



MENTAL HEALTH OF HEALTHCARE WORKERS DURING EPIDEMICS

Mental health problems are one of the major causes of burden of disease globally. During epidemics, healthcare workers (HCWs) are at a heightened risk of adverse mental health symptoms. It is of critical importance to summarize what has been learned in prior epidemics and during the current COVID-19 pandemic to understand the scope of the mental health issues among HCWs, the associated risk and protective factors, and potential interventions. This information will inform the development of interventions that seek to reduce adverse mental health consequences among HCWs.

MENTAL HEALTH SCREENING TOOL DEVELOPMENTS RELATED TO COVID-19

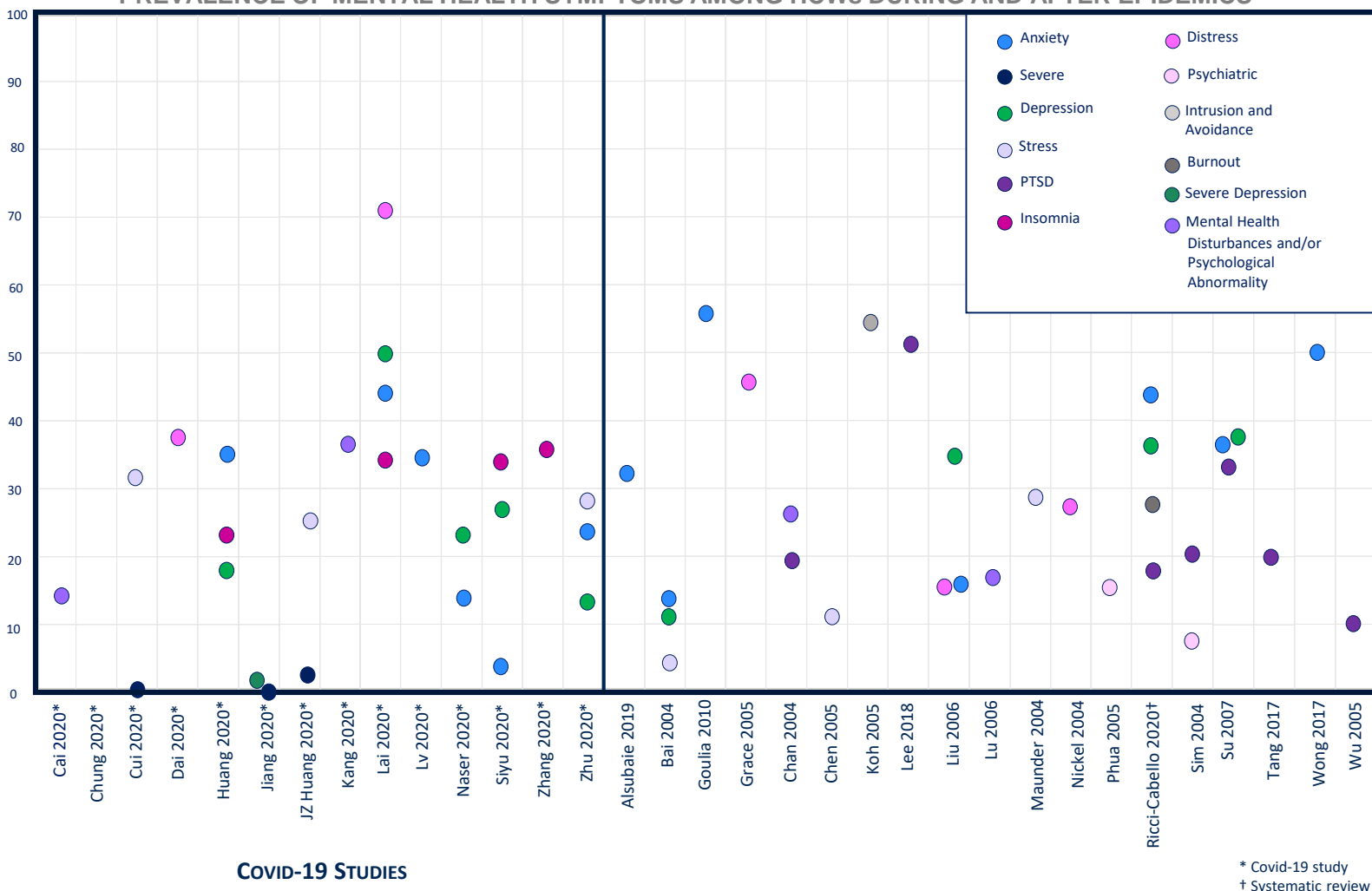
The [Fear of COVID-19 Scale](#), a seven-item scale, has been developed to address fears of the virus among HCWs and the general population.

The [Coronavirus Anxiety Scale \(CAS\)](#), a five-item questionnaire has been developed that screens for dysfunctional anxiety associated with the COVID-19 crisis.

THE BURDEN OF MENTAL HEALTH SYMPTOMS AMONG HEALTHCARE WORKERS

Of 62 total articles on mental health among HCWs during epidemics, 33 reported the prevalence of mental health symptoms. The most common mental health outcome studied was anxiety (13 studies) which ranged from a low of 6% to a high of 57%. Nine studies reported the prevalence of depression which ranged from a low of 11% to a high of 50%. Post traumatic stress disorder was reported to affect 10% to 52% of the HCW population across 7 studies. Across studies, epidemics, and countries, findings indicate that the mental health burden is remarkably high among HCWs, indicating that this group is particularly vulnerable, and interventions should be tailored to meet the unique mental health needs of HCWs. *Detailed findings are presented in the chart below, and in Appendix A.*

