

MENTAL HEALTH SYMPTOMS, ANXIETY AND DEPRESSION LEVELS OF PHYSICIANS AND DENTISTS FROM TURKEY DURING THE COVID-19 PANDEMIC: THE IMPORTANCE OF PRE-PANDEMIC PSYCHOPATHOLOGY

İtir Tarı Cömert¹, Haşim Ercan Özmen², & Zeynep Yıldız³

¹Fatih Sultan Mehmet Vakıf University Psychology Department / Associate Prof (Turkey)

²Fatih Sultan Mehmet Vakıf University Psychology Department / Professor (Turkey)

³Fatih Sultan Mehmet Vakıf University Psychology Department / PhD (Turkey)

Abstract

The aim of this cross-sectional online study is to evaluate depression, anxiety, stress levels and COVID-related anxiety of the physicians and dentists in Turkey during COVID-19 Pandemic. Using the snowball sampling method, data is collected via sociodemographic question form, Depression, Anxiety and Stress Scale, Beck Hopelessness Scale, COVID-19 Anxiety Scale and Obsession with COVID-19 Scale. According to DASS-42, more than half of the participants were free of significant depression and stress (59.4% and 62.1%, respectively) while approximately half was free of significant anxiety (49.8%). The physical and mental well-being of the health care workers is very important when we are facing COVID-19 Pandemic. The well-being of the care givers will effect patients speed of recovery.

Keywords: *Pandemics, COVID-19, mental health, physicians.*

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic caused by the 2019 novel coronavirus (2019-nCoV) has been affecting countries, including Turkey, since March 2020 (World Health Organization, 2020, Zhu et al. 2020). The COVID-19 pandemic is having negative effects on societies' mental health both due to pandemic itself and due to the measures taken to limit its spread (Nokhodian et al. 2020, Tian et al. 2020). Health care workers (HcWs) across the world face an immense pressure to help control the spread of the pandemic, maintain an adequate level of care for patients with other diseases and protect themselves and their loved ones from the effects of the pandemic. El-Hage et al reported that rapid spread, severity of symptoms, lack of knowledge of disease, deaths among health care workers, organizational problems including lack of required equipment, changes in daily and social routines, feeling isolated, uncertain, stigmatized along with overwhelming workload as factors negatively affecting mental health of HcWs (El-Hage et al. 2020). Previous studies conducted on Turkish HcWs have reported elevated depression, anxiety and stress levels (Erkal Aksoy and Koçak 2020, Murat, Köse and Savaşer 2020, Şahin et al. 2020, Tengilimoğlu et al. 2020, Yörük and Güler 2020). Tengilimoğlu et al. reported that the major cause of anxiety/ stress among participants was potential of contamination to their family members (86.9%). According to their results, female HcWs and those working at pandemic, emergency and working in an internal medical sciences department displayed significantly elevated depression, anxiety, stress levels (Tengilimoğlu et al. 2020). Alan et al. reported that altruism and perception of being a hero by their patients did not compensate for the negative effects of the pandemic on mental health of Turkish HcWs. Elevated levels of anxiety/stress may be related with younger age, less experience, female gender, working at emergency/intensive care units, working actively with COVID-19 patients, experiential avoidance, fear of consequences of COVID-19, comorbid psychopathology, limited social supports and lack of training (Alan et al. 2020, Nokhodian et al. 2020, Yörük and Güler 2020). On the other hand, adequate sleep and exercise, psychological resilience, social supports, emotional stability, conscientiousness may reduce mental health problems experienced by HcWs (Bozdağ and Ergun 2020, Gokdemir et al.2020).

2. Materials and methods

The present study is part of an exploratory cross-sectional online project designed to evaluate the mental health status of physicians and dentists during COVID-19 pandemic in Turkey. Between May 2020 and September 2020, 828 participants answered the questions anonymously. An electronic survey form was produced in Google Forms and the form link was distributed through social media groups established for physicians and dentists. Snowball sampling methodology was used whereby participants were encouraged to share the link with their colleagues. Informed consent was obtained from participants. Ethical approval was obtained from the Fatih Sultan Mehmet Vakif University Ethics Committee (Date: 21.05.2020, No: 9) and all the study procedures were in accordance with the Declaration of Helsinki and local laws.

