Lessons from the Early Phase of the COVID-19 Pandemic: Prevalence, Risk and Protective Factors for Psychological Morbidity– Systematic Review

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Abstract

The COVID-19 pandemic has had a devastating impact on psychological well-being globally. Study aims were to examine the extent of psychological morbidity and to identify risk and protective factors that could be targeted with interventions. A systematic review was performed using PRISMA guidelines. Studies reporting depression, anxiety and COVID-related fear were included. 30 studies (43,634 participants) were included. Anxiety prevalence was 6.3–34% and depression 14.6%–43.7%. Higher levels of anxiety, depression and/or COVID-related fear were found in women, younger people, rural residents, areas with high rates of COVID-19 and people with poor general health. Quarantine and feeling overwhelmed with negative information were risk factors for COVID-related fear. Protective factors were: comfortable amount of information, good social support' and confidence in doctor. Health professionals had high rates of psychological morbidity.

Risk and protective factors were identified in this study. These could be targeted with COVID-specific public health support and interventions.

What we already know

a. The COVID-19 pandemic has had a devastating impact on psychological well-being globally.

b. Rates of anxiety and/or depression over 35% have been reported during the pandemic.

c. Responding to mental health issues is a priority area of public health policy.

What this article adds

a. Risk groups for psychological morbidity have been identified, including health professionals, young people, women, people affected by quarantine and those living in hot-spot and rural areas.

b. Protective factors have also been identified, including good family and social supports, positive coronavirus news feeds and confidence in doctors.

c. This information can be used to target strategies to support the mental health of communities affected by COVID-19.

Keywords: Anxiety; COVID-19; Depression; Fear; Mental health; Psychological distress

Introduction

As the COVID-19 pandemic progresses and cases pass 21 million worldwide [1,2], concern about its psychological morbidity as well as its physical devastation is increasing. It is unsurprising that the rapid spread of such a lethal disease from which humans have no immunity and to which global society is extremely vulnerable causes fear. The grief related to loss of life and loss of livelihood,

along with the loss of freedom and loss of social connection caused by lock-down and quarantine recommendations have made life extremely challenging for many people. Health care workers are experiencing job security and are currently regarded by many as heroes; however, they are particularly vulnerable to psychological harm as they are witnessing trauma, working long hours, worrying about becoming infected themselves and have concerns about bringing disease home to their family members [3,4].

Rates of anxiety and/or depression over 35% have been reported in several studies during the pandemic [3-5]. Understanding more about the context of these studies, identifying who is most at risk and appreciating the type of psychological morbidity experienced during the COVID-19 pandemic will allow the development and implementation of targeted strategies to attempt to address this problem.

The aims of this study were to (1) examine the extent of psychological morbidity by documenting the prevalence of anxiety, depression and/or other mental illness in different populations (such as health professionals and general populations); and (2) to identify risk groups and protective factors that could be targeted with psychological interventions during the COVID-19 pandemic. The research question was 'In populations affected by the early phase of the pandemic, what is the prevalence of mental illness and are there any risk or protective factors that can be identified to potentially reduce psychological morbidity?

Methods

The study was registered with PROSPERO (CRD42020186894) [6]. Searches of the OVID MEDLINE, PsycINFO and PubMed databases were conducted.Studies were tracked using PRIMA methods [7]. Data were extracted from eligible studies, and each was allocated a 'risk of bias'category using a standardised critical appraisal tool for prevalence studies.9Further methodological detail is provided in on-line Appendix (Supplementary File).

Eligibility criteria for inclusion were: (1) primary studies published in peer-reviewed scientific journals AND (2) reportingprevalence of anxiety, depression, fear of COVID-19 or other mental health outcomes. Exclusion criteria were: (1) non-primary studies (review articles, letters, correspondence, and abstract-only publications), AND (2) non-human studies. This review analysed the studies reporting anxiety, depression and COVID-19-related fear. Studies reporting other psychological outcomes were identified for future evaluation.