PREVALENCE OF MENTAL HEALTH SYMPTOMS AMONG HCWs DURING AND AFTER EPIDEMICS



FACTORS THAT AFFECT THE RISK OF DEVELOPING MENTAL HEALTH SYMPTOMS AMONG HEALTHCARE WORKERS

There are several factors the increase and decrease the risk of mental health problems among HCWs during epidemics. Of 62 total articles written on mental health among HCWs during epidemics, 47 quantitative studies report factors that significantly increase or decrease the risk of HCWs developing adverse mental health symptoms. Many of the factors presented were related to HCWs' sociodemographic status, occupation, and preparedness and knowledge relating to the epidemic. In qualitative interviews, many HCWs reported major disruptions to their professional, social, and personal lives and relationships, which are related to factors described in the quantitative literature. *Detailed findings are presented below, and in Appendix B.*

PROTECTIVE FACTORS	MIXED FINDINGS	RISK FACTORS	RELATED QUALITATIVE THEMES AND ILLUSTRATIVE QUOTES
SOCIODEMOGRAPHIC			
<ul style="list-style-type: none"> High income³¹ 	<ul style="list-style-type: none"> Marital status^{5,24,25,31,35} Age^{31,25,13,35,41} Sense of duty¹³ 	<ul style="list-style-type: none"> Female sex^{9,15,19,31,36,40,42,47} Insecurity¹² Having children¹³ Fatigue²¹ High school education or below⁴⁶ Regret in occupational choice⁹ Low professional title⁴¹ History of psychiatric disorder or chronic disease before outbreak^{19,31,4} Prior exposure to other traumatic event²⁴ Poor self-rated physical health⁴⁰ History of mental disorders⁴⁷ Part-time employment³² 	<p>Feeling emotionally exhausted and drained</p> <p><i>"It's very emotional. Sometimes you feel like running to the toilet and crying a little bit before coming back."</i></p> <p>Feeling a sense of purpose</p> <p><i>"Professionally it would be the highlight of my career, I do not think I would ever do anything as difficult, yet rewarding."</i></p> <p>Feeling 'isolated', 'deprived', and 'ostracized'</p> <p><i>"We did not even have access to even our own children. We were lying on the floor for 21 days."</i></p>
SOCIAL			
<ul style="list-style-type: none"> Social support from family and friends¹ A need to care for elders¹³ 		<ul style="list-style-type: none"> Restricted social activities/isolation^{10,13} Working in most affected city¹⁰ Having or fearing family/colleagues that are infected^{10,45,47,39,46,9} Lifestyle affected by epidemic^{32,37} Not living with family²⁵ HCWs being perceived negatively⁴⁶ 	<p>Yearning for 'the ways things were before the epidemic'</p> <p><i>"Children used to come here and hug us. Now they run away from us... they call us the devil."</i></p> <p>Feeling as if they 'own the disease'</p> <p><i>Family, friends, and community members believed that HCWs "possess the disease."</i></p>

FACTORS THAT AFFECT THE RISK OF DEVELOPING MENTAL HEALTH SYMPTOMS AMONG HEALTHCARE WORKERS

PROTECTIVE FACTORS	MIXED FINDINGS	RISK FACTORS
OCCUPATIONAL		
<ul style="list-style-type: none"> Off-duty shifts/rest time^{7,9} Occupational support^{14,47} Perceived adequacy of training and support^{10,23,28} Limited contact with affected patients²⁸ Limited quarantine²⁸ Psychiatric services²⁹ Protective measures⁴⁷ 	<ul style="list-style-type: none"> Quarantine^{2,20,24,45} Occupation^{15,32,40,42,5,36,42} 	<ul style="list-style-type: none"> Pulmonologist³¹ Working in high risk unit or emergency department^{6,22,25,29,37,42,45,46} Length of contact time with epidemic-affected patients/greater exposure^{14,16,17,30,41} Participating in frontline treatment^{10,11,19,20,25,38,43} Job hindered by epidemic precaution measures³² Inadequate support from employer⁴⁰
PREPAREDNESS AND KNOWLEDGE		
<ul style="list-style-type: none"> Confidence in fighting transmission⁹ Desire to learn about disease¹³ Altruistic acceptance of risk^{24,45} Trust in infection control²⁸ 	<ul style="list-style-type: none"> Experience in epidemic^{4,13,2,25} Years of working^{13,4,7} 	<ul style="list-style-type: none"> Lack of confidence in fighting transmission⁹ Less than five years of experience^{41,42} Perceived lack of knowledge²¹ No relevant training or experience⁴¹ Perceived risk level^{24,37,39}

RELATED QUALITATIVE THEMES AND ILLUSTRATIVE QUOTES

Experiencing a lack of trust in treatment centers

"Providers do not even trust one another. We nurses do not get close to patients because there is no trust."

Observing that infection control measures negatively impacted the ability to provide care

"You cannot put your hand on their shoulder. You cannot physically touch them at all... that's cruel, and... very hard."

Feeling fearful at first, but getting into a routine after some time

"After some time it becomes more normal. After a few nights, [...] it just becomes sort of a routine."

Dealing with increases in workload

"Thinking of the ratio of nurses to patients, we are always short staffed. There is really no time."

Difficulty keeping up with changing guidelines

"First they say, 'This is sufficient'. And two weeks later it is completely different."

Fearing their own deaths and grieving the loss of others

"I have begun to imagine my own death, how sad my family would be without me."



INTERVENTIONS TO ADDRESS THE MENTAL HEALTH BURDEN AMONG HEALTHCARE WORKERS

The following section provides an overview of the ways in which HCWs cope with mental health symptoms during epidemics, and potential interventions that could reduce adverse mental health impacts.

