



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.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

## REVIEW

## Coronavirus disease 2019 (COVID-19) and global mental health

Klaus W. Lange\*

Institute of Psychology, University of Regensburg, Regensburg, Bavaria 93040, Germany



## ARTICLE INFO

**Article history:**

Received 14 July 2020

Received in revised form 5 November 2020

Accepted 1 February 2021

Available online 13 February 2021

**Keywords:**

Coronavirus disease 2019 (COVID-19)

Mental health

Prevention

Treatment

Task shifting

Digital technology

## ABSTRACT

The mental health effects of the coronavirus disease 2019 (COVID-19) pandemic may shape population health for many years to come. Failure to address the mental health issues stemming from the pandemic is likely to prolong its impact. The COVID-19 pandemic has created a significant global challenge and, in lower-income countries, even a disruption of mental health services. Given our experience with previous pandemics, the present COVID-19 crisis can be expected to cause psychological trauma, and steps are needed to address this issue proactively. Policies focusing on the long-term mental health consequences of COVID-19 may equal the importance of those currently seeking to mitigate its physical effects. The implications of the COVID-19 pandemic for mental health call for a greater focus on the needs of those with mental disorders and on mental health issues affecting health care workers and the general public. Timely preventive and therapeutic mental health care is essential in addressing the psychosocial needs of populations exposed to the pandemic. In addition to specialist care, “task-shifting” and digital technologies may provide cost-effective means of providing mental health care in lower-income countries worldwide as well as in higher-income countries with mental health services overwhelmed by the effects of the COVID-19 pandemic. In view of the ever-increasing pressure on global health systems resulting from the COVID-19 pandemic, adopting and adapting “task-shifting”, i.e., the delegation of psychotherapeutic interventions to trained non-specialists, as an element of the provision of mental health services, is overdue. Digital technologies can be used to enhance social support and facilitate resilience to the detrimental mental health effects of the pandemic; they may also offer an efficient and cost-effective way to provide easy access to mental health care.

**1. Mental health in coronavirus disease 2019 (COVID-19) patients**

The novel infectious COVID-19, caused by the previously unknown severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2, previously provisionally named 2019 novel coronavirus or 2019-nCoV), is typically characterised by clinical symptoms affecting the respiratory system, such as cough, fever, respiratory problems and, in severe cases, atypical pneumonia.<sup>1</sup> However, SARS-CoV-2 also appears to affect the cardiovascular, gastrointestinal and urinary systems<sup>2</sup> and has been reported to pose a general threat to the central and peripheral nervous system.<sup>3</sup> SARS-CoV-2 might infect the brain or cause immune responses that could adversely affect the human nervous system and brain function. Neurological manifestations of SARS-CoV-2 infection may be the result of various mechanisms, such as direct infection of the brain, virus-induced hyperinflammatory and hypercoagulable states as well as postinfectious immune-mediated processes.<sup>3</sup>

As is the case with other coronaviruses causing severe respiratory syndromes, i.e., the severe acute respiratory syndrome (SARS) and

the Middle East respiratory syndrome (MERS), SARS-CoV-2 is likely to be biologically neurotropic and clinically neurotoxic.<sup>4</sup> SARS and MERS were found to be associated with psychiatric and neuropsychiatric presentations. In the acute phase of SARS and MERS, common psychiatric symptoms included confusion, depressed mood, anxiety, panic attacks, psychotic symptoms and delirium.<sup>5–7</sup> In the post-illness stage, depression, anxiety, irritability, memory impairment, fatigue, insomnia and post-traumatic stress disorder were frequently reported.<sup>7</sup> Neurological manifestations observed to be related to COVID-19 include hyposmia, dysgeusia, encephalitis, meningitis and acute cerebrovascular disease.<sup>8–9</sup> In a consecutive series of 58 patients in France, acute respiratory distress syndrome due to SARS-CoV-2 infection was associated with encephalopathy, prominent agitation and confusion as well as corticospinal tract signs, and a small number of patients suffered single acute ischemic strokes.<sup>10</sup> In a nationwide surveillance study of acute neurological and psychiatric complications of COVID-19 performed in the United Kingdom, altered mental status was the second most common presentation, involving encephalopathy or

\* Corresponding author: [klaus.lange@ur.de](mailto:klaus.lange@ur.de).

encephalitis and primary psychiatric diagnoses, such as new-onset psychosis, neurocognitive (dementia-like) syndrome and affective disorder; almost half of the patients with altered mental status were younger than 60 years.<sup>11</sup>