Results

The initial search identified 104 studies; 33 abstracts met eligibility criteria. Two further studies were added from reference lists of eligible studies. Five studies were later excluded, leaving 30 for inclusion in data analysis. PRISMA flowchart [10] is shown in Figure 1. The study population, methodology, outcome measures and risk of bias score of eligible studies are shown in Table 1.
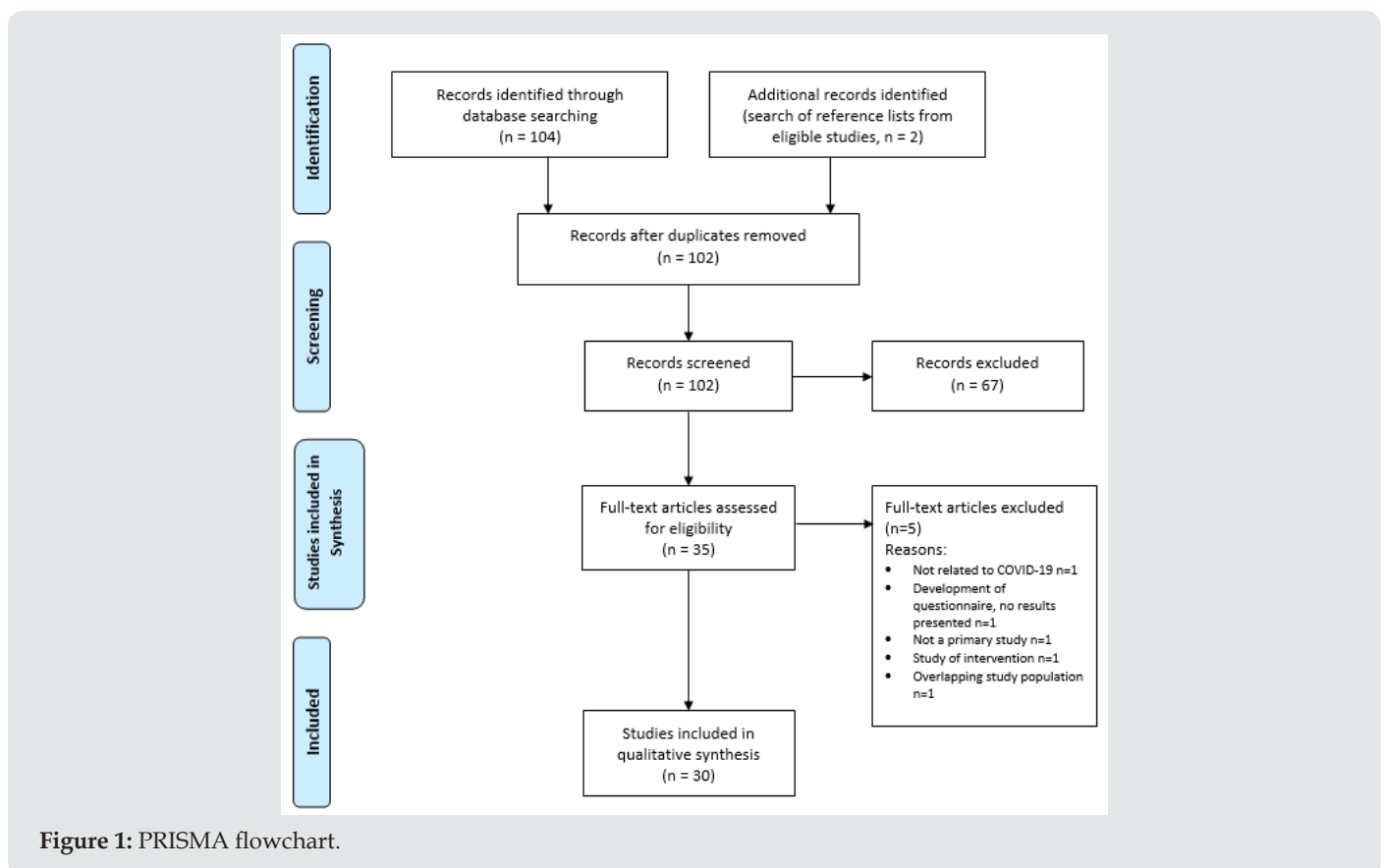

Figure 1: PRISMA flowchart.