COPING AMONG HEALTHCARE WORKERS

REFUSING TO TREAT INFECTED PATIENTS	BEING PRESENT AT WORK	DEEPENING ENGAGEMENT WITH PATIENTS	COLLABORATING WITH STAFF	ACCESSING PSYCHIATRIC SERVICES	SEEKING EMOTIONAL SUPPORT	VENTING EMOTIONS
TAKING TIME OFF	DISTRACTION	SHARING HUMOR WITH COLLEAGUES	ADOPTING STRICT PROTECTION	AVOIDING MEDIA/NEWS	LEARNING ABOUT THE DISEASE	RELAXATION ACTIVITIES



[Chiang 2007](#) [Lee 2005](#) [Khalid 2016](#) [Sim 2004](#)

INTERVENTIONS TO REDUCE MENTAL HEALTH SYMPTOMS AMONG HCWS

Study	Country; Disease	Intervention Description and Results
Aiello 2011	Canada; SARS	Face to face group training session covering the following topic areas: pandemic stressors (e.g. isolation); organizational approaches to building resilience and reducing stress; individual approaches to coping and maintaining resilience; and resources for further support. Results: Most participants did not feel prepared to deal confidently with the pandemic before the session (N=356; 35%), but felt better able to cope after the session (N=776; 76%) (z=17.98, P=0.0020).
Maunder 2010	Canada; H1N1	Computer-assisted resilience training with modules on knowledge, relaxation skills, interpersonal problems, and coping styles. Results: The training resulted in improvements in confidence in support and training (P<0.0001), pandemic self-efficacy (P<0.0001), and interpersonal problems (P<0.05).
Chen 2006	Taiwan; SARS	Multi-component intervention consisting of in-service training, allocation of workers, gathering PPE, and establishing a mental health team. Results: After two weeks of the initiation of the program, there were significant improvements in nursing staff's anxiety, depression, and sleep quality (p<0.05).
Schreiber 2019 *	USA, Philippines, West Africa; Ebola	Development of an individualized resilience plan for HCWs to be able to assess and manage risk and resilience individually.
Khee 2004 *	Singapore; SARS	Support group sessions focused on externalizing emotions and supporting one another.
Bauerle 2020 *	Germany; Covid-19	An e-mental health intervention offering manualized, evidence-based psychotherapeutics support to overcome psychological distress during Covid-19. This has been tailored for the general population but modules relevant for HCWs.
Albott 2020 *	USA; Covid-19	A psychological resilience intervention that includes peer support and a mental health consultant to provide support, training in stress management, and referrals.
Geoffroy 2020	France; Covid-19	A hotline psychological support system of certified psychologist volunteers for hospital workers. Results: In the first 26 days, there were 146 calls with an average duration of 18.5 minutes. About 70.5% of callers were referred to psychosocial, Covid-19, and general support services.
Chen 2020	China; Covid-19	A hospital-based psychological intervention plan was developed, which covered building a psychological medical team to develop an online course of common mental health issues for medical staff, a hotline team to provide support, and group activities to alleviate stress. Results: There was an unsuccessful implementation due to staff reluctance. As such, the intervention was expanded to address the concerns raised by HCWs by the provision of food and daily living supplies, additional training, leisure activities, rest areas, and on-site psychological counselors.
Cole 2020 *	United Kingdom; Covid-19	An online portal with three phases: Phase 1) a screening and psychological first aid provision for during the outbreak; Phase 2) cognitive behavioral therapy-based interventions which can be conducted in a group format through video or online while practicing social distancing; and Phase 3) participants that continue experiencing difficulties through the initial two phases will be provided additional treatment.

*studies did not report results and/or are ongoing.

HCWs are at high risk for adverse mental health consequences during and after epidemics. It is likely that levels of anxiety, depression, and stress will continue to increase, providing a critical opportunity for healthcare facilities, organizations, and governments to implement programs and policies to mitigate mental health harm of epidemics. Given the massive scale of the Covid-19 pandemic, it is imperative that interventions such as training to increase health worker confidence and preparedness, provision of protection supplies for HCWs to do their jobs safely, and social and behavioural support that is accessible during distancing are implemented to meet the needs of HCWs globally.

