Prevalence of Mental Health Problems During Virus Epidemics in the General Public, Health Care Workers and Survivors: A Rapid Review of the Evidence

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Abstract

Background: The swift spread of SARS-CoV-2 provides a challenge worldwide. As a consequence of restrictive public health measures like isolation, quarantine, and community containment, the provision of mental health services is a major challenge. Evidence from past virus epidemics and the current SARS-CoV-2 outbreak indicate high prevalence rates of mental health problems (MHP) as short- and long-term consequences. However, a broader picture of MHP among different populations is still lacking.

Methods: We conducted a rapid review on MHP prevalence rates published since 2000, during and after epidemics, including the general public, health care workers, and survivors. Any quantitative articles reporting on MHP rates were included. Out of 2855 articles screened, a total of 74 were included in this review.

Results: Most original studies on MHP were conducted in China in the context of SARS-CoV-1, and reported on anxiety, depression, post-traumatic stress symptoms/disorder, general psychiatric morbidity, and psychological symptoms. The MHP rates across studies, populations, and epidemics vary substantially. While some studies show high and persistent rates of MHP in populations directly affected by isolation, quarantine, threat of infection, infection, or life-threatening symptoms (e.g. health care workers), other studies report minor effects. Furthermore, even less affected populations (e.g. distant to epidemic epicenter, no contact history with suspected or confirmed cases) can show high rates of MHP.

Discussion: MHP vary largely across countries and risk-groups in reviewed studies. The results call attention to potentially high MHP during epidemics. Individuals affected directly by an epidemic might be at a higher risk of short or even long-term mental health impairments. This study delivers insights stemming from a wide range of psychiatric instruments and questionnaires. The results call for the use of validated and standardized instruments, reference norms, and pre-post measurements to better understand the magnitude of the MHP during and after the epidemics. Nevertheless, emerging MHP should be considered during epidemics including the provision of access to mental health care to mitigate potential mental impairments.

NOTE: This preprint reports new research that has not been certified by peer review and should not be used to guide clinical practice.
1 Introduction

In the past two decades, many countries faced challenges in the realm of major infectious disease epidemics including SARS-CoV-1 (Peiris et al., 2003), Swine flu (H1N1) (Trifonov et al., 2009), Middle East respiratory syndrome coronavirus (MERS-CoV) (Zaki et al., 2012), avian influenza (H7N9) (Gao et al., 2013), Ebolavirus (Baseler et al., 2017), and the recent worldwide SARS-CoV-2 outbreak (Wu et al., 2020). Epidemic outbreaks can result in high case fatality rates and morbidity (Van Bortel et al., 2016; Meo et al., 2020) and may require communities to introduce restrictive public health measures like isolation, mass quarantine, and community containment interventions in order to stop transmissions and save lives (Wilder-Smith and Freedman, 2020). In consequence, epidemics can cause a high individual and societal burden and can lead to substantial economic loss (Smith, 2006; Mak et al., 2009; Van Bortel et al., 2016; Dorn et al., 2020). While considerable efforts rely on protective and treatment measures such as virus transmission pathways, clinical presentations, and the development of vaccinations, attention is only recently given to short or long-term mental health problems (MHP, hereafter defined as psychiatric/psychological symptoms and mental illness/disorders) (Rajkumar, 2020) that may arise due to the different surrounding consequences of an epidemic in the general public, health care workers (HCW), and survivors of infectious diseases (survivors).

Epidemics can negatively impact a substantial part of the general public in many different ways such as feelings of a personal threat of being infected (Van Bortel et al., 2016; Brooks et al., 2020; Chew et al., 2020), worries about relatives and family members or losing loved ones (Brooks et al., 2020; Chew et al., 2020; Li et al., 2020), and protective measures like mass quarantining. The consequences of which leads to individual and social restrictions, and economic loss (Brooks et al., 2020). As a result, these factors can elicit feelings of anxiety, anger, loneliness, grief, boredom and may lead to serious MHP (Brooks et al., 2020; Chew et al., 2020; Fardin, 2020). Furthermore, the extensive and sometimes controversial mass media coverage during epidemics may amplify uncertainty, loss of control and anxiety (Brooks et al., 2020; Fardin, 2020). Aside from the general public, HCW are prone to different MHP since they usually face an immediate threat of infection through patient contact by working at the epidemic frontline. Studies suggest that HCW accounted for up to 57% of SARS-CoV-1, 27% of MERS-CoV, and 12% of Ebola cases in some countries, which frequently resulted in morbidity or even death (Chan-Yeung, 2004; Suwantarat and Apisarnthanarak, 2015). In HCW, epidemics often result in difficult working conditions like staff shortage, increased workload (Van Bortel et al., 2016), overwhelming patient numbers (Suwantarat and Apisarnthanarak, 2015; Van Bortel et al., 2016), limited safety equipment (Van Bortel et al., 2016), and quarantine or isolation after infectious disease transmission (Van Bortel et al., 2016; Brooks et al., 2020). Furthermore, HCW often suffer social consequences like stigma (Bai et al., 2004; Verma et al., 2004; Van Bortel et al., 2016), mistrust and violence (Van Bortel et al., 2016) avoidance from relatives, and the fear of infecting others (Verma et al., 2004). Given the high risk of transmission, HCW often account for a substantial fraction of survivors, who frequently experience isolation, intensive treatment, stigmatization and exposure to an immediate threat of morbidity or death (Van Bortel et al., 2016; Troyer et al., 2020). To date, many studies exist that describe MHP related to epidemics across a wide range of populations. However, to the best of our knowledge no review covering MHP during epidemics currently exists.
1.1 Objectives

The purpose of this rapid review is to provide an overview of MHP prevalence rates during and after large epidemics of the past two decades. We aim to provide a broad picture of MHP that may arise across a wide range of populations including a) the general public, b) HCW, and c) and virus disease survivors.

2 Materials and Methods

2.1 Search Strategy

The rapid and dynamic development of the current situation with SARS-CoV-2 requires quick evidence synthesis in order to inform decision-making processes in health care systems. The methodology of this article is based on the practical guide for rapid reviews provided by WHO (Tricco et al., 2017). We undertook a review of evidence on prevalence rates during and after epidemic outbreaks on MHP in the general public, HCW, and survivors. The focus was on SARS-CoV-1, H1N1, MERS-CoV, H7N9, Ebolavirus, and SARS-CoV-2. PubMed was searched on April 1, 2020 with a broad search strategy (see Supplementary Table 1).

2.2 Participants, Interventions, and Comparators

Any type of quantitative study that provided prevalence rates of MHP in adults (≥ 18 years) during and after epidemic outbreaks, published in English from the year 2000 to March 31, 2020 was included. Studies that measured MHP rates assessed by psychometrically validated instruments, diagnostic interview, and medical records (chart review), were also included. We excluded studies that used a qualitative design, that did not report on MHP prevalence rates (e.g. providing mean scores only), that did not provide prevalence rates based on previously defined cut-off values for a measurement instrument (e.g. median based sample splitting), and that included MHP measured by single questions/items. Studies on common seasonal influenza were also excluded. Furthermore, general states like social functioning, quality of life, generic fears (e.g. fear of contracting a virus or worries) or stigma were excluded. Based on the titles and abstracts of studies, potential eligible studies of the database search were selected by CA using a co-developed standardized review form to assess study eligibility. The primary reviewer SJZ then selected eligible studies after searching the full-text of each potentially eligible publication. Doubts and uncertainty in eligibility of a certain study were solved by discussion.

2.3 Data Sources, Study Selection, and Data Extraction

An electronic data extraction form was developed to assess the characteristics of the included studies and the reported MHP prevalence rates. Data was extracted by SJZ, CA, PK, and FH. Collected items included: author(s), year of publication, country or region, number of participants, type of epidemic outbreak, time point of assessment, type of MHP assessed, MHP prevalence rate, and assessment method. Time point of assessment was coded as: during epidemic/hospital stay, post-epidemic/discharge including one-year follow-up (≤1y), between one and four years follow-up (>1-4y), or a combination of both if applicable (e.g. for longitudinal studies). MHP were categorized into anxiety, depression, post-traumatic symptoms/disorders (PTSD) or stress, burnout, psychiatric morbidity, and further MHP like hallucinations or insomnia. We used baseline assessment data for intervention studies that provided prevalence rates. Data was stratified by the following populations: a) general public including general surveys, b) HCW including all hospital staff, military duty members, and family members as caregivers involved in active treatment or in potential contact with patients, and c) infectious disease
survivors (that may include suspected cases in some studies). Data quality and strength of evidence was not rated in the current review. All authors who extracted data discussed possible uncertainties with the primary reviewer SJZ.

2.4 Data Analysis

Included studies varied in assessment of MHP (e.g. questionnaires, diagnostic interviews), MHP instruments with applied cut-off scores, sampling methods and response rates, outbreak-related time points of assessments, and in regional differences in the magnitude/level of affect. Due to the approach chosen (rapid review), no meta-analysis was conducted. Therefore, a descriptive approach was utilized to synthesize reported MPH prevalence rates. If provided, we show MHP rates from a moderate degree of severity as defined by authors within original studies.

3 Results

3.1 Study Characteristics

Our PubMed search yielded 2,855 articles of which 74 were included in the qualitative synthesis (see Figure 1). The majority of studies were cross-sectional in design and focused on MHP during SARS-CoV-1 (n=41), followed by Ebolavirus (n=12), MERS-CoV and SARS-CoV-2 (n=7), H1N1 (n=6), and H7N9 (n=1). About half of the studies in the general public used random sampling, while the majority of articles in HCW and survivors were non-random samples. The vast majority of studies was conducted in China, including Taiwan and Hong Kong (n = 39), followed by other countries in Asia (n = 14), in Africa (n = 12), and the American continent (mainly Canada; n = 6), with three studies conducted in Europe. We found n=28, 26, and 20 studies that investigated the general public, HCW, and survivors, respectively. The vast majority of studies assessed MHP using self-reported questionnaires, while only few used standardized diagnostic interviews. Results stratified by general public, HCW, and survivors can be found in Tables 1-3.

3.2 Synthesized Findings

3.2.1 General public

Range of prevalence rates across original articles were as follows: anxiety (0.7-47.2%), depression (1.4-32.4%), any anxiety/depression symptoms combined (48.6%), PTSD/stress (2.0-76.4%), and psychiatric morbidity (8.0-26.2%). The rates of further MHP included any mental disorder (<1.0%), alcohol/substance use disorders (<1.0%), anger (6.4-52.8%), moderate to severe emotional disorder or depression (12.0%), intellectual disability (5.0%), and psychotic symptoms like hallucinations (21.0%). The highest and lowest rates of anxiety were found in MERS-CoV (48.6%), and SARS-CoV-2 (0.7%), respectively. For depression the highest rates were found in SARS-CoV-1 (32.4%) and the lowest in Ebolavirus (1.4%). For PTSD/stress, the highest rates were shown for Ebolavirus (76.4%), and the lowest in H1N1 (2.0%). Psychiatric morbidity was highest in SARS-CoV-1 (26.2%) and lowest in H1N1 (8.0%).

