The Psychological Burden of Attention-Deficit/Hyperactivity Disorder Traits on Medical Workers Under the COVID-19 Outbreak: A Cross-Sectional Web-Based Questionnaire Survey

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Kentaro Matsui[1, 2, 3] MD, PhD; Takuya Yoshiike[1] MD, PhD; Ayumi Tsuru[1, 2] MD; Rei Otsuki[1, 2, 4] MD; Kentaro Nagao[1] MD; Naoko Ayabe[1, 5] PhD; Megumi Hazumi[1] PhD; Tomohiro Utsumi[1, 6] MD; Kentaro Yamamoto[1, 3] MD; Michio Fukumizu[1, 7] MD, PhD; Kenichi Kuriyama[1] MD, PhD

[1]Department of Sleep-Wake Disorders National Institute of Mental Health National Center of Neurology and Psychiatry Kodaira JP
[2]Department of Clinical Laboratory National Institute of Mental Health National Center of Neurology and Psychiatry Kodaira, Tokyo JP
[3]Department of Psychiatry Tokyo Women's Medical University Tokyo JP
[4]Department of Psychiatry Nihon University School of Medicine Tokyo JP
[5]Department of Regional Studies and Humanities Faculty of Education and Human Studies Akita University Akita JP
[6]Department of Psychiatry The Jikei University School of Medicine Tokyo JP

Corresponding Author:
Kenichi Kuriyama MD, PhD
Department of Sleep-Wake Disorders
National Institute of Mental Health
National Center of Neurology and Psychiatry
4-1-1 Ogawa-Higashi
Kodaira
JP

Abstract

Background: There are numerous reports on the psychological burden of medical workers after the COVID-19 outbreak; however, no study has examined the influence of developmental characteristics on the mental health of medical workers.

Objective: The objective of this study was to examine whether the developmental characteristics of medical workers are associated with anxiety and depression after the COVID-19 outbreak.

Methods: An online questionnaire survey was conducted in October 2020. The questionnaire included items on sociodemographic data, changes in their life after the COVID-19 outbreak, and symptoms of depression, anxiety, attention deficit/hyperactivity disorder (ADHD) traits, and autism spectrum disorder traits. We performed hierarchical multiple regression analyses.

Results: The data of 640 medical workers were analyzed. Increases in physical and psychological burden were observed in 49.1% and 78.3% of the subjects, respectively. The results of a multiple regression analysis showed that ADHD traits were significantly associated with both depression (?=0.390, P<.001) and anxiety (?=0.426, P<.001). Autistic traits were significantly associated with depression (?=0.069, P<.05) but not anxiety. Increased physical and psychological burden, being female, medical workers other than physicians and nurses, fear of COVID-19, and experience of discrimination were also significantly associated with both depression and anxiety.

Conclusions: Globally, the burden on medical workers increased. This study suggested that medical workers with higher ADHD traits may need special attention during the COVID-19 pandemic.

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Keywords: health care worker; medical personnel; psychological impact; depression; anxiety; ADHD; ASD

Introduction

Previous studies have shown that outbreaks of serious infectious diseases can place a heavy psychological burden on healthcare workers [1-4]. Immediately after the coronavirus disease 2019 (COVID-19) outbreak, it was pointed out that mental health problems can emerge among medical workers due to the fear of risking infection to their own family, friends, and colleagues, with uncertainty about the future, and stigmatization of themselves [5]. There have already been a number of studies reporting mental health problems among health care workers working against COVID-19 [1-4, 6-12]. However, these reports were mainly from regions such as China, the United States, and European countries that experienced severe consequences of the COVID-19 pandemic.

Compared to the above-mentioned countries, the number of new cases and deaths caused by COVID-19 in Japan was small (Figure 1) [13] hence, people experiencing loss through death were considered rare. Although there has been no government-imposed lockdown with legal restraints, the further spread of COVID-19 has been prevented by only a request for self-restraint in social activities by the Prime Minister and prefectural governors [14]. People's compliance with the request of wearing masks and avoiding unnecessary outings might have contributed to preventing the spread of the disease, but their effectiveness are not clear. In contrast, medical institutes, along with restaurants/bars and music events, were reported to have contributed to cluster outbreaks [15], leading to increased stigma and discrimination against health care workers. Thus, it is not only the fear of infection by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), but also the increased workload related to infection control, stigma/discrimination, and stress in healthcare workers. When healthcare workers experience physical or mental health problems, it could lead to a decline in healthcare services and ultimately affect patients [16]. Since maintaining the quality of healthcare services affects the interests of society as a whole, reducing the physical and mental burden of healthcare providers would be the most essential factor to overcome the COVID-19

pandic.

People with specific developmental characteristics may experience greater psychological burden during the COVID-19 pandemic [17-22]. However, there have been no reports on the psychological effects of the COVID-19 pandemic on adult health care workers with attention-deficit hyperactivity disorder (ADHD) and/or autistic traits. In recent years, ADHD and autistic traits are regarded as spectra and have been shown to co-occur [23]. ADHD traits may make compliance with the COVID-19 precautions highly stressful because of factors like inattention, hyperactivity, and impulsivity. Similarly, autism spectrum disorder (ASD) traits may make people vulnerable to anxiety because of the need to adjust their daily lifestyles to the COVID-19 crisis. Considering this, we hypothesized that medical workers with developmental characteristics such as ADHD and autistic traits experience depression and anxiety symptoms to a greater extent during the COVID-19 outbreak due to changes in their daily lifestyle. We investigated the constraints from the COVID-19 outbreak on daily lifestyles along with the physical and psychological burdens among medical workers. After controlling these variables, we aimed to determine the effect of ADHD and autistic traits on depression and anxiety symptoms among medical workers.

Methods

Setting and study population

The present study was conducted as part of a comprehensive research project [MEdical Workers' MEntal health and Working conditions in Japan under the COVID-19 pandemic (MEW2-J-COVID) project] to investigate the mental health, work, lifestyle, and distraction of medical workers after the COVID-19 outbreak. This cross-sectional web-based questionnaire survey was conducted between October 1 and 30, 2020. Participants were recruited via snowball sampling and accessed the link to a Google Form containing the questionnaire posted on the National Center of Neurology and Psychiatry website. The study protocol was approved by the ethical committee of the National Center of Neurology and Psychiatry. Informed consent was obtained from all participants via the survey website.

Of the 712 participants who completed the Google Form questionnaire, the data of 683 participants were analyzed. Data of 29 participants were excluded because they were duplicates (n=24), were below 20 years or not medical workers (n=3), contained garbled data (n=1), or contained invalid data on working hours (n=1). Of these, those not working at a medical institution (n=25) and working less than 15 days in a month (n=18) were excluded. Totally, 43 participants were excluded. Finally, 640 participants were included in the analyses.

Assessments

Questionnaires consisted of the sociodemographic questionnaire, the Patient Health Questionnaire-9 (PHQ-9) for estimating depressive symptoms [24, 25], the Generalized Anxiety Disorder-7 (GAD-7) for assessing anxiety symptoms [26, 27], the Adult ADHD Self-Report Scale (ASRS-V1.1) for estimating ADHD symptoms [28, 29], and the Autism Spectrum Quotient-10 (AQ-10) for quantifying autistic traits [30, 31].