Appendix A: Prevalence of Mental Health Symptoms Among HCWs

Study	Mental health indicator	Prevalence	Sample size	Measurement Tool	Country	Disease	Timing
Alsubaie 2019	Anxiety	33.0%	284	PHQ-9	Saudi Arabia	MERS-Cov	During
Bai 2004	Acute stress disorder	5.0%	338	SARS-related stress reactions questionnaire	Taiwan	SARS	During
	Depression	11.0%					
	Anxiety	13.0%					
Cai 2020	Psychological abnormality	14.1%	1,521	SLC-90	China	Covid-19	During
Chan 2004	PTSD	20.0%	661	IES	Singapore	SARS	During
Chen 2005	Psychiatric symptoms	27.0%		unclear			
Chen 2005	Stress reaction syndrome	11.0%	128	unclear	Taiwan	SARS	During
Chung 2020	Mild depression	34.8%	69	PHQ-9	China	Covid-19	During
	Moderate depression	45.2%					
	Severe anxiety	0.4%					
Cui 2020	Moderate anxiety	34.0%	481	SAS	China	Covid-19	During
	Mild anxiety	62.0%		SAS			
	Excessive stress	3223.0%		PSS			
Dai 2020	Psychological distress	39.1%		GHQ-12	China	Covid-19	During
Goulia 2010	Anxiety	56.7%	469	GHQ-28	Greece	H1N1	During
Grace 2005	Psychological distress	45.7%	193	unclear	Canada	SARS	During
Huang 2020	Depressive symptoms	19.8%	7,236	CES-D	China	Covid-19	During
	Poor sleep quality	23.6%		PSQI			
	Anxiety	35.6%		GAD-7			
Jiang 2020	Severe anxiety	0.6%	1,569	SAS	China	Covid-19	During
	Severe depression	1.5%		SDS			
	Moderate anxiety	3.7%		SAS			
	Moderate depression	6.6%		SDS			
	Mild anxiety	16.0%		SAS			
	Mild depression	24.7%		SDS			
	Severe anxiety	2.2%					
	Moderate anxiety	4.8%					
JZ Huang 2020	Mild anxiety	16.1%	246	PTSD-SS	China	Covid-19	During
	stress disorder	27.4%					
	Severe disturbances	6.2%					
	Moderate disturbances	22.4%					
Kang 2020	Mild disturbances	34.4%	994	PHQ-9	China	Covid-19	During
	Mental health disturbances	36.9%					
Koh 2005	Intrusion and avoidance	56.0%	10,514	IES	Singapore	Covid-19	During
Lai 2020	Insomnia	34.0%	1,257	ISI	China	Covid-19	During
	Anxiety	44.6%		GAD-7			
	Depression	50.4%		PHQ-9			
Lee 2018	Distress	71.5%	359	IES-R)	South Korea	MERS	During
	PTSD	51.5%		IES-R			
	Psychological distress	15.9%		SRQ-20			
Liu 2020	Anxious symptoms	16.0%	4,679	SAS	China	Covid-19	During
	Depressive symptoms	34.6%		SDS			
Lu 2006	Mental symptoms	17.3%	127	CHQ	Taiwan	SARS	After
Lv 2020	Mild Anxiety	24.8%	8,028	unclear	China	Covid-19	During
	Anxiety	34.7%		unclear			
Maunder 2004	Psychological stress	29-35%	1,557	IES	Canada	SARS	During
Naser 2020	Anxiety	13.1%	4,126	PHQ-9	Jordan	Covid-19	During
	Depression	23.8%		GAD-7			
Nickel 2004	Emotional distress	29.0%	2,001	GHQ-12	Canada	SARS	During
Phua 2005	Psychiatric morbidity	17.7%	99	IES	Singapore	SARS	After
	Psychiatric morbidity	18.8%		GHQ			
	PTSD	19.0%					
	Burnout	29.0%					
Ricci-Cabello 2020	Depression	38.0%	1,168 across 3 studies	varied	Worldwide	multiple diseases	During and after
	Anxiety	45.0%	3,535 across 6 studies				
	Psychiatric morbidity	9.4%	3,373 across 6 studies				
Sim 2004	PTSD	20.6%	277	GHQ-28	Singapore	SARS	During
	Anxiety	5.9%		IES-R			
	Depression	28.0%		SAS			
Siyu 2020	Insomnia	34.3%	5,393	CES-D	China	Covid-19	During
	PTSD	33.0%		ISI			
Su 2007	Anxiety	37.0%	102	DTs	Taiwan	SARS	During
	Depression	38.5%		STAI			
Tang 2017	PTSD	20.6%	102	BDI	China	H7N9	After
Wong 2007	Anxiety	50.8%	188	PCL-C			
	Anxiety	51.0%		a visual analogue scale for Anxiety	Canada	SARS	After
Wu 2005	PTSD	10.0%	549	IES-R	China	SARS	After
Zhang 2020	Insomnia	36.1%	1,563	IES-R	China	Covid-19	During
Zhu 2020	Depression	13.5%	5,062	PHQ-9	China	Covid-19	During
	Anxiety	24.1%		GAD-7			
	Stress	29.8%		IES-R			

