Burnout and its associated factors among healthcare workers and the general working population in Japan during the COVID-19 pandemic: a nationwide cross-sectional internet-based study

Takahiro Matsuo,1,2,3 Takashi Yoshioka,4,5 Ryo Okubo,6 Kazuya Nagasaki,6 Takahiro Tabuchi7,8

ABSTRACT

Objectives To examine the prevalence and the associated factors of burnout among both healthcare workers (HCWs) and the general working population, which has not yet been unknown, using large-scale, nationwide data.

Design Cross-sectional internet-based study.

Setting Nationwide internet survey conducted between 8 and 26 February 2021 in Japan.

Participants Workers aged 20–64 years. We classified the workers as HCWs and the general working population.

Exposures Demographic characteristics (age, sex and marital status), socioeconomic status (education, employment and income), health-related, work-related and industry-related factors (smoking, alcohol use, physical and psychiatric comorbidities, working hours, types of healthcare professionals, experience on the COVID-19 frontline and working industries).

Main outcome measures Burnout defined as a score of ≥3 points on the Mini-Z Single-Item Burnout Scale.

Results Of the included 12 650 workers, 1087 were HCWs. After inverse probability weighting on data from the 2016 Comprehensive Survey of Living Conditions, burnout in HCWs and the general working population was 33.5% (95% CI 29.2% to 38.0%) and 31.0% (95% CI 29.7% to 32.4%), respectively. In the weighted multivariable modified Poisson regression models, working 60 hours or more was associated with burnout in all workers (HCWs: prevalence ratio (PR) 2.52, 95% CI 1.68 to 3.76; general population: PR 1.26, 95% CI 1.07 to 1.48). Widowed/separated compared with married was associated with burnout only among HCWs (PR 1.69, 95% CI 1.16 to 2.47), whereas presence of physical or psychiatric comorbidities was associated with burnout among the general working population (PR 1.14, 95% CI 1.03 to 1.28; and PR 1.65, 95% CI 1.45 to 1.87, respectively).

Conclusions Burnout was prevalent in both HCWs and the general working population in Japan. Both common and specific risk factors were observed. Our findings highlight the need for the general workplace policy and targeted interventions for burnout prevention.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Using homogenous large-scale survey data in Japan, this study revealed the burnout and associated factors among healthcare workers and the general working population, all of which were underexamined.

⇒ This study only evaluates the burnout symptoms measured by Mini-Z Single-Item Burnout Scale.

⇒ There may be concerns about the differences between respondents from the internet survey and the general public in Japan.

⇒ There may also be concerns about temporal or geographical external validity.

INTRODUCTION

The COVID-19 pandemic, which originated in December 2019, has become a global health crisis. As of 11 April 2022, more than 497 million confirmed cases and 6.1 million deaths had been attributed to COVID-19 according to WHO.1 Besides high rates of infection and mortality, the COVID-19 pandemic has impacted healthcare systems, causing shortage of health resources and overwhelming demands of acute care.2 The pandemic has necessitated major lifestyle changes, such as universal mask wearing, social distancing and home confinement, for maintaining healthcare systems.3 The socio-cultural changes and economic difficulties caused by the prolongation of the pandemic have led to various psychological problems, such as fear, anxiety and burnout, in general populations over the long term.4

Burnout, characterised by emotional exhaustion, depersonalisation and personal accomplishment, is one of the most relevant...
psychological issues among workers because it has serious physical, psychological and occupational consequences. Burnout was a common phenomenon even before the COVID-19 pandemic, as a study from the Netherlands reported that 3%–7% of all workers in various industries experienced burnout. During the pandemic, burnout has been particularly prevalent among healthcare workers (HCWs), because they have struggled with patient care equipment supply. In fact, some studies have reported insufficient workplace policy and inadequate protective equipment. Additionally, among the general working population, workers have been exposed to substantial COVID-19-related stress emerging from workplace factors, such as missing or insufficient workplace policy and inadequate protective equipment. In fact, some studies have reported burnout among non-HCWs during the pandemic, such as hotel employees. Although assumptions have been made regarding different occupations’ relative risks for burnout during the pandemic, such speculations have been based on comparisons across heterogeneous studies. Differences in study populations, settings or trends in the number of newly diagnosed COVID-19 cases have made it difficult for policymakers to ascertain the full extent of burnout. Thus, there is a need for large-scale, nationwide studies incorporating sufficiently large representative samples including HCWs and non-HCWs and examine the rates of burnout during the COVID-19 pandemic. However, to our knowledge, such evidence has been rather scarce.

Therefore, we aimed to clarify the prevalence of burnout among HCWs and the general working population separately during the COVID-19 pandemic, using Japanese large-scale internet survey data with various occupational disciplines. Furthermore, we focused on exploring the factors associated with burnout in these populations, which is crucial to identify individuals who are more susceptible to burnout. We hypothesised that those factors vary in each working population. Hence, we examined such factors among HCWs and the general working population separately.