Main outcome measures

Depression symptoms were assessed by the PHQ-9 [24, 25]. Based directly on the nine diagnostic criteria for major depressive disorder in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) [32], the scale consists of 9 items that assess the frequency with which 9 depressive symptoms had occurred in the past 2 weeks. Participants rated items as 0, 1, 2, or 3 for "not at all," "several days," "more than half the days," and "nearly every day," respectively. Responses to each item were summed to provide a single score ranging from 0 to 27, with higher

scores indicating more severe depressive symptoms.

Anxiety symptoms were assessed by the GAD-7 [26, 27]. The GAD-7 is derived from the 13-item criteria for GAD in the DSM-IV [32]. It consists of seven items with the highest correlation to the 13-item scale score. Participants rated the frequency of seven anxiety symptoms during the last two weeks as 0, 1, 2, or 3 for "not at all," "several days," "more than half the days," and "nearly every day," respectively. The responses to each item were summed to provide a single score ranging from 0 to 21, with higher scores indicating more severe anxiety symptoms.

Predictors—developmental characteristics

ADHD traits were assessed by the ASRS-V1.1 Screener [28, 29]. The ASRS-V1.1 Screener was derived from the 18-item criteria for ADHD in the DSM-IV [American Psychiatric Association., 32], consisting of six questions considered most predictive of symptoms consistent with ADHD. The 6-item questionnaire includes questions on inattention (four items) and hyperactivity symptoms (two items). Participants rated the frequency of ADHD symptoms over the past six months as 0, 1, 2, 3, or 4 for "never," "rarely," "sometimes," "often," and "very often." The responses to each item were summed to provide a single score ranging from 0 to 24, with higher scores indicating higher ADHD traits.

Autistic traits were assessed by the AQ-10 [30, 31]. The AQ-50, an original version of the AQ-10, was originally developed as a tool for screening autistic traits in intellectually able adults. Albeit a short version of the AQ-50, the AQ-10 has been well validated for measuring autistic traits [33]. Responses are rated on a four-point scale: "definitely disagree," "slightly disagree," "slightly agree," and "definitely agree." Responses indicating autistic traits were scored 1, while other responses scored 0. (For 5 items, "definitely disagree" and "slightly disagree" were scored 1, but for the 5 reverse-scored items, "slightly agree" and "definitely agree" were scored 1). The responses to each item were summed to provide a single score ranging from 0 to 10, with higher scores indicating a higher level of autistic traits.

Predictors—changes in lifestyle

With regard to changes in lifestyle after the COVID-19 outbreak, changes in physical and psychological burden were rated: "markedly decreased," "decreased," "unchanged," "increased," or "markedly increased." Also, changes in income, frequency of going out, and interpersonal interactions (including online interactions) were assessed using the rate of change: "Greater than or equal to 150%," "110 to 150%," "90 to 110 %," "50 to 90%," or "Less than 50%."

Other covariates

The questionnaire included items on demographic characteristics, such as age (stratified by decade), sex, body mass index (BMI), residential area (urban, suburban, or rural), number of households, smoking habit (yes/no), habitual alcohol consumption (yes/no), and history of COVID-19 infection (yes/no). Participants' work status including occupation, commuting time (< 30 min, 30 min to 1 h, or ≥ 1 h), working hours per day and number of workdays per month, engagement in night-shift (yes/no), frequency of contact with confirmed/suspected COVID-19 patients, fear of COVID-19 (no fear, moderate fear, or extreme fear), and experience of discrimination (a yes/no answer to the question, "After the COVID-19 epidemic, have you experienced discrimination in daycare centers, schools, or from community residents because you are a medical worker?" were also evaluated. In this study, we defined frontline workers as those directly involved in COVID-19 prevention and treatment and having direct contact with confirmed or suspected cases once or more than once a week.

Recruitment

Notice that the first subheading immediately follows the last heading. Subheadings under subheadings are also possible (see Statistical Analysis).

Statistical Analysis

A series of hierarchical multiple regression analyses were performed to test the effects of developmental characteristics on depression (the score of the PHQ-9) after controlling for sociodemographic factors and changes in participants' lives after the COVID-19 outbreak. First, developmental characteristics (the ASRS score and the AQ-10 score) were entered into the regression model (Model 1). Then changes in lifestyle after the COVID-19 outbreak (changes in physical and psychological burden, changes in income, frequency of going out, and interpersonal interaction) were entered into the regression model in the second step (Model 2). Lastly, sociodemographic variables including age group, sex, BMI, residential area, number of households, habitual smoking and alcohol consumption, history of COVID-19 infection, work status (occupation, commuting time, working hours per month, engagement in night-shifts, whether a frontline worker or not), fear of COVID-19, and experience of discrimination were entered in the third and final step (Model 3). The same hierarchical multiple regression analyses were performed to test the effects of developmental characteristics on anxiety (GAD-7 score). We used SPSS statistics version 22 (SPSS Japan, Inc., Tokyo Japan) to perform all analyses. Statistical significance was set at $P<.05$.

Results

The 640 participants consisted of 270 (42.2%) physicians (including dentists), 190 (29.7%) nurses (including midwives), and 180 (28.1%) other workers (pharmacists (n=34), nutritionists (n=4), radiologists (n=4), clinical technologists (n=17), physical therapists (n=6), occupational therapists (n=14), certified orthoptists (n=1), clinical engineers (n=4), speech therapists (n=8), certified care workers (n=3), clinical psychologists (n=25), psychiatric social workers (n=13), music therapists (n=1), medical assistants (n=7), and office workers (n=39)). The most predominant age groups were 30s and 40s (37.3% and 34.8%, respectively), and 359 subjects (59.1%) were female. Only 5 participants (0.8%) had a history of COVID-19 infection. Forty-six participants (7.2%) were frontline workers. Other descriptive information of the participants is presented in Table 1. A majority of the participants (85.4%) were concerned about COVID-19, and about 20% of them were extremely fearful of COVID-19 (17.7% of all participants). Discrimination against medical workers was experienced by 8.8% of the respondents. The prevalence of clinically significant depressive symptoms (PHQ-9 ≥10), anxiety symptoms (GAD-7 ≥10), ADHD traits (ASRS ≥14) and autistic traits (AQ-10 ≥6) were 77 (12.0%), 54 (8.4%), 65 (10.2%), and 64 (10.0%), respectively.

Changes in physical and psychological burden are shown in Figure 2; changes in life circumstances (income, frequency of going out, and interpersonal interaction) are shown in Figure 3. In terms of workload after the COVID-19 outbreak, 49.1% and 78.3% of the participants reported that their physical and psychological burdens increased, respectively. As for income, only 19.7% of the subjects experienced a decrease below 90%. Overall, a noticeable decrease in the frequency of going out was reported—92.2% reported reducing activities by 10% or more, and 40% reported reducing their activities by 50% or more. A similar decrease in interpersonal interaction was noted, with 83.5% reporting a decrease of less than 90% and 37.7% reporting a decrease of less than 50%.