Appendix B: Risk and Protective Factors Related To Mental Health Symptoms

Ref #	Study	Country; Disease; Mental Health Indicator	Key finding: factors that increase and decrease risk of mental health symptoms
1	Alsubaie 2019	Saudi Arabia; MERS-Cov; Anxiety	The mean anxiety score was similar for physicians and other HCWs (3/5). However, non physicians expressed higher levels of anxiety toward the risk of transmitting MERS CoV to their families, with an anxiety score of 4/5 compared to 3/5 for the physicians group. Non physicians were more likely to report being worried about contracting MERS transmitting it to their family members than physicians (OR=3.2).
2	Bai 2004	Taiwan; SARS; Acute stress disorder, depression, anxiety	Stepwise multiple logistic regression analysis determined that quarantine was the most related factor ($\beta=1.405$, $SE=.647$, $OR=4.077$, 95 percent confidence interval=1.148 to 14.48). In contrast to administrative personnel, health care workers reported experiencing significantly more insomnia, exhaustion, and uncertainty about the frequent modifications to infection control procedures. About 9% reported that they were reluctant to work during the outbreak or had considered resignation.
3	Brooks 2018	Worldwide; multiple diseases; Depression, Anxiety, PTSD, Stress	This systematic review of found the following are important factors related to the wellbeing of HCWs: Occupational role, training/preparedness, high-risk work environments, quarantine, role-related stressors, perceived risk, social support, social rejection/isolation, and impact of the disease on personal or professional life.
4	Cai 2020	China; Covid-19; Psychological Abnormality	Lack of public health emergency treatment experience was significantly associated with a decreased prevalence of psychological abnormality (14.8% prevalence in no experience group vs. 8.2 in experience group, $p < 0.029$).
5	Chan 2004	Singapore ; SARS; PTSD, Psychiatric symptoms	Doctors [$P = 0.026$, $OR = 1.6$ and 95% $CI = 1.1$ -2.5] and single health care workers were at higher risk ($P = 0.048$, $OR = 1.4$ and 95% $CI = 1.02$ -2.0) compared to nurses and those who were married.
6	Chen 2005	Taiwan; SARS; Stress reaction syndrome	The highest rate of stress reaction syndrome was observed in the group that originally worked in a high-risk unit (17% vs. 2.5% in the control), and the conscripted group experienced the most severe distress on average (.72 vs. .49 on the GSI).
7	Chen 2007	Taiwan; SARS; Mental health	The social functioning, role emotional, and role physical subscales significantly improved after self-quarantine and off-duty shifts ($P < .05$, by paired t-test). The length of contact time (mean number of contact-hours per day) with patients with SARS was associated with some subscales (role emotional, role physical, and mental health) to a mild extent. The total number of contact-hours with symptomatic patients with SARS was a borderline predictor (adjusted $R^2=0.069$; $P=.038$) of mental health score.
8	Chua 2004	China; SARS; Stress	HCWs who were confident about infection control (74%, $n = 179$) had lower stress levels (independent samples t test, 2-tailed, $P = 0.001$) and fewer negative effects (independent samples t test, 2-tailed, $P = 0.004$). Confidence about infection control was independent of education, perhaps because of 100% attendance at infection-control training.
9	Cui 2020	China; Covid-19; Severe Anxiety, Moderate Anxiety, Mild Anxiety, Excessive Stress	Fear of infecting family members ($\beta=0.263$, $P=0.000$), regretting being a nurse ($\beta=0.216$, $P=0.000$) and having children ($\beta=0.096$, $P=0.028$) were positively associated with anxiety. Confidence in fighting transmission ($\beta=-0.147$, $P=0.001$), gender ($\beta= -0.106$, $P= 0.015$) and rest time each week in the past month ($\beta= -0.092$, $P=0.032$) were inversely associated with anxiety. Fear of infecting family members ($\beta=0.239$, $P=0.000$), regretting being a nurse ($\beta=0.199$, $P=0.000$) and number of night shifts in a week ($\beta=0.109$, $P=0.014$) were positively associated with stress. Having attended infection prevention training ($\beta= -0.122$, $P=0.006$) was inversely associated with stress. The analysis showed that regretting being a nurse, not having an emergency protection training, fear of infection in family and the more night shifts were risk factors of perceived stress.
10	Dai 2020	China; Covid-19; Psychological Distress	Through multiple factor regression analysis, it was found that women ($OR=1.53$, 95% $CI 1.26$ -1.85) and working in primary hospitals were poor prognostic factors. Not working in Wuhan, including either in other regions of Hubei or any other provinces reduced risk ($OR=0.56$, 95% $CI 0.45$ -0.71, and $OR=0.70$, 95% $CI 0.54$ -0.91 compared to Wuhan). Other poor prognostic factors include participating in frontline treatment ($OR=0.66$, 95% $CI 0.54$ -0.82 for group that won't participate in front line compared to front line), involuntarily participating in treatment work ($OR=2.30$, 95% $CI 1.86$ -2.84), having been isolated (not isolated group compared to isolated group $OR=0.75$, 95% $CI 0.62$ -0.91), and having family members or colleagues infected (not infected group compared to infected $OR=0.72$ 0.53-0.99).
11	Grace 2005	Canada; SARS; Psychological Distress	There were no significant sex differences in the reporting of new psychological symptoms ($\chi^2 = 0.01$, $df = 1$, $p = 0.91$). However, the rate of psychological distress was significantly higher among physicians providing direct care to SARS patients (45.7%, $N = 16$) than among physicians not providing direct care (17.7%, $N = 28$) ($\chi^2 = 11.62$, $df = 1$, $p < 0.001$).
12	Ho 2005	China; SARS; PTSD	The standardized regression coefficients (β) showed that insecurity followed by instability and infection were significant predictors of the PTSD score. Insecurity, instability, infection, and perceived self efficacy together accounted for 48.1% of the total variation of CIES-R total, $F(4, 90) = 20.89$, $p < .01$. Perceived self-efficacy was not significant after the effect of SARS-related fear was taken into account.
13	Jiang 2020	China; Covid-19; Severe Anxiety, Severe Depression, Moderate Anxiety, Moderate Depression, Mild Anxiety, Mild Depression	Nurses who were older and needed to care for children, worked in COVID-19-designated hospital, desired knowledge related to COVID-19, and restricted social activities had high anxiety scores. It was found that the years of working, fear of contagion, and sense of duty were positive correlations with anxiety ($P < 0.05$). The need to care for elders, desire to learn about COVID-19, interpersonal isolation, and social support were negatively correlated with anxiety ($P < 0.001$). Depression scores were higher for older nurses who were reserved personnel to assist Wuhan, needed to take care of elders, and worked in COVID-19-designated hospitals. The working department, the experience of caring for a confirmed or suspected case, knowledge level related to COVID-19, and social support were negatively correlated with depression ($P < 0.001$). The years of working, fear of contagion, and sense of duty had positive correlations with depression ($P < 0.001$).

Appendix B: Risk and Protective Factors Related To Mental Health Symptoms (continued)