3.2.2 Health care workers

Range of prevalence rates were as follows: anxiety (1.5-88.0%), depression (2.3-49.1%), PTSD/stress (1.5-71.5%), burnout (19.2-30.4%), and psychiatric morbidity (6.0-75.3%). The rates of further MPH included any new Axis 1 diagnosis (6.8%), insomnia (9.4-37.1%), and substance abuse or alcohol related symptoms (1.5%-
19.0%). The full range of rates in anxiety were both found in H1N1 (1.5-88.0%). For depression, the highest rates were found in SARS-CoV-2 (49.1%) and the lowest in Ebolavirus (2.3%). For PTSD/stress, the highest rates were shown for SARS-CoV-2 (71.5%) and the lowest for SARS-CoV-1 (1.5%). Highest and lowest rates for psychiatric morbidity were both found for SARS-CoV-1 (6.0-75.3%).

3.2.3 Survivors

Range of prevalence rates were as follows: anxiety (13.0-94.4%), depression (11.0-50.5%), PTSD/stress (1.2-96.2%), and psychiatric morbidity (49.1-90.3%). Furthermore, the rates of further MHP included any psychiatric diagnosis (33.3-58.9%), fatigue (27.1-48.1%), fear and panic (13.7-26.5%), hallucinations (1-5.9%), insomnia (10.1-52.5%), low mood (18.6-36.3%), obsession-compulsion (15.6-83.3%), panic disorder (32.5%), paranoid ideation (72.2%), somatoform pain disorder (36.4%), suicidal ideation (2.0%), and tensions/hostility (20.6-94.4%). The highest and lowest rates of anxiety were fund in Ebolavirus (94.4%), and SARS-CoV-1/Ebolavirus (13%) respectively. Depression was highest in SARS-CoV-1 (50.5%) and lowest in ebolavirus (11%). For PTSD/stress, the highest rates were shown for SARS-CoV-2 (96.2%) and lowest for Ebolavirus (1.2%). Psychiatric morbidity was described only in SARS-CoV-1 (49.1-90.3%).
4 Discussion

4.1 Summary of Main Findings

In this rapid review of 74 original articles we found a wide range of MHP including anxiety, depression, PTSD and stress related symptoms or disorders, psychiatric morbidity, and many further MHP like paranoid ideation, hallucinations, and insomnia that may occur in the general public, HCW or survivors during and after epidemic outbreaks. Aside from methodological issues and the large heterogeneity of original studies (e.g. poor validation, different cut-offs for case definition), MHP may be prevalent in all three populations. These problems may be substantial and can persist over time in HCW and survivors more directly affected by the epidemic threat. However, it should be noted that epidemic circumstances can also yield positive impacts on mental health like spending more time on physical activity and taking more care of one’s mental health (Lau et al., 2006).

4.2 General public

MHP ranged widely both across the general public and in all epidemics, which makes it difficult to estimate the magnitude and associated characteristics that may aggravate MHP. However, many studies investigated risk and protective factors of MHP. Although some controversy exists among studies, a higher level of epidemic exposure (e.g. living proximity to epidemic epicenter, contact history to high prevalent virus regions) (Lee et al., 2006b; Sun et al., 2020), hospitalization during epidemic (Sim et al., 2010), being quarantined (Ko et al., 2006), or having infected family members (Lee et al., 2006a; Xu et al., 2011; Cao et al., 2020) may aggravate MHP. Further risk factors include being female (Lee et al., 2007; Wang et al., 2011; Xu et al., 2011; Sun et al., 2020), chronic physical illness (Cheng et al., 2004b), poor self-rated health (Wang et al., 2020a), and dissatisfaction with measures controlling the virus (Wang et al., 2011). Furthermore, many studies reported problems like loneliness, boredom, anger, worries about family members (Wang et al., 2020a), and financial problems or economic loss (Chua et al., 2004; Lau et al., 2005; Mishra et al., 2016; Cao et al., 2020) that negatively interfere with mental health. In contrast, accurate health information (e.g., treatment, local outbreak situation) (Wang et al., 2020a), particular precautionary measures (e.g., hand hygiene, wearing a mask) (Wang et al., 2020a), social support (Ko et al., 2006; Lau et al., 2006; Cao et al., 2020), and appraisals and coping strategies (Cheng et al., 2004b; Chew et al., 2020) may be protective.

4.3 Health care workers and survivors

Similarly, HCW and survivors showed a wide range of mental health impacts. However, MHP rates in these populations may be more substantial than in the general public. HCW that were directly involved in patient care (Verma et al., 2004), working in high risk units and with infected patients (Chen et al., 2005; Maunder et al., 2006; McAlonan et al., 2007; Su et al., 2007) conscripted workers (Chen et al., 2005), or that underwent quarantine during outbreak (Bai et al., 2004; Liu et al., 2012) were found to be associated with a higher risk of MHP. Furthermore, younger age (Verma et al., 2004; Su et al., 2007), being single (Chan and Huak, 2004; Liu et al., 2012), fear of adversely affecting relatives (Maunder et al., 2003; McAlonan et al., 2007), pre-exposure to traumatic events or history of MHP (Su et al., 2007; Lancee et al., 2008; Liu et al., 2012) were also found to be associated with a higher risk of MHP. In contrast, adequate professional education and training (Maunder et al., 2006; Lancee et al., 2008; Tang et al., 2017), support from colleagues (Chan and Huak, 2004), appropriate information and communication (directives, precautionary measures, disease information) (Chan and Huak,
2004), and altruistic risk acceptance (Liu et al., 2012) were found to be protective. In survivors MHP may be aggravated by a history of mental illness (Jeong et al., 2016), the fear of permanent damage or death (Cheng et al., 2004b; Wu et al., 2005b), longer duration of quarantine (Hawryluck et al., 2004), having physical late sequelae (Pers et al., 2017), and impairment of ability to work (Lam et al., 2009). Furthermore, survivors that are HCW were shown to be more susceptible to long term MHP compared to non-HCW survivors (Cheng et al., 2004a; Lee et al., 2007).

4.4 Mental health problems and methodological issues

The methodological characteristics and quality of studies in assessing MHP ranges widely. We found only few studies that did not utilize a cross-sectional design without repetition. Further, most cross-sectional studies did not report any comparative data from which the change of prevalence rates due to the epidemic could be estimated. Sampling characteristics were also varying. Only about half of the studies in the general public were based on representative samples. As many studies were conducted during or shortly after the peak phase of the epidemic, results have to be regarded as acute stress reactions that do not allow for inference of longer-lasting MHP. While some authors used well established and widely used instruments and standardized diagnostic interviews (e.g. Ji et al. (2017) or Lancee et al. (2008)), others used instruments with unclear quality (e.g. Guetiya Wadoum et al. (2017)). Besides the possibility of biased results, this approach makes it challenging to identify clinically relevant cases. With respect to the application of diagnostic instruments, cut-off values might vary between countries and cultures. Therefore, a lack of validated, country-specific, cut-off values of the measurement instruments might be problematic (Jalloh et al., 2018).

4.5 Future Directives and Implications for Research, Policy, and Practice

4.5.1 Monitoring MHP as a tool for mental health care provision

As shown by this review, MHP may be prevalent across a broad range of populations. In this vein, clinical monitoring of risk groups that are vulnerable to psychological impairments due to the current SARS-CoV-2 epidemic is essential (Pfefferbaum and North, 2020). Pfefferbaum and North (2020) pointed out, that the monitoring of psychosocial needs should assess SARS-CoV-2–related stressors, secondary adversities, psychosocial effects, and indicators of vulnerability. Besides others, routine outcome monitoring (Carlier et al., 2012) as a measurement feedback system, apps for (self-)monitoring of mood, sleep-quality, or medication adherence (Rubanovich et al., 2017), and artificial intelligence predicting relevant psychiatric outcomes (Lovejoy et al., 2019), are available for public mental health monitoring. In the best case, mental health service providers should be aided by e-monitoring during epidemics. As mentioned above, in research MHP should be assessed by standardized diagnostic interviews or measurement instruments enabling appropriate case detection identifying risk groups in order to inform policy and practice.

4.5.2 Access to mental health service in epidemics

Furthermore, access to mental health services for those in need is paramount during the SARS-CoV-2 crisis, especially when social isolation is experienced (Wang et al., 2017). Beside the psychosocial consequences of public health measures such as quarantine (Brooks et al., 2020), acute viral infection is unknown but likely to be accompanied by substantial neuropsychiatric symptoms (anxiety, depression, and trauma-related symptoms) as a host immunologic response to the infection (Troyer et al., 2020). Mental health care interventions are expected to reduce symptoms such as PTSD (Torales et al., 2020). However, during epidemic scenarios care needs to be
adapted to upcoming circumstances by respective governments in order to prevent or support individuals with MHP (Duan and Zhu, 2020). In epidemic conditions, where consultation in-person is restricted there are important implications for digital health approaches. Online psychotherapy and consultation might help to improve access to mental health care, particularly in times of quarantine and isolation (Langarizadeh et al., 2017; Tuerk et al., 2018). It does need to be highlighted that the effectiveness of online services for the improvement of mental health services requires further assessment (Kauer et al., 2014). Consequently, the outbreak of SARS-CoV-2 calls for rapid reports and insights, as well as long-term health service research focusing on both remote and in-person mental health resources during epidemics (Starace and Ferrara, 2020; Wind et al., 2020).

4.5.3 Implications for HCW as a highly demanded group

Working conditions play an important role in mental health. For HCW, protective working conditions such as social support, constructive communication and staff training and education have already been mentioned in some studies (Maunder et al., 2006; Lancee et al., 2008; Tang et al., 2017). Employers should consider strengthening these resources by implementing support systems and coping management strategies. Besides such protective factors there might be even health promoting occupational aspects to be considered. For HCW, the intent to help can buffer mental health-impairing consequences (Liu et al., 2012) but might be a rewarding factor in and of itself (De Gieter et al., 2006). It is also conceivable that enhanced public attention can trigger public appreciation of HCW. Furthermore, HCW could move to the political fore promoting improvements in the working conditions. Such rewarding aspects should be investigated in future studies.