COVID-19 status assessment: Participants were evaluated by questions related to COVID-19 (COVID-19 diagnosis, place of treatment, any first degree relative with COVID-19 etc).

Depression, Anxiety and Stress Scale (DASS-42): The DASS-42 was used to measure depression, anxiety, stress levels within the past week. The validation study of the Turkish version of DASS-42 reported a Cronbach's alpha of 0.92 for depression, 0.7 for anxiety, and 0.68 for stress (Lovibond and Lovibond, 1995; Bilgel and Bayram, 2010).

Beck Hopelessness Scale (BHS): This 20-item scale has three (emotional, motivational, cognitive) factors and was developed to evaluate perceived levels of hopelessness about future events (Beck et al. 1974). The Turkish version was found to be reliable and valid previously (Durak 1994).

COVID-19 Anxiety Scale (CAS) and Obsession with COVID-19 Scale (OCS): Both CAS and OCS were developed by Lee to evaluate dysfunctional anxiety and ruminations related to COVID-19. CAS includes five likert-type items while OCS consists of four items. Turkish versions of CAS and OCS were found to be valid and reliable previously (Lee, 2020a; Lee, 2020b; Evren et al. 2020).

The data was entered into a database prepared via SPSS (IBM Inc., Armonk, NY) Version 22.0. Nominal data were summarized as counts and frequencies while quantitative data were summarized either as means and standard deviations or medians and inter-quartile ranges depending on assumptions of normality. Distribution of nominal data across groups were compared with chi square tests while T test for independent groups was used for comparing quantitative data. Ordinal and logistic regression analyses were used to determine predictors of depression, anxiety and stress levels. p was set at 0.05 (two-tailed).

3. Findings

Within the specified time frame 828 participants (75.2% female) with a mean age of 41.5 years (SD = 6.7) were enrolled in the study. Specialties of participants were listed as internal medical sciences (69.9%), dentistry (12.9%) and surgical medical sciences (12.0%). Most common sub-specialties for physicians were listed as pediatrics (5.8%, n = 48), family medicine (4.2%, n = 35), anesthesiology (3.5%, n = 29), child and adolescent psychiatry (3.5%, n = 29) and psychiatry (2.7%, n = 22). Most common places of work were universities/ training hospitals (26.0%, n = 215), family health centers (22.6%, n = 187) and state hospitals (16.4%, n = 136). Two hundred ninety-four participants (35.5%) were working actively with COVID-19 patients. Thirty-seven participants (4.5%) started to live away from home during the pandemic to protect their family while another 36 (6.1%) reported that their HcW partners did the same. Most were living with their families and children at the time of participation (90.8%, n = 752). Less than half of the partners of participants (41.4%, n = 343) were HcWs themselves and almost one-fifth of partners (17.6%, n = 129) were also working with COVID-19 patients. Two hundred thirty-seven participants (28.6%) reported having chronic medical disorders requiring treatment (vs. 22.2% of partners). One hundred four participants (12.6%) reported having psychopathology requiring treatment in themselves prior to the pandemic. Most common psychopathologies before the pandemic were depressive spectrum disorders (5.6%, n = 46), generalized anxiety disorder (5.4%, n = 45), and panic disorder (1.2%, n = 10). Regardless of previous psychopathology, 199 participants (24.0%) reported requiring psychiatric support during the pandemic while only 46 (23.1%) could access it. Mean time to access psychiatric support since the start of the pandemic precautions in Turkey was 30.0 (SD = 25.8) days. Of those who accessed professional service during the pandemic, 17.4% (n = 8) received new psychiatric diagnoses. Novel diagnoses included acute stress disorder (ASD), generalized anxiety disorder (GAD), major depressive disorder (MDB), obsessive compulsive disorder (OCD), panic disorder (PD) and social phobia (SP) [GAD: n = 4, (50%); PD: n = 1, (12.5%); GAD+MDB: n = 1 (12.5%); GAD+OCD: n = 1, (12.5%), ASD+OCD+SP: n = 1 (12.5%)]. DASS-42, BHS, CAS and OCS were used in evaluations. According to DASS-42, more than half of participants were free of significant depression and stress (59.4%, n = 492 and 62.1%, n = 514, respectively) while almost half was free of significant anxiety (49.8%, n = 412). Mean score of participants in BHS was 11.4 (SD = 10.2). According to BHS cut-off scores more than half of participants (54.3%, n = 450) were free of clinically significant