Ref #	Study	Country; Disease; Mental Health Indicator	Key finding: factors that increase and decrease risk of mental health symptoms
14	Jung 2020	South Korea; MERS; PTSD	PTSD, supervisor support, and turnover intention measures. Department ($p < .05$), mental health ($p < .01$), and the level of involvement during the MERS outbreak ($p < .05$) were associated with post-traumatic stress. Mental health was negatively associated with supervisor support ($p < .01$). Years of work experience ($p < .01$), shift work ($p < .05$), marital status ($p < .05$), annual income ($p < .01$), and self-reported mental health (negative association, $p < .01$) were associated with turnover intention.
15	JZ Huang 2020	China; Covid-19; Severe Anxiety, Moderate Anxiety, Mild Anxiety, Stress Disorder	The incidence of anxiety in female medical staff was higher than that in male [25.67% (48/187) vs 11.63% (5/43), $Z=-2.008$, $P=0.045$], the score of SAS in female medical staff was higher than that in male [(43.78±11.12) vs (39.14 ± 9.01), $t=-2.548$, $P=0.012$]. The incidence of anxiety in nurses was higher than that in doctors [26.88% (43/160) vs 14.29% (10/70), $Z=-2.066$, $P=0.039$], and the score of SAS in nurses was higher than that in doctors [(44.84±10.42) vs (38.50±10.72), $t=-4.207$, $P<0.001$]. The incidence of stress disorder in medical staff was 27.39% (63/230), and the score of PTSD-SS was (42.92 ± 17.88). The score of PTSD-SS in female medical staff was higher than that of male [(44.30±18.42) vs(36.91 ± 13.95), $t=-2.472$, $P=0.014$].
16	Kang 2020	China; Covid-19; Severe disturbances, Moderate Disturbances, Mild Disturbances, Mental Health Disturbances	There were no significant differences in demographic data of groups varying in mental health states. Each group with a higher level of distress had a more extensive scope of exposure ($p<0.001$). There were also significant differences in mental healthcare services; those with severe disturbances had accessed fewer psychological materials and psychological resources available through media ($p=0.002$). In addition, the perception of current health status compared to that before the outbreak of COVID-19 was also different, with those with a worse mental state reporting a worse perceived health status ($p<0.001$)
17	Koh 2005	Singapore ; Covid-19; Intrusion and avoidance	Impact of event scale score was associated with HCWs feeling that their jobs puts them at an increased risk of exposure to SARS (OR=1.88, 95% CI=1.6-2.09).
18	Lai 2020	China; Covid-19; Insomnia, Anxiety, Depression, Distress	Multivariable logistic regression analysis showed participants from outside Hubei province were associated with lower risk of experiencing symptoms of distress compared with those in Wuhan (odds ratio [OR], 0.62; 95% CI, 0.43-0.88; $P = .008$). Frontline health care workers engaged in direct diagnosis, treatment, and care of patients with COVID-19 were associated with a higher risk of symptoms of depression (OR, 1.52; 95% CI, 1.11-2.09; $P = .01$), anxiety (OR, 1.57; 95% CI, 1.22-2.02; $P < .001$), insomnia (OR, 2.97; 95% CI, 1.92-4.60; $P < .001$), and distress (OR, 1.60; 95% CI, 1.25-2.04; $P < .001$).
19	Lancee 2008	Canada; SARS; Depression, Anxiety, PTSD, Burnout	New episodes of psychiatric disorders were directly associated with a history of having a psychiatric disorder before the SARS outbreak ($p=.02$) and inversely associated with years of health care experience ($p=.03$) and the perceived adequacy of training and support ($p=.03$).
20	Lee 2018	South Korea; MERS; PTSD	Post-hoc comparisons were conducted to examine differences across job types. While the difference between nurses and doctors approached the p value of .048, no statistically significant differences were found. HCWs who performed MERS-related tasks had significantly higher total IES-R scores ($T = 3.894$, $p < .001$) and sub-scores, including hyper arousal ($T = 3.535$, $p < .001$), avoidance ($T = 3.573$, $p < .001$), intrusion ($T = 3.756$, $p < .001$), and sleep and numbness ($T = 3.583$, $p < .001$), than those who did not.
21	Lehmann 2016	Germany; Ebola; Depression, Anxiety, General Mental Health	The best predictors of poor physical and mental HrQoL were perceived lack of knowledge about the Ebola virus disease (physical: $B=-1.2$, $p=0.05$; mental: $B=-1.3$, $p=0.03$) and fatigue (physical: $B=-0.3$, $p=0.02$; mental: $B=-0.53$, $p<0.001$). Ebola patient treatment in tertiary care does not seem to be associated with lower HrQoL and enhanced subjective risk of infection, but seems to yield feelings of social isolation in health-care professionals.
22	Lin 2007	Taiwan; SARS; PTSD	The average DTS-C scores of staff in the emergency department were significantly higher than those of staff in the psychiatric ward. No significant difference in CHQ average score was seen between the two groups. The percentages of staff with DTS-C scores >40 were 21.7% in the emergency department and 13.0% in the psychiatric ward ($p=0.537$). The percentages of staff with CHQ-12 scores >3 in the emergency department and in the general ward were 51.6% and 38.5%, respectively ($p=0.371$).
23	Lin 2020	China; Covid-19; Anxiety/Depression, Resilience	Multiple regression analysis showed that active coping ($\beta=1.314$, $p<0.05$), depression ($\beta= -.806$, $p<0.05$), anxiety ($\beta= -1.091$, $p<0.05$) and training and support from hospital ($\beta= -3.510$, $p<0.05$) were significant influence factors of resilience.
24	Liu 2012	China; SARS; Depression	The results of multinomial regression analyses showed that, with other relevant factors controlled for, being single, having been quarantined during the outbreak, having been exposed to other traumatic events before SARS, and perceived SARS-related risk level during the outbreak were found to increase the odds of having a high level of depressive symptoms 3 years later.
25	Liu 2020	China; Covid-19; Psychological Distress, Anxious Symptoms, Depressive Symptoms	Those with middle age (OR=1.9, 95% CI= 1.4-2.6), being divorced or widowed (OR=1.7, 95% CI=1.1-2.89), seldom or not living with family members (OR=1.3, 95% CI=1.1-1.7), being a nurse (OR=0.6, 95% CI=0.5-0.8 doctor compared vs. nurse), working at high-risk departments (OR=1.4, 95% CI=1.1-1.8), having experiences of treatment for COVID-19 or other infectious diseases (OR=1.2, 95% CI=1.002-1.5), from designated hospitals for COVID-19 treatment (OR=1.4, 95% CI=1.1-1.7), non-infectious disease hospitals (OR=2.0, 1.5-2.6) , and higher level hospitals (OR=2.2, 95% CI= 1.1-4.1) had higher risk to have at least one of the mental health problems.
26	Lu 2006	Taiwan; SARS; Mental symptoms	The structural equation model showed that maternal care ($\beta = -0.18$, $p = 0.011$) and neuroticism ($\beta = 0.54$, $p < 10^{-6}$) directly influenced the ability of health care workers to deal with the impact of SARS. Maternal overprotection ($\beta = 0.30$, $p < 10^{-4}$) had an indirect influence on the ability to cope with the impact of SARS.

