
Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Journal of Psychiatric Research 159 (2023) 153–158

Contents lists available at ScienceDirect

Journal of Psychiatric Research

journal homepage: www.elsevier.com/locate/jpsychires

# Association of COVID-19-related discrimination with subsequent depression and suicidal ideation in healthcare workers

Zui Narita [a], Ryo Okubo [b,*], Yohei Sasaki [b], Kazuyoshi Takeda [b], Norio Ohmagari [c], Koushi Yamaguchi [d], Naho Morisaki [e], Makiko Sampei [e,f], Kazue Ishitsuka [e], Masayo Kojima [g], Kunihiro Nishimura [h], Manami Inoue [i], Shohei Yamamoto [j], Maki Konishi [j], Kengo Miyo [k], Tetsuya Mizoue [j]

[a] Department of Behavioral Medicine, National Institute of Mental Health, National Center of Neurology and Psychiatry, Tokyo, Japan
[b] Clinical Research & Education Promotion Division, National Center Hospital, National Center of Neurology and Psychiatry, Tokyo, Japan
[c] Disease Control and Prevention Center, National Center for Global Health and Medicine, Tokyo, Japan
[d] Center of Maternal-Fetal, Neonatal and Reproductive Medicine, National Center for Child Health and Development, Tokyo, Japan
[e] Department of Social Medicine, National Research Institute for Child Health and Development, Tokyo, Japan
[f] Department of Health Science, Health Promotion, Nippon Sport Science University, Tokyo, Japan
[g] Department of Frailty Research, Research Institute, National Center for Geriatrics and Gerontology, Aichi, Japan
[h] Department of Preventive Medicine and Epidemiology, National Cerebral and Cardiovascular Center, Osaka, Japan
[i] Division of Prevention, Institute for Cancer Control, National Cancer Center, Tokyo, Japan
[j] Department of Epidemiology and Prevention, Center for Clinical Sciences, National Center for Global Health and Medicine, Tokyo, Japan
[k] Center for Medical Informatics Intelligence, National Center for Global Health and Medicine, Tokyo, Japan

ARTICLE INFO

*Keywords:*
Major depressive disorder
Stigma
SARS-CoV-2
Work-related stress
Mental health

ABSTRACT

Previous cross-sectional studies showed that COVID-19-related discrimination against healthcare workers was linked to depression. However, no study has examined the longitudinal association that allows causal interpretations. This prospective cohort study aimed to examine whether COVID-19-related discrimination at baseline is associated with depression and suicidal ideation several months later. Data were collected from October 2020 to July 2021. Multivariable logistic regression was performed. Fixed effects models were used to control for the effect of hospitals (Level 2 variable). Adjustments also included age, sex, living alone, alcohol consumption, exercise, BMI, working hours, comorbidity, and frontline worker status (Level 1 variables). Multiple sensitivity analyses were conducted to examine if the results substantially changed and were robust to unmeasured confounding. Multiple imputation for missing data was conducted via chained equations. As the final sample, 2862 healthcare workers without depression at baseline were studied. A total of 269 individuals (9.4%) experienced COVID-19-related discrimination. Depression was suggested in 205 participants (7.2%), and suicidal ideation in 108 participants (3.8%). In the adjusted models, COVID-19-related discrimination was significantly associated with subsequent depression (OR = 2.18, 95% CI = 1.39 to 2.90) and suicidal ideation (OR = 2.07, 95% CI = 1.22 to 3.50). Multiple sensitivity analyses verified the results. COVID-19-related discrimination results in depression and suicidal ideation in healthcare workers. Interventions to prevent such discrimination against healthcare workers, e.g., anti-discrimination campaigns, are crucial during the COVID-19 pandemic.

* Corresponding author.
*E-mail addresses:* zuinarita@ncnp.go.jp (Z. Narita), ryo-okubo@ncnp.go.jp (R. Okubo), ysasaki@ncnp.go.jp (Y. Sasaki), ktakeda@ncnp.go.jp (K. Takeda), nohmagari@hosp.ncgm.go.jp (N. Ohmagari), yamaguchi-k@ncchd.go.jp (K. Yamaguchi), morisaki-n@ncchd.go.jp (N. Morisaki), sanpei-m@ncchd.go.jp (M. Sampei), ishitsuka-k@ncchd.go.jp (K. Ishitsuka), masayok@ncgg.go.jp (M. Kojima), knishimu@ncvc.go.jp (K. Nishimura), mnminoue@ncc.go.jp (M. Inoue), syamamoto@hosp.ncgm.go.jp (S. Yamamoto), mkonishi@hosp.ncgm.go.jp (M. Konishi), kmiyo@hosp.ncgm.go.jp (K. Miyo), mizoue@hosp.ncgm.go.jp (T. Mizoue).

https://doi.org/10.1016/j.jpsychires.2023.01.025
Received 26 October 2022; Received in revised form 13 January 2023; Accepted 18 January 2023
Available online 19 January 2023

## 1. Introduction

COVID-19 has profoundly impacted the health and well-being of people worldwide (Xiong et al., 2020). In addition to the recognized threat to physical health and life, there have been growing concerns over its role in mental health (Wu et al., 2021). Specifically, healthcare workers dealing with COVID-19 patients may experience a devastating workload, drug shortage, lack of personal protection equipment, and self-isolation (Lai et al., 2020), which may result in unfavorable mental health outcomes such as depression and anxiety (Sasaki et al., 2021). Indeed, a meta-analysis verified that healthcare workers were more likely to experience depression, anxiety, distress, insomnia, and indirect traumatization than non-healthcare workers (da Silva and Neto, 2021).