To evaluate the effect of developmental characteristics, changes in lifestyle due to COVID-19, and sociodemographic variables, we performed two separate regression analyses. For depression, the first model testing the contributions of developmental characteristics were statistically significant (R^2=21.7%, $P<.001$). The addition of changes in lifestyle due to COVID-19 (model 2) resulted in a significant increase in the R^2 value (ΔR^2=12.6%, $P<.001$). The final model (the standard multiple regression analysis) in which all of the variables were entered simultaneously explained 43.3% of the

variance in depression. Finally, ASRS score (β=0.390, *P*<.001), AQ-10 score (β=0.069, *P*=.032), changes in physical burden (β=0.121, *P*=.001), changes in psychological burden (β=0.161, *P*<.001), changes in interpersonal interaction (β=0.103, *P*=.002), being female (β=0.199, *P*<.001), body mass index (β=0.094, *P*=.004), number of households (β=−0.086, *P*=.008), habitual smoking (β=0.068, *P*=.031), other worker (β=0.130, *P*<.001), working hours per month (β=0.083, *P*=.018), fear of COVID-19 (β=0.135, *P*<.001), and experience of discrimination (β=0.069, *P*=.032) were identified as significant correlates of depression. However, the correlation between AQ-10 score and depression was not significant in the bivariate analysis (Multimedia Appendix 1). For anxiety, the first model testing the contributions of developmental characteristics were statistically significant (R^2=22.5%, *P*<.001). The addition of changes in lifestyle with COVID-19 (model 2) resulted in a significant increase in the R^2 value (ΔR^2=0.105%, *P*<.001). The final full model (the standard multiple regression analysis) in which all of the variables were entered simultaneously explained 39% of the variance in anxiety. Finally, the ASRS score (β=0.426, *P*<.001), changes in physical burden (β=0.120, *P*=.002), changes in psychological burden (β=0.146, *P*<.001), being female (β=0.089, *P*=.019), other worker (β=0.123, *P*=.003), fear of COVID-19 (β=0.170, *P*<.001), and experience of discrimination (β=0.067, *P*=.045) were identified as significant correlates of anxiety (Multimedia Appendix 2).

Table 1. Demographic data and employment status (N=640)X**Age group (years), N (%)**	
20 to 29	75 (11.7)
30 to 39	239 (37.3)
40 to 49	223 (34.8)
50 to 59	74 (11.6)
≥60	29 (4.5)
Female, N (%)	359 (56.1)
Body mass index, median (IQR), kg/m2	21.8 (20.1–24.2)
Residential area, N (%)	
Urban	260 (40.6)
Suburban	279 (43.6)
Rural	101 (15.8)
Number of households, N (%)	
1	187 (29.7)
2	139 (21.7)
3	130 (20.3)
≥4	184 (28.7)
Habitual smoking, N (%)	60 (9.4)
Habitual alcohol consumption, N (%)	170 (26.6)
COVID-19 infection, N (%)	5 (0.8)
Occupation, N (%)	
Physician	270 (42.2)
Nurse	190 (29.7)
Other worker	180 (28.1)
Commuting time, N (%)	

<30 min	374 (58.4)
30 min to 1 h	183 (28.6)
≥1 h	83 (13.0)
Working hours, median (IQR), per month	207.5 (187–247)
Working night-shift, N (%)	316 (49.4)
Frontline worker, N (%)	46 (7.2)
Fear of COVID-19, N (%)	
No fear	94 (14.7)
Moderate fear	433 (67.7)
Extreme fear	113 (17.7)
Experience of discrimination, N (%)	56 (8.8)
PHQ-9 score, median (IQR), points	4 (1–8)

X

Discussion

This is the first study investigating the influence of developmental characteristics on depression and anxiety in medical workers after the COVID-19 outbreak. Results indicated that ADHD traits might have a strong influence on depression and anxiety symptoms even after controlling for physical and psychological burden and fear of COVID-19, with its effect possibly being greater than other factors, including autistic traits.

In general, and not only during a pandemic, the relationship between ADHD and depression or anxiety has already been addressed [34-39]. Additionally, in general, ASD patients are more prone to develop depression and anxiety [40]. However, in this study, wherein a strong correlation was found between ADHD traits and depression/anxiety symptoms, this was no significant correlation for autistic traits. The difference in the association between the two traits for depression/anxiety is not clear. One possible reason for the strong correlation between ADHD traits and depression/anxiety is that people with ADHD traits may have faced a higher risk of infection due to their own inattention and impulsivity, which can be an obvious stressor among medical workers. Further, due to the calls for self-restraint by government leaders [14], those with high ADHD traits may have experienced high stress [41]; self-restraint prevents one from engaging in a variety of activities, and it would be difficult for people with ADHD traits to adapt to such activities even after months or years. Meanwhile, people with autistic traits may have shown some level of adaption to the situation, as the survey was conducted more than six months after the COVID-19 outbreak. Furthermore, unnecessary outings or interpersonal interactions, which can be stressors for people with autistic traits [42], have been reduced due to COVID-19. It is also noteworthy that the correlation between autistic traits and depression, which was not significant in the bivariate analysis, was significant in the multivariate analysis. This makes it undeniable that autistic traits are also a unique factor that can be associated with depression. From the above results, it can be inferred that the relationship between psychological burden and ADHD or autistic traits after the COVID-19 outbreak should be evaluated and further investigated not only among health care workers but also among the general population.

Contrary to the above hypothesis that reducing unnecessary interpersonal interaction could be protective for individuals with autistic traits, this study highlighted the importance of maintaining interpersonal interaction to fight against depression. Both belonging to a large household and maintaining interpersonal interactions had a protective effect against depression symptoms. This result is consistent with the known importance of receiving direct social support from friends, family, colleagues, and supervisors during a pandemic, which has already been suggested in numerous

studies [3, 4, 7-9, 11]. In this study, the association between changes in interpersonal interaction and anxiety symptoms was not significant; this may be because reduced interpersonal interaction may lower the risk of infection and could thus reduce anxiety. Contrarily, the experience of discriminatory treatment was independently associated with both depression and anxiety symptoms. The negative psychological impact of discrimination on health care workers has been reported in previous pandemics, such as severe acute respiratory syndrome, Middle East respiratory syndrome, or other viral infections [3, 4]. This study's results are consistent with the findings of the COVID-19 outbreak, which also revealed mental disorders due to discrimination [43-46].