Appendix B: Risk and Protective Factors Related To Mental Health Symptoms (continued)

Ref #	Study	Country; Disease; Mental Health Indicator	Key finding: factors that increase and decrease risk of mental health symptoms
27	Lv 2020	China; Covid-19; Mild Anxiety, Anxiety	This study showed that the incidence of anxiety and mild anxiety were 34.7% and 24.8%, respectively. Anxiety incidence varied across regions: Wuhan and Hubei are 40%, and the incidence for Guangdong and Hainan were under 40%, whereas several provinces had the incidence over 50%. Anxiety was higher during the epidemic compared to before, as was expected.
28	Marjanovic 2007	Canada; SARS; Emotional Exhaustion, State Anger, Avoidance	Higher levels of vigor ($\beta = -.15, p = .003$), organizational support ($\beta = .26, p < .001$), and trust in equipment/infection control initiative ($\beta = -.15, p = .005$), and lower levels of contact with SARS patients ($\beta = -.15, p = .003$); and less time spent in quarantine ($\beta = -.15, p = .005$) predicted to lower levels of avoidance behavior, emotional exhaustion, and state anger.
29	Matsuishi 2012	Japan; H1N1; Anxiety, PTSD	Total IES score was affected by job, hospital and work environment. The total IES score of nurses and others was higher than that of MDs (nurses: $B = 0.90, SE = 0.32, \beta = 0.14, P = 0.005$; others: $B = 0.60, SE = 0.20, \beta = 0.13, P = 0.002$). Workers in high-risk work environments had higher total IES scores than did workers in low-risk work environments ($B = 1.24, SE = 0.38, \beta = 0.09, P = 0.001$). The mean total IES score was 2.49 ± 6.63 and ranged from 0 to 73.
30	Maunder 2004	Canada; SARS; Psychological Stress	HCWs that treated SARS in Toronto reported significantly higher levels of burnout ($p = 0.019$), psychological distress ($p < 0.001$), and posttraumatic stress ($p < 0.001$) compared to HCWs that did not treat SARS patients in Hamilton. Toronto workers were more likely to have reduced patient contact (16.5% Toronto compared to 8.3% Hamilton, $p = 0.007$) and work hours (8.6% Toronto vs. 2.2% Hamilton, $p = 0.003$) and to report behavioral consequences of stress (increased drinking/smoking/other behavior: 21.6% Toronto vs. 12.6% Hamilton, $p = 0.001$).
31	Naser 2020	Jordan; Covid-19; Anxiety, Depression	Logistic regression analysis identified the following group to be at a higher risk of depression: a) females HCWs (OR=1.48, 95% CI: 1.11-1.97), b) divorced HCWs (OR=1.86, 95% CI= 1.02-3.38) (c) pulmonologists (OR=4.17, 95% CI=1.94-9.00). Logistic regression analysis showed that HCWs were at higher risk (OR=1.63, 95% CI=1.11-2.39). HCWs with high income were at lower risk of anxiety (OR=0.42, 95% CI=0.18-0.98).
32	Nickel 2004	Canada; SARS; Emotional distress	Logistic regression analysis identified four actors as being significantly associated with increased levels of concern for personal or family health: perception of a greater risk of death from SARS (adjusted odds ratio [aOR] 5.0, 95% CI 2.6-9.6), living with children (aOR 1.8, 95% CI 1.5-2.3), personal or family lifestyle affected by SARS outbreak (adjusted OR 3.3, 95% CI 2.5-4.3) and being treated differently by people because of working in a hospital (adjusted OR 1.6, 95% CI 1.2-2.1). Four factors were identified as being significantly associated with the presence of emotional distress: being a nurse (aOR 2.8, 95% CI 1.5-5.5), part-time employment status (aOR 2.6, 95% CI 1.2-5.4), lifestyle affected by SARS outbreak (OR 2.2, 95% CI 1.4-3.5) and ability to do one's job affected by the precautionary measures (aOR 2.9, 95% CI 1.9-4.6).
33	Phua 2005	Singapore ; SARS; Psychiatric morbidity	Nurses to report higher psychiatric morbidity than physicians, reaching statistical significance ($p = 0.03$) on the IES but not on the GHQ 28.
34	Ricci-Cabello 2020	Worldwide; multiple diseases; PTSD, Burnout, Depression, Anxiety	This systematic review of 61 studies evaluated 37 that reported factors associated with likelihood of developing mental health symptoms among HCWs including sociodemographic (younger age and female gender), social (lack of social support, social rejection or isolation, stigmatization), and occupational (working in a high-risk environment (frontline staff), specific occupational roles (e.g., nurse), and lower levels of specialized training, preparedness and job experience) factors.
35	Sim 2004	Singapore ; SARS; Psychiatric morbidity, PTSD	Multivariate analysis showed that psychiatric morbidity was associated with post-traumatic morbidity ($p = .02$) and denial ($p = .03$), whereas posttraumatic morbidity was associated with younger age ($p = .007$), being married ($p = .02$), psychiatric morbidity ($p = .02$), self-distraction ($p = .02$), behavioral disengagement ($p = .01$), religion ($p = .003$), less venting ($p = .04$), less humor ($p = .04$), and less acceptance ($p = .02$).
36	Siyu 2020	China; Covid-19; Anxiety, Depression, Insomnia	Being female, contact with confirmed or suspected cases, work in the clinical first-line, low social support total score and low score in each dimension, nurses and other factors are closely related to the occurrence of depression, anxiety, insomnia symptoms (P values ≤ 0.001).
37	Styra 2008	Canada; SARS; PTSD	ANOVA of continuous IES-R scores by unit was significant at $P < .001$ (SARS unit: 22.05 ± 19.3 ; ICU: 22.07 ± 16.1 ; ED: 24.16 ± 16.7 ; comparison units: 13.77 ± 13.2). Univariate logistical regression showed that taking care of only one patient with SARS was more stressful (OR=6.3; 95% CI=2.5–15.9) than taking care of none or taking care of two or more patients with SARS (OR=2.6; 95% CI=1.4–5.0). Multivariate logistical regression indicates that working in a high-risk unit (OR=2.2 1.0-4.4), attending only one SARS patient (OR=3.5, 95%CI=1.3-9.5), perception of personal risk (OR=2.0, 5% CI=1.4-2.8), impact on work life (OR=1.9 95% CI=1.3-2.7), and depressive affect (OR=2.2, 95% CI=1.4-3.5) contributed to the presence of post traumatic stress symptoms.
38	Su 2007	Taiwan; SARS; PTSD, Anxiety, Depression	The prevalence of symptomatic depressed cases during the study period was 27.5% with higher rate in the SARS vs. non-SARS units (38.5%, vs. 6.7%, $p < 0.001$). Multivariate logistic regression for SARS unit subjects only revealed that history of mood disorders might predict depressive disorder and insomnia (OR=5.6, 95%CI 1.3–23.9, and OR=8.5, 95%CI 2.1–34.2, respectively). Age < 30 years was a high risk for depression (OR= 21.4, 95%CI 2.8-165). Perceived negative feelings towards SARS at baseline was highly associated with symptomatic PTSD and insomnia (OR= 11.1 and 3.5 with 95%CI 2.3–53 and 1–12.5, respectively), while positive attitude towards SARS was associated with decreasing depression (OR=12.7, 95%CI 1.1–150).