4.5.4 Implications for the general public

The importance of social support for mental health has been highlighted by several studies (Ko et al., 2006; Lau et al., 2006; Cao et al., 2020). Digital communication with friends, relatives and colleagues might buffer the negative effects of loneliness and separation. Although most of the studies have highlighted stressors and protective factors to cope with these stressors, there might even be rewarding aspects in times of an epidemic. Some positive mental health-related factors like family support, mental health awareness and lifestyle changes such as time to rest, to relax or to exercise have already been investigated (Lau et al., 2006). During epidemics, a substantial proportion of individuals might be confronted with altered working conditions like teleworking, which is generally associated with pros and cons for mental health (Mann and Holdsworth, 2003). Future studies should examine ways to reduce the negative impact of home-office situations in times of an epidemic crisis.

4.5.5 Information policies for public crisis management

Many studies have highlighted the role of timely and adequate information that should be provided (Wang et al., 2020a). Epidemics with escalating case numbers and mass quarantine convey the impression of a serious personal threat and increase feelings of anxiety, loss of control and being trapped (Rubin and Wessely, 2020). The extensive mass and social media coverage is associated with public concerns and may contribute to negative psychological effects (Rubin et al., 2010; Bo et al., 2020). Appropriate information and education programs may not only help to decrease anxiety (Chan et al., 2007) but also benefit in adopting protective measures (Leung et al., 2009). Thus, adequate media is essential for the promotion of protective measures (Rubin et al., 2010). Besides the responsibility of (health-) authorities to provide adequate information, it is necessary to understand the development of public attitudes to better target communication strategies, particularly with the rise of fake news and conspiracy theories (Atlani-Duault et al., 2020). Furthermore, strengthening health literacy (Kickbusch, 2001) appears to be important in enabling people to evaluate the relevant information. Generally,
the application of health behavior theories in research of public attitudes and behaviors would enhance the development of public health interventions that address the mental health-impairing processes of an epidemic crisis.

4.5.6 Addressing the needs of subpopulations in public health policy

With regard to the general public, the consideration of subpopulations was mainly neglected. For instance, people with mental illness (Holmes et al., 2020) or children and families that might be victims of domestic violence, particularly in times of quarantine (Campbell, 2020). Also, for the elderly, the effects of social distancing could lead to isolation, loneliness and severe mental health consequences (Newman and Zainal, 2020). It is generally accepted to assume that people lacking resources (such as financial, cultural or social resources) might be more vulnerable within a crisis (Hobfoll, 2001). Given this, future studies should examine mental-health effects for specific subpopulations. This would result in targeted interventions in these populations in addition to general public mental health approaches.

4.6 Strengths and Limitations

An important strength of our study is the inclusion of a broad range of populations that may be affected by MHP during or after an epidemic. This review provides an essential overview of a highly relevant public health topic since the impact of impaired mental health itself on individuals, society and economy can be substantial. Furthermore, the data shown (Tables 1-3) allows for further interpretations and delivers insights to aspects that are of interest for researchers, practitioners and policy planning (e.g. country specific prevalence rates). Limitations may arise from our search strategy since we searched for scientific publication on PubMed and did not screen reference lists of relevant articles. Additionally, no quality assessment of the studies was conducted. Further limitations arise from the large heterogeneity and methodological issues (see sections of mental health problems and methodological issues in this paper). At the same time, the heterogeneity of integrated studies is an asset, as they offer an extensive perspective on the studied issue.
5 Conclusion

In this rapid review of 74 original articles, we found a large range in prevalence rates of MHP such as anxiety, depression, post-traumatic stress symptoms or disorders, during and after epidemics across the general public, HCW, and survivors. MHP might be especially prominent among HCW and survivors that are directly affected by epidemics and face a real threat of infection and difficult circumstances like isolation/quarantine or difficult working conditions. As shown by various original studies, MHP across all populations can be substantially influenced by risk and protective factors, some of which are modifiable like social support and appropriate information by authorities. From a clinical point of view, policy makers and health care providers should be aware of potential short term or even persistent MHP. During epidemics, mental health care needs to be adapted to changing circumstances in order to grant access and treatment to those in need. Digital mental health approaches can support access to care for the public. This allows for psychological monitoring and treatment when in-person consultations are not possible. Yet, digital health interventions are still in developmental stages and need further assessment. During lockdowns, they seem to be a relevant supplement to the provision of in-person mental health care. Furthermore, HCW that often account for a substantial fraction of virus cases need to be supported. However, health authorities and policy makers should keep in mind separating short-term acute stress reactions from long-term mental illness.

It is of note that many original studies used different approaches and show methodological diversity in the assessment of MHP, which at least partly explains the broad range of MHP. Thus, results should be treated with some caution since a comparison of prevalence rates across studies and assessment of magnitude of MHP is currently not possible. Future studies should monitor MHP with standardized methods and apply comparisons with country-specific norms in order to gain a better understanding of MHP, to learn about influential factors, and to better understand how to provide appropriate access to mental health care during epidemics. Although, this was out of scope for this review, evidence of MHP in vulnerable populations such as children or people with pre-existing mental illness seems to be scarce and should be covered in future studies.
6 Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

7 Author Contributions

DR and SJZ contributed to the design of the study, data acquisition, data interpretation, manuscript development and revisions. PK contributed to data acquisition, data interpretation, manuscript development and revisions. CA, FH contributed to data acquisition and manuscript revisions. CB contributed to data interpretation and manuscript revision. AL contributed to data interpretation, manuscript development and revisions. All authors approved the final version of the submitted manuscript.

8 Funding

No funding

9 Acknowledgements

No acknowledgements
| Author (year) | Country /Region | N (including other population) | Epidemic / Time point | Mental health problem\(^a\) (Assessment instrument\(^b\)): Prevalence rates |
|---------------|----------------|-------------------------------|----------------------|----------------------------------------------------------------------|
| Cao et al. (2020) | China | 7143 | SARS-CoV-2 / During | Anxiety (GAD-7): 2.7% moderate; 0.9% severe |
| Qiu et al. (2020) | China, Hong Kong, Taiwan | 52730 | SARS-CoV-2 / During | PTSD/Stress (CPD1): 29.9% mild to moderate; 5.14% severe |
| Wang et al. (2020a) | China | 1210 | SARS-CoV-2 / During | Anxiety (DASS-21): 20.4% moderate; 8.4% severe/extremely severe |
| | | | | Depression (DASS-21): 12.2% moderate; 4.3% severe/extremely severe |
| | | | | PTSD/Stress (IES-R): 53.8% moderate/severe |
| | | | | PTSD/Stress (DASS-21): 5.5% moderate; 2.6% severe/extremely severe |
| | | | | Depression (DASS-21): 20.4% moderate; 8.4% severe/extremely severe |
| Wang et al. (2020b) | China | 600 | SARS-CoV-2 / During | Anxiety (SAS): 0.67% moderate; 0% severe |
| | | | | Depression (SDS): 2.5% moderate; 0.33% severe |
| Zhang and Ma (2020) | China | 263 | SARS-CoV-2 / During | PTSD/Stress (IES): 7.6% moderate/severe |
| Kamara et al. (2017) | Sierra Leone | 143 | Ebola virus / During | Further MHP (Med-rec): <1% alcohol/substance use disorder; 21% psychotic symptoms (e.g. hallucinations); 12% moderate to severe emotional disorder or depression |
| Koroma et al. (2019) | Sierra Leone | 10011 | Ebola virus / During / Post\(\leq 1\)y | Further MHP (Med-rec), any mental health disorders in various hospital types: <1% pre-Ebola; <1% during Ebola; ≤1% post-Ebola |
| Betancourt et al. (2016) | Sierra Leone | 1008 | Ebola virus / Post \(\leq 1\)y | Anxiety (HSCL-25): 1.3% |
| | | | | Depression (HSCL-25): 1.4% |
| | | | | PTSD/Stress (PSS-I): 11.3% likely PTSD |
| Jalloh et al. (2018) | Sierra Leone | 3564 | Ebola virus / Post \(\leq 1\)y | Anxiety (Depression) (PHQ-4): 48.6% any symptoms |
| | | | | PTSD/Stress (IES-R): 76.4% any symptoms; 27% levels of clinical concern for PTSD; 16% levels of probable PTSD diagnosis |
| Mollers et al. (2015) | Netherlands | 72 | MERS-CoV / During | Anxiety (GAD-7): 4.6% moderate; 0% severe |
| Al-Rabiaah et al. (2020) | Saudi Arabia | 174 | MERS-CoV / During | During isolation: |
| | | | | Anxiety (GAD-7): 47.2% MERS positive; 7.6% negative |
| Jeong et al. (2016) | Republic of Korea (incl. HCW, Survivors) | 1'692 | MERS-CoV / Post \(\leq 1\)y | Further MHP/Anxiety (STAXI): 52.8% MERS positive; 16.6% negative |
| Rubin et al. (2009) | England, Scotland | 997 | H1N1 / During | 4-6 months after isolation: |
| | | | | Anxiety (GAD-7): 19.4% MERS positive; 3% negative |
| | | | | Further MHP/Anxiety (STAXI): 30.6% MERS positive; 6.4% negative |
| | | | | Anxiety (STAI-6): 23.8% symptoms; 2.1% high |
| Study                  | Country | Sample Size | Exposure | Measure                        | Findings                                           |
|------------------------|---------|-------------|----------|-------------------------------|---------------------------------------------------|
| Wang et al. (2011)     | China   | 419         | H1N1 / During | SRQ-20                         | Psychiatric morbidity (8% quarantined group; 14% non-quarantined group) |
| Xu et al. (2011)       | China   | 1082        | H1N1 / During | IES-R                          | PTSD/Stress (10.8% quarantined group; 16.9% non-quarantined group) |
| Leung et al. (2003)    | Hong Kong | 1115       | SARS-CoV-1 / During | STAI                          | Anxiety (STAI): 12.6% quite/very anxious |
| Hawryluck et al. (2004)| Canada  | 129 (incl. HCW) | SARS-CoV-1 / During | PCL-C                          | PTSD/Stress: 2% symptomatic PTSD                  |
| Xu et al. (2011)       | China   | 1082        | H1N1 / During | IES-R                          | PTSD/Stress (16.9% non-quarantined group)          |
| Leung et al. (2003)    | Hong Kong | 1115       | SARS-CoV-1 / During | STAI                          | Anxiety (STAI): 12.6% quite/very anxious        |
| Quah and Hin-Peng (2004)| Singapore | 1202    | SARS-CoV-1 / During | PCL-C                          | PTSD/Stress (2.9% high)                          |
| Lau et al. (2005)      | Hong Kong | 818        | SARS-CoV-1 / During | STAI                          | PTSD/Stress (13.3% moderate to severe)      |
| Lau et al. (2006)      | Hong Kong | 818        | SARS-CoV-1 / During | IES-R                          | PTSD/Stress (16% moderate to severe)            |
| Lee et al. (2006a)     | Hong Kong | 235        | SARS-CoV-1 / During | STAI                          | Depression (BDI): 12.3%                          |
| Chan et al. (2007)     | Hong Kong | 122        | SARS-CoV-1 / During | STAI                          | Anxiety (STAI): 29.5% moderate; 4.1% high       |
| Reynolds et al. (2008) | Canada  | 1057 (incl. HCW) | SARS-CoV-1 / During | PCL-C                          | PTSD/Stress (14.6%)                              |
| Sim et al. (2010)      | Singapore | 415        | SARS-CoV-1 / During | STAI                          | Psychiatric morbidity (22.9%)                    |
| Ko et al. (2006)       | Taiwan   | 1499        | SARS-CoV-1 / Post ≤ 1y | STAI                          | PTSD/Stress (25.8% high levels)                  |
| Lee et al. (2006b)     | Hong Kong | 146        | SARS-CoV-1 / Post ≤ 1y | STAI                          | Depression (TDQ): 3.7% depressive symptoms       |
| Mihashi et al. (2009)  | China    | 187         | SARS-CoV-1 / Post ≤ 1y | STAI                          | Depression (CES-D): 32.4% elderly; 18.7% middle-aged |
| Peng et al. (2010)     | Taiwan   | 1278        | SARS-CoV-1 / Post ≤ 1y | STAI                          | Psychiatric morbidity (GHQ-30): 24.6% during the isolation period; 26.2% during the recovery period |