Study characteristics

The 30 eligible studies [3-5, 11-37] (Table 1) included assessment of psychological outcomes in 43,634 individual participants [3-5,11-37]. Studies were conducted between January and April 2020. They evaluated the main psychological outcomes of interest: general anxiety (22 studies) [3-5,11-14,16-22,24,25,28-30, 32,34,35], depression (14 studies) [3-5,12-14,16,17,19,21,22,28-30,32] and COVID-19-related fear, anxiety and/or knowledge (10 studies) [4, 11, 17, 22, 30, 32].

Studies were conducted across six countries: China (22 studies), Spain (2 studies) [19,27], Italy (2 studies) [26 29], other (Iran [12], Israel [14], United Kingdom [13] and international [11],

1 study each). 18 studies were focused on general populations [4,5,12-14,18,19,22,23,26,27,29-32,36,37], ten on health professionals [3,11,15,20,21,24,25,28,33,35] and two on university students. [16,17] Most studies had a cross-sectional design, asking participants to self-administer an on-line questionnaire.

The risk of bias was 'low' in nine studies [12,16,17,21,22,25-27,33], 'medium' in 15 studies [3-5,13,14,18-20,23,24,30-32,35,37] and 'high' in six studies [11,15,28,29,34,36]. Even in the studies where 'risk of bias' was low, none used random sampling of the population (for example from census data) to estimate prevalence. Therefore, these studies provide some insight into prevalence in individual, very defined groups but do not provide information about prevalence across the entire population (Table 1).

Table 1: Studies reporting psychological outcomes related to COVID-19 (n=30 studies, grouped by study population, and ordered by date of study).

First author	Country (region)	Date study conducted (month in 2020)	Language of published paper	Number of participants	Age (years)	Gender	Methodology and population	Psychological outcomes measured	Risk of bias***
Studies in general populations									
Lei L [22]	China (southwestern) Adjacent to Hubei Province	January	English	1593	32.3. (mean)	Male 38.7% Female 61.3%	Self-administered on-line questionnaire, response rate 80.3%. Chinese adults affected (n = 420) or unaffected (n = 1173) by quarantine, general population.	Anxiety, depression (validated measures), COVID-19 awareness (non-validated measure)	Low
Li S [23]	China (multiple provinces)	January	English	17,865 posts	NR	NR	Analysis of social media posts of active Weibo users in China; derivation of emotional indicators by computer analysis of posts. Comparison before and after January 20, 2020	Anxiety/ depression/ indignation/ positive psychological traits in social media posts using Online Ecological Recognition (OER)	Medium
Xiao H [34] (Self-isolation)	China (central China)	January	English	170	37.8 (mean)	Male 59.4% Female 40.6%	Self-administered on-line questionnaire. Response rate 85%. Chinese adults who self-isolated for 14 days in January 2020, general population.	Anxiety, stress, sleep, social capital (validated measures)	High