Factors related to employment can also be a psychological burden for medical workers. We found that the physical and psychological burden of the COVID-19 outbreak was increased in around 50% and 80% of medical workers, respectively. Both increases in psychological and physical burden were independently associated with symptoms of depression and anxiety, which is consistent with previous studies [47, 48]. It has also been reported that protective garments can increase physical burden [49, 50] and that strict infection control measures can increase stress levels [47]. In addition to changes in physical and psychological burden, long working hours were significantly correlated with depression symptoms in this study. This confirms that the long working hours of nurses were associated with increased stress under the COVID-19 outbreak [51]. Furthermore, a significant association between the fear of COVID-19, depression, and anxiety has been replicated consistent with previous study findings [2, 4, 9]. Despite the increased psychological and physical burden and fear of COVID-19, the prevalence of clinically significant symptoms of depression and anxiety was lower than in health care workers in other nations [6, 8, 12, 52]. This may reflect the low number of dominant COVID-19 patients and the low number of deaths due to COVID-19 in Japan as compared to other countries [13]. In addition, the low prevalence of clinically significant symptoms of depression and anxiety could be attributed to the current study's small sample of medical workers who had direct contact with COVID-19 patients compared to the sample size in previously conducted studies [10-12, 53, 54]. Besides, unlike previous reports on the general population [55-58], the association between the income loss associated with the COVID-19 outbreak, depression, and anxiety was not clear in this study. This can be due to the limited number of medical workers who experienced a decline in income; the impact could be greater if the economy collapsed and their incomes drastically decreased.

The current results suggested that, remarkably, medical workers other than physicians or nurses have an independent risk of both depression and anxiety. In terms of occupation, although frontline physicians had a higher incidence of depression than other occupations [52], a number of studies on health care workers have reported lower depression and anxiety in physicians than in other occupations [3, 4, 6-8, 12], as in this study. For health care workers other than physicians and nurses, one study reported that anxiety was significantly higher, but depression was comparable [59]. Another study conducted on a cruise ship during the early stages of the COVID-19 epidemic in Japan reported that distress was significantly stronger among clerical workers than physicians or nurses [60], consistent with the results of the current study. Even in health care workers, inadequate medical knowledge was reported to be associated with increased levels of anxiety and depression [3, 61, 62]. Moreover, numerous reports have stated that shorter years of health care experience was associated with worse mental health outcomes [3, 6]; other medical workers in this study may have had less experience in infection prevention. Therefore, both job-specific support and appropriate knowledge development would be important to improve the psychological burden of medical workers.

In terms of demographic variables, being female, BMI, and smoking habits were independently associated with depression symptoms. Being female was also independently associated with anxiety symptoms. The association between BMI, smoking habits, and depression has long been shown in the general population [63, 64] and may not be unique to the COVID-19 outbreak. The association of sex, especially being female, with depression and anxiety, has been reported in a number of studies conducted on health care workers after the onset of the COVID-19 pandemic [2-4, 7, 11, 12, 21, 40].

This may also reflect the higher prevalence of depression and anxiety among women in the general population [65, 66]; however, these relationships can be unique in the COVID-19 pandemic. Experimental studies have shown that women are more responsive to neural networks associated with fear and arousal responses than men [67]; the response to fear associated with COVID-19 may have been stronger in women than men. In addition, there are indications that the sociological burden on women has increased after the COVID-19 outbreak [68]. Moreover, a longitudinal study of women with children showed that depression and anxiety were higher among women who had disrupted income, difficulty balancing work and family education, and difficulty obtaining daycare [69]. Indeed, in Japan, it has been reported that suicide among women increased significantly after the COVID-19 outbreak [70]. The direct causes of depression and anxiety in females, and what interventions are best for them should be examined in the future.

Limitations

There are some limitations to this study. First, the present study adopted the snowball sampling strategy. While this approach is valuable for exploratory studies and provides access to the target population, it can hinder the generalizability of results since the representativeness of the sample is not guaranteed. Second, the participants with ADHD or autistic traits in this study were not formally diagnosed as having ADHD or ASD. In addition, determining whether they are traits or symptoms can be difficult using the questionnaire method. Third, the study only examined the changes in income, frequency of going out, and interpersonal interaction and did not assess baseline status. In particular, we did not investigate economic status, which is thought to strongly influence depression and anxiety. Since this study included people working in medical institutions, it may have been biased toward middle- and high-income populations in Japan.

Conclusions

The present study suggested that individual developmental characteristics, especially ADHD traits, have a considerable effect on the psychological health of medical workers. By contrast, the relationship between autistic traits and depression/anxiety symptoms was less significant. Indentifying stressors in medical workers with high ADHD traits and the subsequent development of appropriate interventions for them are warranted. Additionally, the relationship between specific developmental characteristics and stress-related outcomes should be replicated in further studies with both health care workers and the general population.

Acknowledgements

Conflicts of Interest

None declared.

Abbreviations

ADHD: attention deficit/hyperactivity disorder
ASD: autism spectrum disorder
AQ-10: Autism Spectrum Quotient-10
ASRS: Adult ADHD Self-Report Scale
BMI: body mass index
COVID-19: coronavirus disease 2019
DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition

GAD-7: Generalized Anxiety Disorder-7
PHQ-9: Patient Health Questionnaire-9

References

1. Chew QH, Wei KC, Vasoo S, Sim K. Psychological and Coping Responses of Health Care Workers Toward Emerging Infectious Disease Outbreaks: A Rapid Review and Practical Implications for the COVID-19 Pandemic. The Journal of clinical psychiatry. 2020 Oct 20;81(6). PMID: 33084255. doi: 10.4088/JCP.20r13450.

2. Serrano-Ripoll MJ, Meneses-Echavez JF, Ricci-Cabello I, Fraile-Navarro D, Fiol-deRoque MA, Pastor-Moreno G, et al. Impact of viral epidemic outbreaks on mental health of healthcare workers: a rapid systematic review and meta-analysis. Journal of affective disorders. 2020 Dec 1;277:347-57. PMID: 32861835. doi: 10.1016/j.jad.2020.08.034.

3. Sirois FM, Owens J. Factors Associated With Psychological Distress in Health-Care Workers During an Infectious Disease Outbreak: A Rapid Systematic Review of the Evidence. Frontiers in psychiatry. 2020;11:589545. PMID: 33584364. doi: 10.3389/fpsyt.2020.589545.

4. Cabarkapa S, Nadjidai SE, Murgier J, Ng CH. The psychological impact of COVID-19 and other viral epidemics on frontline healthcare workers and ways to address it: A rapid systematic review. Brain, behavior, & immunity - health. 2020 Oct;8:100144. PMID: 32959031. doi: 10.1016/j.bbih.2020.100144.

5. Xiang YT, Yang Y, Li W, Zhang L, Zhang Q, Cheung T, et al. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. Lancet Psychiatry. 2020 Mar;7(3):228-9. PMID: 32032543. doi: 10.1016/s2215-0366(20)30046-8.

6. Sanghera J, Pattani N, Hashmi Y, Varley KF, Cheruvu MS, Bradley A, et al. The impact of SARS-CoV-2 on the mental health of healthcare workers in a hospital setting-A Systematic Review. Journal of occupational health. 2020 Jan;62(1):e12175. PMID: 33131192. doi: 10.1002/1348-9585.12175.

7. Pappa S, Ntella V, Giannakas T, Giannakoulis VG, Papoutsi E, Katsaounou P. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. Brain, behavior, and immunity. 2020 Aug;88:901-7. PMID: 32437915. doi: 10.1016/j.bbi.2020.05.026.