Previous studies showed that discrimination has deleterious effects on mental health. Past reports suggested an increased risk of COVID-19-related discrimination among healthcare workers (Bagcchi, 2020; Singh and Subedi, 2020). A descriptive study demonstrated that 47% of adults wanted to avoid healthcare workers who treat COVID-19 patients (Taylor et al., 2020). Another study showed that healthcare workers were more likely to experience COVID-19-related bullying (Dye et al., 2020).

COVID-19-related discrimination against healthcare workers is reportedly linked to poorer mental health (Labrague et al., 2021; Monterrosa-Castro et al., 2020; Narita et al., 2022; Shrestha et al., 2022). Specifically, cross-sectional studies showed that depression correlated with COVID-19-related discrimination (Campo-Arias et al., 2021; Correia da Silva et al., 2022; Moro et al., 2022). However, past research analyzed cross-sectional data that did not allow causal interpretation. No study has examined the prospective association between COVID-19-related discrimination and mental health in healthcare workers.

Depression is linked to healthcare workers' negative professional performance, such as absenteeism or presenteeism (Johnston et al., 2019). Further, negative emotional states due to discrimination might adversely affect cognition (Barnes et al., 2012; Zahodne et al., 2020) and increase the chances of medical errors (Zhang et al., 2004). These potential negative impacts are specifically pertinent during the pandemic considering the devastating workload on healthcare workers (Lai et al., 2020); thus, prevention is crucial. Evaluating a causal pathway from COVID-19-related discrimination to depression may provide potential strategies and warrant further exploration, e.g., detailed mechanisms can be dissected through causal mediation analysis (VanderWeele, 2015).

The objective of the present study was to examine whether COVID-19-related discrimination at baseline is associated with depression and suicidal ideation several months later.

## 2. Material and methods

### 2.1. Study design and participants

This prospective cohort study evaluated a multi-center collaborative survey of the National Centers for Advanced Medical and Research. The researchers agreed on the questionnaire before conducting the study. Written informed consent was obtained from each participant. After completing the opt-out process, the study committee anonymized and pooled the data. The National Center for Global Health and Medicine Institutional Review Board approved the study (NCGM-G-004233). Data from two hospitals evaluating the survey for the Patient Health Questionnaire-9 (PHQ-9) (Kroenke et al., 2001) were used. All healthcare workers in these hospitals were contacted, and the sample size was not calculated. Participants were drawn from survey data for baseline (October 2020 to March 2021) and follow-up (June to July 2021). To handle potential reverse causation, participants with depression at baseline were excluded.

### 2.2. Depression and suicidal ideation at follow-up

The primary outcome was depression. Depression in the past two weeks was evaluated using the Japanese version of the PHQ-9 (Muramatsu et al., 2018), a validated depression screener (Kroenke et al., 2001). Each item was self-reported on four-point response options ranging from 0 (not at all) to 3 (nearly every day), with possible total scores ranging from 0 to 27. The data showed good internal consistency ($\alpha = 0.83$). A PHQ-9 score of 10 was used as the cut-off point, as recommended by the validation study (Kroenke et al., 2001). Further, the PHQ-9 item 9 was used to evaluate suicidal ideation (Simon et al., 2013). Scoring 1 or higher in this item constituted suicidal ideation.

### 2.3. COVID-19-related discrimination at baseline

Participants were asked the following questions with a yes/no answer option: (1) "Have you or your family ever experienced verbal discrimination related to COVID-19?", (2) "Have you ever perceived discrimination related to COVID-19?". Selecting "yes" for either of these items was considered to experience COVID-19-related discrimination. These items were used based on past reports (Do Duy et al., 2020; Narita et al., 2022).

### 2.4. Covariates

Covariates were studied if they may confound the association of COVID-19-related discrimination with depression and suicidal ideation. The following variables were used: age, sex (male or female), living alone (yes or no), alcohol consumption ($<$ once a week or $\geq$ once a week), exercise ($<$1 h/week or $\geq$ 1 h/week), body mass index (BMI), working hours ($<$9 h/day or $\geq$ 9 h/day), comorbidity (yes or no), and frontline worker status (yes or no). For comorbidity, participants were asked if they had a history of hypertension, diabetes, chronic lung diseases, heart diseases, cerebrovascular diseases, or cancer. Endorsing either of them constituted comorbidity. For frontline worker status, participants were asked the following question with a yes/no answer option: "Have you ever engaged in COVID-19-related work?". Participants were also asked to select a single occupation they spent the most time on from the following answer options: (1) administrators, (2) physicians, (3) nurses, (4) medical staff other than office workers, (5) medical office workers, (6) other office workers, (7) information technology officers, (8) researchers, (9) janitors or security officers, and (10) other jobs. Those who selected "yes" in the first question and either (2), (3), or (4) in the second question were regarded as frontline workers. Other individuals were considered as second-line workers.