Psychological responses observed during previous large-scale outbreaks of rapidly spreading infectious diseases can provide insights into their impact on mental health problems.<sup>12</sup> During the outbreak of the Ebola virus disease epidemic from 2014 to 2016, fear-related behaviours were found to hamper public health efforts and impede the recovery of survivors.<sup>13</sup> Persistent distress has frequently been reported in follow-up studies of infectious disease survivors. For example, anxiety, depression and post-traumatic stress disorder were observed in almost half of the survivors of Ebola virus disease.<sup>13</sup> Most survivors of an outbreak of Legionnaires' disease were reported, after 17 months, to be experiencing persistent symptoms, such as fatigue and neurological and neuromuscular symptoms, and post-traumatic stress disorder was found in 15%.<sup>14</sup> Compared with controls, SARS survivors showed higher stress levels during the SARS outbreak, which were found one year later to have persisted unabated, and survivors also presented with increased levels of depression, anxiety and post-traumatic symptoms.<sup>15</sup> Almost a quarter of those surviving acute respiratory distress syndrome were found to have post-traumatic stress disorder at 8-year follow-up.<sup>16</sup>

If COVID-19 follows a similar course to that of infection with the SARS or MERS coronaviruses, depression, anxiety, fatigue and post-traumatic stress disorder may be expected in the longer term.<sup>7</sup> Mental disorder comorbidities in COVID-19 patients are likely to make the treatment of these individuals more challenging and potentially less effective.<sup>17</sup>

## 2. Mental health in health care providers

Health professionals caring for COVID-19 patients are vulnerable not only to a high risk of infection but also to mental health problems. The high level of exposure of front-line health care workers to the virus and to COVID-19-related traumatic events, together with the need to make difficult decisions, puts them at particular risk of stress responses.<sup>18-19</sup> In healthcare workers, quarantine was shown to be positively associated with avoidance behaviours, such as absence from work or minimising direct contact with patients.<sup>20</sup> Furthermore, healthcare workers showed more severe symptoms of post-traumatic stress following quarantine than did members of the general public.<sup>21</sup> Three years after the outbreak of SARS, dependency symptoms and alcohol abuse in health-care workers were also associated with having been quarantined.<sup>22</sup> Health professionals who worked in SARS units and hospitals during the SARS outbreak also experienced emotional distress and showed symptoms of post-traumatic stress symptoms, anxiety and depression.<sup>5,23-25</sup> During the outbreaks of SARS, health care worker SARS survivors showed stress levels similar to those of SARS survivors not working in health care; one year later; however, they had significantly higher stress levels and higher depression, anxiety and post-traumatic symptom scores.<sup>26</sup>

## 3. Mental health in the general population

Unprecedented physical distancing measures have been introduced in countries all over the world in an attempt to mitigate the spread of SARS-CoV-2. The resulting economic and societal shutdowns and changes in normal behavioural patterns will have short- and long-term consequences for wellbeing and mental health. Central areas of social connection, interaction and support are significantly affected by the closure of sports facilities, restaurants, libraries as well as cultural and community centres. Business and school closures will lead to greater isolation, loss of employment, income insecurity and financial distress, which are linked to an increased mental health burden and poor mental health outcomes. Fear-related behaviours, such as extreme avoidance of social contact, will also contribute significantly to the risk of mental health

problems.<sup>27</sup> All of these factors may influence the short- and long-term trajectory of the pandemic.

Large-scale natural, environmental or traumatic disasters are often accompanied by increased rates of depression, post-traumatic stress disorder and substance use disorder; domestic violence and child abuse are also commonly seen.<sup>28</sup> Evidence from previous infectious outbreaks has shown the deleterious effects of social isolation on mental health.<sup>29-30</sup> In the COVID-19 pandemic, physical distancing and confinement to indoor spaces during economic lockdowns may be associated with an increase in the prevalence of depression and suicidality among all age groups.<sup>31-32</sup> A large-scale nationwide survey of psychological distress in the general population of China during the COVID-19 epidemic reported a wide variety of psychological problems, such as panic disorder, anxiety and depression.<sup>33</sup> Almost doubled rates of anxiety and depression were reported for adults from the general population affected by quarantine.<sup>34</sup> A survey from the United Kingdom reported that, in the general population, a wide range of issues relating to the social and psychological aspects of the COVID-19 pandemic, such as the effects of physical distancing and social isolation, loss of employment or financial problems, were of greater concern than the prospect of infection with the virus.<sup>35</sup> The prevalence of reported symptoms of psychological distress among adults in the United States was shown to be increased in 2020 during the COVID-19 pandemic compared to 2018.<sup>36</sup> The prevalence of pandemic-related mental health issues appears to be increasing rapidly. In May 2020, the U.S. Census Bureau Household Pulse Survey found a spike in symptoms of anxiety and depression since late April 2020, with a third of Americans reporting clinically significant symptoms.<sup>37</sup> In comparison, only 11% of Americans had reported these symptoms in a similar survey in the first three months of 2019. In addition to the potentially fatal outcome of infection with the novel coronavirus, "deaths of despair" may result from the impact of COVID-19 on mental health. For example, it has been estimated that by 2029 between 27,000 and 154 000 additional deaths due to mental health issues related to the economic consequences of COVID-19, mainly alcohol and drug misuse and suicide, may occur in the United States.<sup>38</sup> In particular, physical distancing and social isolation create challenges for vulnerable older individuals and may take a heavy toll on their mental and physical health.<sup>39</sup> A decrease in cognitive stimulation, which is usually associated with contact with other people or the wider world, may worsen behavioural and cognitive symptoms of dementia. Social isolation and loneliness of extended duration in older people appear to increase the risk of depression, suicide and dementia.<sup>40</sup>