* PTSD, Post-traumatic stress disorder

BDI, Beck Depression Inventory; BSRS-5, 5-item Brief Symptom Rating Scale; CAS, B.A. Thyer’s Clinical Anxiety Scale; CES-D, Center for Epidemiological Studies Depression Scale; CPDI, COVID-19 Peritraumatic Distress Index; DASS-21, Depression, Anxiety and Stress Scale; GAD-7, 7-item Generalized Anxiety Disorder Scale; GHQ, General Health Questionnaire; HSCL-25, Hopkins Symptom Checklist-25; IES-R, Impact of Event Scale – Revised; Med-rec, medical records; PCL-C, PTSD Checklist – Civilian Version; PHQ-4, Patient Health Questionnaire; PSS-I, PTSD Symptom Scale-Interview; SAS, Self-Rating Anxiety Scale; SDS, Self-Rating Depression Scale; SRQ-20, Self-Report Questionnaire; STAI, Spielberger State-Trait Anxiety Inventory; STAXI, State-Trait Anger Expression Inventory; TDQ, Taiwanese Depression Questionnaire
Table 2 Prevalence rates of mental health problems in health care workers in chronological order of the respective epidemic outbreak

| Author (year)          | Country/Region | N (including other population) | Epidemic / Time point | Mental health problem\(^a\) (Assessment instrument\(^b\)); Prevalence rates |
|------------------------|----------------|-------------------------------|-----------------------|--------------------------------------------------------------------------------|
| Lai et al. (2020)      | China          | 1257                          | SARS-CoV-2 / During   | Anxiety (GAD-7): 32.3% mild; 7% moderate; 5.3% severe |
|                        |                |                               |                       | Depression (PHQ-9): 35.6% mild; 8.6% moderate; 4.9% severe |
|                        |                |                               |                       | PTSD/Stress (IES-R): 36.5% mild; 24.5% moderate; 10.5% severe |
|                        |                |                               |                       | Further MHP/Insomnia (ISI): 26.2% mild; 6.8% moderate; 1% severe |
| Sipos et al. (2018)    | Liberia        | 173                           | Ebolavirus / During   | Anxiety (GAD-7): 2.3% |
|                        |                |                               |                       | Depression (PHQ-8): 2.3% |
|                        |                |                               |                       | PTSD/Stress (PCL): 4.0% |
|                        |                |                               |                       | Further MHP/Insomnia (ISI): 12.4% |
| Tang et al. (2017)     | China          | 102                           | H7N9 / During         | PTSD/Stress (IES-R): 64.1% symptoms of; 51.5% diagnosis of PTSD |
| Lee et al. (2018)      | Republic of Korea | 359 during; 77 after | MERS-CoV / During     | 1 month after hospital shutdown (in those with PTSD diagnosis): |
|                        |                |                               |                       | Anxiety (HADS): 11% |
|                        |                |                               |                       | Depression (HADS): 15.1% |
|                        |                |                               |                       | PTSD/Stress (IES-R): 54.5% symptoms of; 40.3% diagnosis of PTSD |
|                        |                |                               |                       | Psychiatric morbidity (MINI): 5.5% major depression; 11% generalized anxiety disorder |
| Jung et al. (2020)     | Republic of Korea | 147                          | MERS-CoV / Post ≤ 1y | PTSD/Stress (IES-R): 57.1% total; 32.0% moderate; 25.1% full PTSD |
| Mishra et al. (2016)   | India          | 271                           | H1N1 / During         | Anxiety (BAI): 1.5% moderate/high |
| Elizarraras-Rivas et al. (2010) | Mexico | 35                           | H1N1 / Post ≤ 1y     | Anxiety (DAQ): 71% moderate; 17% high |
| Gouli et al. (2010)    | Greece         | 469                           | H1N1 / Post ≤ 1y     | Depression (CES-D): 34% low; 6% moderate; 3% high |
| Bai et al. (2004)      | Taiwan         | 338                           | SARS-CoV-1 / During   | PTSD/Stress (DSM-IV): 5% acute stress disorder |
| Chan and Huak (2004)   | Singapore      | 661                           | SARS-CoV-1 / During   | Psychiatric morbidity (GHQ-28): 27% |
| Chong et al. (2004)    | Taiwan         | 1257                          | SARS-CoV-1 / During   | PTSD/Stress (IES): 20% |
| Nickell et al. (2004)  | Canada         | 2001                          | SARS-CoV-1 / During   | Psychiatric morbidity (GHQ-12): 75.3% |
| Verma et al. (2004)    | Singapore      | 1050                          | SARS-CoV-1 / During   | Psychiatric morbidity (GHQ-12): 29% |
| Chen et al. (2005)     | Taiwan         | 131                           | SARS-CoV-1 / During   | Psychiatric morbidity (GHQ-28): 14.1% of general practitioners; 6% TCM practitioners |
|                        |                |                               |                       | PTSD/Stress (IES): 11% total; 17% in high-risk units; 10% in low risk units |
Table 2 Continued

| Author(s)          | Location | Sample Size | Exposure Time | Psychiatric morbidity (GHQ-12): | Depression (BDI): | PTSD/Stress (DTS-C): | Further MHP/Insomnia (PSQI): | Psychiatric morbidity (GHQ-12): |
|--------------------|----------|-------------|---------------|----------------------------------|-------------------|----------------------|-------------------------------|----------------------------------|
| Lu et al. (2006)   | Taiwan   | 127         | SARS-CoV-1 / During | 17.3%                           | 27.5% total; 38.5% in SARS units; 6.7% in non-SARS units | 33% SARS units; 19% non-SARS units | 37.1% SARS units; 9.4% non-SARS units | 56.7%                             |
| Su et al. (2007)   | Taiwan   | 102         | SARS-CoV-1 / During |                                |                   |                      |                               |                                  |
| Tam et al. (2004)  | Hong Kong| 652         | SARS-CoV-1 / During / Post ≤1y | Psychiatric morbidity (GHQ-12): | 17.3%             |                      |                               |                                  |
| Lung et al. (2009) | Taiwan   | During 127 Follow-up 123 | SARS-CoV-1 / During / Post ≤1y | Psychiatric morbidity (GHQ-12): | 17.3%             |                      |                               |                                  |
| Sim et al. (2004)  | Singapore| 277         | SARS-CoV-1 / Post ≤1y | Psychiatric morbidity (GHQ-28): | 20.6%             |                      |                               |                                  |
| Phua et al. (2005) | Singapore| 96          | SARS-CoV-1 / Post ≤1y | Psychiatric morbidity (GHQ-28): | 18.8%             |                      |                               |                                  |
| Lin et al. (2007)  | Taiwan   | 92          | SARS-CoV-1 / Post ≤1y | PTSD/Stress (DTS-C): | 19.3% likely PTSD | Psychiatric morbidity (GHQ-12): | 47.8%                           |
| Lancee et al. (2008)| Canada  | 133         | SARS-CoV-1 / Post ≤1y | Depression (SCID): | 3.8% major depression | PTSD/Stress (SCID): | 1.5%                           |
| Maunder et al. (2006) | Canada  | 587 exposed; 182 non exposed | SARS-CoV-1 / Post >1-4y | PTSD/Stress (IES): | 13.8% high in exposed; 8.4% high in non-exposed group | PTSD/Stress (K10): | 44.9% high in exposed; 30.2% high in non-exposed Burnout (MBI-EE): | 30.4% high in exposed; 19.2% high in non-exposed |
| Wu et al. (2008)   | China    | 549         | SARS-CoV-1 / Post >1-4y | Depression (CES-D): | 22.8%             | PTSD/Stress (IES-R): | 10.1% high PTSD symptoms Further MHP/Alcohol-related symptoms (NHSDA-adapted): | 19%                           |
| Wu et al. (2009)   | China    | 549         | SARS-CoV-1 / Post >1-4y | PTSD/Stress (IES-R): | 10.1% high PTSD symptoms Further MHP/Alcohol-related symptoms (NHSDA-adapted): | 19%                           |
| Liu et al. (2012)  | China    | 549         | SARS-CoV-1 / Post >1-4y | Depression (CES-D): | 14% moderate; 8.8% high level PTSD/Stress (IES-R): | 10% high level |