### 2.5. Statistical analysis

Multivariable logistic regression was performed to examine the association of COVID-19-related discrimination (exposure) with subsequent depression and suicidal ideation (outcomes). Fixed effects models were used to account for a clustered data structure (McNeish and Kelley, 2019). The number of clusters was small in the data (i.e., two hospitals). In such data, fixed effects models would safeguard against bias for the estimates by controlling for the effect of hospitals (Level 2 variable). In contrast, mixed effects models could yield biased estimates (McNeish and Kelley, 2019). Adjustments also included age, sex, living alone, alcohol consumption, exercise, BMI, working hours, comorbidity, and frontline worker status (Level 1 variables). Unadjusted and adjusted models were fitted.

Two sensitivity analyses were conducted. First, the Patient Health Questionnaire-8 (PHQ-8) was studied as a continuous variable (Kroenke et al., 2009), in which the PHQ-9 item 9 for suicidal ideation was removed, given that this item was analyzed as a separate outcome. Second, the robustness of the estimates to unmeasured confounding was evaluated by E-values (VanderWeele and Ding, 2017). E-values

quantified the minimum strength of association on the odds ratio that unmeasured confounding would need to have above and beyond the covariates mentioned above to explain away the estimates.

Multiple imputation for missing data was conducted via chained equations using the mice R package (van Buuren and Groothuis-Oudshoorn, 2011). All variables used in the analysis were included creating five imputed data sets. Each imputed dataset was analyzed, and the results across imputations were combined using Rubin's rules (Rubin, 1987).

## 3. Results

### 3.1. Baseline characteristics

A total of 3310 healthcare workers from two hospitals were enrolled. Of these, 448 with depression were excluded. Thus, the remaining 2862 individuals were analyzed as the final sample. Table 1 summarizes the baseline characteristics of individuals at baseline. A total of 269 individuals (9.4%) experienced COVID-19-related discrimination. Seventy-four (2.6%) experienced verbal discrimination against themselves or their family, while 250 (8.7%) experienced perceived discrimination against themselves. Fifty-six (2.0%) experienced both of them. Compared with individuals without COVID-19-related discrimination, individuals with such discrimination were more likely to be female, live alone, drink alcohol once a week or more, exercise 1 h per week or more, and work on the frontline. Age, BMI, working hours, and comorbidity did not substantially differ between the two groups. Nurses were the largest group experiencing COVID-19-related discrimination ($n = 122$, 45.4%), followed by physicians ($n = 41$, 15.2%). Details of occupations are shown in Supplementary Table S1.

**Table 1**
Baseline characteristics of the study population.

| Variables | Overall ($n$ = 2862) | COVID-19-related discrimination | | $p$ |
|---|---|---|---|---|
| | | Yes ($n$ = 269) | No ($n$ = 2592) | |
| Age, mean (SD), y | 39.5 (12.0) | 38.9 (11.3) | 39.5 (12.1) | 0.44 |
| Sex, no. (%) | | | | 0.03 |
| Male | 856 (29.9) | 65 (24.2) | 791 (30.5) | |
| Female | 2006 (70.1) | 204 (75.8) | 1801 (69.5) | |
| Living alone, no. (%) | | | | 0.03 |
| No | 1866 (65.2) | 159 (59.1) | 1707 (65.9) | |
| Yes | 996 (34.8) | 110 (40.9) | 885 (34.1) | |
| Alcohol consumption, no. (%) | | | | 0.03 |
| Less than once a week | 1767 (61.7) | 149 (55.4) | 1617 (62.4) | |
| Once a week or more | 1095 (38.3) | 120 (44.6) | 975 (37.6) | |
| Exercise, no. (%) | | | | 0.02 |
| Less than 1 h/week | 1878 (65.6) | 159 (59.1) | 1718 (66.3) | |
| 1 h/week or more | 984 (34.4) | 110 (40.9) | 874 (33.7) | |
| BMI, mean (SD) | 21.8 (3.40) | 21.9 (3.67) | 21.8 (3.37) | 0.64 |
| Working hours, no. (%) | | | | 0.10 |
| Less than 9 h/day | 1436 (50.2) | 122 (45.4) | 1313 (50.7) | |
| 9 h/day or more | 1424 (49.8) | 147 (54.6) | 1277 (49.3) | |
| Missing | 2 (0.1) | 0 (0) | 2 (0.1) | |
| Comorbidity, no. (%) | | | | 0.48 |
| No | 2415 (84.4) | 222 (82.5) | 2192 (84.8) | |
| Yes | 439 (15.3) | 45 (16.7) | 394 (15.2) | |
| Missing | 8 (0.3) | 2 (0.7) | 6 (0.2) | |
| Frontline worker status, no. (%) | | | | <0.001 |
| Second-line worker | 1738 (60.7) | 134 (49.8) | 1603 (61.8) | |
| Frontline worker | 1120 (39.1) | 134 (49.8) | 986 (38.0) | |
| Missing | 4 (0.1) | 1 (0.4) | 3 (0.1) | |

Data are Mean ± SD or $n$ (%).
BMI: body mass index.

