	(86.5)	111	(13.5)	1.30	(1.07–1.57)
> = 1 day/week	2,423	(87.2)	356	(12.8)	1.32	(1.15–1.51)
Sex						
Men	4,408	(85.4)	752	(14.6)	1.00	
Women	2,944	(94.0)	188	(6.0)	0.48	(0.41–0.56)
Age group						
10 s and 20 s	1,630	(93.2)	119	(6.8)	1.00	
30 s	1,884	(91.3)	179	(8.7)	1.06	(0.85–1.33)
40 s	1,850					

Table 3 The association between remote work frequency and hazardous alcohol use

	AUDIT scores ≤ 7		AUDIT scores ≥ 8		PR	(95%CI)
	N	(%)	N	(%)		
Total	6,807	(82.1)	1,485	(17.9)		
Frequency of remote work						
0/week	4,013	(85.6)	677	(14.4)	1.00	
<1/week	628	(76.3)	195	(23.7)	1.41	(1.23–1.62)
1/week	2,166	(77.9)	613	(22.1)	1.35	(1.22–1.50)
Sex						
Men	3,991	(77.3)	1,169	(22.7)	1.00	
Women	2,816	(89.9)	316	(10.1)	0.50	(0.45–0.57)
Age group						
10 s and 20 s	1,450	(82.9)	299	(17.1)	1.00	
30 s	1,739	(84.3)	324	(15.7)	0.79	(0.68–0.91)
40 s	1,708	(81.6)	386	(18.4)	0.89	(0.78–1.02)
50 s	1,379	(81.0)	324	(19.0)	0.79	(0.68–0.92)
60 s	531	(77.7)	152	(22.3)	0.82	(0.68–0.99)
Educational attainment						
High school or lower	1,112	(81.9)	246	(18.1)	1.00	
College	1,063	(83.4)	211	(16.6)	1.07	(0.91–1.26)
University or higher	4,632	(81.8)	1,028	(18.2)	0.96	(0.84–1.09)
Marital status						
Married	3,648	(80.4)	889	(19.6)	1.00	
Single	2,768	(85.4)	473	(14.6)	0.79	(0.71–0.88)
Widowed/Divorced	391	(76.1)	123	(23.9)	1.37	(1.17–1.61)
Equivalent household income						
Very low	562	(83.9)	108	(16.1)	1.00	
Low	1,031	(83.5)	203	(16.5)	1.08	(0.88–1.32)
High	1,758	(82.3)	377	(17.7)	1.17	(0.97–1.41)
Very high	2,345	(78.3)	650	(21.7)	1.33	(1.11–1.59)
No answer	1,111	(88.3)	147	(11.7)	0.84	(0.67–1.05)
Average working hour per day						
7 h	2,314	(80.1)	575	(19.9)	1.00	
8–9 h	3,488	(83.9)	667	(16.1)	0.85	(0.77–0.94)
10 h	1,005	(80.5)	243	(19.5)	0.92	(0.81–1.06)

- cigarette and heated tobacco product use: a cross-sectional analysis of the 2020 JASTIS study. *Prev Med Rep.* 2022;29: 101938.
22. Dirkzwager AJ, Bramsen I, Van Der Ploeg HM. Social support, coping, life events, and posttraumatic stress symptoms among former peacekeepers: a prospective study. *Personal Individ Differ.* 2003;34(8):1545–59.
 23. Boniface S, Kneale J, Shelton N. Drinking pattern is more strongly associated with under-reporting of alcohol consumption than socio-demographic factors: evidence from a mixed-methods study. *BMC Public Health.* 2014;14:1297.
 24. Hwang J, Kim J, Lee D, Jung H, Park SW. Underestimation of Self-Reported Smoking Prevalence in Korean Adolescents: Evidence from Gold Standard by Combined Method. *Int J Environ Res Public Health.* 2018;15(4):689.
 25. Stockwell T, Donath S, Cooper-Stanbury M, Chikritzhs T, Catalano P, Mateo C. Under-reporting of alcohol consumption in household surveys: a comparison of quantity-frequency, graduated-frequency and recent recall. *Addiction.* 2004;99(8):1024–33.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.