Gao J [18]	China (multiple provinces)	Jan-Feb	English	4827	32 (mean)	Male 32.3% Female 67.7%	Self-administered on-line questionnaire. Response rate NR. Chinese adults, general population.	Anxiety, well-being (validated measures), social media use (non-validated measure)	Medium
Zhang Y [37]	China (Jinzhou)	Jan-Feb	English	263	Highest proportion in 21–30 yrs group (47.9%)	Male 40% Female 60%	Self-administered on-line questionnaire. Response rate 65.8%. Chinese adults living in Jinzhou, general population.	Post-traumatic stress (validated measure), negative mental health impacts, social and family support, and mental health-related lifestyle change (non-validated measures)	Medium
Wang C [4](Int J Environ Res Public Health)	China (multiple provinces)	Jan-Feb	English	1210	Highest proportion in 21-31 yrs group (53%)	Male 33%, Female 67%	Self-administered on-line questionnaire. Response rate NR. Chinese adults, general population.	Anxiety, depression, stress, post-traumatic stress (validated measures), COVID-19 anxiety and knowledge (non-validated measure)	Medium
Wang C [30] (Brain Behav Immun)	China (multiple provinces)	Jan-Mar	English	1738	Highest proportion 21-30 yrs (1st survey 53·1%, 2nd survey 46·5%)	Male 32.7% Female 67.3% (1st survey) Male 25% Female 75% (2nd survey)	Self-administered on-line questionnaires (two cohorts, 4-week interval, 1738 participants in both combined; 333 participated in both cohorts). Response rate NR.Chinese adults, general population.	Anxiety, depression, stress, post-traumatic stress, COVID-19 anxiety (validated measures)	Medium
Wang H [31]	China (multiple provinces)	February	English	1599	33.9 (mean)	Male 33.2% Female 66.8%	Self-administered on-line questionnaire. Response rate NR. Chinese adults, general population.	Distress, coping (validated measures)	Medium
Wang Y [32]	China (multiple provinces)	February	English	600	34 (mean)	Male 44.5% Female 55.5%	Self-administered on-line questionnaire. Response rate 99.2%.	Anxiety, depression (validated measures)	Medium

Yuan S [36]	China (Hunan) Adjacent to Hubei Province	February	English	939	Highest proportions in 18-24 yrs (35.89%) and 25-39 yrs (35.57%)	Male 38%; Female 62%	Self-administered on-line questionnaire. Response rate NR. Chinese adults. Living in Hubei (n=33) and non-endemic regions (n=906). General population, includes University students (65.92%).	Stress, sleep (validated measures)	High
Ozamiz-Etxebarria N [27]	Spain	March	English	976	Highest proportion 18-25yrs (56.5%)	Male 18.9% Female 81.1%	Self-administered on-line questionnaire. Response rate 41.8%. Spanish adults, general population.	Anxiety, depression, sleep (validated measures)	Low
Soraci P [29]	Italy	March	English	249	34.5 (mean)	Male 8% Female 92%	Self-administered on-line questionnaire. Response rate 100%. Italian adults, general population.	Anxiety, depression, phobia (validated measures), COVID-19 anxiety (validation study)	High
Bacon A [13]	UK	March	English	202	NR	Male 37% Female 63%	Self-administered on-line questionnaire. Response rate NR. British adults. General population.	Anxiety, depression (validated measures)	Medium
González-Sanguino C [19]	Spain	March	English	3480	Highest proportion 40-59 yrs = 2054 (58.9%)	Male 25% Female 75%	Self-administered on-line questionnaire. Response rate NR. Spanish adults. General population.	Anxiety, depression, post-traumatic stress, day-to-day discrimination, loneliness, social support, spiritual well-being, self-compassion (validated measures)	Medium
Ahorsu D [12]	Iran	NR; submitted to journal March	English	717	31.3 (mean)	Male 58% Female 42%	Self-administered on-line questionnaire. Response rate NR. Iranian adults. General population.	Anxiety, depression, perceived vulnerability (validated measures). Development and validation of Fear of Covid scale.	Low