8. Luo M, Guo L, Yu M, Jiang W, Wang H. The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public - A systematic review and meta-analysis. Psychiatry research. 2020 Sep;291:113190. PMID: 32563745. doi: 10.1016/j.psychres.2020.113190.

9. Muller AE, Hafstad EV, Himmels JPW, Smedslund G, Flottorp S, Stensland S, et al. The mental health impact of the covid-19 pandemic on healthcare workers, and interventions to help them: A rapid systematic review. Psychiatry research. 2020 Nov;293:113441. PMID: 32898840. doi: 10.1016/j.psychres.2020.113441.

10. da Silva FCT, Neto MLR. 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. Progress in neuro-psychopharmacology & biological psychiatry. 2021 Jan 10;104:110057. PMID: 32777327. doi: 10.1016/j.pnpbp.2020.110057.

11. Vindegaard N, Benros ME. COVID-19 pandemic and mental health consequences: Systematic review of the current evidence. Brain, behavior, and immunity. 2020 Oct;89:531-42. PMID: 32485289. doi: 10.1016/j.bbi.2020.05.048.

12. Vizheh M, Qorbani M, Arzaghi SM, Muhidin S, Javanmard Z, Esmaeili M. The mental health of healthcare workers in the COVID-19 pandemic: A systematic review. Journal of diabetes

and metabolic disorders. 2020 Oct 26:1-12. PMID: 33134211. doi: 10.1007/s40200-020-00643-9.

13. Johns Hopkins University. COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE). Available from: https:coronavirus.jhu.edu/map.htmlhttps:coronavirus.jhu.edu/map.html. [Accessed 15 Feb 2021].

14. Tokumoto A, Akaba H, Oshitani H, Jindai K, Wada K, Imamura T. COVID-19 Health system response monitor: Japan. New Delhi: World Health Organization. Regional Office for South-East Asia; 2020 2020. ISBN: 9789290228264.

15. Furuse Y, Sando E, Tsuchiya N, Miyahara R, Yasuda I, Ko YK, et al. Clusters of Coronavirus Disease in Communities, Japan, January-April 2020. Emerging infectious diseases. 2020 Sep;26(9):2176-9. PMID: 32521222. doi: 10.3201/eid2609.202272.

16. Rotenstein LS, Torre M, Ramos MA, Rosales RC, Guille C, Sen S, et al. Prevalence of Burnout Among Physicians: A Systematic Review. Jama. 2018 Sep 18;320(11):1131-50. PMID: 30326495. doi: 10.1001/jama.2018.12777.

17. Colizzi M, Sironi E, Antonini F, Ciceri ML, Bovo C, Zoccante L. Psychosocial and Behavioral Impact of COVID-19 in Autism Spectrum Disorder: An Online Parent Survey. Brain sciences. 2020 Jun 3;10(6). PMID: 32503172. doi: 10.3390/brainsci10060341.

18. Melegari MG, Giallonardo M, Sacco R, Marcucci L, Orecchio S, Bruni O. Identifying the impact of the confinement of Covid-19 on emotional-mood and behavioural dimensions in children and adolescents with attention deficit hyperactivity disorder (ADHD). Psychiatry research. 2020 Dec 29;296:113692. PMID: 33421841. doi: 10.1016/j.psychres.2020.113692.

19. Bobo E, Lin L, Acquaviva E, Caci H, Franc N, Gamon L, et al. [How do children and adolescents with Attention Deficit Hyperactivity Disorder (ADHD) experience lockdown during the COVID-19 outbreak?]. L'Encephale. 2020 Jun;46(3s):S85-s92. PMID: 32522407. doi: 10.1016/j.encep.2020.05.011.

20. Sciberras E, Patel P, Stokes MA, Coghill D, Middeldorp CM, Bellgrove MA, et al. Physical Health, Media Use, and Mental Health in Children and Adolescents With ADHD During the COVID-19 Pandemic in Australia. Journal of attention disorders. 2020 Dec 17:1087054720978549. PMID: 33331195. doi: 10.1177/1087054720978549.

21. Mutluer T, Doenyas C, Aslan Genc H. Behavioral Implications of the Covid-19 Process for Autism Spectrum Disorder, and Individuals' Comprehension of and Reactions to the Pandemic Conditions. Frontiers in psychiatry. 2020;11:561882. PMID: 33304279. doi: 10.3389/fpsyt.2020.561882.

22. Amorim R, Catarino S, Miragaia P, Ferreras C, Viana V, Guardiano M. The impact of COVID-19 on children with autism spectrum disorder. Revista de neurologia. 2020 Oct 16;71(8):285-91. PMID: 33034366. doi: 10.33588/rn.7108.2020381.

23. Antshel KM, Russo N. Autism Spectrum Disorders and ADHD: Overlapping Phenomenology, Diagnostic Issues, and Treatment Considerations. Current psychiatry reports. 2019 Mar 22;21(5):34. PMID: 30903299. doi: 10.1007/s11920-019-1020-5.

24. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. Journal of general internal medicine. 2001 Sep;16(9):606-13. PMID: 11556941. doi: 10.1046/j.1525-1497.2001.016009606.x.

25. Muramatsu K, Miyaoka H, Kamijima K, Muramatsu Y, Tanaka Y, Hosaka M, et al. Performance of the Japanese version of the Patient Health Questionnaire-9 (J-PHQ-9) for depression in primary care. General hospital psychiatry. 2018 May-Jun;52:64-9. PMID: 29698880. doi: 10.1016/j.genhosppsych.2018.03.007.

26. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized

anxiety disorder: the GAD-7. Arch Intern Med. 2006 May 22;166(10):1092-7. PMID: 16717171. doi: 10.1001/archinte.166.10.1092.

27. Muramatsu K, Muramatsu Y, Miyaoka H, Fuse K, Yoshimine F, Hosaka M, et al., editors. Validation and utility of a Japanese version of the GAD-7. 2009.

28. Kessler RC, Adler L, Ames M, Demler O, Faraone S, Hiripi E, et al. The World Health Organization Adult ADHD Self-Report Scale (ASRS): a short screening scale for use in the general population. Psychological medicine. 2005 Feb;35(2):245-56. PMID: 15841682. doi: 10.1017/s0033291704002892.

29. Kessler RC, Adler LA, Gruber MJ, Sarawate CA, Spencer T, Van Brunt DL. Validity of the World Health Organization Adult ADHD Self-Report Scale (ASRS) Screener in a representative sample of health plan members. International journal of methods in psychiatric research. 2007;16(2):52-65. PMID: 17623385. doi: 10.1002/mpr.208.

30. Baron-Cohen S, Wheelwright S, Skinner R, Martin J, Clubley E. The autism-spectrum quotient (AQ): evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. Journal of autism and developmental disorders. 2001 Feb;31(1):5-17. PMID: 11439754. doi: 10.1023/a:1005653411471.

31. Kurita H, Koyama T, Osada H. Autism-Spectrum Quotient-Japanese version and its short forms for screening normally intelligent persons with pervasive developmental disorders. Psychiatry and clinical neurosciences. 2005 Aug;59(4):490-6. PMID: 16048456. doi: 10.1111/j.1440-1819.2005.01403.x.