The detrimental consequences of physical distancing measures are sufficiently serious to warrant the immediate introduction of psychological interventions addressing the mental health impact of the pandemic at both individual and population levels.<sup>41</sup> The National Health Commission of China has published basic principles for emergency psychological crisis interventions for COVID-19,<sup>42</sup> and both the World Health Organisation and Mental Health UK have issued psychological first aid guidance.<sup>43-44</sup>

The current efforts to mitigate the short-term effects of COVID-19 and to save lives are undoubtedly necessary. However, focusing on the long-term mental health consequences may also be important. Physical distancing and social isolation are likely to have adverse psychological effects, particularly in high-risk individuals. However, little is known concerning the nature, extent, duration and distribution of the effects of the pandemic on mental health. To date, epidemiological data on the mental health problems of people with COVID-19, their health care providers and the general population is not available. Consequently, the most effective response to these COVID-19-related issues is, at present, unclear, and the need to collect reliable and representative data on the mental health effects of COVID-19 in both vulnerable groups and whole populations is pressing.<sup>45-46</sup>

As described above, major public mental health challenges during the COVID-19 pandemic include the protection of those with mental disorders from COVID-19 and the associated consequences, the

psychological needs of health care providers and the deterioration in mental wellbeing and increase in mental disorders in the entire population.<sup>47</sup> Population-wide implementation of effective public mental health interventions is required to ameliorate the anticipated exacerbation of mental disorders resulting from the pandemic. In regard to therapeutic approaches, stepped care will be useful. This involves an initial delivery of the most effective, least resource-consuming treatment to individuals in need, and subsequently a stepping up to more resource-demanding therapy tailored to patients' needs.<sup>48</sup>

In consideration of the markedly increased demand for mental health services during the pandemic, approaches allowing population-wide delivery of these services in areas with limited available resources are urgently needed. In order to reduce the risk of infection with SARS-CoV-2, virtual care using digital technologies has increasingly been adopted by health care personnel worldwide.<sup>49</sup> Digital technologies available through worldwide web and electronic devices may also be of use in mental health care. Another strategy may be "task-switching", i.e., the delegation of psychotherapeutic interventions to trained non-specialists.

#### 4. "Task-shifting" in mental health care

Ideally, multidisciplinary mental health teams, consisting of psychiatrists, psychiatric nurses and clinical psychologists, should deliver mental health services. Most patients and health workers affected by COVID-19 present with adaptive emotional and behavioural responses to high levels of stress, and, thus, psychotherapy techniques based on the stress-adaptation model may be useful.<sup>6,50</sup> In severe cases of mental illness, treatment by specialists is required. However, experience with disaster relief has shown that certain aspects of therapy for mental disorders can be delegated to non-specialists. This concept is known as "task-shifting". For example, lay persons can be trained to treat mild-to-moderate depression and anxiety. When too few psychiatrists are available, these lay workers may play a useful role in the care of those most in need, such as the suicidal. Task-shifting could also be employed to support health care providers in hospitals and isolation units, where most health professionals receive no training in mental health care.

An example of successful task-shifting was the innovative health care system introduced in China in the 1960s to ensure that people living in rural communities received basic medical care.<sup>51</sup> This system relied on large numbers of lay people, who received a modicum of medical and paramedical training, enabling them to provide prenatal care and to treat common infectious diseases.<sup>52-53</sup> While these community health workers lacked the medical expertise of doctors, their provision of basic low-cost health care was crucial in rural areas. This approach of community generalism rather than hospital specialism has demonstrated that many diseases in poor countries can be prevented and treated without significant financial resources, provided that appropriate policies support rural-based and non-commercial forms of preventive health care and primary care therapies.<sup>53-54</sup> Community health workers can provide needed primary care not only in lower-income countries, but also in underserved regions of higher-income countries.

Given the known benefits of social support as a buffer against mental distress, interventions delivered by peers or mental health support groups should be encouraged and enhanced. Social prescribing, which is the use of non-medical interventions such as physical activity, the arts or other community engagement, is concerned with broader determinants of health and can be adopted, through the use of existing resources in communities, to improve wellbeing.<sup>55</sup> Social prescribing has been shown to be a low-cost approach in the prevention of mental and physical health conditions.<sup>56</sup> In the current COVID-19 pandemic, social prescribing could be delivered by trained non-clinical staff and could effectively address people's social needs<sup>57</sup> and mitigate the negative psychological impact of social isolation.<sup>58</sup>

In mental health care, the notion that only psychiatrists and psychotherapists can provide treatment for mental illness should be abandoned. Other forms of community-based and collaborative approaches

are needed. Lay health workers can be trained to deliver health care in non-specialist settings. The World Health Organisation has recommended talking therapies, such as cognitive behaviour therapy, as a first-line treatment for mild-to-moderate depression and anxiety,<sup>59</sup> and this can easily be delegated to non-specialists.<sup>60-61</sup> At present, too little use is made of low-cost talking therapy provided by lay health workers. Concerns that this approach may lead to poor-quality care appear to be unfounded, since it has been demonstrated that, when proper supervision is provided, trained laypeople can provide a valuable contribution to mental health care. No significant difference was found in effectiveness between cognitive behavioural therapy provided by expert practitioners and lay practitioners with no previous mental health training or experience.<sup>60</sup>