Zhou S [5]	China (multiple provinces)	NR; submitted to journal March	English	8079	16 (median)	Male 46.5% Female 53.5%	Self-administered on-line questionnaire. Response rate NR. Chinese adults. General population. City residents (38.4%) and rural residents in China (61.6%).	Anxiety, depression (validated measures), COVID-19 knowledge (non-validated measure)	Medium
Bitan DT [14]	Israel	March and April 2020	English	649	Highest proportion 31-40 yrs (33%)	Male 15% Female 85%	Self-administered on-line questionnaire. Response rate NR. Israeli adults. General population.	Anxiety, depression, COVID-19 anxiety (validated measures)	Medium
Moccia L [26]	Italy	April	English	500	Highest proportion 28-37 yrs (25.8%)	Male 40.4%; Female 59.6%	Self-administered on-line questionnaire. Response rate NR. Italian adults. General population.	Distress, temperament, attachment (validated measures)	Low
Studies in health professionals									
Lai J [21]	China (Wuhan)	January	English	1257	Highest proportions 26-30yrs (32.4%) and 31-40 yrs (32.3%)	Male 23.3% Female 76.7%	Self-administered on-line questionnaire. Response rate 68.7%. Healthcare workers in China: physician 39.2%, nurse 60.8%. Wuhan 60.5%; Hubei province outside Wuhan 20.8%, outside Hubei province 18.8%.	Anxiety, depression, sleep, post-traumatic stress (validated measures)	Low
Xiao H [35] (Medical staff)	China (Wuhan)	January	English	180	32.3 (mean)	Male 28.3%; Female 71.7%	Self-administered on-line questionnaire. Response rate 81.82%. Healthcare workers in China: physician 45.6%; nurse 54.4%.	Anxiety, self-efficacy, social support, stress, sleep (validated measures)	Medium
Kang L [3]	China (Wuhan)	Jan-Feb	English	994	Highest proportion 25-30yrs (34.1%)	Male 14.5% Female 85.5%	Self-administered on-line questionnaire. Response rate NR. Healthcare workers in China: physician 18.4%, nurse 81.6%	Anxiety, depression, sleep, post-traumatic stress (validated measures)	Medium

Cai H [15]	China (Hunan) Adjacent to Hubei Province	Jan-Mar	English	534	36.4 (mean)	Male 31.3% Female 68.7%	Self-administered on-line questionnaire. Response rate NR. Healthcare workers in China: physician 43.6%, nurse 46,4%, medical technician 9%, hospital staff 1%.	Feelings, stress-causing and stress-relieving factors, stress coping (non-validated measures)	High
Huang JZ [20]	China (Fuyang)	February	Chinese	230	Highest proportion 30-40 yrs (53%)	Male 18.7% Female 81.3%	Self-administered on-line questionnaire. Response rate 93.5%. Healthcare workers in China: physician 30.4% nurse 69.6%.	Anxiety, post-traumatic stress (validated measures)	Medium
Liu CY [24]	China (multiple provinces)	February	English	512	Highest proportion 18-39 yrs = 386 75.39%	Male 15.43% Female 84.57%,	Self-administered on-line questionnaire. Response rate 85.3%. Healthcare workers in China (occupations NR). Clinical department 72.1%, fever clinic 13.3%, service/managerial 14.7%. Hubei province yes 14.3%, no 85.7%. City 98.4% rural 1.6%.	Anxiety (validated measure)	Medium
Sheng X [28]	China (Guangzhou) Southern China	February	Chinese	92	21 (mean)	Male 6.5%, Female 93.5%	Self-administered on-line questionnaire. Response rate 96.8%. Healthcare workers in China: nursing interns 100%, surveyed after 1 week of centralised lock-down in hospital.	Anxiety, depression, sleep (validated measures)	High

Ahmed MA [11]	International	March	English	650	Highest proportion 20-30 yrs (54%)	Male 25% Female 75%	Self-administered on-line questionnaire. Response rate NR. Healthcare workers: dentists around the world.	Anxiety, COVID-19 fear and knowledge (non-validated measures)	High
Mo Y [25]	China (Guangxi) Southern China; staff deployed to Wuhan	March	English	180	32.7 (mean)	Male 10% Female 90%	Self-administered on-line questionnaire. Response rate 85.7%. Healthcare workers in China: nurses 100%.	Anxiety, stress (validated measures)	Low
Wu Y [33]	China (Hubei)	March	English	190	33 (mean)	Male 17% Female 83%	Self-administered on-line questionnaire. Response rate 85.7%. Healthcare workers in China: physician 39% nurse 61%. Oncology professionals deployed to COVID front line 50.5%, oncology professionals in usual ward 49.5%.	Burn-out (validated measure), personal accomplishment, COVID-19 anxiety (non-validated measures)	Low
Studies in university students								
Chang J [17]	China (Guangdong) Southern China	NR; submitted to journal Feb	Chinese	3881	NR	Male 37% Female 63%	Self-administered on-line questionnaire. Response rate NR. University students in China; health/ medical students 86.6%, non-health/ medical 13.5%.	Anxiety, depression (validated measures), COVID-19 awareness (non-validated measures)	Low
Cao W [16]	China (Changzhi) Adjacent to Hubei Province	NR; submitted to journal March	English	7143	NR	Male 30.4% Female 69.7%	Self-administered on-line questionnaire. Response rate NR. University students in China: medical students 100%.	Anxiety (validated measure)	Low