METHODS
Study design and survey participants
We conducted a cross-sectional study using data from a large-scale internet survey called the Japan ‘COVID-19 and Society’ Internet Survey (JACSIS). The JACSIS is a longitudinal study project comprising a series of biannual internet surveys since August 2020. As of 1 January 2022, three survey waves had been conducted; in this study, we used data from the second wave (n=26 000). Participants of the JACSIS in the first wave were recruited from a survey panel provided by a Japanese internet research agency (Rakuten Insight, Tokyo, Japan) that has approximately 2.3 million panellists and their socioeconomic status information. Participants in the first wave were recruited from among 224 389 panellists aged 15–79 years, who were randomly sampled from the total panellists. We conducted the enrolment for the first wave between 25 August and 30 September 2020 until the targeted number of respondents (n=28 000) was reached. When enrolling the participants, the agency stratified the participants by sex, age and prefecture (covering all 47 prefectures in Japan) and matched them on the distribution of the general Japanese population in 2019. The respondents of the second wave of the JACSIS were enrolled between 8 and 26 February 2021. The period was in the middle of the third wave of the COVID-19 pandemic, from 1 November 2021 to 31 March 2021. During the enrolment, the average daily numbers of SARS-CoV-2 infections and deaths due to COVID-19 were 1267 and 74, respectively; and the vaccine coverage was less than 1%. In each survey, we collect different information about the COVID-19 pandemic. Because we obtained burnout-related variables only in the second survey wave, we used the data in this study. For enrolment of the second wave participants, we primarily recruited those who had participated in the first wave; 81.6% (22 840/28 000) of the respondents from the first wave participated in the second wave. To achieve the targeted response number in the second wave (n=26 000), we additionally recruited 3160 participants from randomly sampled panellists as described above.

The online questionnaire was designed such that respondents had to answer each question before they could proceed to the next, ensuring that no missing data were generated.

Inclusion and exclusion criteria
Of the 26 000 respondents in the second wave, we included respondents who had not chosen any of the following options to report their employment status: ‘student’, ‘retired’, ‘househusband/housewife’, ‘unemployed’. Further, respondents aged 20–64 years were included according to the definition of a working-age population in the literature. We excluded respondents with straight-lining responses, that is, if they chose the same response option to answer all questions in a set of questions. In addition to these exclusion criteria, we performed an attention check using the following instruction: ‘Please choose the answer second from the bottom.’ Respondents who selected responses other than the second answer from the bottom were excluded.

Definition of types of industry
In each wave of the JACSIS, respondents have been asked to report their working industry. Based on our questionnaire and the International Standard Industrial Classification of All Economic Activities, we classified the respondents’ working industry into the following 16 types: agriculture, forestry, fishing, mining; utilities; construction; manufacturing; wholesale trade; retail trade; transportation, warehousing; information services; finance, insurance; real estate, rental, leasing; education services; healthcare; social assistance; accommodation, food services; other services; and public administration. Subsequently, we identified HCWs working in the field of social
assistance, such as public health nurses. To identify this population, we asked respondents classified as working on social assistance whether they were HCWs, and based on their responses, we reclassified them as HCWs.

Exposure variables
Exposure variables of interest were demographic characteristics, socioeconomic status, health-related status and work-related factors. The demographics included age group (20–29, 30–39, 40–49, 50–59, 60–64 years), sex (male, female) and marital status (unmarried, married, widowed/separated). The socioeconomic status included educational attainment (high school educated or lower, college educated or higher), employment status (employer, self-employed, regular employee, non-regular employee) and equivalent household income calculated by dividing the household income by the square root of household size (categorised by the tertiles of equivalent household income (low, <JPY2.49 million (Japanese yen); intermediate, JPY2.5–JPY4.29 million; high, JPY4.3– million; unknown/declined to answer)).

Health-related status included smoking status (never, past, current), alcohol use (never, past, current) and presence of physical and psychiatric comorbidities. Physical comorbidities of interest included those at high risk of severe COVID-19, death and delay in disease care due to the pandemic (hypertension, diabetes, asthma, chronic obstructive pulmonary disease, stroke, ischaemic heart disease and cancer). Psychiatric comorbidities were depression and other psychiatric disorders based on questionnaire responses (online supplemental method S1). Working hours per week (39, 40–59 and 60–) were included as a work-related factor. Furthermore, industry-specific variables were assessed. In HCWs, we included types of healthcare professionals (doctor, nurse, pharmacist, others), and the experience of working on COVID-19 frontline (yes, no).

Outcome variable
The outcome of interest was the prevalence of burnout among HCWs and the general working population. We used the Mini-Z Single-Item Burnout Scale (MZSIB), which is a burnout screening tool. A score of 3 or higher on the MZSIB was defined as burnout. MZSIB has been established crosswalks from the Maslach Burnout Inventory (MBI), which is a gold standard in burnout assessment; its reliability and validity in Japanese have been confirmed.

Statistical analyses
First, baseline characteristics of HCWs and the general working population were noted. Second, we estimated the distribution of MZSIB scores and the prevalence of burnout in each industry. Lastly, using modified Poisson regression analysis, we estimated the prevalence ratios (PRs) and CIs to identify the associated factors of burnout. Because a previous study reported that burnout among HCWs during the COVID-19 pandemic was approximately 30%, we assumed that burnout was not rare among the respondents of this study.

All CIs and p values were based on the robust variance estimator to account for IPW. Statistical significance was set at p<0.05. All analyses were performed using STATA V.16.1 (StataCorp, College Station, Texas, USA) and SPSS V.19.0 (IBM).

Patient and public involvement
This study involved neither patients nor the public about the research question. This study did not invite any patients to comment on the study design, interpretation of the results, or the readability or accuracy of this document.