Task-shifting has been successful in many innovative mental health services and also appears to offer promise in low-resource settings.<sup>62</sup> In summary, in view of the ever-increasing pressure on global health systems as a consequence of the COVID-19 pandemic, adopting and adapting task-shifting as an element of mental health service provision is overdue. Future studies should further explore task-shifting strategies in order to improve population-wide access to mental health services.

#### 5. Digital technologies in mental health care

The preventive measures introduced during the COVID-19 pandemic drastically limit social and cultural life and access to school and work. Approaches supporting social interaction and ensuring continuity of work and study are therefore needed in order to mitigate the effects of physical distancing and social isolation.

Physical distancing required to prevent the spread of SARS-CoV-2 does not necessarily imply social distance. Telephone or video may provide means to stay connected and maintain social relationships. For example, for children not attending school, digital technologies may become online substitutes for daily routines and may be able to provide access to regular programmed work and tuition and ameliorate the effects of social isolation and loneliness. Employers may be able to create video connections and virtual workspaces where people can work and connect virtually with other employees. Establishments in which people congregate, such as gyms or places of worship, could offer online activities similar to their usual schedules. Video conferencing using smartphones may reduce subjective feelings of loneliness in residents of nursing homes.<sup>63</sup> However, the extent to which the use of these technologies can bridge physical and social distance remains to be investigated.<sup>64</sup> It may be the case, for example, that seniors are less comfortable with virtual means of communication than younger people.<sup>65</sup>

Timely preventive and therapeutic mental health care is essential in addressing the psychosocial needs of populations exposed to the SARS-CoV-2 pandemic.<sup>66</sup> The 2018 Lancet Commission on global mental health and sustainable development recognised the potential of digital means to increase access to the delivery of mental health services.<sup>67</sup> The internet may be used to reduce the risk of mental health problems and as a platform for intervention. As an immediate response to the COVID-19 crisis and related preventive measures, psychoeducation may decrease risks and promote resilience to the effects of social changes necessitated by the pandemic.<sup>68</sup> Physical distancing interferes with and may diminish the support networks commonly provided by family and friends. Social media can be harnessed to improve social support and connectedness.<sup>64</sup> Frequent contact with relatives and friends via telephone, social media and video chats should be encouraged. Interventions based on social contact have been shown to be effective in altering perceptions and behaviours.<sup>69</sup>

The general public can be advised as to accessible health and wellbeing activities.<sup>70</sup> Brief, contact-based, online population interventions should be developed pro-actively to promote healthy lifestyle choices, including a balanced diet, physical exercise, regular sleep patterns and outdoor activities, as well as encouraging stress-relieving and anxiety-reducing activities, such as meditation.<sup>71-73</sup> Physical exercise routines are

particularly relevant due to the benefits they offer for both physical and mental health.<sup>74</sup>

Ongoing mental health ambulatory treatments should be continued using online telemedicine platforms. Given the expected increase in the need for mental health and addiction services, the general public should be advised to seek support and care using alternative means. Online platforms can be used for the diagnosis, real-time monitoring and evaluation of individuals with mental health problems. Telemedicine mental health visits and delivery of care could become components of stepped care and may be useful for both acute crisis intervention and long-term routine support. Access to computers and internet, independent of geographical location and socioeconomic status, is essential. In addition, digital technologies need to be configured and evaluated for use in elderly people.<sup>75</sup>

Individuals with severe symptoms or pre-existing mental health conditions may need to meet health professionals in person and be referred to community mental health services. In many cases, however, counselling and psychotherapy may be delivered through remote consultation. Electronic devices and applications can be used to provide psychological counselling for people with mental health disorders, their families and the general public. Consultation by telephone is well established in primary care. However, its use in mental health care is limited by the lack of non-verbal communication.<sup>76</sup> Relevant visual information and therapeutic presence may be provided through video consultations.<sup>77-78</sup> When significant numbers of people are quarantined or socially isolated, services for mental health and addiction problems should be accessible through video conference options, such as telehealth, i.e., the distribution of health-related services and information via electronic information and telecommunication technologies. Digital health care provides a means to counsel and treat more people with mental health disorders remotely. It can also be personalised to the daily life of people with mental health problems and provide direct delivery of psychological treatment.<sup>79</sup> Digital technologies and electronic devices may also help overcome cost and stigma-related barriers to mental health care.<sup>80</sup>