NR- not reported. *Study by Yuan et al mixed population that included university students (66%). **Study by Chang et al mixed population of university students, health/medical students (86.6%)***Based on score derived using criteria by Joanna Briggs Institute (Reference: Joanna Briggs Institute. Critical Appraisal Instrument for Studies Reporting Prevalence Data [9].

Anxiety

Twenty two studies reported anxiety (Table 2) [3-5,11-14,16-22,24,25,28-30,32,34,35]. A variety of validated measurement tools were used: Zung Self-Rating Anxiety Scale (8 studies [20,22,24,25,28,32,34,35], General Anxiety Disorder Scale (GAD-7, 7 studies [3,5,13,16-18,21] and GAD-2, 1 study [19], Depression, Anxiety and Stress Scale (3 studies [4,14,30]), Hospital Anxiety and Depression Scale (2 studies [12,29]) and one non-validated questionnaire [11].

Table 2: Anxiety and depression related to COVID-19 (n=22 studies, grouped by measurement tool).

Month (2020)	N	Outcomes measured	ANXIETY Measurement tool	ANXIETY Prevalence and/ or score	ANXIETY Associations	DEPRESSION Measurement tool	DEPRESSION Prevalence and/ or score	DEPRESSION Associations	Risk of bias*
January	180	Anxiety, self-efficacy, social support, stress, sleep (validated measures)	Zung Self-Rating Anxiety Scale (SAS)	Prevalence NR. Mean SAS score= 55.3 (mild-moderate anxiety).	Anxiety higher if less social support (SSRS score) and lower self-efficacy (GSES). Increased levels of anxiety, stress, and self-efficacy that were dependent on sleep quality and social support.	Not reported	Not reported	Not reported	Medium
January	1593	Anxiety, depression (validated measures), COVID-19 awareness (non-validated measure)	Zung Self-Rating Anxiety Scale (SAS)	Anxiety prevalence (SAS≥50)= 8.3%. (Mild=5.8%, moderate=2.1%, severe= 0.4%.)	Female gender, Poor self-perception of health, excessive worry, economic loss, had higher anxiety (SAS) scores. Anxiety prevalence higher in group affected by quarantine of self/family.	Zung Self-Rating Depression Scale (SDS)	Depression prevalence 14.6% (mild=8.3%, moderate=5.2%, severe 1.1%. Prevalence of depression (SDS) in group 'affected' by quarantine was higher than 'unaffected' group (p<0.001).	Higher depression scores in female gender, poor self-perception of health, excessive worry, economic loss, region of living	Low
January	170	Anxiety, stress, sleep, social capital (validated measures)	Zung Self-Rating Anxiety Scale (SAS)	Prevalence NR Mean SAS score= 55.4 SD 14.29 (mild-moderate anxiety).	Lower anxiety with higher social capital; anxiety correlated with poor sleep quality. Increased social capital improved sleep quality by reducing anxiety and stress.	Not reported	Not reported	Not reported	High
February	230	Anxiety, post-traumatic stress (validated measures)	Zung Self-Rating Anxiety Scale (SAS)	Anxiety prevalence 23% (mild=16%, moderate=4.8%, severe=2.2%)	Higher anxiety female vs male (total female=25.7%, male=11.6%) Anxiety higher in nurses than doctors [26.9% vs 14.3%)	Not reported	Not reported	Not reported	Medium
February	92	Anxiety, depression, sleep	Zung Self-Rating Anxiety Scale (SAS)	Prevalence NR Mean SAS score=37.8 (normal range).	SAS scores normal but higher than the national norm (29.78, P <0.001). No difference between genders, single children vs others, educational background	Zung Self-Rating Depression Scale (SDS)	Prevalence NR Mean SDS score=43.98 (normal range).	Mean SDS score normal but higher than the national norm (P <0.05). No difference between genders, single children vs others, educational background	High