RESULTS
Characteristics of respondents
Of the 14 444 workers, we excluded 1794 who met the exclusion criteria (figure 1). Of the included 12 650 workers, 1087 (8.6%) were HCWs. Overall, 39.6% were female, 29.8% were in the 40–49 years age group, 63.9% were married, 46.7% had college or higher education and 58.6% were regular employees (table 1). Compared with the general working population, HCWs were likely to be female, young, regular employees, with higher education and higher income levels. Moreover, HCWs were less likely to be smoking, using alcohol, having physical or psychiatric comorbidities and working 60 hours/week or more (table 1).

Among HCWs, 9.2% were working on the COVID-19 frontline and 23.9% were nurses, whereas in the general working population, 22.0% were working on manufacturing (online supplemental table S1).
Prevalence of burnout

Burnout was prevalent in 31.2% of the overall sample, with 33.5% and 31.0% among HCWs and the general working population, respectively (figure 2, online supplemental table S2). Among the general working population, ‘finance, insurance’ and ‘wholesale trade’ industries had high proportions of workers with burnout (37.1% and 36.9%, respectively), whereas ‘retail trade’ and ‘agriculture, forestry, fishing, mining’ showed low proportions of workers with burnout (24.0% and 25.5%, respectively).

Distribution of MZSIB scores

When focusing on each score of MZSIB, the distributions among HCWs and the general working population were similarly right skewed (online supplemental figure S1).

Factors associated with burnout among HCWs and the general working population

The multivariable model showed that among HCWs, being widowed/separated was associated with burnout (PR 1.69, 95% CI 1.16 to 2.46; p=0.01). In contrast, among the general working population, presence of physical or psychiatric comorbidities (PR 1.14, 95% CI 1.03 to 1.28; p=0.01; and PR 1.65, 95% CI 1.45 to 1.87; p<0.001, respectively) was associated with burnout (table 2).

A significant association between working 60 hours or more per week and burnout was observed in both HCWs and the general working population (PR 2.52, 95% CI 1.69 to 3.76; p<0.001; and PR 2.61, 95% CI 1.07 to 1.48; p=0.01, respectively).

Discussion

Using a large-scale internet survey that included more than 12 000 workers in Japan, we clarified the prevalence of burnout and its associated factors among HCWs and the general working population. The prevalence of burnout among HCWs and the general working population was approximately 33.5% and 31.2%, respectively. In the general working population, the prevalence of burnout varied according to industry; burnout was observed in more than 35.0% of the workers in ‘finance, insurance’, ‘wholesale trade’ and ‘manufacturing’, whereas it was seen among less than 27.5% of those in ‘construction’ and ‘agriculture, forestry, fishing, mining’. We identified both common and specific associated factors of burnout among HCWs and the general population. For example, long working hours, which is a known indicator of burnout, were associated with burnout in both HCWs and the general working population; however, for marital status, an association with burnout was observed in HCWs but not in the general working population. In contrast, individual comorbidities, a statistically significant indicator of burnout in the general working population, were not associated with burnout in HCWs. Our findings imply that there may be differences in the aetiology of burnout between HCWs and the general working population, thus highlighting the importance of targeted and tailored intervention for burnout prevention.

There are several potential mechanisms that may explain our results. First, burnout in the general working population was similarly observed as among HCWs. As noted above, general workers as well as HCWs have struggled with insufficient protective equipment against COVID-19. In addition to COVID-19-related stressors in the working environment, economic downturn impacted workers’ income. Such socioeconomic changes may account for the high prevalence of burnout in the general population. Second, among the general working population, the high prevalence of burnout in the ‘finance, insurance’, ‘wholesale trade’ and ‘manufacturing’ industries was noteworthy. This may be explained by the impact of the pandemic on the economy. Due to the COVID-19 pandemic and subsequent shutdowns worldwide, financial markets have been exposed to substantial stress and volatility. Workers in financial industries, such as bankers, had to fulfil their duties even during the pandemic to keep the economy afloat. Such difficulties may negatively impact them. Moreover, the financial distress from the pandemic has negatively affected households, communities and small businesses, such as manufacturing and wholesale. Individuals working in these industries have also faced difficulties in maintaining a steady flow of required services due to the economic downturn. The occupational stress caused by the pandemic may render workers in these industries vulnerable to burnout.

In terms of the risk factors, we can also speculate some common and specific mechanistic explanations for HCWs and the general working population. A study showed that HCWs have not sufficiently coped with occupational stress, such as hopelessness, sadness or frustration during the COVID-19 pandemic. Furthermore, poor work-life integration (WLI), characterised by conflicts of career and personal responsibilities, is responsible for burnout, and may have become evident during the pandemic among HCWs. Factors associated with burnout identified in this study, such as being single and working long hours, are risk factors for both job stress and poor WLI, and might have strongly contributed to burnout during the pandemic. Of the general working population, individual health concerns may have strongly...
Table 1  Baseline characteristics of respondents