### 3.2. Association of COVID-19-related discrimination with subsequent depression and suicidal ideation

Among the study sample, 538 (18.8%) for depression and 532 (18.6%) for suicidal ideation were lost to follow-up. Depression was suggested in 205 (7.2%), and suicidal ideation in 108 (3.8%). Table 2 summarizes the association of COVID-19-related discrimination with subsequent depression and suicidal ideation, controlling for the effect of hospitals and adjusting for Level 1 covariates. In the adjusted model,

**Table 2**
Fixed effects models for the association of COVID-19-related discrimination with subsequent depression and suicidal ideation, controlling for the effect of hospitals and adjusting for Level 1 covariates.

| Variables | Depression | | Suicidal ideation | |
|---|---|---|---|---|
| | Unadjusted OR (95% CI) | Adjusted OR (95% CI) | Unadjusted OR (95% CI) | Adjusted OR (95% CI) |
| COVID-19-related discrimination | | | | |
| No | Reference | Reference | Reference | Reference |
| Yes | 2.06*** (1.42, 2.98) | 2.18*** (1.49, 3.20) | 1.89* (1.14, 3.14) | 2.07** (1.22, 3.50) |
| Age | NA | 0.98* (0.97, 0.996) | NA | 0.98* (0.95, 0.997) |
| Sex | | | | |
| Male | NA | Reference | NA | Reference |
| Female | NA | 1.69 (0.98, 2.92) | NA | 0.87 (0.50, 1.53) |
| Living alone | | | | |
| No | NA | Reference | NA | Reference |
| Yes | NA | 1.26 (0.89, 1.80) | NA | 1.45 (0.87, 2.41) |
| Alcohol consumption | | | | |
| Less than once a week | NA | Reference | NA | Reference |
| Once a week or more | NA | 0.84 (0.62, 1.13) | NA | 0.78 (0.52, 1.16) |
| Exercise | | | | |
| Less than 1 h/week | NA | Reference | NA | Reference |
| 1 h/week or more | NA | 0.71 (0.50, 1.00) | NA | 0.73 (0.46, 1.14) |
| BMI | NA | 1.04 (0.995, 1.10) | NA | 0.99 (0.92, 1.05) |
| Working hours | | | | |
| Less than 9 h/day | NA | Reference | NA | Reference |
| 9 h/day or more | NA | 0.90 (0.65, 1.26) | NA | 0.73 (0.49, 1.08) |
| Comorbidity | | | | |
| No | NA | Reference | NA | Reference |
| Yes | NA | 1.10 (0.61, 1.95) | NA | 1.32 (0.63, 2.74) |
| Frontline worker status | | | | |
| Second-line worker | NA | Reference | NA | Reference |
| Frontline worker | NA | 0.67 (0.49, 0.91) | NA | 0.67 (0.43, 1.06) |

OR: odds ratio; CI: confidence interval; NA: not applicable; BMI: body mass index.
Adjusted models accounted for hospitals, age, sex, living alone, alcohol consumption, exercise, BMI, working hours, comorbidity, and frontline worker status.
$p < 0.05$.
$p < 0.01$.
$p < 0.001$.

COVID-19-related discrimination at baseline was significantly associated with depression (OR = 2.18, 95% CI = 1.39 to 2.90) and suicidal ideation (OR = 2.07, 95% CI = 1.22 to 3.50). For both outcomes, similar OR was found in unadjusted and adjusted models.

### 3.3. Sensitivity analysis: PHQ-8

Supplementary Table S2 summarizes the association of COVID-19-related discrimination at baseline with the PHQ-8 at follow-up, controlling for the effect of hospitals and adjusting for Level 1 covariates. The results did not substantially change, i.e., COVID-19-related discrimination at baseline was associated with higher PHQ-8 scores at follow-up in the adjusted model ($\beta$ = 1.61, 95% CI = 1.10 to 2.11). Similar coefficients were found in both unadjusted and adjusted models.