* PTSD, Post-traumatic stress disorder

Notes: BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; CES-D, The Center for Epidemiologic Studies Depression Scale; CHQ-12, Chinese Health Questionnaire; DAQ, Death Anxiety Questionnaire; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders – 4th edition; DTS-C, Davidson Trauma Scale – Chinese version; GAD-7, 7-item Generalized Anxiety Disorder Scale; GHQ, General Health Questionnaire; HADS, Hospital Anxiety and Depression Scale; IES-R, Impact of Event Scale – Revised; ISI, Insomnia Severity index; K10, Kessler Psychological Distress Scale; MBI-EE, Maslach Burnout Inventory – Emotional Exhaustion Scale; MINI, Mini International Neuropsychiatric Interview; NHSDA-adapted, 7-items adaptation of the National Household Survey on Drug Abuse; PCL, PTSD Checklist; PCL-C, PTSD Checklist – Civilian Version; PHQ, Patient Health Questionnaire; PSQI, Pittsburgh Sleep Quality Index; PSS-10, Perceived Stress Scale; SCID, Structured Clinical Interview for DSM-IV
| Author (year)          | Country/ Region | N (including other population) | Epidemic / Time point | Mental health problem\(^a \) (Assessment Instrument\(^b \)): Prevalence rates |
|-----------------------|-----------------|--------------------------------|-----------------------|--------------------------------------------------------------------------------|
| Bo et al. (2020)      | China           | 714                            | SARS-CoV-2 / During    | PTSD/Stress (PCL-C): 96.2% significant symptoms                                 |
| Ji et al. (2017)      | Sierra Leone    | 18                             | Ebolavirus / During    | Anxiety (SCL-90-R): 94.4% phobic anxiety; 83.3% anxiety  Further MHP (SCL-90-R): 83.3% obsession-compulsion; 94.4% hostility; 72.2% paranoid ideation |
| Howlett et al. (2018) | Sierra Leone    | 35                             | Ebolavirus / During    | Anxiety (MINI-plus/MMSE): 27.5% anxiety symptoms  Depression (MINI-plus/MMSE): 30% depressive symptoms  Further MHP/Insomnia (MINI-plus/MMSE): 52.5%  Depression (CES-D): 17% |
| Etard et al. (2017)   | Guinea          | 713                            | Ebolavirus / Post ≤ 1y | Further MHP (ESMHCLA): 3.3% hallucinations; 24.4% psychotrauma; 10.1% insomnia |
| Guetiya Wadoum et al. (2017) | Sierra Leone | 246                      | Ebolavirus / Post ≤ 1y | Depression (CES-D/ICD-10): 15%; 10.9%  PTSD (ICD-10): 1.2%  Depression (CES-D): 18.3% |
| Keita et al. (2017)   | Guinea          | 256                            | Ebolavirus / Post ≤ 1y | Anxiety (Med-rec): 13%  Depression (Med-rec): 13%  Insomnia (Med-rec): 15%  Depression (PHQ-9): 40.7% |
| Pers et al. (2017)    | Guinea          | 142                            | Ebolavirus / Post > 1-4y | 12 months follow-up:  Depression (PHQ-9): 26.9%  PTSD/Stress (IES-R): 42.3%  Further MHP/Fatigue (FSS): 48.1% |
| de St Maurice et al. (2018) | Liberia | 329                      | Ebolavirus / Post ≤ 1-y | 18 months follow-up:  Depression (PHQ-9): 17.3%  PTSD/Stress (IES-R): 26.9%  Further MHP/Fatigue (FSS): 32.7% |
| Kim et al. (2018)     | Republic of Korea | 27                     | MERS-CoV / During     | Additional MHP/Fatigue (FSS): 48.1% |
| Lee et al. (2019)     | Republic of Korea | 72                     | MERS-CoV / Post > 1-4y | Additional MHP/Fatigue (FSS): 48.1% |
| Cheng et al. (2004b)  | Hong Kong       | 180                            | SARS-CoV-1 / Post ≤ 1y | Anxiety (BAI): 23.4% mild/moderate; 24.6% moderate/severe; 7.3% severe  Depression (BDI): 24.7% mild/moderate; 19.1% moderate/severe; 6.7% severe  Acute phase:  Further MHP (NPSC, examples): 46.1% insomnia; 36.3% low mood; 2% suicidal idea; 26.5% fear and panic; 36.3% tension; 5.9% hallucinations  Convalescent phase:  Psychiatric morbidity (GHQ-28): 64.7%  Further MHP (NPSC, examples): 22.5% insomnia; 16.8% low mood; 0% suicidal idea; 13.7% fear and panic; 20.6% tension; 1% hallucinations |
| Sheng et al. (2005)   | Hong Kong       | 102                            | SARS-CoV-1 / Post ≤ 1y | 12 months follow-up:  Depression (PHQ-9): 26.9%  PTSD/Stress (IES-R): 42.3%  Further MHP/Fatigue (FSS): 48.1% |
Table 3 Continued

| Source                  | Location | Sample Size | SARS-CoV-1 / Post | Follow-up Period | Mental Health Outcomes |
|-------------------------|----------|-------------|-------------------|------------------|------------------------|
| Wu et al. (2005a)       | Hong Kong (incl. HCW) | 131 | SARS-CoV-1 / Post ≤1y | 1 month follow-up: | Anxiety (HADS): 13%  
Depression (HADS): 18%  
PTSD/Stress (IES-R): 4% all subscales; 12% intrusion; 9% avoidance; 15% hyperarousal |
| Wu et al. (2005b)       | Hong Kong (incl. HCW) | 195 | SARS-CoV-1 / Post ≤1y | 3 months follow-up: | Anxiety (HADS): 14%  
Depression (HADS): 18%  
PTSD/Stress (IES-R): 6% |
| Kwek et al. (2006)      | Singapore (incl. HCW) | 63 | SARS-CoV-1 / Post ≤1y | Anxiety (HADS): 17.5% at least moderate anxiety  
Depression (HADS): 11.1% at least moderate depression  
PTSD/Stress (IES): 41.7% at least moderate; 36.7% at least severe |
| Lee et al. (2007)       | Hong Kong (incl. HCW) | 96 | SARS-CoV-1 / Post ≤1y | Anxiety (DASS-21): 36.7% moderate/severe; 14.4% extremely severe  
Depression (DASS-21): 36.3% moderate/severe; 4.4% extremely severe  
Psychiatric morbidity (GHQ-12): 64% total; 90.3% HCW; 49.1% non-HCW  
PTSD/Stress (IES-R): at least moderate level on subscales: 32.2% Intrusion; 20.0% avoidance; 22.2% hyperarousal |
| Hong et al. (2009)      | China    | 70 | SARS-CoV-1 / Post ≤1y and >1-4y | PTSD/Stress (DSM-IV): 44.1% met criteria in at least one follow-up visit |
| Lam et al. (2009)       | Hong Kong (incl. HCW) | 181 | SARS-CoV-1 / Post >1-4y | Depression (HADS/SCID): 35.6%; 39%  
PTSD/Stress (IES-R): 27.9% intrusion; 17.6% avoidance; 33.5% hyperarousal  
Further MHP (SCID): 42.5% at least one active psychiatric illness; 54.5% PTSD; 36.4% somatoform pain disorder; 32.5% panic disorder; 15.6% obsessive compulsive disorder  
Fatigue (CFQ/CFS): 40.3%; 27.1% |
| Mak et al. (2009)       | Hong Kong (incl. HCW) | 90 | SARS-CoV-1 / Post >1-4y | PTSD/Stress (IES-R/SCID): 47.8%  
Further MHP (SCID): 58.9% any diagnosis; 46.7% depressive disorder; 21.1% anxiety disorders  
30 months post-SARS:  
Anxiety (HADS): 15.6% moderate/severe anxiety  
Depression (HADS): 18.9% moderate/severe depression  
PTSD/Stress (IES-R/SCID): 25.6%  
Further MHP (SCID): 33.3% any diagnosis; 15.6% depressive disorder; 14.6% anxiety disorders  
PTSD (SCID): total of 47.8% at some time point after the SARS outbreak; 25.6% at 30 months post-SARS |
| Mak et al. (2010)       | Hong Kong (incl. HCW) | 90 | SARS-CoV-1 / Post >1-4y | PTSD, Post-traumatic stress disorder |

* PTSD, Post-traumatic stress disorder  
+ BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; CES-D, The Center for Epidemiologic Studies Depression Scale; CFQ, Chalder Fatigue Questionnaire; CFS, modified criteria for chronic fatigue syndrome (CFS) according to the Centers for Disease Control and Prevention; DASS-21, Depression, Anxiety and Stress Scale; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders – 4th edition; ESMHCMAF, Ebola Survivors Mobile Health Clinic Medical Assessment Form; FSS, Fatigue Severity Scale; GHQ, General Health Questionnaire; HADS, Hospital Anxiety and Depression Scale; ICD-10, International Classification of Diseases – 10th edition; IES-R, Impact of Event Scale – Revised; Med-rec, medical records; MINI-plus, Mini International Neuropsychiatric Interview; MMSE, Mini Mental State Examination; NPSC, Neuropsychiatric Symptoms Checklist; PCL-C, PTSD Checklist – Civilian Version; PHQ-9, Patient Health Questionnaire; SCID, Structured Clinical Interview for DSM-IV; SCL-90-R, Symptom Checklist
### 10 Supplements

**Supplementary Table 1** PubMed search strategy (search at April 1, 2020)

| Population          | Sars*[Title/Abstract] OR COVID*[Title/Abstract] OR 2019-nCoV[Title/Abstract] OR Corona[Title/Abstract] OR Coronavirus[Title/Abstract] OR Mers*[Title/Abstract] OR “Severe Acute Respiratory”[Title/Abstract] OR Influenza*[Title/Abstract] OR Flu[Title/Abstract] OR Grippe[Title/Abstract] OR Ebola*[Title/Abstract] |
|---------------------|--------------------------------------------------------------------------------------------------|
| AND                 |                                                                                                 |
| Outcomes            | Mental[Title/Abstract] OR Psychological[Title/Abstract] OR depress*[Title/Abstract] OR schizophren* OR psychosis OR psychotic OR anxiety OR bipolar OR Stress[Title/Abstract] OR PTSD [Title/Abstract] OR Emotional [Title/Abstract] OR Trauma*[Title/Abstract] |
| NOT                 |                                                                                                 |
| Conditions / Interventions | Coronary[Title] OR Cardiac[Title] OR Cardiovascular[Title] OR “Physical activity”[Title] OR Biomarkers[Title] OR Injury[Title] OR Anaesthesia[Title] OR Melatonin[Title] OR Validation[Title] OR Pain[Title] OR Obesity[Title] OR Opioid[Title] OR fentanyl[Title] OR Orthopaedic[Title] OR Vaccin*[Title]) |
11 References

Al-Rabiaah, A., Temsah, M.-H., Al-Eyadhy, A.A., Hasan, G.M., Al-Zamil, F., Al-Subaie, S., et al. (2020). Middle East Respiratory Syndrome-Corona Virus (MERS-CoV) associated stress among medical students at a university teaching hospital in Saudi Arabia. J Infect Public Health. 13:5. doi: 10.1016/j.jiph.2020.01.005

Atlani-Duault, L., Ward, J.K., Roy, M., Morin, C., and Wilson, A. (2020). Tracking online heroisation and blame in epidemics. Lancet Public Health. 5:3. doi: 10.1016/s2468-2667(20)30033-5

Bai, Y., Lin, C.C., Lin, C.Y., Chen, J.Y., Chue, C.M., and Chou, P. (2004). Survey of stress reactions among health care workers involved with the SARS outbreak. Psychiatr Serv. 55:9. doi: 10.1176/appi.ps.55.9.1055

Baseler, L., Chertow, D.S., Johnson, K.M., Feldmann, H., and Morens, D.M. (2017). The Pathogenesis of Ebola Virus Disease. Annu Rev Pathol. 12:doi: 10.1146/annurev-pathol-052016-100506