|                         | Overall n=12 650 |                         | HCWs n=1087 |                         | General working population n=11 563 |
|-------------------------|------------------|-------------------------|-------------|-------------------------|-------------------------------------|
|                         | Weighted number  | Weighted % (95% CI)    | Weighted number | Weighted % (95% CI)    | Weighted number | Weighted % (95% CI) |
| Sex, female             | 5013             | 39.6 (38.3 to 41.0)    | 721          | 66.4 (62.1 to 70.4)    | 4326              | 37.4 (36.0 to 38.9)   |
| Age (years)             |                  |                        |              |                        |                      |                      |
| 20–29                   | 1947             | 15.4 (14.3 to 16.6)    | 221          | 20.3 (16.5 to 24.7)    | 1733               | 15.0 (13.9 to 16.2)   |
| 30–39                   | 2593             | 20.5 (19.4 to 21.7)    | 309          | 28.4 (24.7 to 32.5)    | 2295               | 19.9 (18.7 to 21.1)   |
| 40–49                   | 3765             | 29.8 (28.5 to 31.0)    | 294          | 27.0 (23.2 to 31.3)    | 3468               | 30.0 (28.7 to 31.3)   |
| 50–59                   | 3228             | 25.5 (24.4 to 26.7)    | 205          | 18.8 (15.9 to 22.2)    | 3014               | 26.1 (24.9 to 27.3)   |
| 60–64                   | 1116             | 8.8 (8.0 to 9.7)       | 59           | 5.4 (3.7 to 7.8)       | 1053               | 9.1 (8.2 to 10.1)     |
| Marital status          |                  |                        |              |                        |                      |                      |
| Married                 | 8083             | 63.9 (62.6 to 65.2)    | 722          | 66.4 (62.1 to 70.4)    | 7364               | 63.7 (62.3 to 65.1)   |
| Never married           | 3615             | 28.6 (27.3 to 29.9)    | 276          | 25.4 (21.7 to 29.4)    | 3335               | 28.8 (27.5 to 30.2)   |
| Widowed/separated       | 953              | 7.5 (6.9 to 8.2)       | 89           | 8.2 (6.2 to 10.8)      | 864                | 7.5 (6.8 to 8.2)      |
| Educational attainment  |                  |                        |              |                        |                      |                      |
| High school graduate or less | 6749       | 53.4 (52.0 to 54.7)    | 220          | 20.3 (16.3 to 25.0)    | 6487               | 56.1 (54.7 to 57.5)   |
| College graduate or more | 5901         | 46.7 (45.3 to 48.0)    | 867          | 79.7 (75.0 to 83.7)    | 5076               | 43.9 (42.5 to 45.3)   |
| Types of employment     |                  |                        |              |                        |                      |                      |
| Employer                | 573              | 4.5 (4.0 to 5.1)       | 40           | 3.7 (2.2 to 6.2)       | 532                | 4.6 (4.0 to 5.2)      |
| Self-employed           | 1111             | 8.8 (8.0 to 9.6)       | 36           | 3.3 (2.2 to 4.9)       | 1067               | 9.2 (8.4 to 10.1)     |
| Regular employee        | 7410             | 58.6 (57.2 to 60.0)    | 746          | 68.7 (64.4 to 72.6)    | 6676               | 57.7 (56.3 to 59.2)   |
| Non-regular employee    | 3557             | 28.1 (26.8 to 29.4)    | 265          | 24.4 (20.8 to 28.3)    | 3287               | 28.4 (27.1 to 29.8)   |
| Equivalent household income |            |                        |              |                        |                      |                      |
| Low (~JPY2.49 million)  | 3207             | 25.4 (24.1 to 26.7)    | 225          | 20.7 (17.5 to 24.4)    | 2975               | 25.7 (24.4 to 27.1)   |
| Medium (JPY2.5–JPY4.29 million) | 3527     | 27.9 (26.7 to 29.1)    | 315          | 29.0 (24.9 to 33.4)    | 3212               | 27.8 (26.5 to 29.1)   |
| High (JPY4.3– million)  | 3618             | 28.6 (27.4 to 29.8)    | 344          | 31.6 (27.7 to 35.8)    | 3278               | 28.4 (27.1 to 29.6)   |
| Unknown/declined to answer | 2300     | 18.2 (17.1 to 19.4)    | 203          | 18.7 (15.3 to 22.6)    | 2098               | 18.1 (17.0 to 19.4)   |
| Smoking status          |                  |                        |              |                        |                      |                      |
| Never                   | 6043             | 47.8 (46.4 to 49.2)    | 706          | 64.9 (60.6 to 69.0)    | 5358               | 46.3 (44.9 to 47.8)   |
| Past                    | 4061             | 32.1 (30.8 to 33.4)    | 276          | 25.4 (21.9 to 29.3)    | 3776               | 32.7 (31.3 to 34.0)   |
| Current                 | 2546             | 20.1 (19.0 to 21.4)    | 105          | 9.7 (7.3 to 12.8)      | 2428               | 21.0 (19.8 to 22.3)   |
| Alcohol use             |                  |                        |              |                        |                      |                      |
| Never                   | 1751             | 13.8 (12.9 to 14.9)    | 171          | 15.7 (12.5 to 19.6)    | 1582               | 13.7 (12.7 to 14.8)   |
| Past                    | 4091             | 32.3 (31.0 to 33.7)    | 407          | 37.5 (33.2 to 41.9)    | 3690               | 31.9 (30.6 to 33.3)   |
| Current                 | 6808             | 53.8 (52.4 to 55.2)    | 509          | 46.8 (42.4 to 51.3)    | 6290               | 54.4 (52.9 to 55.9)   |
| Physical comorbidities, present | 2538   | 20.1 (19.0 to 21.2)    | 161          | 14.8 (12.0 to 18.2)    | 2370               | 20.5 (19.3 to 21.7)   |
| Psychiatric comorbidities, present | 758   | 6.0 (5.4 to 6.7)       | 51           | 4.7 (3.1 to 7.1)       | 705                | 6.1 (5.4 to 6.8)      |

Continued
influenced the occurrence of burnout. Worker’s physical and mental health concerns are known predictors of burnout. As the COVID-19 pandemic has impacted healthcare systems, and delays in doctor consultation have been widely reported, workers with comorbidities may have experienced increased worry about their health conditions and consultation delay, leading to fear of COVID-19 and subsequent burnout.