32. American Psychiatric Association. DSM-IV: Diagnostic and statistical manual (Fourth Edition). Washington, DC: American Psychiatric Association; 1994.

33. Lundin A, Kosidou K, Dalman C. Measuring Autism Traits in the Adult General Population with the Brief Autism-Spectrum Quotient, AQ-10: Findings from the Stockholm Public Health Cohort. Journal of autism and developmental disorders. 2019 Feb;49(2):773-80. PMID: 30244391. doi: 10.1007/s10803-018-3749-9.

34. Nankoo MMA, Palermo R, Bell JA, Pestell CM. Examining the Rate of Self-Reported ADHD-Related Traits and Endorsement of Depression, Anxiety, Stress, and Autistic-Like Traits in Australian University Students. Journal of attention disorders. 2019 Jun;23(8):869-86. PMID: 29502467. doi: 10.1177/1087054718758901.

35. Combs MA, Canu WH, Broman-Fulks JJ, Rocheleau CA, Nieman DC. Perceived stress and ADHD symptoms in adults. Journal of attention disorders. 2015 May;19(5):425-34. PMID: 23034340. doi: 10.1177/1087054712459558.

36. Evren B, Evren C, Dalbudak E, Topcu M, Kutlu N. The impact of depression, anxiety, neuroticism, and severity of Internet addiction symptoms on the relationship between probable ADHD and severity of insomnia among young adults. Psychiatry research. 2019 Jan;271:726-31. PMID: 30791348. doi: 10.1016/j.psychres.2018.12.010.

37. Shen Y, Zhang Y, Chan BSM, Meng F, Yang T, Luo X, et al. Association of ADHD symptoms, depression and suicidal behaviors with anxiety in Chinese medical college students. BMC Psychiatry. 2020 Apr 22;20(1):180. PMID: 32321462. doi: 10.1186/s12888-020-02555-7.

38. Mohamed SMH, Börger NA, van der Meere JJ. Executive and Daily Life Functioning Influence the Relationship Between ADHD and Mood Symptoms in University Students. Journal of attention disorders. 2020 Jan 23:1087054719900251. PMID: 31971050. doi: 10.1177/1087054719900251.

39. Oh Y, Yoon HJ, Kim JH, Joung YS. Trait Anxiety as a Mediator of the Association between Attention Deficit Hyperactivity Disorder Symptom Severity and Functional Impairment. Clinical psychopharmacology and neuroscience : the official scientific journal of the Korean College of Neuropsychopharmacology. 2018 Nov 30;16(4):407-14. PMID: 30466213. doi: 10.9758/cpn.2018.16.4.407.

40. Hollocks MJ, Lerh JW, Magiati I, Meiser-Stedman R, Brugha TS. Anxiety and depression in adults with autism spectrum disorder: a systematic review and meta-analysis. Psychological medicine. 2019 Mar;49(4):559-72. PMID: 30178724. doi: 10.1017/s0033291718002283.

41. Jarrett MA. Attention-deficit/hyperactivity disorder (ADHD) symptoms, anxiety symptoms, and executive functioning in emerging adults. Psychological assessment. 2016 Feb;28(2):245-50. PMID: 26121381. doi: 10.1037/pas0000190.

42. Howlin P, Magiati I. Autism spectrum disorder: outcomes in adulthood. Current opinion in psychiatry. 2017 Mar;30(2):69-76. PMID: 28067726. doi: 10.1097/yco.0000000000000308.

43. Rana W, Mukhtar S, Mukhtar S. Mental health of medical workers in Pakistan during the pandemic COVID-19 outbreak. Asian journal of psychiatry. 2020 Jun;51:102080. PMID: 32283512. doi: 10.1016/j.ajp.2020.102080.

44. Singh R, Subedi M. COVID-19 and stigma: Social discrimination towards frontline healthcare providers and COVID-19 recovered patients in Nepal. Asian journal of psychiatry. 2020;53:102222-. PMID: 32570096. doi: 10.1016/j.ajp.2020.102222.

45. Abdel Wahed WY, Hefzy EM, Ahmed MI, Hamed NS. Assessment of Knowledge, Attitudes, and Perception of Health Care Workers Regarding COVID-19, A Cross-Sectional Study from Egypt. J Community Health. 2020;45(6):1242-51. PMID: 32638199. doi: 10.1007/s10900-020-00882-0.

46. Chatterjee SS, Bhattacharyya R, Bhattacharyya S, Gupta S, Das S, Banerjee BB. Attitude, practice, behavior, and mental health impact of COVID-19 on doctors. Indian J Psychiatry. 2020 May-Jun;62(3):257-65. PMID: 32773868. doi: 10.4103/psychiatry.IndianJPsychiatry_333_20.

47. Zhang C, Yang L, Liu S, Ma S, Wang Y, Cai Z, et al. Survey of Insomnia and Related Social Psychological Factors Among Medical Staff Involved in the 2019 Novel Coronavirus Disease Outbreak. Frontiers in psychiatry. 2020;11:306. PMID: 32346373. doi: 10.3389/fpsyt.2020.00306.

48. Du J, Dong L, Wang T, Yuan C, Fu R, Zhang L, et al. Psychological symptoms among frontline healthcare workers during COVID-19 outbreak in Wuhan. General hospital psychiatry. 2020 Nov-Dec;67:144-5. PMID: 32381270. doi: 10.1016/j.genhosppsych.2020.03.011.

49. Epstein Y, Heled Y, Ketko I, Muginshtein J, Yanovich R, Druyan A, et al. The effect of air permeability characteristics of protective garments on the induced physiological strain under exercise-heat stress. The Annals of occupational hygiene. 2013 Aug;57(7):866-74. PMID: 23378525. doi: 10.1093/annhyg/met003.

50. Davey SL, Lee BJ, Robbins T, Randeva H, Thake CD. Heat stress and PPE during COVID-19: impact on healthcare workers' performance, safety and well-being in NHS settings. The Journal of hospital infection. 2021 Feb;108:185-8. PMID: 33301841. doi: 10.1016/j.jhin.2020.11.027.

51. Mo Y, Deng L, Zhang L, Lang Q, Liao C, Wang N, et al. Work stress among Chinese nurses to support Wuhan in fighting against COVID-19 epidemic. Journal of nursing management. 2020 Jul;28(5):1002-9. PMID: 32255222. doi: 10.1111/jonm.13014.

52. Salari N, Khazaie H, Hosseinian-Far A, Khaledi-Paveh B, Kazeminia M, Mohammadi M, et al. The prevalence of stress, anxiety and depression within front-line healthcare workers caring for COVID-19 patients: a systematic review and meta-regression. Human resources for health. 2020 Dec 17;18(1):100. PMID: 33334335. doi: 10.1186/s12960-020-00544-1.

53. Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. JAMA network open. 2020 Mar 2;3(3):e203976. PMID: 32202646. doi:

10.1001/jamanetworkopen.2020.3976.