Betancourt, T.S., Brennan, R.T., Vinck, P., VanderWeele, T.J., Spencer-Walters, D., Jeong, J., et al. (2016). Associations between Mental Health and Ebola-Related Health Behaviors: A Regionally Representative Cross-sectional Survey in Post-conflict Sierra Leone. PLoS Med. 13:8. doi: 10.1371/journal.pmed.1002073

Bo, H.X., Li, W., Yang, Y., Wang, Y., Zhang, Q., Cheung, T., et al. (2020). Posttraumatic stress symptoms and attitude toward crisis mental health services among clinically stable patients with COVID-19 in China. Psychol Med. doi: 10.1017/s0033291720000999

Brooks, S.K., Webster, R.K., Smith, L.E., Woodland, L., Wessely, S., Greenberg, N., et al. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. The Lancet. 395:10227. doi: 10.1016/S0140-6736(20)30460-8

Campbell, A.M. (2020). An increasing risk of family violence during the Covid-19 pandemic: Strengthening community collaborations to save lives. Forensic Science International: Reports. 2:doi: 10.1016/j.fsir.2020.100089

Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., et al. (2020). The psychological impact of the COVID-19 epidemic on college students in China. Psychiatry Res. 287:doi: 10.1016/j.psychres.2020.112934

Carlier, I.V., Meuldijk, D., Van Vliet, I.M., Van Fenema, E., Van der Wee, N.J., and Zitman, F.G. (2012). Routine outcome monitoring and feedback on physical or mental health status: evidence and theory. J Eval Clin Pract. 18:1. doi: 10.1111/j.1365-2753.2010.01543.x

Chan-Yeung, M. (2004). Severe acute respiratory syndrome (SARS) and healthcare workers. Int J Occup Environ Health. 10:4. doi: 10.1179/oeh.2004.10.4.421

Chan, A.O., and Huak, C.Y. (2004). Psychological impact of the 2003 severe acute respiratory syndrome outbreak on health care workers in a medium size regional general hospital in Singapore. Occup Med (Lond). 54:3. doi: 10.1093/occmed/kqh027

Chan, S.S., So, W.K., Wong, D.C., Lee, A.C., and Tiwari, A. (2007). Improving older adults' knowledge and practice of preventive measures through a telephone health education during the SARS epidemic in Hong Kong: a pilot study. Int J Nurs Stud. 44:7. doi: 10.1016/j.ijnurstu.2006.04.019

Chen, C.S., Wu, H.Y., Yang, P., and Yen, C.F. (2005). Psychological distress of nurses in Taiwan who worked during the outbreak of SARS. Psychiatr Serv. 56:1. doi: 10.1176/appi.ps.56.1.76

Cheng, S.K., Tsang, J.S., Ku, K.H., Wong, C.W., and Ng, Y.K. (2004a). Psychiatric complications in patients with severe acute respiratory syndrome (SARS) during the acute treatment phase: a series of 10 cases. Br J Psychiatry. 184:doi: 10.1192/bjp.184.4.359

Cheng, S.K., Wong, C.W., Tsang, J., and Wong, K.C. (2004b). Psychological distress and negative appraisals in survivors of severe acute respiratory syndrome (SARS). Psychol Med. 34:7. doi: 10.1017/s0033291704002272

Chew, Q.H., Wei, K.C., Vasoo, S., Chua, H.C., and Sim, K. (2020). Narrative synthesis of psychological and coping responses towards emerging infectious disease outbreaks in the general population: practical considerations for the COVID-19 pandemic. Singapore Med J. doi: 10.11622/smedj.2020046
Chong, M.Y., Wang, W.C., Hsieh, W.C., Lee, C.Y., Chiu, N.M., Yeh, W.C., et al. (2004). Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. Br J Psychiatry. 185:doi: 10.1192/bjp.185.2.127

Chua, S.E., Cheung, V., McAlonan, G.M., Cheung, C., Wong, J.W., Cheung, E.P., et al. (2004). Stress and psychological impact on SARS patients during the outbreak. Can J Psychiatry. 49:6. doi: 10.1177/070674370404900607

De Gieter, S., De Cooman, R., Pepermans, R., Caers, R., Du Bois, C., and Jegers, M. (2006). Identifying nurses' rewards: a qualitative categorization study in Belgium. Hum Resour Health. 4:doi: 10.1186/1476-074X-4-15

de St Maurice, A., Ervin, E., Orone, R., Choi, M., Dokubo, E.K., Rollin, P.E., et al. (2018). Care of Ebola Survivors and Factors Associated With Clinical Sequelae-Monrovia, Liberia. Open Forum Infect Dis. 5:10. doi: 10.1093/ofid/ofy239

Dorn, F., Fuest, C., Göttert, M., Krolage, C., Lautenbacher, S., Link, S., et al. (2020). Die volkswirtschaftlichen Kosten des Corona- Shutdown für Deutschland: Eine Szenarienrechnung. ifo Schnelldienst. 4.

Duan, L., and Zhu, G. (2020). Psychological interventions for people affected by the COVID-19 epidemic. Lancet Psychiatry. 7:4. doi: 10.1016/s2215-0366(20)30073-0

Elizarraras-Rivas, J., Vargas-Mendoza, J.E., Mayoral-Garcia, M., Matadamas-Zarate, C., Elizarraras-Cruz, A., Taylor, M., et al. (2010). Psychological response of family members of patients hospitalised for influenza A/H1N1 in Oaxaca, Mexico. BMC Psychiatry. 10:doi: 10.1186/1471-244X-10-104

Etard, J.F., Sow, M.S., Leroy, S., Toure, A., Taverne, B., Keita, A.K., et al. (2017). Multidisciplinary assessment of post-Ebola sequelae in Guinea (Postebogui): an observational cohort study. Lancet Infect Dis. 17:5. doi: 10.1016/s1473-3099(16)30516-3

Fardin, M.A. (2020). COVID-19 and Anxiety: A Review of Psychological Impacts of Infectious Disease Outbreaks. Arch Clin Infect Dis. 15:COVID-19. doi: 10.5812/archcid.102779

Gao, R., Cao, B., Hu, Y., Feng, Z., Wang, D., Hu, W., et al. (2013). Human Infection with a Novel Avian-Origin Influenza A (H7N9) Virus. N Engl J Med. 368:20. doi: 10.1056/NEJMoal1304459

Goulia, P., Mantas, C., Dimitroula, D., Mantis, D., and Hyphantis, T. (2010). General hospital staff worries, perceived sufficiency of information and associated psychological distress during the A/H1N1 influenza pandemic. BMC infectious diseases. 10:doi: 10.1186/1471-2334-10-322

Guetiya Wadoum, R.E., Samin, A., Mafopa, N.G., Giovanetti, M., Russo, G., Turay, P., et al. (2017). Mobile health clinic for the medical management of clinical sequelae experienced by survivors of the 2013-2016 Ebola virus disease outbreak in Sierra Leone, West Africa. Eur J Clin Microbiol Infect Dis. 36:11. doi: 10.1007/s10096-017-3045-1

Hawryluck, L., Gold, W.L., Robinson, S., Pogorski, S., Galea, S., and Styra, R. (2004). SARS control and psychological effects of quarantine, Toronto, Canada. Emerg Infect Dis. 10:7. doi: 10.3201/eid1007.030703

Hobfoll, S.E. (2001). The Influence of Culture, Community, and the Nested-Self in the Stress Process: Advancing Conservation of Resources Theory. Applied Psychology. 50:3. doi: 10.1111/1464-0597.00062

Holmes, E.A., O'Connor, R.C., Perry, V.H., Tracey, I., Wessely, S., Arseneault, L., et al. (2020). Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. Lancet Psychiatry. doi: 10.1016/s2215-0366(20)30168-1

Hong, X., Currier, G.W., Zhao, X., Jiang, Y., Zhou, W., and Wei, J. (2009). Posttraumatic stress disorder in convalescent severe acute respiratory syndrome patients: a 4-year follow-up study. Gen Hosp Psychiatry. 31:6. doi: 10.1016/j.genhosppsych.2009.06.008

Howlett, P.J., Walder, A.R., Lisk, D.R., Fitzgerald, F., Sevalie, S., Lado, M., et al. (2018). Case Series of Severe Neurologic Sequelae of Ebola Virus Disease during Epidemic, Sierra Leone. Emerg Infect Dis. 24:8. doi: 10.3201/eid2408.171367

Jalloh, M.F., Li, W., Bunnell, R.E., Ethier, K.A., O’Leary, A., Hageman, K.M., et al. (2018). Impact of Ebola experiences and risk perceptions on mental health in Sierra Leone, July 2015. BMJ Glob Health. 3:2. doi: 10.1136/bmjgh-2017-000471
Jeong, H., Yim, H.W., Song, Y.J., Ki, M., Min, J.A., Cho, J., et al. (2016). Mental health status of people isolated due to Middle East Respiratory Syndrome. Epidemiol Health. 38:doi:10.4178/epih.e2016048

Ji, D., Ji, Y.J., Duan, X.Z., Li, W.G., Sun, Z.Q., Song, X.A., et al. (2017). Prevalence of psychological symptoms among Ebola survivors and healthcare workers during the 2014-2015 Ebola outbreak in Sierra Leone: a cross-sectional study. Oncotarget. 8: doi:10.18632/oncotarget.14498

Jung, H., Jung, S.Y., Lee, M.H., and Kim, M.S. (2020). Assessing the Presence of Post-Traumatic Stress and Turnover Intention Among Nurses Post-Middle East Respiratory Syndrome Outbreak: The Importance of Supervisor Support. Workplace Health Saf. doi:10.1177/2165079919897693

Kamara, S., Walder, A., Duncan, J., Kabbedijk, A., Hughes, P., and Muana, A. (2017). Mental health care during the Ebola virus disease outbreak in Sierra Leone. Bulletin of the World Health Organization. 95:12. doi: 10.2471/BLT.16.190470

Kauer, S.D., Mangan, C., and Sanci, L. (2014). Do online mental health services improve help-seeking for young people? A systematic review. J Med Internet Res. 16:3. doi: 10.2196/jmir.3103

Keita, M.M., Taverne, B., Sy Savane, S., March, L., Doukoure, M., Sow, M.S., et al. (2017). Depressive symptoms among survivors of Ebola virus disease in Conakry (Guinea): preliminary results of the PostEboGui cohort. BMC Psychiatry. 17:1. doi: 10.1186/s12888-017-1280-8

Kickbusch, I.S. (2001). Health literacy: addressing the health and education divide. Health Promot Int. 16:3. doi: 10.1093/heapro/16.3.289

Kim, H.C., Yoo, S.Y., Lee, B.H., Lee, S.H., and Shin, H.S. (2018). Psychiatric Findings in Suspected and Confirmed Middle East Respiratory Syndrome Patients Quarantined in Hospital: A Retrospective Chart Analysis. Psychiatry Investig. 15:4. doi: 10.30773/pi.2017.10.25.1