Evidence focused on differences in the prevalence and associated factors across the occupational industries during the COVID-19 pandemic is scarce. Before the pandemic, Shanafelt et al explored the prevalence of burnout among physicians and other workers in the USA. In their study, physicians had a higher likelihood of burnout than general employees (37.9% vs 27.8%). Additionally, they found that longer working hours and higher educational attainment were associated with higher risk of burnout. After the pandemic, numerous studies reported the prevalence of burnout. Ghahramani et al conducted a systematic review and meta-analysis of burnout among HCWs during the pandemic and reported that the pooled prevalence of burnout was as high as 52%, highlighting the heavy burden of burnout for policymakers. Particularly, the meta-analysis highlighted that job types (eg, physicians, nurses and other HCWs), country-level income and frontline exposure to patients with COVID-19 were crucial predictors of high prevalence of burnout. In Japan, Matsuo et al conducted a survey study that investigated burnout and its associated factors among 312 HCWs in a Japanese single hospital between 6 and 19 April 2020; the prevalence of burnout was approximately 31.4%, and notably, high prevalence of burnout was observed in HCWs other than physicians. Another study by Kuriyama et al examined the prevalence and associated factors among 214 Japanese physicians via an internet survey between 2 and 16 March 2021. In their study, the proportion of burnout among physicians was approximately 34.4%, and marital status (eg, being without a partner) was associated with burnout. Although these studies provide crucial information, all analyses were based on either data collected before the pandemic or heterogeneous data collected during the pandemic. Hence, evidence based on homogeneous, large-scale data during the COVID-19 pandemic was limited. To the best of our knowledge, this is the first study that examined the prevalence of burnout across job industries including both HCWs and non-HCWs, and explored the factors associated with burnout in HCWs and the general working population separately, using large-scale, nationally representative data.

Our study has limitations. First, because this study was internet based, all respondents may not be workers from Japan. Furthermore, we did not obtain each respondent’s nationality. However, to minimise the differences, we used IPW, which is commonly used in internet-based studies. Second, we did not include individual work-related factors, which are important to document burnout, such as resilience or work engagement. Although these factors are crucial components of organisational strategies to reduce burnout, our study focused on overall prevalence of burnout and its associated factors in Japan and included a wide range of socioeconomic and health-related factors, which are essential in the context of policymaking from current evidence. Third, we defined the outcome using MZSIB and we did not use the MBI, which is the most commonly used to diagnose burnout. Thus, we could neither evaluate other components of burnout (eg, emotional exhaustion, depersonalisation and personal accomplishment) nor confirm the diagnosis of burnout. However, the primary objective of our research was to clarify the prevalence of burnout across HCWs and the general working population, and MZSIB

Table 1 Continued

| Overall | HCWs | General working population |
|---------|------|-----------------------------|
| Weighted number | Weighted % (95% CI) | Weighted number | Weighted % (95% CI) | Weighted number | Weighted % (95% CI) |
| −39 | 5391 | 42.6 (41.2 to 44.0) | 489 | 45.0 (40.7 to 49.5) | 4905 | 42.4 (41.0 to 43.9) |
| 40–59 | 6454 | 51.0 (49.6 to 52.4) | 557 | 51.2 (46.8 to 55.7) | 5897 | 51.0 (49.5 to 52.5) |
| 60– | 806 | 6.4 (5.7 to 7.1) | 41 | 3.7 (2.5 to 5.5) | 761 | 6.6 (5.9 to 7.4) |

HCW, healthcare worker; JPY, Japanese yen.

Figure 2 Weighted prevalence of burnout in healthcare workers and the general working population.
Table 2  Results from multivariable modified Poisson regression analysis