Telehealth can be used for assessment, psychoeducation and treatment. Text messaging using mobile phones appears to be supportive in patient recovery, even in severe mental illness involving psychosis.<sup>81</sup> It has been shown that telehealth is equivalent to in-person care in respect of accuracy of diagnosis, effectiveness of therapy, quality of care and satisfaction of patients.<sup>82</sup> For example, telehealth problem solving therapy was shown to be as efficacious as face-to-face therapy in depressed low-income homebound elderly adults.<sup>83</sup> Furthermore, online, self-guided cognitive behavioural therapy was found to be as effective as “in-person” therapy for various mental health conditions, such as anxiety and depression.<sup>84-85</sup>

In summary, the available evidence-based approaches to the prevention and treatment of anxiety, depression and suicide, such as cognitive behavioural therapy, are insufficient to surmount the challenges faced by mental health practitioners in the current COVID-19 crisis. Due to physical distancing rules, the availability of traditional individual or group face-to-face sessions with mental health specialists will be unable to meet the current demand. Thus, evidence-based, remotely accessible mental health care, including telemedicine therapy sessions, need to be developed. This is of particular importance in lower- and middle-income countries.<sup>86</sup> Electronic devices can also facilitate access to training, support and supervision of care providers.<sup>87</sup>

It should be noted, however, that the use of social media necessitated by social distancing and quarantine during the COVID-19 pandemic may not be without problems. The widespread use of digital and social media, with their sometimes unverified and unreliable information,<sup>64</sup> may cause fear and anxiety, exacerbate confusion and lead to stress-related disorders.<sup>88</sup> Initial evidence suggests that increased social media consumption during social isolation may lead to a significant elevation in mental health problems. In a recent study from China, people with high social media exposure were found to be almost twice as likely to present with anxiety and depression as people with less exposure.<sup>89</sup> Individuals

with psychosis may have difficulty distinguishing between real and fake news. Anxiety and stress induced by graphic imagery and troubling messages may increase the risk of long-term fear-related disorders.<sup>88</sup> Time exposed to social media, especially to anxiety-provoking information, should therefore be limited.<sup>90</sup>

## 6. Conclusion

The implications of the COVID-19 pandemic for mental health call for a greater focus on the needs of those with mental disorders and on mental health issues affecting health care workers and the general population. Public mental health interventions are needed during the pandemic in order to address the anticipated increases in the prevalence of mental disorders and poor mental health across populations. Longitudinal data will be needed to track the prevalence of mental health problems and the associated need for treatment and public health measures. Furthermore, timely preventive and therapeutic mental health care is essential in addressing the psychosocial needs of populations exposed to the pandemic. In addition to specialist care, task-shifting and digital technologies may provide cost-effective means of providing mental health care in lower-income countries worldwide and also in higher-income countries with mental health services overwhelmed by the effects of the COVID-19 pandemic.

## Competing interests

The author declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## References

- Zhu N, Zhang D, Wang W, et al. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med.* 2020;382(6):727-733.
- Puelles VG, Lütgehetmann M, Lindenmeyer MT, Sperhake JP, Wong MN, Allweiss L, et al. Multiorgan and renal tropism of SARS-CoV-2. *N Engl J Med.* 2020;383(6):590-592.
- Koralnik IJ, Tyler KL. COVID-19: a global threat to the nervous system. *Ann Neurol.* 2020;88(1):1-11.
- Lu R, Zhao X, Li J, et al. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. *Lancet.* 2020;395(10224):565-574.
- Liu TB, Chen XY, Miao GD, et al. Recommendations on diagnostic criteria and prevention of SARS-related mental disorders. *J Clin Psychol Med.* 2003;13:188-191.
- Maunder R, Hunter J, Vincent L, et al. The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital. *CMAJ.* 2003;168(10):1245-1251.
- Rogers JP, Chesney E, Oliver D, et al. Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the COVID-19 pandemic. *Lancet Psychiatry.* 2020;7(7):611-627.
- Ahmed MU, Hanif M, Ali MJ, et al. Neurological manifestations of COVID-19 (SARS-CoV-2): a review. *Front Neurol.* 2020;11:518.
- Mao L, Jin H, Wang M, et al. Neurological manifestations of hospitalized patients with coronavirus disease 2019 in Wuhan, China. *JAMA Neurol.* 2020;77(6):683-690.
- Helms J, Kremer S, Merdji H, et al. Neurologic features in severe SARS-CoV-2 infection. *N Engl J Med.* 2020;382(23):2268-2270.
- Varatharaj A, Thomas N, Ellul MA, et al. Neurological and neuropsychiatric complications of COVID-19 in 153 patients: a UK-wide surveillance study. *Lancet Psychiatry.* 2020;7(10):875-882.
- Shultz JM, Baingana F, Neria Y. The 2014 Ebola outbreak and mental health: current status and recommended response. *JAMA.* 2015;313(6):567-568.
- Kamara S, Walder A, Duncan J, Kabbedijk A, Hughes P, Muana A. Mental health care during the Ebola virus disease outbreak in Sierra Leone. *Bull World Health Organ.* 2017;95(12):842-847.
- Lettinga KD, Verbon A, Nieuwkerk PT, et al. Health-related quality of life and post-traumatic stress disorder among survivors of an outbreak of legionnaires disease. *Clin Infect Dis.* 2002;35(1):11-17.
- Lee AM, Wong JGWS, McAlonan GM, et al. Stress and psychological distress among SARS survivors 1 year after the outbreak. *Can J Psychiatry.* 2007;52(4):233-240.
- Kapfhammer HP, Rothenhäusler HB, Krauseneck T, Stoll C, Schelling G. Posttraumatic stress disorder and health-related quality of life in long-term survivors of acute respiratory distress syndrome. *Am J Psychiatry.* 2004;161(1):45-52.
- Sartorius N. Comorbidity of mental and physical diseases: a main challenge for medicine of the 21st century. *Shanghai Arch Psychiatry.* 2013;25(2):68-69.
- Greenberg N, Docherty M, Gnanapragasam S, Wessely S. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *BMJ.* 2020;368:m1211.