54. Lu W, Wang H, Lin Y, Li L. Psychological status of medical workforce during the COVID-19 pandemic: A cross-sectional study. Psychiatry research. 2020 Jun;288:112936. PMID: 32276196. doi: 10.1016/j.psychres.2020.112936.

55. Fukase Y, Ichikura K, Murase H, Tagaya H. Depression, risk factors, and coping strategies in the context of social dislocations resulting from the second wave of COVID-19 in Japan. BMC Psychiatry. 2021 Jan 12;21(1):33. PMID: 33435930. doi: 10.1186/s12888-021-03047-y.

56. Kuang Y, Shen M, Wang Q, Xiao Y, Lv C, Luo Y, et al. Association of outdoor activity restriction and income loss with patient-reported outcomes of psoriasis during the COVID-19 pandemic: A web-based survey. Journal of the American Academy of Dermatology. 2020 Aug;83(2):670-2. PMID: 32407741. doi: 10.1016/j.jaad.2020.05.018.

57. Shevlin M, McBride O, Murphy J, Miller JG, Hartman TK, Levita L, et al. Anxiety, depression, traumatic stress and COVID-19-related anxiety in the UK general population during the COVID-19 pandemic. BJPsych open. 2020 Oct 19;6(6):e125. PMID: 33070797. doi: 10.1192/bjo.2020.109.

58. Witteveen D, Velthorst E. Economic hardship and mental health complaints during COVID-19. Proceedings of the National Academy of Sciences of the United States of America. 2020 Nov 3;117(44):27277-84. PMID: 33046648. doi: 10.1073/pnas.2009609117.

59. Tan BYQ, Chew NWS, Lee GKH, Jing M, Goh Y, Yeo LLL, et al. Psychological Impact of the COVID-19 Pandemic on Health Care Workers in Singapore. Annals of internal medicine. 2020 Aug 18;173(4):317-20. PMID: 32251513. doi: 10.7326/m20-1083.

60. Ide K, Asami T, Suda A, Yoshimi A, Fujita J, Nomoto M, et al. The psychological effects of COVID-19 on hospital workers at the beginning of the outbreak with a large disease cluster on the Diamond Princess cruise ship. PloS one. 2021;16(1):e0245294. PMID: 33428676. doi: 10.1371/journal.pone.0245294.

61. Cag Y, Erdem H, Gormez A, Ankarali H, Hargreaves S, Ferreira-Coimbra J, et al. Anxiety among front-line health-care workers supporting patients with COVID-19: A global survey. General hospital psychiatry. 2021 Jan-Feb;68:90-6. PMID: 33418193. doi: 10.1016/j.genhosppsych.2020.12.010.

62. García-Fernández L, Romero-Ferreiro V, López-Roldán PD, Padilla S, Calero-Sierra I, Monzó-García M, et al. Mental health impact of COVID-19 pandemic on Spanish healthcare workers. Psychological medicine. 2020 May 27:1-3. PMID: 32456735. doi: 10.1017/s0033291720002019.

63. Anda RF, Williamson DF, Escobedo LG, Mast EE, Giovino GA, Remington PL. Depression and the dynamics of smoking. A national perspective. Jama. 1990 Sep 26;264(12):1541-5. PMID: 2395193.

64. de Wit L, Luppino F, van Straten A, Penninx B, Zitman F, Cuijpers P. Depression and obesity: a meta-analysis of community-based studies. Psychiatry research. 2010 Jul 30;178(2):230-5. PMID: 20462641. doi: 10.1016/j.psychres.2009.04.015.

65. Piccinelli M, Wilkinson G. Gender differences in depression. Critical review. The British journal of psychiatry : the journal of mental science. 2000 Dec;177:486-92. PMID: 11102321. doi: 10.1192/bjp.177.6.486.

66. McLean CP, Asnaani A, Litz BT, Hofmann SG. Gender differences in anxiety disorders: prevalence, course of illness, comorbidity and burden of illness. Journal of psychiatric research. 2011 Aug;45(8):1027-35. PMID: 21439576. doi: 10.1016/j.jpsychires.2011.03.006.

67. Felmingham K, Williams LM, Kemp AH, Liddell B, Falconer E, Peduto A, et al. Neural responses to masked fear faces: sex differences and trauma exposure in posttraumatic

stress disorder. Journal of abnormal psychology. 2010 Feb;119(1):241-7. PMID: 20141261. doi: 10.1037/a0017551.

68. McLaren HJ, Wong KR, Nguyen KN, Mahamadachchi KND. Covid-19 and women's triple burden: Vignettes from Sri Lanka, Malaysia, Vietnam and Australia. Social Sciences. 2020;9(5):87.

69. Racine N, Hetherington E, McArthur BA, McDonald S, Edwards S, Tough S, et al. Maternal depressive and anxiety symptoms before and during the COVID-19 pandemic in Canada: a longitudinal analysis. The lancet Psychiatry. 2021 Mar 24. PMID: 33773109. doi: 10.1016/s2215-0366(21)00074-2.

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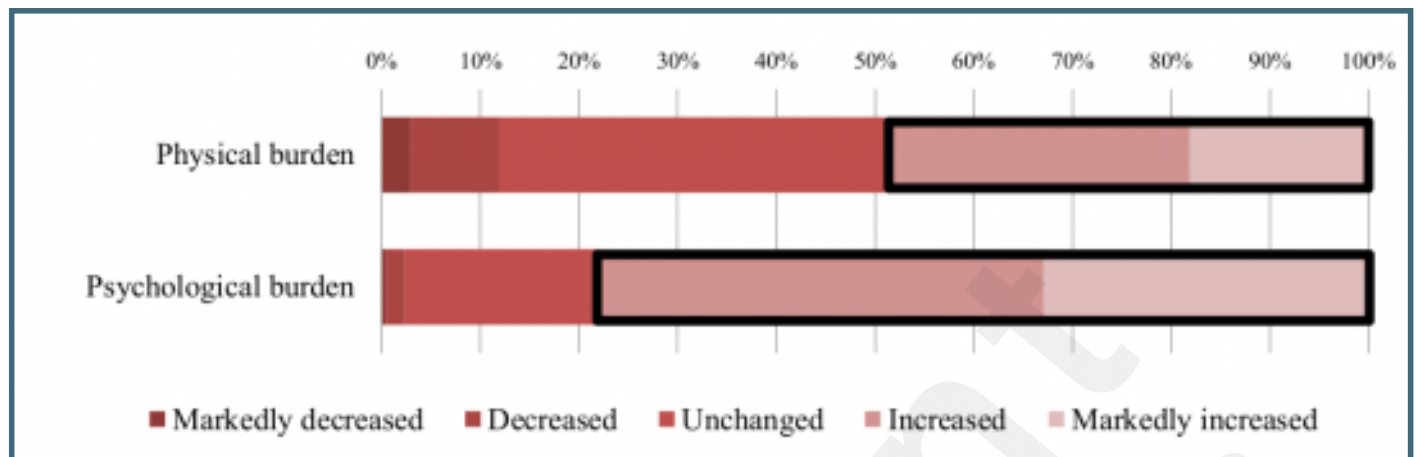
Supplementary Files