|                              | HCWs PR (95% CI) | P value | General working population PR (95% CI) | P value |
|------------------------------|------------------|---------|--------------------------------------|---------|
| **Sex**                      |                  |         |                                      |         |
| Male                         | Reference        |         | Reference                             |         |
| Female                       | 1.19 (0.87 to 1.61) | 0.28    | 1.03 (0.92 to 1.15)                  | 0.59    |
| **Age (years)**              |                  |         |                                      |         |
| 20–29                        | 1.13 (0.76 to 1.68) | 0.54    | 0.96 (0.82 to 1.12)                  | 0.62    |
| 30–39                        | 1.04 (0.73 to 1.48) | 0.84    | 0.95 (0.84 to 1.08)                  | 0.44    |
| 40–49                        | Reference        |         | Reference                             |         |
| 50–59                        | 0.85 (0.57 to 1.28) | 0.44    | 1.01 (0.90 to 1.12)                  | 0.91    |
| 60–64                        | 0.54 (0.29 to 1.01) | 0.05    | 0.74 (0.60 to 0.91)                  | <0.001  |
| **Educational attainment**   |                  |         |                                      |         |
| High school graduate or less | Reference        |         | Reference                             |         |
| College graduate or more     | 1.24 (0.82 to 1.87) | 0.31    | 1.02 (0.93 to 1.11)                  | 0.72    |
| **Marital status**           |                  |         |                                      |         |
| Married                      | Reference        |         | Reference                             |         |
| Never married                | 1.20 (0.90 to 1.59) | 0.21    | 1.10 (0.99 to 1.22)                  | 0.07    |
| Widowed/separated            | **1.69 (1.16 to 2.46)** | **0.01** | 1.08 (0.93 to 1.26)                  | 0.30    |
| **Equivalent household income** |                  |         |                                      |         |
| Low (~JPY2.49 million)       | 1.31 (0.89 to 1.93) | 0.17    | 1.03 (0.91 to 1.17)                  | 0.66    |
| Medium (JPY2.5~JPY4.29 million) | Reference        |         | Reference                             |         |
| High (JPY4.3– million)       | 1.42 (0.99 to 2.04) | 0.06    | 0.96 (0.86 to 1.08)                  | 0.50    |
| Unknown/ declined to answer  | 1.35 (0.93 to 1.97) | 0.12    | 1.00 (0.87 to 1.16)                  | 0.96    |
| **Employment**               |                  |         |                                      |         |
| Employer                     | 0.92 (0.37 to 2.28) | 0.85    | 0.60 (0.47 to 0.76)                  | <0.001  |
| Self-employed                | 0.71 (0.33 to 1.52) | 0.37    | 0.81 (0.69 to 0.96)                  | 0.02    |
| Regular employee             | Reference        |         | Reference                             |         |
| Non-regular employee         | 1.12 (0.78 to 1.62) | 0.53    | 0.82 (0.72 to 0.95)                  | 0.01    |
| **Working hours per week**   |                  |         |                                      |         |
| ~39                          | Reference        |         | Reference                             |         |
| 40–59                        | 1.15 (0.85 to 1.55) | 0.36    | 0.97 (0.87 to 1.08)                  | 0.53    |
| 60–                          | **2.52 (1.69 to 3.76)** | **<0.001** | **1.26 (1.07 to 1.48)** | **0.01** |
| **Smoking status**           |                  |         |                                      |         |
| Never                        | Reference        |         | Reference                             |         |
| Past                         | 0.90 (0.67 to 1.21) | 0.49    | 1.05 (0.94 to 1.17)                  | 0.38    |
| Current                      | 1.30 (0.87 to 1.96) | 0.20    | 1.07 (0.95 to 1.22)                  | 0.27    |
| **Alcohol use**              |                  |         |                                      |         |
| Never                        | Reference        |         | Reference                             |         |
| Past                         | 0.80 (0.57 to 1.13) | 0.21    | 0.94 (0.81 to 1.09)                  | 0.43    |
| Current                      | 0.66 (0.47 to 0.94) | 0.02    | 0.93 (0.81 to 1.08)                  | 0.35    |
| **Physical comorbidities**   |                  |         |                                      |         |
| Absent                       | Reference        |         | Reference                             |         |
| Present                      | 1.20 (0.83 to 1.74) | 0.34    | **1.14 (1.03 to 1.28)** | **0.01** |
| **Psychiatric comorbidities**|                  |         |                                      |         |
| Absent                       | Reference        |         | Reference                             |         |
| Present                      | 1.11 (0.64 to 1.95) | 0.71    | **1.65 (1.45 to 1.87)** | **<0.001** |

Continued
is a reliable and valid measure of screening burnout in our study setting. Fourth, our results are based on the situation as of February 2021 and may not have temporal and geographical external validity. To ensure generalisability, studies conducted in other time periods of the pandemic in Japan or abroad are warranted. Fifth, this study did not obtain some unmeasured but important candidate predictors for burnout, such as night shift. This study did not investigate the pandemic-specific occupational factors, such as personal protective equipment in the workplace. Such potential predictors should be also examined in future studies. Sixth, due to the limited sample size, we could not conduct subgroup analyses for evaluating heterogeneity for each occupation. Further large-scale studies that incorporate enough individuals of each occupation are still warranted.

In conclusion, this nationwide internet-based study found that more than 30% of HCWs and the general population experienced burnout during the COVID-19 pandemic. However, the prevalence of burnout varied across working industries; burnout was observed in more than 35.0% of workers in ‘finance, insurance’, ‘wholesale trade’ and ‘manufacturing’, compared with less than 27.5% of the workers in ‘construction’ and ‘agriculture, forestry, fishing, mining’. Although long working hours was a common associated factor, marital status in HCWs and comorbidities in the general workers were specific risk factors. Given our results, targeted intervention for HCWs and the general working population, in addition to general workplace policy for long working hours, is warranted to prevent burnout in workers.