19. Li Z, Ge J, Yang M, et al. Vicarious traumatization in the general public, members, and non-members of medical teams aiding in COVID-19 control. *Brain Behav Immun*. 2020;88:916-919.
20. Marjanovic Z, Greenglass ER, Coffey S. The relevance of psychosocial variables and working conditions in predicting nurses' coping strategies during the SARS crisis: an online questionnaire survey. *Int J Nurs Stud*. 2007;44(6):991-998.
21. Reynolds DL, Garay JR, Deamond SL, Moran MK, Gold W, Styra R. Understanding compliance and psychological impact of the SARS quarantine experience. *Epidemiol Infect*. 2008;136(7):997-1007.
22. Wu P, Liu X, Fang Y, et al. Alcohol abuse/dependence symptoms among hospital employees exposed to a SARS outbreak. *Alcohol Alcohol*. 2008;43(6):706-712.
23. Nickell LA, Crighton EJ, Tracy CS, et al. Psychosocial effects of SARS on hospital staff: survey of a large tertiary care institution. *CMAJ*. 2004;170(5):793-798.
24. Wei YL, Han B, Liu W, Liu G, Huang Y. Psychosomatic discomfort and related factors among 1,411 first-line SARS staff in Beijing. *Manual of the 7th national experimental medicine symposium of Chinese association of integrative medicine*. Beijing: Chinese Association of Integrative Medicine; 2004:6-12.
25. Wu P, Fang Y, Guan Z, et al. The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. *Can J Psychiatry*. 2009;54(5):302-311.
26. Lee AM, Wong JGWS, McAlonan GM, et al. Stress and psychological distress among SARS survivors 1 year after the outbreak. *Can J Psychiatry*. 2007;52(4):233-240.
27. Shultz JM, Cooper JL, Baingana F, et al. The role of fear-related behaviors in the 2013-2016 West Africa Ebola virus disease outbreak. *Curr Psychiatry Rep*. 2016;18(11):104.
28. Neria Y, Nandi A, Galea S. Post-traumatic stress disorder following disasters: a systematic review. *Psychol Med*. 2008;38(4):467-480.
29. Hawryluck L, Gold WL, Robinson S, Pogorski S, Galea S, Styra R. SARS control and psychological effects of quarantine, Toronto, Canada. *Emerg Infect Dis*. 2004;10(7):1206-1212.
30. Jeong H, Yim HW, Song YJ, et al. Mental health status of people isolated due to Middle East respiratory syndrome. *Epidemiol Health*. 2016;38:e2016048.
31. Gerst-Emerson K, Jayawardhana J. Loneliness as a public health issue: the impact of loneliness on health care utilization among older adults. *Am J Public Health*. 2015;105(5):1013-1019.
32. Santini ZI, Jose PE, Cornwell EY, et al. Social disconnectedness, perceived isolation, and symptoms of depression and anxiety among older Americans (NESHAPE): a longitudinal mediation analysis. *Lancet Public Health*. 2020;5(1):e62-e70.
33. Qiu J, Shen B, Zhao M, Wang Z, Xie B, Xu Y. A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *Gen Psychiatry*. 2020;33(2):e100213.
34. Lei L, Huang X, Zhang S, et al. Comparison of prevalence and associated factors of anxiety and depression among people affected by versus people unaffected by quarantine during the COVID-19 epidemic in southwestern China. *Med Sci Monit*. 2020;26:e924609.
35. COVID-19 and Mental Wellbeing. Ipsos MORI website. <https://www.ipsos.com/ipsos-mori/en-uk/COVID-19-and-mental-wellbeing>. Accessed May 3, 2020.
36. McGinty EE, Presskreischer R, Han H, Barry CL. Psychological distress and loneliness reported by US adults in 2018 and April 2020. *JAMA*. 2020;324(1):93-94.
37. Anxiety and Depression: Household Pulse Survey. U.S. Centers for Disease Control and Prevention website. <https://www.cdc.gov/nchs/covid19/pulse/mentalhealth.htm>. Accessed June 15, 2020.
38. The COVID pandemic could lead to 75,000 additional deaths from alcohol and drug misuse and suicide. Well Being Trust website. <https://wellbeingtrust.org/areas-of-focus/policy-and-advocacy/reports/projected-deaths-of-despair-during-covid-19/>. Accessed June 17, 2020.
39. Steinman MA, Perry L, Perissinotto CM. Meeting the care needs of older adults isolated at home during the COVID-19 pandemic. *JAMA Intern Med*. 2020;180(6):819-820.
40. Donovan NJ, Wu Q, Rentz DM, Sperling RA, Marshall GA, Glymour MM. Loneliness, depression and cognitive function in older US adults. *Int J Geriatr Psychiatry*. 2017;32(5):564-573.
41. Galea S, Merchant RM, Lurie N. The mental health consequences of COVID-19 and physical distancing – the need for prevention and early intervention. *JAMA Intern Med*. 2020;180(6):817-818.
42. Principles for emergency psychological crisis intervention for the new coronavirus pneumonia. National Health Commission of the People's Republic of China website. <http://www.nhc.gov.cn/jkj/s3577/202001/6adc08b966594253b2b791be5c3b9467>. Accessed May 3, 2020.
43. World Health Organization. Mental health and psychosocial considerations during the COVID-19 outbreak. <https://www.who.int/publications/i/item/mental-health-and-psychosocial-considerations-during-the-covid-19-outbreak>. Accessed June 1, 2020.
44. Managing your mental health during the coronavirus outbreak. Mental Health UK website. Available: <https://mentalhealth-uk.org/help-and-information/covid-19-and-your-mental-health/>. Accessed June 1, 2020.
45. Lange KW. The prevention of COVID-19 and the need for reliable data. *Mov Nutr Health Dis*. 2020;4:53-63.
46. Lange KW. Mental health in COVID-19 and the need for reliable data. *Mov Nutr Health Dis*. 2020;4:64-69.
47. Campion J, Javed A, Sartorius N, Marmot M. Addressing the public mental health challenge of COVID-19. *Lancet Psychiatry*. 2020;7(8):657-659.
48. Cohen GH, Tamrakar S, Lowe S, et al. Comparison of simulated treatment and cost-effectiveness of a stepped care case-finding intervention vs usual care for post-traumatic stress disorder after a natural disaster. *JAMA Psychiatry*. 2017;74(12):1251-1258.