### 3.4. Sensitivity analysis: robustness to unmeasured confounding

Finally, the robustness to unmeasured confounding was evaluated by E-values. The association between depression and COVID-19-related discrimination appeared robust to unmeasured confounding (E-value: point estimate = 3.78, limit of CI = 2.34). These values mean that unmeasured confounding would need to be associated with depression and COVID-19-related discrimination above and beyond the adjusted covariates by an odds ratio of 3.78 to explain away the estimate and 2.34 to shift the 95% CI and include the null value. These values were numerically larger than the estimates of all adjusted covariates, as shown in Table 2. The findings were similarly verified when examining the robustness to unmeasured confounding of the association between COVID-19-related discrimination and suicidal ideation (E-value: point estimate = 3.56, limit of CI = 1.49).

## 4. Discussion

COVID-19-related discrimination was associated with subsequent depression and suicidal ideation. Individuals who already had depression at baseline were excluded, and participants newly scored above the cut-off point of the PHQ-9. This association did not change with the inclusion of various covariates. Sensitivity analyses using the PHQ-8 verified that these findings did not substantially change. Also, sensitivity analysis evaluating E-values demonstrated the robustness to unmeasured confounding. The results were consistent with previous cross-sectional studies (Campo-Arias et al., 2021; Correia da Silva et al., 2022; Moro et al., 2022). The present study is the first to show that COVID-19-related discrimination was associated with subsequent depression and suicidal ideation in healthcare workers.

A previous study using the PHQ-9 suggested the prevalence of depression in healthcare workers as 25.1% (Correia da Silva et al., 2022). In the present study, relatively fewer people scored above the cut-off point (7.2%), which may be reasonable considering that we excluded participants who had depression at baseline. The trajectory of depression in healthcare workers during the COVID-19 pandemic appears to be highly heterogeneous across regions and countries (Saragih et al., 2021); hence, the findings should be cautiously generalized.

Although the specific mechanism for the pathway from COVID-19-related discrimination to depression is unclear, it might be reasonably argued by employing a social cognitive model. A previous study explained the path from racial discrimination to depression by using a social cognitive model (Mikrut et al., 2022). The authors suggested three primary dimensions: concerns about rejection and invalidation, social vigilance, and mistrust (Mikrut et al., 2022). These findings might not be fully utilizable for COVID-19-related discrimination research. On the other hand, healthcare workers who experienced such discrimination may develop mistrust in society, considering that discrimination is reportedly linked to mistrust (Williamson et al., 2019). Exploring these dimensions using causal mediation analyses (VanderWeele, 2015) may contextualize the harmful effect of COVID-19-related discrimination on depression.

Depression may lead to healthcare workers' negative professional performance, e.g., absenteeism or presenteeism (Johnston et al., 2019). Moreover, negative emotional states due to discrimination might impair cognition (Barnes et al., 2012; Zahodne et al., 2020), resulting in higher chances of medical errors (Zhang et al., 2004). Thus, the findings are clinically important in the context of prevention. Three potential strategies may be suggested. First, an anti-discrimination campaign might help decrease the overall level of discrimination (Henderson et al., 2012; Thornicroft et al., 2014). Second, healthcare workers with less family support may have a higher risk of depression (Correia da Silva et al., 2022), and providing social support to such individuals may help prevent depression. Third, interventions that focus on coping strategies may be recommended, which moderate the debilitating effect of discrimination on depression (Noh and Kaspar, 2003).

The strengths of the present study include that the longitudinal data may allow causal interpretations, while previous studies used cross-sectional data. Data included multiple healthcare centers with a relatively large sample, which provided statistical power to detect significant associations. Multiple sensitivity analyses were conducted; the results did not substantially change and were robust to unmeasured confounding.

## 5. Limitations

The present study includes three limitations. First, participants self-reported information including depression and suicidal ideation, which may have resulted in social desirability biases, e.g., reluctance to disclose the occurrence of these symptoms. Certified psychiatrists' examinations would have provided more accurate diagnoses of depression, although the PHQ-9 used in this study was a validated measurement. Also, the PHQ-9 item 9 was used to evaluate suicidal ideation. While the PHQ-9 item 9 is associated with suicide (Simon et al., 2013), a validation study suggested that this item may be insufficient for assessing suicidal outcomes (Na et al., 2018). A validated scale designed to evaluate suicidal outcomes, such as the Columbia Suicide Severity Rating Scale (Posner et al., 2011), should be employed. Second, some potential confounders were not adjusted for due to a lack of data. Psychosocial factors play an essential role in mental health outcomes (Narita et al., 2019, 2020, 2021), including suicide (Fedina et al., 2021; Stickley et al., 2020). For example, neighborhood disruption might be a common cause of discrimination and mental health problems, which should be controlled for in future studies. Third, the data did not include detailed information on COVID-19-related discrimination, e.g., frequency. A validated and continuous measurement of discrimination is warranted.

## 6. Conclusions

COVID-19-related discrimination results in depression and suicidal ideation in healthcare workers. Interventions to prevent such discrimination against healthcare workers, e.g., anti-discrimination campaigns, are crucial during the COVID-19 pandemic. Future studies should employ continuous measurements of discrimination and adjustments for psychosocial factors.

## Funding

This work was supported by Japan Health Research Promotion Bureau Research Fund (2020-B-09).