### Table 2 Continued

|                        | HCWs PR (95% CI) | General working population PR (95% CI) | P value | P value |
|------------------------|------------------|--------------------------------------|---------|---------|
| Working on the COVID–19 frontline | No Reference | No Reference | | |
| Yes 1.25 (0.87 to 1.78) | 0.23 |
| Types of healthcare workers | | | |
| Doctor Reference | | | |
| Pharmacist 0.97 (0.45 to 2.13) | 0.95 |
| Nurse 1.26 (0.67 to 2.37) | 0.48 |
| Others 1.75 (0.94 to 3.26) | 0.08 |
| Types of industries | | | |
| Finance, insurance 1.05 (0.86 to 1.28) | 0.63 |
| Wholesale trade 1.06 (0.83 to 1.34) | 0.65 |
| Manufacturing Reference | | |
| Social assistance 0.97 (0.76 to 1.25) | 0.84 |
| Information services 0.95 (0.80 to 1.14) | 0.58 |
| Real estate 0.92 (0.70 to 1.21) | 0.57 |
| Accommodation, food services 0.89 (0.70 to 1.15) | 0.38 |
| Other services 0.90 (0.78 to 1.03) | 0.12 |
| Transportation 0.84 (0.67 to 1.04) | 0.11 |
| Public administration 0.82 (0.68 to 1.00) | 0.05 |
| Utilities 0.85 (0.62 to 1.18) | 0.34 |
| Education services 0.81 (0.65 to 1.02) | 0.07 |
| Construction 0.79 (0.65 to 0.97) | 0.03 |
| Agriculture, forestry, fishing, mining 0.76 (0.51 to 1.14) | 0.19 |
| Retail trade 0.72 (0.59 to 0.87) | <0.001 |

HCW, healthcare worker; JPY, Japanese yen; PR, prevalence ratio.

**Author affiliations**

1Department of Infectious Diseases, The University of Texas Health Science Center at Houston, Houston, Texas, USA
2Department of Infectious Diseases, Infection Control and Employee Health, The University of Texas MD Anderson Cancer Center, Houston, Texas, USA
3Department of Infectious Diseases, St. Luke’s International Hospital, Chuo-ku, Tokyo, Japan
4Department of Preventive Medicine and Public Health, School of Medicine, Keio University, Shinjuku-ku, Tokyo, Japan
5Department of Psychiatry, Hokkaido University Graduate School of Medicine, Sapporo, Hokkaido, Japan
6Department of Internal Medicine, Mito Kyodo General Hospital, Mito, Ibaraki, Japan
7Cancer Control Center, Osaka International Cancer Institute, Osaka-ku, Osaka, Japan

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REFERENCES

1 World health Organization. WHO coronavirus disease (COVID-19) Dashboard. Available: https://covid19.who.int/ [Accessed 12 Apr 2022].

2 Blumenthal D, Fowler EJ, Abrams M, et al. Covid-19 — implications for the health care system. N Engl J Med Overseas Ed 2020;383:1483–8.

3 Pfefferbaum B, North CS. Mental health and the Covid-19 pandemic. N Engl J Med 2020;383:510–2.

4 Saladino V, Aliger D, Auriemma V. The psychological and social impact of Covid-19: new perspectives of well-being. Front Psychol 2020;11:577684.

5 Maslach C, Leiter MP. Understanding the burnout experience: recent research and its implications for psychiatry. World Psychiatry 2015;16:103–11.

6 Matsuo T, Kobayashi D, Taki F, et al. Prevalence of health care worker burnout during the coronavirus disease 2019 (COVID-19) pandemic in Japan. JAMA Netw Open 2020;3:e2017271.

7 Wong E, KF H, Wong SY. Workplace safety and coronavirus disease (COVID-19) pandemic: survey of employees. Bull World Health Organ E-pub 2020;20:20.

8 Chi OH, Saldamli A, Gursoy D. Impact of the COVID-19 pandemic on management-level hotel employees’ work behaviors: Modifying effects of working-from-home. Int J Hosp Manag 2021:98:103020.

9 Shanafelt TD, Boone S, Tan L, et al. Burnout and satisfaction with work-life balance among US physicians relative to the general US population. Arch Intern Med 2012;172:1377–85.

10 West CP, Dyrbye LN, Sinsky C, et al. Resilience and burnout among physicians and the general US working population. JAMA Netw Open 2020;3:e209385.

11 Johns Hopkins University. Coronavirus resource center: Japan. Available: https://coronavirus.jhu.edu/region/japan [Accessed 25 Aug 2020].

12 Matsunaga N, Hayakawa K, Asai Y, et al. Clinical characteristics of the first three waves of hospitalised patients with COVID-19 in Japan prior to the widespread use of vaccination: a nationwide observational study. Lancet Reg Health West Pac 2022:22:100421.

13 Ishimaru T, Okawara M, Ando H, et al. Gender differences in the determinants of willingness to get the COVID-19 vaccine among the working-age population in Japan. Hum Vaccin Immunother 2021;17:3975–81.

14 Statistics Division, United Nations. International standard industrial classification of all economic activities revision 4. Available: https://unstats.un.org/unsd/publication/seriessm/seriessm_4rev4e.pdf [Accessed 12 Apr 2022].

15 NHS. Public health nurse. Available: https://www.healthcareers.nhs.uk/explore-roles/public-health-roles/public-health-public-health-nurse [Accessed 12 Apr 2022].

16 Cañadas-De la Fuente G, Ortega E, Ramirez-Baena L, et al. Gender, marital status, and children as risk factors for burnout in nurses: a meta-analytic study. Int J Environ Res Public Health 2018;15:2102.

17 Sasson I, Hayward MD. Association between educational attainment and causes of death among white and black us adults, 2010-2017. JAMA 2019;322:756–63.

18 Lin K-H, Wu C-C, Chu T-S, et al. Employer or employee: who is more likely to suffer from burnout? J Occup Environ Med 2020;62:e154–9.