Figures

Epidemic curve of COVID-19 in Japan until October 2020. The bar graph shows the epidemic curve displaying the number of patients. The red line shows the cumulative number of deaths.
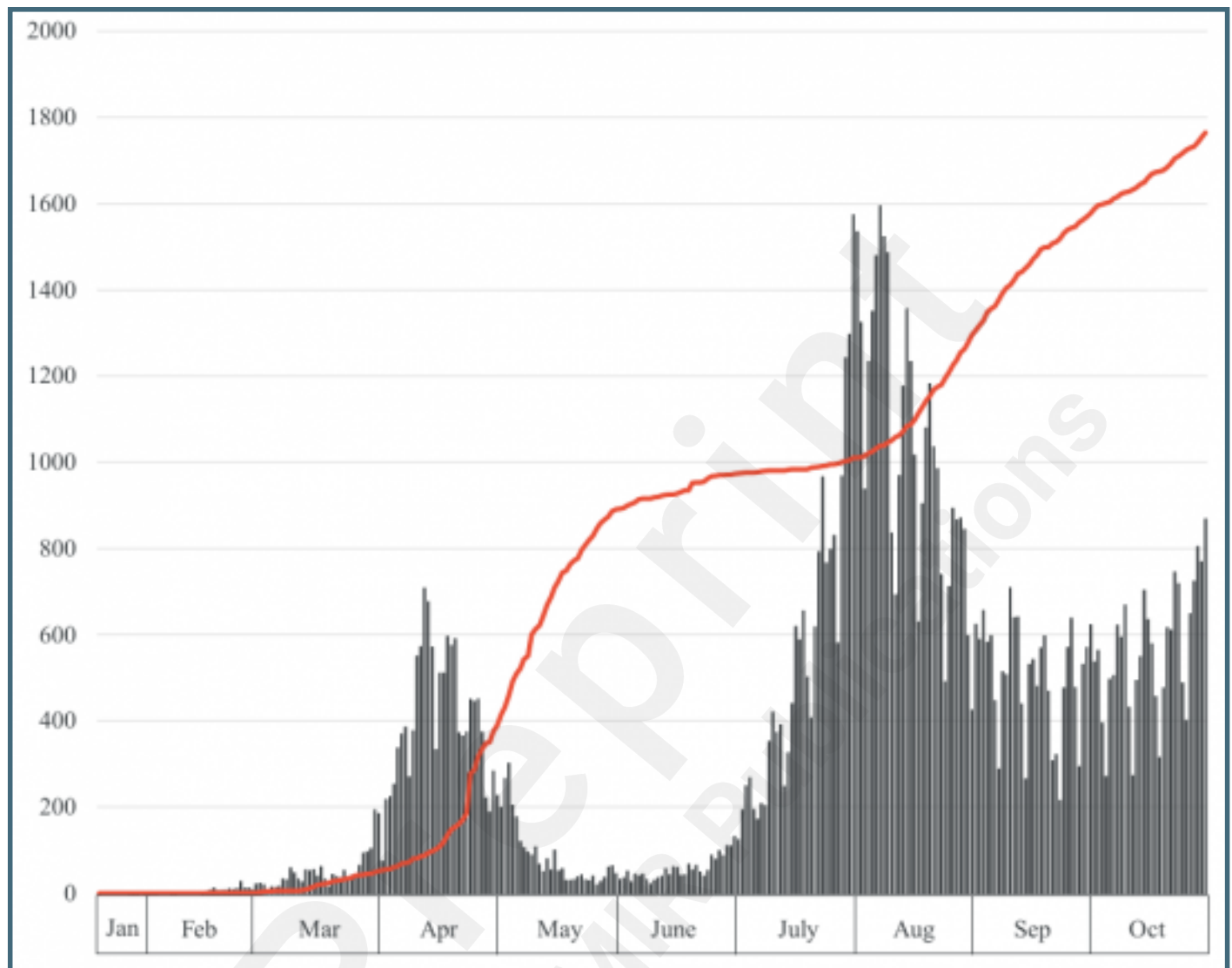
Changes in physical and psychological burden. The bold square shows an increase in physical and psychological burden.

Changes in life circumstances. The bold square shows a decrease of less than 90%.
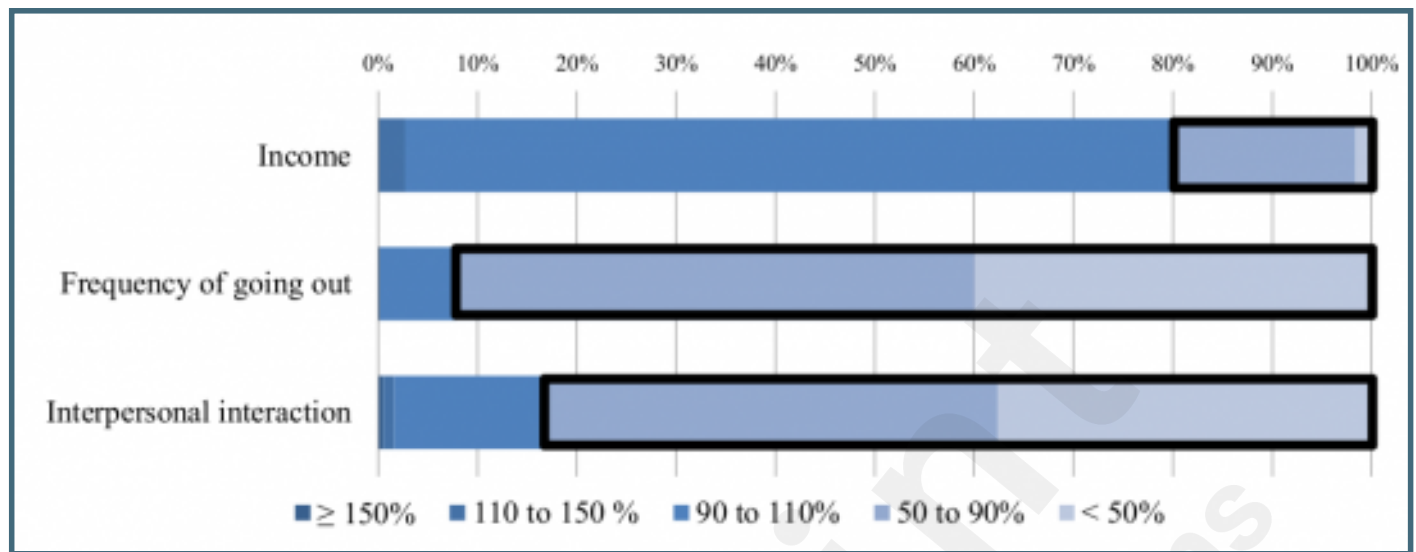
Multimedia Appendixes

Multiple linear regression model predicting depressive symptoms.
URL: http://asset.jmir.pub/assets/eee3124221b744bfaa72519a5c788dc0.pdf

Multiple linear regression model predicting anxiety symptoms.
URL: http://asset.jmir.pub/assets/d4bfc25ec0fb9d9db648a44ffba565d2.pdf