depressive symptoms. Mild, moderate, severe depressive symptoms were found in 151 (18.2%), 156 (18.8%) and 71 (8.6%) participants, respectively. Mean CAS and OCS scores were 8.3 (SD = 1.4) and 8.4 (SD = 1.4), respectively. According to the CAS cut-off values, 140 participants (16.9%) reported significant anxiety symptoms related to COVID-19. Bivariate associations of sociodemographic and work-related variables with psychometric measures. In bivariate analyses, only participants specialized in internal medical sciences tended to have significant CAS scores, although this did not reach significance ($\chi^2 [8] = 15.8$, $p = 0.05$, Cramer's $V = 0.10$). Predictors of depression, anxiety and stress levels in DASS-42 scale were analyzed with ordinal logistic regression analyses. Actively working during the pandemic, working with COVID-19 patients, living with children at home, partners' actively working with COVID-19 patients, chronic diseases and premorbid psychopathology in participants and the need for mental health support during the pandemic were used as predictors. The model for DASS-42 Depression was statistically significant (AIC = 1869, BIC = 1935, Nagelkerke $R^2 = 0.075$, $\chi^2 [10] = 119$, $p < 0.001$) and could explain 7.5% of the variance in depression groups. Omnibus LR tests for premorbid psychopathology ($\chi^2 = 0.2$, $p = 0.007$) and the need for psychiatric support during the pandemic ($\chi^2 = 88.0$, $p < 0.001$). The model could differentiate no clinically significant depression from mild depression (OR = 2.6, $p = 0.011$), mild depression from moderate depression (OR = 6.5, $p < 0.001$), moderate depression from severe depression (OR = 17.4, $p < 0.001$) and severe depression from very severe depression (OR = 59.6, $p < 0.001$). The model for DASS-42 Anxiety was statistically significant (AIC = 2113, BIC = 2179, Nagelkerke $R^2 = 0.099$, $\chi^2 [10] = 175$, $p < 0.001$) and could explain 9.9% of the variance in anxiety groups. Omnibus LR tests for the need for psychiatric support during the pandemic ($\chi^2 = 142.8$, $p < 0.001$) was significant only. Chronic medical disorders in the participant ($\chi^2 = 3.1$, $p = 0.08$) and premorbid psychopathology ($\chi^2 = 3.8$, $p = 0.051$) failed to reach significance. The model could not differentiate no clinically significant anxiety from mild anxiety (OR = 1.8, $p = 0.098$). But it could differentiate mild from moderate anxiety (OR = 3.1, $p = 0.001$), moderate from severe anxiety (OR = 9.9, $p < 0.001$) and severe from very severe anxiety (OR = 27.1, $p < 0.001$). The model for DASS-42 Stress was statistically significant (AIC = 1764, BIC = 1830, Nagelkerke $R^2 = 0.096$, $\chi^2 [10] = 148$, $p < 0.001$) and could explain 9.6% of the variance in stress groups. Omnibus LR tests for actively working during the pandemic ($\chi^2 = 6.0$, $p = 0.014$), premorbid psychopathology ($\chi^2 = 5.2$, $p = 0.023$) and the need for psychiatric support during the pandemic ($\chi^2 = 107.9$, $p < 0.001$) were significant only. Chronic medical disorders in the participant ($\chi^2 = 2.9$, $p = 0.09$) failed to reach significance. The model could differentiate no clinically significant stress from mild stress (OR = 2.4, $p = 0.022$). It also could differentiate mild from moderate stress (OR = 5.1, $p < 0.001$), moderate from severe stress (OR = 16.3, $p < 0.001$) and severe from very severe stress (OR = 69.5, $p < 0.001$). The model for significant COVID-19 related anxiety (i.e. CAS above cut-off) was significant (Hosmer-Lemeshow, $\chi^2 [8] = 9.2$, $p = 0.329$), - 2LL = 211.4, Nagelkerke $R^2 = 0.210$) and could explain 21.0% of the variance. It could correctly classify 100.0% of participants with non-significant COVID-19 related anxiety and 0.0% of those with clinically significant anxiety. Predictive value of actively working during the pandemic, working with COVID-19 patients, living with children at home, partners' actively working with COVID-19 patients, chronic diseases and premorbid psychopathology in participants and the need for support during the pandemic for COVID-19 related anxiety and ruminations were evaluated with binary logistic regression analysis. The model for significant COVID-19 related ruminations (i.e. OCS above cut-off) was significant (Hosmer-Lemeshow, $\chi^2 [8] = 9.0$, $p = 0.343$), - 2LL = 555.9, Nagelkerke $R^2 = 0.107$) and could explain 10.7% of the variance. It could correctly classify 97.9% of participants with non-significant COVID-19 related ruminations and 11.1% of those with clinically significant ruminations. The need for psychiatric support during the pandemic was the only significant predictor while having a partner actively working with COVID-19 patients tended to increase the odds of COVID-19 related rumination.