49. Webster P. Virtual health care in the era of COVID-19. *Lancet*. 2020;395(10231):1180-1181.
50. Folkman S, Greer S. Promoting psychological well-being in the face of serious illness: when theory, research and practice inform each other. *Psychooncology*. 2000;9(1):11-19.
51. Mao Z. Directive on public health, June 26, 1965. In: Schram S, ed. *Chairman Mao talks to the people: talks and letters: 1956–1971*. New York, N.Y.: Pantheon Books; 1974:232-233.
52. Sidel VW. The barefoot doctors of the People's Republic of China. *N Engl J Med*. 1972;286(24):1292-1300.
53. Zhang D, Unschuld PU. China's barefoot doctor: past, present, and future. *Lancet*. 2008;372(9653):1865-1867.
54. Cueto M. The origins of primary health care and selective primary health care. *Am J Public Health*. 2004;94(11):1864-1874.
55. Drinkwater C, Wildman J, Moffatt S. Social prescribing. *BMJ*. 2019;364:l1285.
56. World Health Organization. What is the evidence on the role of the arts in improving health and well-being? A scoping review. <https://www.euro.who.int/en/publications/abstracts/what-is-the-evidence-on-the-role-of-the-arts-in-improving-health-and-well-being-a-scoping-review-2019>. Accessed June 1, 2020.
57. Alderwick HAJ, Gottlieb LM, Fichtenberg CM, Adler NE. Social prescribing in the US and England: emerging interventions to address patients' social needs. *Am J Prev Med*. 2018;54(5):715-718.
58. Razai MS, Oakeshott P, Kankam H, Galea S, Stokes-Lampard H. Mitigating the psychological effects of social isolation during the covid-19 pandemic. *BMJ*. 2020;369:m1904.
59. Mental disorders, 2020. World Health Organization website. <https://www.who.int/news-room/fact-sheets/detail/mental-disorders>. Accessed June 1, 2020.
60. Stanley MA, Wilson NL, Amspoker AB, et al. Lay providers can deliver effective cognitive behavior therapy for older adults with generalized anxiety disorder: A randomized trial. *Depress Anxiety*. 2014;31(5):391-401.
61. Winiarski DA, Rufa AK, Karnik NS. Using layperson-delivered cognitive-behavioral therapy to address mental health disparities. *Psychiatric Annals*. 2019;49(8):353-357.
62. Javadi D, Feldhaus I, Mancuso A, Ghaffar A. Applying systems thinking to task shifting for mental health using lay providers: a review of the evidence. *Glob Ment Health*. 2017;4:e14.
63. Tsai HH, Cheng CY, Shieh WY, Chang YC. Effects of a smartphone-based videoconferencing program for older nursing home residents on depression, loneliness, and quality of life: a quasi-experimental study. *BMC Geriatr*. 2020;20(1):27.
64. Merchant RM, Lurie N. Social media and emergency preparedness in response to novel coronavirus. *JAMA*. 2020;323(20):2011-2012.
65. Knowles B, Hanson VL. The wisdom of older technology (non-users). *Comm ACM*. 2018;61(3):72-77.
66. Xiang YT, Yang Y, Li W, et al. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry*. 2020;7(3):228-229.
67. Patel V, Saxena S, Lund C, et al. The Lancet Commission on global mental health and sustainable development. *Lancet*. 2018;392(10157):1553-1598.
68. Cénat JM, Mukunzi JN, Noorishad PG, Rousseau C, Derivois D, Bukaka J. A systematic review of mental health programs among populations affected by the Ebola virus disease. *J Psychosom Res*. 2020;131:109966.
69. Thornicroft G, Mehta N, Clement S, et al. Evidence for effective interventions to reduce mental-health-related stigma and discrimination. *Lancet*. 2016;387(10023):1123-1132.
70. The effects of isolation on the physical and mental health of older adults. BMJ Opinion website. <https://blogs.bmj.com/bmj/2020/04/09/the-effects-of-isolation-on-the-physical-and-mental-health-of-older-adults/>. Accessed June 1, 2020.
71. Lange KW. Diet, exercise, and mental disorders – public health challenges of the future. *Mov Nutr Health Dis*. 2018;2:39-59.
72. Lange KW, Nakamura Y. Lifestyle factors in the prevention of COVID-19. *Glob Health J*. 2020;4(4):146-152.
73. Lange KW. Food science and COVID-19. *Food Sci Hum Wellness*. 2021;10(1):1-5.
74. Lange KW. Movement and nutrition in health and disease. *Mov Nutr Health Dis*. 2017;1:1-2.
75. van den Berg N, Schumann M, Kraft K, Hoffmann W. Telemedicine and telecare for older patients—a systematic review. *Maturitas*. 2012;73(2):94-114.
76. McKinstry B, Watson P, Pinnock H, Heaney D, Sheikh A. Telephone consulting in primary care: a triangulated qualitative study of patients and providers. *Br J Gen Pract*. 2009;59(563):e209-e218.
77. Donaghy E, Atherton H, Hammersley V, et al. Acceptability, benefits, and challenges of video consulting: a qualitative study in primary care. *Br J Gen Pract*. 2019;69(686):e586-e594.
78. Greenhalgh T, Koh GCH, Car J. COVID-19: a remote assessment in primary care. *BMJ*. 2020;368:m1182.
79. Holmes EA, O'Connor RC, Perry VH, et al. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. *Lancet Psychiatry*. 2020;7(6):547-560.
80. Kohrt BA, Asher L, Bhardwaj A, et al. The role of communities in mental health care in low- and middle-income countries: a meta-review of components and competencies. *Int J Environ Res Public Health*. 2018;15(6):1279.
81. Ben-Zeev D, Buck B, Kopelovich S, Meller S. A technology-assisted life of recovery from psychosis. *NPJ Schizophr*. 2019;5(1):15.
82. Hilty DM, Ferrer DC, Burke Parish M, Johnston B, Callahan EJ, Yellowlees PM. The effectiveness of telemental health: a 2013 review. *Telemed J E Health*. 2013;19(6):444-454.
83. Choi NG, Hegel MT, Marti N, Marinucci ML, Sirrianni L, Bruce ML. Telehealth problem-solving therapy for depressed low-income homebound older adults. *Am J Geriatr Psychiatry*. 2014;22(3):263-271.