19 Shah MK, Gadrankota N, Cimitiopi JP, et al. Prevalence of and factors associated with burnout in the US. JAMA Netw Open 2021;4:e2036469.

20 Xia L, Jiang F, Rakovsky J, et al. Cigarette smoking, health-related behaviors, and burnout among mental health professionals in China: a nationwide survey. Front Psychiatry 2020;11:706.

21 Gao Ya-dong, Ding M, Dong X, et al. Risk factors for severe and critically ill COVID-19 patients: a review. Allergy 2021;76:428–55.

22 Zhao J, Li H, Kung D, et al. Impact of the COVID-19 epidemic on stroke care and potential solutions. Stroke 2020;51:1996–2001.

23 Marsoor S. Collateral damage of COVID-19 pandemic: delayed medical care. J Card Surg 2020;35:1345–7.

24 COVidsurg Collaborative. Effect of COVID-19 pandemic lockdowns on planned cancer surgery for 15 tumour types in 61 countries: an international, prospective, cohort study. Lancet Oncol 2021;22:1507–17.

25 Wurm W, Vogel K, Holl A, et al. Depression-Burnout overlap in physicians. PLoS One 2016;11:e0149913.

26 Hu N-C, Chen J-D, Cheng T-J. The associations between long working hours, physical inactivity, and burnout. J Occup Environ Med 2016;58:514–8.

27 Ghahramani S, Lankarani KB, Yousefi M, et al. A systematic review and meta-analysis of burnout among healthcare workers during COVID-19. Front Psychiatry 2021;12:758849.

28 Brady KJS, Ni P, Carlarsen L, et al. Establishing Crosswalks between common measures of burnout in US physicians. J Gen Intern Med 2022;37:777–84.
29 Nagasaki K, Shikino K, Nishimura Y, et al. Translation, cultural adaptation, and validation of the Mini-Z 2.0 survey among Japanese physicians and residents. Intern Med 2021;60:2405–11.
30 Casucci T, Locke AB, Henson A, et al. A workplace well-being game intervention for health sciences librarians to address burnout. J Med Libr Assoc 2020;108:605–17.
31 Cummings P. The relative merits of risk ratios and odds ratios. Arch Pediatr Adolesc Med 2009;163:438–45.
32 Zou G. A modified poisson regression approach to prospective studies with binary data. Am J Epidemiol 2004;159:702–6.
33 Mayr A, Gefeller O, Prokosch H-U, et al. Web-Based data collection yielded an additional response bias—but had no direct effect on outcome scales. J Clin Epidemiol 2012;65:970–7.
34 eurostat. Statistics Explained. Impact of COVID-19 on employment income - advanced estimates. Available: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Impact_of_COVID-19_on_employment_income_-_advanced_estimates [Accessed 12 Apr 2022].
35 FDIC. Our response to the coronavirus pandemic. Available: https://www.fdic.gov/coronavirus/ [Accessed 12 Apr 2022].
36 Yasmin S, Alam MK, Ali FB, et al. Psychological impact of COVID-19 among people from the banking sector in Bangladesh: a cross-sectional study. Int J Ment Health Addict 2022;20:1–15.
37 Sharma A, Adhikary A, Borah SB. Covid-19’s impact on supply chain decisions: strategic insights from NASDAQ 100 firms using Twitter data. J Bus Res 2020;117:443–9.
38 Vicentini S, Mercurio A, Romascu C, et al. Critical Issues of Working during the COVID-19 Pandemic: Italian Healthcare Workers’ Experience. Int J Environ Res Public Health 2022;19:927.
39 Tawfik DS, Shanafelt TD, Dyrbye LN, et al. Personal and professional factors associated with work-life integration among US physicians. JAMA Netw Open 2021;4:e2111575.
40 Gauche C, de Beer LT, Brink L. Exploring demands from the perspective of employees identified as being at risk of burnout. Int J Qual Stud Health Well-being 2017;12:1361783.
41 Lai AY-K, Sit SM-M, Wu SY-D, et al. Associations of delay in doctor consultation with COVID-19 related fear, attention to information, and Fact-Checking. Front Public Health 2021;9:797814.
42 Kuriyama A, Shikino K, Moriya M, et al. Burnout, depression, anxiety, and insomnia of internists and primary care physicians during the COVID-19 pandemic in Japan: a cross-sectional survey. Asian J Psychiatr 2022;68:102956.
43 Schonlau M, van Soest A, Kaptelyn A, et al. Selection bias in web surveys and the use of propensity scores. Social Methods Res 2009;37:291–318.
44 Cooke GPE, Doust JA, Steele MC. A survey of resilience, burnout, and tolerance of uncertainty in Australian general practice registrars. BMC Med Educ 2013;13:2.
45 Maricuțoiu LP, Sulea C, Iancu A. Work engagement or burnout: which comes first? A meta-analysis of longitudinal evidence. Burns Res 2017;5:35–43.
46 Rotenstein LS, Torre M, Ramos MA, et al. Prevalence of burnout among physicians: a systematic review. JAMA 2018;320:1131–50.
47 Cheng W-J, Cheng Y. Night shift and rotating shift in association with sleep problems, burnout and minor mental disorder in male and female employees. Occup Environ Med 2017;74:483–8.
48 Matsuo T, Takahashi O, Kitaoka K, et al. Resident burnout and work environment. Intern Med 2021;60:1369–76.