4. Discussion

This cross-sectional, online study aimed to evaluate mental health symptoms, depression, anxiety and stress levels of physicians and dentists during the COVID-19 pandemic in Turkey. Most enrolled participants were female and worked in internal medical sciences. The majority were living in various metropolitan areas, located in western Turkey and more than one-third were working actively with COVID-19 patients. More than one-tenth were diagnosed with various psychopathologies prior to the pandemic and almost one-fourth reported need for psychosocial support during the pandemic, although few could access it. Most common symptoms reported during the pandemic were anxiety, tension, anhedonia. Approximately one-tenth reported severe depression and stress while approximately one-fifth reported severe anxiety related with COVID-19 according to self-reports. Depression, anxiety, stress was predicted significantly by premorbid psychopathology and the need for psychosocial support during the pandemic while COVID-19 related anxiety was significantly predicted by chronic medical disorders in the participant and the need for psychiatric support during the pandemic. HcWs across the world are forced to work under extremely difficult conditions owing to the COVID-19 virus outbreak (Greenberg et

al., 2020). The problems facing them include caring for patients with COVID-19 and those with other diseases while protecting themselves and their families from infection. The novelty of the pandemic, its severity, organizational problems, changes in daily living affect the mental health of HcWs (El-Hage et al. 2020). Previous studies on Turkish HcWs reported elevated levels of depression, anxiety, stress (Erkal Aksoy and Koçak 2020, Murat, Köse and Savaşer 2020, Şahin et al. 2020, Tengilimoğlu et al. 2020, Yörük and Güler 2020). The levels of clinically significant anxiety in previous studies conducted on Turkish HcWs varied between 7.7% and 22.6% depending on specialties of participants and psychometric measures (Şahin et al. 2020; Alan et al. 2020). According to those studies, limited availability of protective equipment, greater workload, female gender, premorbid psychopathology, working on the frontline with COVID-19 patients as a nurse or an internal medicine specialist, having chronic medical disorders and being tested for COVID-19 may be related with greater anxiety. Main sources of anxiety were potential infection of family members and themselves (Şahin et al. 2020; Tengilimoğlu et al. 2020; Yılmaz et al. 2020, Yörük and Güler 2020, Alan et al. 2020). Like those results, we found the rate of clinically significant anxiety in our sample as 16.9% (with CAS) and 19.0% (with DASS-42). Anxiety levels were associated with working as an internal medicine specialist, having premorbid psychopathology, need for psychiatric support during the pandemic and having chronic medical disorders. Most of our sample were female physicians and dentists, this may have affected our results (i.e., suppressing gender differences and differences with nurses). Our sample was skewed towards physicians who do not work as closely as nurses with COVID-19 patients and those working at the most affected institutions (e.g., city hospitals, Tengilimoğlu et al. 2020) were not sampled adequately. Also, the results may have changed had we required the participants to identify the sources of their anxiety in a forced choice format. Previous studies reported clinically significant levels of depression in Turkish HcWs between 6.2% and 31.8% depending on formation of samples (i.e., nurses reported elevated levels) and methods of evaluation (i.e., Depression, Anxiety and Stress Scale-21, DASS-42, Beck Depression Inventory, Patient Health Questionnaire-9 etc.) (Şahin et al. 2020, Tengilimoğlu et al. 2020, Alan et al. 2020, Yörük and Güler 2020). Depression risk was reported to be greater in females, nurses, frontline workers, HcWs with greater workloads, younger and older HcWs, those with poorer general health and from lower socio-economic status, those reporting premorbid psychopathology and need for psychosocial support during the pandemic (Şahin et al. 2020, Tengilimoğlu et al. 2020, Alan et al. 2020, Yörük and Güler 2020). Depression in HcWs was also associated with elevated anxiety and stress (Şahin et al. 2020, Tengilimoğlu et al. 2020). Partially supporting those results, we found the rate of clinically significant depression symptoms in our sample as 10.9% (with DASS-42) and 8.6% (with BHS). Presence of premorbid psychopathology and the need for psychosocial support during the pandemic were the only significant predictors of depression in our sample while we failed to find an effect of gender and other vocational and demographic variables on depression symptoms. Like anxiety, the discrepancies related with depression in our sample may be due to sampling and methodological bias. That is, a more heterogeneous sample of HcWs (e.g., physicians, nurses, dentists, pharmacists, assistant personnel) from more varied backgrounds may have led to differing results. Also, previous studies suggest that depression in Turkish HcWs may be related to burnout, anxiety, stress, rather than hopelessness (Şahin et al. 2020, Tengilimoğlu et al. 2020). Therefore, BHS may not be an adequate instrument to screen for depressive symptoms in such samples. Previous studies reported the rate of needing psychosocial support among Turkish HcWs during the COVID-19 pandemic between 10.2% and 42.6% (Erkal, Aksoy and Koçak 2020, Şahin et al. 2020). Supporting those results, 24.0% of our sample reported needing psychosocial supports during the pandemic while only 23.1% those reporting this need received help. Telepsychiatry may be a viable option in those interventions (Dursun et al. 2020). Our results should be evaluated within their limitations. Firstly, our results are valid for the initial phase of the pandemic in Turkey and may not be valid for the current sample of HcWs. Secondly, the use of online data collection methods may have affected our results and physicians working in rural areas and those not attending the online groups may not be enrolled. Also, nurses/ other health care personnel working in a variety of health care institutions were not adequately sampled. Thirdly, although we used reliable and valid measures, the measures we used may be affected by shared method variance (i.e. self-report), reporting and recall bias. Fourth, we did not evaluate the participants for psychopathology with clinical interviews and our rates of clinically significant symptoms depend on features of psychometric measures. Fifth, the cross-sectional nature of our study prevents hypotheses on causality. Lastly, rather than using snowball sampling we could have used stratified randomized sampling of HcWs which could have increased external validity.