## Availability of data and materials

The sponsoring institution imposes strict rules on sharing the data as these are classified according to ethical restrictions due to privacy concerns. Anonymized data are available to researchers and institutions upon request.

## Author contributions

ZN devised initial research questions. ZN conducted analyses. The manuscript was written by ZN and finalized by SY, MK, NM, MI, and TM, with substantial text contributions from all authors.

## Ethics approval and consent to participate

The National Center for Global Health and Medicine Institutional Review Board approved the present study (NCGM-G-004233). Written informed consent was obtained from each participant.

## Declaration of competing interest

The authors declare no conflict of interest.

## Acknowledgment

Not applicable.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2023.01.025.

## References

Bagcchi, S., 2020. Stigma during the COVID-19 pandemic. Lancet Infect. Dis. 20, 782. https://doi.org/10.1016/S1473-3099(20)30498-9.

Barnes, L.L., Lewis, T.T., Begeny, C.T., Yu, L., Bennett, D.A., Wilson, R.S., 2012. Perceived discrimination and cognition in older African Americans. J. Int. Neuropsychol. Soc. 18, 856–865. https://doi.org/10.1017/S1355617712000628.

Campo-Arias, A., Jiménez-Villamizar, M.P., Caballero-Domínguez, C.C., 2021. Healthcare workers' distress and perceived discrimination related to COVID-19 in Colombia. Nurs. Health Sci. 23, 763–767. https://doi.org/10.1111/nhs.12854.

Correia da Silva, A.T., Mascayano, F., Valeri, L., de Medeiros, M.E., Souza, M.P.E., Ballester, D., Cavalcanti, M.T., Martínez-Alés, G., Moro, M.F., van der Ven, E., Alvarado, R., Susser, E., 2022. COVID-19 pandemic factors and depressive symptoms among primary care workers in São Paulo, Brazil, October and November 2020. Am. J. Publ. Health 112, 786–794. https://doi.org/10.2105/AJPH.2022.306723.

da Silva, F.C.T., Neto, M.L.R., 2021. Psychiatric symptomatology associated with depression, anxiety, distress, and insomnia in health professionals working in patients affected by COVID-19: a systematic review with meta-analysis. Prog. Neuro-Psychopharmacol. Biol. Psychiatry 104, 110057. https://doi.org/10.1016/j.pnpbp.2020.110057.

Do Duy, C., Nong, V.M., Ngo Van, A., Doan Thu, T., Do Thu, N., Nguyen Quang, T., 2020. COVID-19-related stigma and its association with mental health of health-care workers after quarantine in Vietnam. Psychiatr. Clin. Neurosci. 74, 566–568. https://doi.org/10.1111/pcn.13120.

Dye, T.D., Alcantara, L., Siddiqi, S., Barbosu, M., Sharma, S., Panko, T., Pressman, E., 2020. Risk of COVID-19-related bullying, harassment and stigma among healthcare workers: an analytical cross-sectional global study. BMJ Open 10, e046620. https://doi.org/10.1136/bmjopen-2020-046620.

Fedina, L., Mushonga, D.R., Bessaha, M.L., Jun, H.-J., Narita, Z., DeVylder, J., 2021. Moderating effects of perceived neighborhood factors on intimate partner violence, psychological distress, and suicide risk. J. Interpers Violence 36, 10546–10563. https://doi.org/10.1177/0886260519884687.

Henderson, C., Corker, E., Lewis-Holmes, E., Hamilton, S., Flach, C., Rose, D., Williams, P., Pinfold, V., Thornicroft, G., 2012. England's time to change antistigma campaign: one-year outcomes of service user-rated experiences of discrimination. Psychiatr. Serv. 63, 451–457. https://doi.org/10.1176/appi.ps.201100422.

Johnston, D.A., Harvey, S.B., Glozier, N., Calvo, R.A., Christensen, H., Deady, M., 2019. The relationship between depression symptoms, absenteeism and presenteeism. J. Affect. Disord. 256, 536–540. https://doi.org/10.1016/j.jad.2019.06.041.

Kroenke, K., Spitzer, R.L., Williams, J.B., 2001. The PHQ-9: validity of a brief depression severity measure. J. Gen. Intern. Med. 16, 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x.

Kroenke, K., Strine, T.W., Spitzer, R.L., Williams, J.B.W., Berry, J.T., Mokdad, A.H., 2009. The PHQ-8 as a measure of current depression in the general population. J. Affect. Disord. 114, 163–173. https://doi.org/10.1016/j.jad.2008.06.026.

Labrague, L.J., De los Santos, J.A.A., Fronda, D.C., 2021. Perceived COVID-19-associated discrimination, mental health and professional-turnover intention among frontline clinical nurses: the mediating role of resilience. Int. J. Ment. Health Nurs. https://doi.org/10.1111/inm.12920, 10.1111/inm.12920.

Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., Wu, J., Du, H., Chen, T., Li, R., Tan, H., Kang, L., Yao, L., Huang, M., Wang, H., Wang, G., Liu, Z., Hu, S., 2020. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. JAMA Netw. Open 3, e203976. https://doi.org/10.1001/jamanetworkopen.2020.3976.

McNeish, D., Kelley, K., 2019. Fixed effects models versus mixed effects models for clustered data: reviewing the approaches, disentangling the differences, and making recommendations. Psychol. Methods 24, 20–35. https://doi.org/10.1037/met0000182.

Mikrut, E.E., Keating, L.H., Barnwell, P.V., Cioffi, L., Vega, D., Contrada, R.J., Brondolo, E., 2022. Pathways from exposure to racial/ethnic discrimination to depression: testing a social-cognitive model. Soc. Sci. Med. 292, 114558 https://doi.org/10.1016/j.socscimed.2021.114558.

Monterrosa-Castro, A., Redondo-Mendoza, V., Mercado-Lara, M., 2020. Psychosocial factors associated with symptoms of generalized anxiety disorder in general practitioners during the COVID-19 pandemic. J. Invest. Med. 68, 1228–1234. https://doi.org/10.1136/jim-2020-001456.

Moro, M.F., Calamandrei, G., Poli, R., Di Mattei, V., Perra, A., Kurotschka, P.K., Restrepo, A., Romano, F., La Torre, G., Preti, E., Mascayano, F., Picardi, A., Chiarotti, F., Rapisarda, V., Urban, A., Alvarado, R., Susser, E., Carta, M.G., 2022. The impact of the COVID-19 pandemic on the mental health of healthcare workers in Italy: analyzing the role of individual and workplace-level factors in the reopening phase after lockdown. Front. Psychiatr. 13, 867080 https://doi.org/10.3389/fpsyt.2022.867080.

Muramatsu, K., Miyaoka, H., Kamijima, K., Muramatsu, Y., Tanaka, Y., Hosaka, M., Miwa, Y., Fuse, K., Yoshimine, F., Mashima, I., Shimizu, N., Ito, H., Shimizu, E., 2018. Performance of the Japanese version of the Patient Health Questionnaire-9 (J-PHQ-9) for depression in primary care. Gen. Hosp. Psychiatr. 52, 64–69.

Na, P.J., Yaramala, S.R., Kim, J.A., Kim, H., Goes, F.S., Zandi, P.P., Vande Voort, J.L., Sutor, B., Croarkin, P., Bobo, W.V., 2018. The PHQ-9 item 9 based screening for suicide risk: a validation study of the patient health questionnaire (PHQ)-9 item 9 with the Columbia suicide severity rating scale (C-SSRS). J. Affect. Disord. 232, 34–40. https://doi.org/10.1016/j.jad.2018.02.045.

Narita, Z., Banawa, R., Zhou, S., DeVylder, J., Koyanagi, A., Oh, H., 2021. Loneliness and psychotic experiences among US university students: findings from the Healthy Minds Study 2020. Psychiatr. Res. 308, 114362 https://doi.org/10.1016/j.psychres.2021.114362.

Narita, Z., Knowles, K., Fedina, L., Oh, H., Stickley, A., Kelleher, I., DeVylder, J., 2019. Neighborhood change and psychotic experiences in a general population sample. Schizophr. Res. https://doi.org/10.1016/j.schres.2019.11.036.

Narita, Z., Okubo, R., Sasaki, Y., Takeda, K., Takao, M., Komaki, H., Oi, H., Mizoue, T., Miyama, T., Kim, Y., 2022. COVID-19-related discrimination, PTSD symptoms, and psychological distress in healthcare workers. Int. J. Ment. Health Nurs. https://doi.org/10.1111/inm.13069.

Narita, Z., Stickley, A., DeVylder, J., 2020. Loneliness and psychotic experiences in a general population sample. Schizophr. Res. 218, 146–150. https://doi.org/10.1016/j.schres.2020.01.018.

Noh, S., Kaspar, V., 2003. Perceived discrimination and depression: moderating effects of coping, acculturation, and ethnic support. Am. J. Publ. Health 93, 232–238. https://doi.org/10.2105/ajph.93.2.232.

Posner, K., Brown, G.K., Stanley, B., Brent, D.A., Yershova, K.V., Oquendo, M.A., Currier, G.W., Melvin, G.A., Greenhill, L., Shen, S., Mann, J.J., 2011. The Columbia-Suicide Severity Rating Scale: initial validity and internal consistency findings from three multisite studies with adolescents and adults. Am. J. Psychiatr. 168, 1266–1277. https://doi.org/10.1176/appi.ajp.2011.10111704.

Rubin, D.B., 1987. Multiple Imputation for Nonresponse in Surveys. Wiley, New York.

Saragih, I.D., Tonapa, S.I., Saragih, I.S., Advani, S., Batubara, S.O., Suarilah, I., Lin, C.-J., 2021. Global prevalence of mental health problems among healthcare workers during the Covid-19 pandemic: a systematic review and meta-analysis. Int. J. Nurs. Stud. 121, 104002 https://doi.org/10.1016/j.ijnurstu.2021.104002.