84. van der Krieke L, Wunderink L, Emerencia AC, de Jonge P, Sytema S. E-mental health self-management for psychotic disorders: state of the art and future perspectives. *Psychiatr Serv*. 2014;65(1):33-49.
85. Andrews G, Basu A, Cuijpers P, et al. Computer therapy for the anxiety and depression disorders is effective, acceptable and practical health care: an updated meta-analysis. *J Anxiety Disord*. 2018;55:70-78.
86. Kola L. Global mental health and COVID-19. *Lancet Psychiatry*. 2020;7(8):655-657.
87. Naslund JA, Aschbrenner KA, Araya R, et al. Digital technology for treating and preventing mental disorders in low-income and middle-income countries: a narrative review of the literature. *Lancet Psychiatry*. 2017;4(6):486-500.
88. Neria Y, Sullivan GM. Understanding the mental health effects of indirect exposure to mass trauma through the media. *JAMA*. 2011;306(12):1374-1375.
89. Gao J, Zheng P, Jia Y, et al. Mental health problems and social media exposure during COVID-19 outbreak. *PLoS One*. 2020;15(4):e0231924.
90. Coping with stress. U.S. Centers for Disease Control and Prevention website. [https://www.cdc.gov/coronavirus/2019-ncov/dailylife-coping/managing-stress-anxiety.html?CDC\\_AA\\_refVal=https](https://www.cdc.gov/coronavirus/2019-ncov/dailylife-coping/managing-stress-anxiety.html?CDC_AA_refVal=https). Accessed July 1, 2020.

Edited by Yanjie Zhang