Keita, M.M., Taverne, B., Sy Savane, S., March, L., Doukoure, M., Sow, M.S., et al. (2017). Depressive symptoms among survivors of Ebola virus disease in Conakry (Guinea): preliminary results of the PostEboGui cohort. BMC Psychiatry. 17:1. doi: 10.1186/s12888-017-1280-8

Ko, C.H., Yen, C.F., Yen, J.Y., and Yang, M.J. (2006). Psychosocial impact among the public of the severe acute respiratory syndrome epidemic in Taiwan. Psychiatry Clin Neurosci. 60:4. doi: 10.1111/j.1440-1819.2006.01522.x

Koroma, I.B., Javadi, D., Hann, K., Harries, A.D., Smart, F., and Samba, T. (2019). Non-communicable diseases in the Western Area District, Sierra Leone, following the Ebola outbreak. F1000Res. 8:doi:10.12688/f1000research.18563.2

Kwek, S.K., Chew, W.M., Ong, K.C., Ng, A.W., Lee, L.S., Kaw, G., et al. (2006). Quality of life and psychological status in survivors of severe acute respiratory syndrome at 3 months postdischarge. J Psychosom Res. 60:5. doi: 10.1016/j.jpsychires.2005.08.020

Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., et al. (2020). Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. JAMA network open. 3:3. doi:10.1001/jamanetworkopen.2020.3976

Lam, M.H., Wing, Y.K., Yu, M.W., Leung, C.M., Ma, R.C., Kong, A.P., et al. (2009). Mental morbidities and chronic fatigue in severe acute respiratory syndrome survivors: long-term follow-up. Arch Intern Med. 169:22. doi: 10.1001/archinternmed.2009.384

Lancee, W.J., Maunnder, R.G., and Goldbloom, D.S. (2008). Prevalence of psychiatric disorders among Toronto hospital workers one to two years after the SARS outbreak. Psychiatr Serv. 59:1. doi:10.1176/ps.2008.59.1.91

Langarizadeh, M., Tabatabaei, M.S., Tavakol, K., Naghipour, M., Rostami, A., and Moghbili, F. (2017). Telemental Health Care, an Effective Alternative to Conventional Mental Care: a Systematic Review. Acta Inform Med. 25:4. doi:10.5455/aim.2017.25.240-246

Lau, J.T., Yang, X., Tsui, H.Y., Pang, E., and Wing, Y.K. (2006). Positive mental health-related impacts of the SARS epidemic on the general public in Hong Kong and their associations with other negative impacts. J Infect. 53:2. doi: 10.1016/j.jinf.2005.10.019

Lau, J.T.F., Yang, X., Pang, E., Tsui, H.Y., Wong, E., and Wing, Y.K. (2005). SARS-related perceptions in Hong Kong. Emerging infectious diseases. 11:3. doi: 10.3201/eid1103.040675

Lee, A.M., Wong, J.G., McAlonan, G.M., Cheung, V., Cheung, C., Sham, P.C., et al. (2007). Stress and psychological distress among SARS survivors 1 year after the outbreak. Can J Psychiatry. 52:4. doi: 10.1177/070674370705200405

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Lee, D.T., Sahota, D., Leung, T.N., Yip, A.S., Lee, F.F., and Chung, T.K. (2006a). Psychological responses of pregnant women to an infectious outbreak: a case-control study of the 2003 SARS outbreak in Hong Kong. J Psychosom Res. 61:5. doi: 10.1016/j.jpsychores.2006.08.005

Lee, S.H., Shin, H.S., Park, H.Y., Kim, J.L., Lee, J.J., Lee, H., et al. (2019). Depression as a Mediator of Chronic Fatigue and Post-Traumatic Stress Symptoms in Middle East Respiratory Syndrome Survivors. Psychiatry Investig. 16:1. doi: 10.30773/pi.2018.10.22.3

Lee, S.M., Kang, W.S., Cho, A.R., Kim, T., and Park, J.K. (2018). Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients. Compr Psychiatry. 87:doi: 10.1016/j.comppsych.2018.10.003

Lee, T.M., Chi, I., Chung, L.W., and Chou, K.L. (2006b). Ageing and psychological response during the post-SARS period. Aging Ment Health. 10:3. doi: 10.1080/13607860600638545

Leung, G.M., Lam, T.H., Ho, L.M., Ho, S.Y., Chan, B.H., Wong, I.O., et al. (2003). The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. J Epidemiol Community Health. 57:11. doi: 10.1136/jech.57.11.857

Leung, G.M., Quah, S., Ho, L.M., Ho, S.Y., Hedley, A.J., Lee, H.P., et al. (2009). Community psycho-behavioural surveillance and related impact on outbreak control in Hong Kong and Singapore during the SARS epidemic. Hong Kong Med J. 15 Suppl 9:

Li, S., Wang, Y., Xue, J., Zhao, N., and Zhu, T. (2020). The Impact of COVID-19 Epidemic Declaration on Psychological Consequences: A Study on Active Weibo Users. Int J Environ Res Public Health. 17:6. doi: 10.3390/ijerph17062032

Lin, C.Y., Peng, Y.C., Wu, Y.H., Chang, J., Chan, C.H., and Yang, D.Y. (2007). The psychological effect of severe acute respiratory syndrome on emergency department staff. Emerg Med J. 24:1. doi: 10.1136/emj.2006.035089

Liu, X., Kakade, M., Fuller, C.J., Fan, B., Fang, Y., Kong, J., et al. (2012). Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. Compr Psychiatry. 53:1. doi: 10.1016/j.comppsych.2011.02.003

Lovejoy, C.A., Buch, V., and Maruthappu, M. (2019). Technology and mental health: The role of artificial intelligence. Eur Psychiatry. 55:doi: 10.1016/j.eurpsy.2018.08.004

Lu, Y.C., Shu, B.C., Chang, Y.Y., and Lung, F.W. (2006). The mental health of hospital workers dealing with severe acute respiratory syndrome. Psychother Psychosom. 75:6. doi: 10.1159/000095443

Lung, F.W., Lu, Y.C., Chang, Y.Y., and Shu, B.C. (2009). Mental Symptoms in Different Health Professionals During the SARS Attack: A Follow-up Study. Psychiatr Q. 80:2. doi: 10.1007/s11126-009-9095-5

Mak, I.W., Chu, C.M., Pan, P.C., Yiu, M.G., and Chan, V.L. (2009). Long-term psychiatric morbidities among SARS survivors. Gen Hosp Psychiatry. 31:4. doi: 10.1016/j.genhosppsych.2009.03.001

Mak, I.W., Chu, C.M., Pan, P.C., Yiu, M.G., Ho, S.C., and Chan, V.L. (2010). Risk factors for chronic post-traumatic stress disorder (PTSD) in SARS survivors. Gen Hosp Psychiatry. 32:6. doi: 10.1016/j.genhosppsych.2010.07.007

Mann, S., and Holdsworth, L. (2003). The psychological impact of teleworking: stress, emotions and health. New Technology, Work and Employment. 18:3. doi: 10.1111/1468-005x.00121

Maunder, R., Hunter, J., Vincent, L., Bennett, J., Peladeau, N., Leszcz, M., et al. (2003). The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital. Cmaj. 168:10.

Maunder, R.G., Lancee, W.J., Balderson, K.E., Bennett, J.P., Borgundvaag, B., Evans, S., et al. (2006). Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. Emerg Infect Dis. 12:12. doi: 10.3201/eid1212.060584

McAlonan, G.M., Lee, A.M., Cheung, V., Cheung, C., Tsang, K.W., Sham, P.C., et al. (2007). Immediate and sustained psychological impact of an emerging infectious disease outbreak on health care workers. Can J Psychiatry. 52:4. doi: 10.1177/070674370705200406

Meo, S.A., Alhowikan, A.M., Al-Khlaiwi, T., Meo, I.M., Halepoto, D.M., Iqbal, M., et al. (2020). Novel coronavirus 2019-nCoV: prevalence, biological and clinical characteristics comparison with SARS-CoV and MERS-CoV. Eur Rev Med Pharmacol Sci. 24:4. doi: 10.26355/eurrev_202002_20379
Mihashi, M., Otsubo, Y., Yinjuan, X., Nagatomi, K., Hoshiko, M., and Ishitake, T. (2009). Predictive factors of psychological disorder development during recovery following SARS outbreak. Health Psychol. 28:1. doi: 10.1037/a0013674

Mishra, P., Bhadauria, U.S., Dasar, P.L., N, S., Kumar, S., Lalani, A., et al. (2016). Knowledge, attitude and anxiety towards pandemic flu a potential bio weapon among health professionals in Indore City. Przegl Epidemiol. 70:1.

Mollers, M., Jonges, M., Pas, S.D., van der Eijk, A.A., Dirksen, K., Jansen, C., et al. (2015). Follow-up of Contacts of Middle East Respiratory Syndrome Coronavirus-Infected Returning Travelers, the Netherlands, 2014. Emerg Infect Dis. 21:9. doi: 10.3201/eid2109.150560

Newman, M.G., and Zainal, N.H. (2020). The value of maintaining social connections for mental health in older people. Lancet Public Health. 5:1. doi: 10.1016/s2468-2667(19)30253-1

Nickell, L.A., Crighton, E.J., Tracy, C.S., Al-Enazy, H., Bolaji, Y., Hanjrah, S., et al. (2004). Psychosocial effects of SARS on hospital staff: survey of a large tertiary care institution. Cmaaj. 170:5. doi: 10.1503/cmaj.1031077

Peiris, J.S., Yuen, K.Y., Osterhaus, A.D., and Stohr, K. (2003). The severe acute respiratory syndrome. N Engl J Med. 349:25. doi: 10.1056/NEJMra032498

Peng, E.Y., Lee, M.B., Tsai, S.T., Yang, C.C., Morisky, D.E., Tsai, L.T., et al. (2010). Population-based post-crisis psychological distress: an example from the SARS outbreak in Taiwan. J Formos Med Assoc. 109:7. doi: 10.1016/s0929-6646(10)60087-3

Pers, Y.M., Sow, M.S., Taverne, B., March, L., Izard, S., Etard, J.F., et al. (2017). Characteristics of the musculoskeletal symptoms observed among survivors of Ebola virus disease in the Postebogui cohort in Guinea. Rheumatology (Oxford). 56:12. doi: 10.1093/rheumatology/kex074

Pfefferbaum, B., and North, C.S. (2020). Mental Health and the Covid-19 Pandemic. N Engl J Med. doi: 10.1056/NEJMp2008017

Phua, D.H., Tang, H.K., and Tham, K.Y. (2005). Coping responses of emergency physicians and nurses to the 2003 severe acute respiratory syndrome outbreak. Acad Emerg Med. 12:4. doi: 10.1197/j.aem.2004.11.015

Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., and Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. General Psychiatry. 33:2. doi: 10.1136/gpsych-2020-100213

Quah, S.R., and Hin-Peng, L. (2004). Crisis prevention and management during SARS outbreak, Singapore. Emerging infectious diseases. 10:2. doi: 10.3201/eid1002.030418

Rajkumar, R.P. (2020). COVID-19 and mental health: A review of the existing literature. Asian journal of psychiatry. 52:doi: 10.1016/j.ajp.2020.102066

Reynolds, D.L., Garay, J.R., Deamond, S.L., Moran, M.K., Gold, W., and Styra, R. (2008). Understanding, compliance and psychological impact of the SARS quarantine experience. Epidemiol Infect. 136:7. doi: 10.1017/s0950268807009156

Rubanovich, C.K., Mohr, D.C., and Schueller, S.M. (2017). Health App Use Among Individuals With Symptoms of Depression and Anxiety: A Survey Study With Thematic Coding. JMIR Ment Health. 4:2. doi: 10.2196/mental.7603

Rubin, G.J., Amlôt, R., Page, L., and Wessely, S. (2009). Public perceptions, anxiety, and behaviour change in relation to the swine flu outbreak: cross sectional telephone survey. BMJ. 339:doi: 10.1136/bmj.b2651

Rubin, G.J., Potts, H.W., and Michie, S. (2010). The impact of communications about swine flu (influenza A H1N1v) on public responses to the outbreak: results from 36 national telephone surveys in the UK. Health Technol Assess. 14:34. doi: 10.3310/hta14340-03

Rubin, G.J., and Wessely, S. (2020). The psychological effects of quarantining a city. Bmj. 368:doi: 10.1136/bmj.m313

Sheng, B., Cheng, S.K., Lau, K.K., Li, H.L., and Chan, E.L. (2005). The effects of disease severity, use of corticosteroids and social factors on neuropsychiatric complaints in severe acute respiratory syndrome (SARS) patients at acute and convalescent phases. Eur Psychiatry. 20:3. doi: 10.1016/j.eurpsy.2004.06.023

Sim, K., Chong, P.N., Chan, Y.H., and Soon, W.S. (2004). Severe acute respiratory syndrome-related psychiatric and posttraumatic morbidities and coping responses in medical staff within a primary health care setting in Singapore. J Clin Psychiatry. 65:8. doi: 10.4088/jcp.v65n0815
Sim, K., Huak Chan, Y., Chong, P.N., Chua, H.C., and Wen Soon, S. (2010). Psychosocial and coping responses within the community health care setting towards a national outbreak of an infectious disease. J Psychosom Res. 68:2. doi: 10.1016/j.jpsychores.2009.04.004

Sipos, M.L., Kim, P.Y., Thomas, S.J., and Adler, A.B. (2018). U.S. Service Member Deployment in Response to the Ebola Crisis: The Psychological Perspective. Mil Med. 183:3-4. doi: 10.1093/milmed/uxs042

Smith, R.D. (2006). Responding to global infectious disease outbreaks: lessons from SARS on the role of risk perception, communication and management. Social Science & Medicine. 63:12. doi: 10.1016/j.socscimed.2006.08.004

Starace, F., and Ferrara, M. (2020). COVID-19 disease emergency operational instructions for Mental Health Departments issued by the Italian Society of Epidemiological Psychiatry. Epidemiol Psychiatr Sci. 29: doi: 10.1017/S2045796020000372

Su, T.P., Lien, T.C., Yang, C.Y., Su, Y.L., Wang, J.H., Tsai, S.L., et al. (2007). Prevalence of psychiatric morbidity and psychological adaptation of the nurses in a structured SARS caring unit during outbreak: a prospective and periodic assessment study in Taiwan. J Psychiatr Res. 41:1-2. doi: 10.1016/j.jpsychires.2005.12.006

Sun, L., Sun, Z., Wu, L., Zhu, Z., Zhang, F., Shang, Z., et al. (2020). Prevalence and Risk Factors of Acute Posttraumatic Stress Symptoms during the COVID-19 Outbreak in Wuhan, China. medRxiv. doi: 10.1101/2020.03.06.20032425

Suwantarat, N., and Apisarnthanarak, A. (2015). Risks to healthcare workers with emerging diseases: lessons from MERS-CoV, Ebola, SARS, and avian flu. Current Opinion in Infectious Diseases. 28:4. doi: 10.1097/QCO.0000000000000183

Tam, C.W., Pang, E.P., Lam, L.C., and Chiu, H.F. (2004). Severe acute respiratory syndrome (SARS) in Hong Kong in 2003: stress and psychological impact among frontline healthcare workers. Psychol Med. 34:7. doi: 10.1017/s0033291704002247

Tang, L., Pan, L., Yuan, L., and Zhu, L. (2017). Prevalence and related factors of post-traumatic stress disorder among medical staff members exposed to H7N9 patients. Int J Nurs Sci. 4:1. doi: 10.1016/j.ijnss.2016.12.002

Torales, J., O'Higgins, M., Castaldelli-Maia, J.M., and Ventriglio, A. (2020). The outbreak of COVID-19 coronavirus and its impact on global mental health. International Journal of Social Psychiatry. 0:0. doi: 10.1177/0020764020915212

Tricco, A.C., Langlois, E.V., Straus, S.E., Alliance for Health, P., Systems, R., and World Health, O. (2017). Rapid reviews to strengthen health policy and systems: a practical guide. Geneva: World Health Organization.

Trifonov, V., Khiabanian, H., and Rabadan, R. (2009). Geographic Dependence, Surveillance, and Origins of the 2009 Influenza A (H1N1) Virus. N Engl J Med. 361:2. doi: 10.1056/NEJMp0904572

Troyer, E.A., Kohn, J.N., and Hong, S. (2020). Are we facing a crashing wave of neuropsychiatric sequelae of COVID-19? Neuropsychiatric symptoms and potential immunologic mechanisms. Brain, Behavior, and Immunity. doi: 10.1016/j.bbi.2020.04.027

Tuerk, P.W., Keller, S.M., and Acienro, R. (2018). Treatment for Anxiety and Depression via Clinical Videoconferencing: Evidence Base and Barriers to Expanded Access in Practice. Focus (American Psychiatric Publishing). 16:4. doi: 10.1176/appi.focus.20180027

Van Bortel, T., Basnayake, A., Wurie, F., Jambai, M., Koroma, A.S., Muana, A.T., et al. (2016). Psychosocial effects of an Ebola outbreak at individual, community and international levels. Bulletin of the World Health Organization. 94:3. doi: 10.2471/BLT.15.158543

Verma, S., Mythily, S., Chan, Y.H., Deslypere, J.P., Teo, E.K., and Chong, S.A. (2004). Post-SARS psychological morbidity and stigma among general practitioners and traditional Chinese medicine practitioners in Singapore. Ann Acad Med Singapore. 33:6.

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C.S., et al. (2020a). Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. Int J Environ Res Public Health. 17:5. doi: 10.3390/ijerph17051729

Wang, J., Lloyd-Evans, B., Giacco, D., Forsyth, R., Nebo, C., Mann, F., et al. (2017). Social isolation in mental health: a conceptual and methodological review. Soc Psychiatry Psychiatr Epidemiol. 52:12. doi: 10.1007/s00127-017-1446-1
Wang, Y., Di, Y., Ye, J., and Wei, W. (2020b). Study on the public psychological states and its related factors during the outbreak of coronavirus disease 2019 (COVID-19) in some regions of China. Psychol Health Med. doi: 10.1080/13548506.2020.1746817

Wang, Y., Xu, B., Zhao, G., Cao, R., He, X., and Fu, S. (2011). Is quarantine related to immediate negative psychological consequences during the 2009 H1N1 epidemic? Gen Hosp Psychiatry. 33:1. doi: 10.1016/j.genhosppsych.2010.11.001

Wilder-Smith, A., and Freedman, D.O. (2020). Isolation, quarantine, social distancing and community containment: pivotal role for old-style public health measures in the novel coronavirus (2019-nCoV) outbreak. J Travel Med. 27:2. doi: 10.1093/jtm/taaa020

Wind, T.R., Rijkeboer, M., Andersson, G., and Riper, H. (2020). The COVID-19 pandemic: The 'black swan' for mental health care and a turning point for e-health. Internet interventions. 20:doi: 10.1016/j.invent.2020.100317

Wu, J.T., Leung, K., and Leung, G.M. (2020). Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study. Lancet. 395:10225. doi: 10.1016/s0140-6736(20)30260-9

Wu, K.K., Chan, S.K., and Ma, T.M. (2005a). Posttraumatic stress after SARS. Emerging infectious diseases. 11:8. doi: 10.3201/eid1108.041083

Wu, K.K., Chan, S.K., and Ma, T.M. (2005b). Posttraumatic stress, anxiety, and depression in survivors of severe acute respiratory syndrome (SARS). J Trauma Stress. 18:1. doi: 10.1002/jts.20004

Wu, P., Fang, Y., Guan, Z., Fan, B., Kong, J., Yao, Z., et al. (2009). The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. Can J Psychiatry. 54:5. doi: 10.1177/070674370905400504

Wu, P., Liu, X., Fang, Y., Fan, B., Fuller, C.J., Guan, Z., et al. (2008). Alcohol abuse/dependence symptoms among hospital employees exposed to a SARS outbreak. Alcohol Alcohol. 43:6. doi: 10.1093/alcalc/agn073

Xu, J., Zheng, Y., Wang, M., Zhao, J., Zhan, Q., Fu, M., et al. (2011). Predictors of symptoms of posttraumatic stress in Chinese university students during the 2009 H1N1 influenza pandemic. Med Sci Monit. 17:7. doi: 10.12659/msm.881836

Zaki, A.M., van Boheemen, S., Bestebroer, T.M., Osterhaus, A.D., and Fouchier, R.A. (2012). Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. N Engl J Med. 367:19. doi: 10.1056/NEJMoa1211721

Zhang, Y., and Ma, Z.F. (2020). Impact of the COVID-19 Pandemic on Mental Health and Quality of Life among Local Residents in Liaoning Province, China: A Cross-Sectional Study. Int J Environ Res Public Health. 17:7. doi: 10.3390/ijerph17072381
Figure 1 PRISMA flow diagram of the studies retrieved for the review

Records identified through PubMed searching (n=2,855)

No duplicates (only PubMed searched)

Records screened (n=2,855)

Records excluded (n=2630)

Full-text articles assessed for eligibility (n=225)

Full-text articles excluded (n=151)

Common reasons
- No prevalence rates provided
- Mental health problems measured by single items
- No specific mental health measures included (e.g. worry, concerns)
- Qualitative design

Studies included in qualitative synthesis (n=74)