Sasaki, N., Asaoka, H., Kuroda, R., Tsuno, K., Imamura, K., Kawakami, N., 2021. Sustained poor mental health among healthcare workers in COVID-19 pandemic: a longitudinal analysis of the four-wave panel survey over 8 months in Japan. J. Occup. Health 63, e12227. https://doi.org/10.1002/1348-9585.12227.

Shrestha, R.M., Inoue, Y., Yamamoto, S., Fukunaga, A., Sampei, M., Okubo, R., Morisaki, N., Ohmagari, N., Funaki, T., Ishizuka, K., Yamaguchi, K., Sasaki, Y., Takeda, K., Miyama, T., Kojima, M., Nakagawa, T., Nishimura, K., Ogata, S., Umezawa, J., Tanaka, S., Inoue, M., Konishi, M., Miyo, K., Mizoue, T., 2022. The Association between Experience of COVID-19-Related Discrimination and Psychological Distress Among Healthcare Workers for Six National Medical Research Centers in Japan. bioRxiv. https://doi.org/10.1101/2022.08.03.22278304.

Simon, G.E., Rutter, C.M., Peterson, D., Oliver, M., Whiteside, U., Operskalski, B., Ludman, E.J., 2013. Does response on the PHQ-9 Depression Questionnaire predict subsequent suicide attempt or suicide death? Psychiatr. Serv. 64, 1195–1202. https://doi.org/10.1176/appi.ps.201200587.

Singh, R., Subedi, M., 2020. COVID-19 and stigma: social discrimination towards frontline healthcare providers and COVID-19 recovered patients in Nepal. Asian J. Psychiatr. 53, 102222 https://doi.org/10.1016/j.ajp.2020.102222.

Stickley, A., Waldman, K., Ueda, M., Koyanagi, A., Sumiyoshi, T., Narita, Z., Inoue, Y., DeVylder, J.E., Oh, H., 2020. Childhood neglect and suicidal behavior: findings from the National comorbidity survey replication. Child Abuse Negl. 103, 104400 https://doi.org/10.1016/j.chiabu.2020.104400.

Taylor, S., Landry, C.A., Rachor, G.S., Paluszek, M.M., Asmundson, G.J.G., 2020. Fear and avoidance of healthcare workers: an important, under-recognized form of stigmatization during the COVID-19 pandemic. J. Anxiety Disord. 75, 102289 https://doi.org/10.1016/j.janxdis.2020.102289.

Thornicroft, C., Wyllie, A., Thornicroft, G., Mehta, N., 2014. Impact of the like Minds, like Mine anti-stigma and discrimination campaign in New Zealand on anticipated

and experienced discrimination. Aust. N. Z. J. Psychiatr. 48, 360–370. https://doi.org/10.1177/0004867413512687.
van Buuren, S., Groothuis-Oudshoorn, K., 2011. Mice: multivariate imputation by chained equations in R. J. Stat. Software 45, 1–67. https://doi.org/10.18637/jss.v045.i03.
VanderWeele, T.J., 2015. Explanation in Causal Inference: Methods for Mediation and Interaction. Oxford University Press, New York.
VanderWeele, T.J., Ding, P., 2017. Sensitivity analysis in Observational research: introducing the E-value. Ann. Intern. Med. 167, 268–274. https://doi.org/10.7326/M16-2607.
Williamson, L.D., Smith, M.A., Bigman, C.A., 2019. Does discrimination breed mistrust? Examining the role of mediated and non-mediated discrimination experiences in medical mistrust. J. Health Commun. 24, 791–799. https://doi.org/10.1080/10810730.2019.1669742.
Wu, T., Jia, X., Shi, H., Niu, J., Yin, X., Xie, J., Wang, X., 2021. Prevalence of mental health problems during the COVID-19 pandemic: a systematic review and meta-analysis. J. Affect. Disord. 281, 91–98. https://doi.org/10.1016/j.jad.2020.11.117.
Xiong, J., Lipsitz, O., Nasri, F., Lui, L.M.W., Gill, H., Phan, L., Chen-Li, D., Iacobucci, M., Ho, R., Majeed, A., McIntyre, R.S., 2020. Impact of COVID-19 pandemic on mental health in the general population: a systematic review. J. Affect. Disord. 277, 55–64. https://doi.org/10.1016/j.jad.2020.08.001.
Zahodne, L.B., Morris, E.P., Sharifian, N., Zaheed, A.B., Kraal, A.Z., Sol, K., 2020. Everyday discrimination and subsequent cognitive abilities across five domains. Neuropsychology. https://doi.org/10.1037/neu0000693.
Zhang, J., Patel, V.L., Johnson, T.R., Shortliffe, E.H., 2004. A cognitive taxonomy of medical errors. J. Biomed. Inf. 37, 193–204. https://doi.org/10.1016/j.jbi.2004.04.004.