References

- Alan, H., Bacaksiz, F. E., Tiryaki, S. H., Taskiran, E. G., & Gumus, E. (2020). "I'm a hero, but...": An evaluation of depression, anxiety, and stress levels of frontline healthcare professionals during COVID-19 pandemic in Turkey. *Perspectives in Psychiatric Care*, 1-11. <https://doi.org/10.1111/ppc.12666>

- Beck, A. T., Weissman, A., Lester, D., & Trexler, L. (1974). The measurement of pessimism: the hopelessness scale. *Journal of Consulting and Clinical Psychology*, 42(6), 861- 865. <https://doi.org/10.1037/h0037562>
- Bilgel, N., & Bayram, N. (2010). Turkish Version of the Depression Anxiety Stress Scale (DASS-42): Psychometric properties. *Archives of Neuropsychiatry*, 47(2), 118- 126. <https://doi.org/10.4274/npa.5344>
- Durak, A. (1994). The validity and reliability of the Beck Hopelessness Scale. *Turkish Journal of Psychology*, 9, 1–11.
- Dursun, O. B., Turan, B., Pakyürek, M., & Tekin, A. (2020). Integrating telepsychiatric services into the conventional systems for psychiatric support to health care workers and their children during COVID-19 pandemics: results from a national experience. *Telemedicine journal and e-health: the official journal of the American Telemedicine Association*, Advance online publication. <https://doi.org/10.1089/tmj.2020.0237>
- El-Hage, W., Hingray, C., Lemogne, C., Yroni, A., Brunault, P., Bienvenu, T., ... & Auizerate, B. (2020). Health professionals facing the coronavirus disease 2019 (COVID-19) pandemic: What are the mental health risks?. *Encephale*, 46(3S), 73-80. <https://doi.org/10.1016/j.encep.2020.04.008>
- Erkal Aksoy, Y., & Koçak, V. (2020). Psychological effects of nurses and midwives due to COVID-19 outbreak: The case of Turkey. *Archives of Psychiatric Nursing*, 34(5), 427- 433. <https://doi.org/10.1016/j.apnu.2020.07.011>
- Evren, C., Evren, B., Dalbudak, E., Topcu, M., & Kutlu, N. (2020). Measuring anxiety related to COVID-19: A Turkish validation study of the Coronavirus Anxiety Scale. *Death studies*, 1–7. Advance online publication. <https://doi.org/10.1080/07481187.2020.1774969>
- Gokdemir, O., Pak, H., Bakola, M., Bhattacharya, S., Hoedebecke, K., & Jelastopulu, E. (2020). Family Physicians' Knowledge about and Attitudes towards COVID-19 - A Cross-sectional Multicentric Study. *Infection & chemotherapy*, 52(4), 539–549. <https://doi.org/10.3947/ic.2020.52.4.539>
- Greenberg, N., Docherty, M., Gnanapragasam, S., & Wessely, S. (2020). Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *BMJ (Clinical research ed.)*, 368, m1211. <https://doi.org/10.1136/bmj.m1211>