Appendix B: Risk and Protective Factors Related To Mental Health Symptoms (continued)

Ref #	Study	Country; Disease; Mental Health Indicator	Key finding: factors that increase and decrease risk of mental health symptoms
39	Sun 2020	China; Covid-19; Anxiety, Depression	Degree of suspicion of being infected when showing associated symptoms, degree of fear of yourself and your family being infected, and the affiliated hospital ($P < 0.05$) were associated with anxiety. The first two factors similarly influenced depression ($P < 0.05$).
40	Tam 2004	China; SARS; Stress	Variables that were significantly associated with high job-related stress were younger age ($OR = 1.46$, 95% $CI = 1.01-2.10$), being a nursing professional ($OR = 2.33$, 95% $CI = 1.66-3.27$) experience of direct care of SARS patients ($OR = 1.92$, 95% $CI = 1.36-2.71$) and poorer self-rated physical health condition ($OR = 1.63$, 95% $CI = 0.73-3.61$). Variables that were significant predictors of psychological morbidity included female gender (OR of males vs. females = 0.55 , 95% $CI = 0.21-0.98$) poor self-rated physical health ($OR = 5.73$, 95% $CI = 1.70-19.25$), high level of job-related stress ($OR = 4.23$, 95% $CI = 2.28-7.23$) and inadequate support in two aspects: counseling and psychological support from the employer (OR of adequate support = 0.53 , 95% $CI = 0.31-0.89$), and insurance and compensation (OR of adequate insurance/compensation = 0.52 , 95% $CI = 0.29-0.93$)
41	Tang 2017	China; H7N9; PTSD	T-tests and one-way analysis of variance showed that nurses had higher scores than doctors, female participants had higher scores than male participants, and the participants with low professional title and high contact frequency, aged between 20 years and 30 years, with less than five years of work experience, having not received related training and with no related experience obtained higher PTSD scores than the others ($P < 0.05$, $P < 0.01$).
42	Tolomiczenko 2005	Canada; SARS; Burnout	Statistically significant differences of burnout were found for gender (73.9% women), nurses (24.7%) vs. others, doctors (20.3%) vs. others, older (40 years or older, 60.0%) vs. younger persons, emergency or intensive care unit workers (8.0%) vs. others, and those employed fewer years at the hospital (less than 5 years: 46.2%) vs. five or more years $P < 0.05$).
43	Verma 2004	Singapore; SARS; Depression, Anxiety, PTSD, Perception of Stigma	General practitioners who were directly involved in the care of patients with SARS were significantly more likely to be anxiety case as compared to those not involved in the care of patients with SARS ($P = 0.02$; $OR = 2.9$, 95% CI , 1.3-6.3). The mean score of the GHQ somatic, anxiety and social dysfunction subscales were significantly higher in general practitioners as compared to traditional Chinese practitioners ($P < 0.001$).
44	Wong 2005	China; SARS; Mental Distress	The overall distress level for nurses was significantly higher than for healthcare assistants ($P < 0.005$) but not doctors. The overall distress level was highly and significantly correlated with the six sources of distress: vulnerability/loss of control ($r = 0.68$); health of self ($r = 0.62$); spread of virus ($r = 0.60$); health of family and others ($r = 0.59$); changes in work ($r = 0.46$); being isolated ($r = 0.45$). Scores for nurses were significantly higher than for doctors in terms of the six sources of distress ($P < 0.01$).
45	Wu 2005	China; SARS; PTSD	Respondents who had been quarantined ($OR = 3.47$, 95% $CI = 1.9-6.2$), or worked in high-risk locations such as SARS wards ($OR = 3.11$, 95% $CI = 1.8-5.5$), or had friends or close relatives who contracted SARS ($OR = 3.74$, 95% $CI = 1.8-7.6$), were likely to have high PTS symptom levels, than those without these exposures. However, altruistic acceptance of work-related risks was negatively related to PTS levels ($OR = 0.56$, 95% $CI = 0.3-1.0$)
46	Zhang 2020	China; Covid-19; Insomnia	Logistic regression model revealed that insomnia symptoms were associated with the education level of high school or below ($OR = 2.69$, $p = 0.042$, 95% $CI = 1.0-7.0$), occupation of doctor ($OR = 0.44$, $p = 0.007$, 95% $CI = 0.2-0.8$), currently working in isolation unit ($OR = 1.71$, $p = 0.038$, 95% $CI = 1.0-2.8$), worried about being infected ($OR = 2.30$, $p < 0.001$, 95% $CI = 1.6-3.4$), being perceived not helpful on psychological support from news or social media about COVID-19 ($OR = 2.10$, $p = 0.001$, 95% $CI = 1.3-3.3$) and having very strong uncertainty regarding effective disease control ($OR = 3.30$, $p = 0.013$, 95% $CI = 1.3-8.5$).
47	Zhu 2020	China; Covid-19; Depression, Anxiety, Stress	Women (hazard ratio[HR], 1.31; $P = 0.032$), years of working > 10 years (HR, 2.02; $P < 0.001$), concomitant chronic diseases (HR, 1.51; $P < 0.001$), history of mental disorders (HR, 3.27; $P < 0.001$), and family members or relatives confirmed or suspected (HR, 1.23; $P = 0.030$) were risk factors for stress, whereas care provided by hospital and department administrators ($OR = 0.76$; $P = 0.024$) and full coverage of all departments with protective measures ($OR = 0.69$; $P = 0.004$) were protective factors.