- Lee, S. A. (2020b). How much “Thinking” about COVID-19 is clinically dysfunctional? *Brain, Behavior, and Immunity*, 87, 97–98. <https://doi.org/10.1016/j.bbi.2020.04.067>
- Lee, S. A. (2020a). Coronavirus Anxiety Scale: A brief mental health screener for COVID-19 related anxiety. *Death Studies*, 44(7), 393-401. <https://doi.org/10.1080/07481187.2020.1748481>
- Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour research and therapy*, 33(3), 335–343. [https://doi.org/10.1016/0005-7967\(94\)00075-u](https://doi.org/10.1016/0005-7967(94)00075-u)
- Murat, M., Köse, S., & Savaşer, S. (2020). Determination of stress, depression and burnout levels of front-line nurses during the COVID-19 pandemic. *International journal of mental health nursing*, 10.1111/inm.12818. Advance online publication.
- Nokhodian, Z., Ranjbar, M. M., Nasri, P., Kassaian, N., Shoaie, P., Vakili, B., ... & Ataei, B. (2020). Current status of COVID-19 pandemic; characteristics, diagnosis, prevention, and treatment. *Journal of Research in Medical Sciences: The Official Journal of Isfahan University of Medical Sciences*, 25(101), 1-44. https://doi.org/10.4103/jrms.JRMS_476_20
- Şahin, M. K., Aker, S., Şahin, G., & Karabekiroğlu, A. (2020). Prevalence of Depression, Anxiety, Distress and Insomnia and Related Factors in Healthcare Workers During COVID-19 Pandemic in Turkey. *Journal of Community Health*, 45: 1168–1177. <https://doi.org/10.1007/s10900-020-00921>
- Tengilimoğlu, D., Zekioglu, A., Tosun, N., Işık, O., & Tengilimoğlu, O. (2021). Impacts of COVID-19 pandemic period on depression, anxiety and stress levels of the healthcare employees in Turkey. *Legal medicine (Tokyo, Japan)*, 48, 101811. <https://doi.org/10.1016/j.legalmed.2020.101811>
- Tian, F., Li, H., Tian, S., Yang, J., Shao, J., & Tian, C. (2020). Psychological symptoms of ordinary Chinese citizens based on SCL-90 during the level I emergency response to COVID-19. *Psychiatry Research*, 288, 1-9. 112992. <https://doi.org/10.1016/j.psychres.2020.112992>
- World Health Organization. (2020). Coronavirus disease 2019 (COVID-19): situation report, 52. World Health Organization. <https://apps.who.int/iris/handle/10665/331476>
- Yörük, S., & Güler, D. (2021). The relationship between psychological resilience, burnout, stress, and sociodemographic factors with depression in nurses and midwives during the COVID-19 pandemic: A cross-sectional study in Turkey. *Perspectives in psychiatric care*, 57(1), 390–398. <https://doi.org/10.1111/ppc.12659>
- Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., ... & Tan, W. (2020). A novel coronavirus from patients with pneumonia in China, 2019. *New England Journal of Medicine*, 382(8), 727-733. <https://doi.org/10.1056/NEJMoa2001017>