February	600	Anxiety, depression (validated measures)	Zung Self-Rating Anxiety Scale (SAS)	Anxiety prevalence=6.33% (mild=5.67%, moderate=0.67%, severe 0%.; female 29/333 (8.7%) > male 9267 (3.4%); χ2 = 7.118, p = 0.011	Higher anxiety in female vs male (sig); higher anxiety<40yrs vs older 40 and above age group (not sig). No sig difference with education level, occupation, and region.	Zung Self-Rating Depression Scale (SDS)	Depression prevalence 17.17% (mild 14.33%, moderate 2.5%, severe 0.33% ; r = 0.694, p<0.001; female 62/333 (18.6%), male 41/267 (15.4%)	Depression in masters level education higher than a bachelors level education (p = 0.005); Depression in industrial workers/ other staff higher than "professionals" (p = 0.024). No difference between genders, age, region of USA (midwestern vs eastern)	Medium
February	512	Anxiety (validated measure)	Zung Self-Rating Anxiety Scale (SAS)	Anxiety prevalence 12.5% (mild=10.4%, moderate=1.4%, severe=0.8%). SAS score=38.83 direct contact COVID patients vs 41.11 indirect contact with COVID patients, both in normal range but significantly different (41.11 ± 9.79 vs. 38.83 ± 8.38, p=0.007)	Anxiety levels higher in Hubei medical staff vs non-Hubei, staff with suspected COVID-19 infections. No difference between gender, age group, hospital department, rural vs city. Nurses vs doctors NR.	Not reported	Not reported	Not reported	Medium
March	180	Anxiety, stress (validated measures)	Zung Self-Rating Anxiety Scale (SAS)	Prevalence NR Mean SAS score 32.19 (normal range) but sig higher than Chinese general population score of 29.78.	Anxiety strongly correlated with stress scores: higher stress= higher anxiety.	Not reported	Not reported	Not reported	Low
January	1257	Anxiety, depression, sleep, post-traumatic stress (validated measures)	General Anxiety Disorder Scale (GAD-7)	Anxiety prevalence overall 44.6% (mild=32.3%, moderate=7.0%, severe=5.3%). Median GAD-7 score=4 (mild anxiety).	Anxiety prevalence significantly higher in nurses than doctors, in women than men, in front line workers, in Wuhan higher anxiety than other parts of Hubei and non-Hubei areas.	Patient Health Questionnaire 9 (PHQ-9)	Depression prevalence= overall 50.4% (mild=35.6%, moderate=8.6%, severe=6.2%). Median PHQ score=5 (mild depression).	Higher depression scores in front line vs second line workers (p<0.001), health workers in Wuhan vs other areas and in secondary vs tertiary hospitals; P = <0.05	Low

Jan-Feb	994	Anxiety, depression, sleep, post-traumatic stress (validated measures)	General Anxiety Disorder Scale (GAD-7)	Subthreshold mental health disturbance 36%; mild disturbance 34.4%; moderate 22.4%; severe disturbance 6.2%. Combined mental health score by clustering method. Individual questionnaire scores not reported.	More severe disturbance in younger people, caring for infected patients, family, colleague or friend infected, not received mental health resources. No difference between gender or occupation (doctor/nurse) or counselling.	Patient Health Questionnaire 9 (PHQ-9)	See combined mental health assessment in 'Anxiety' section.		Medium
Jan-Feb	4827	Anxiety, well-being (validated measures), social media use (non-validated measure)	General Anxiety Disorder Scale (GAD-7)	Anxiety prevalence 22.6%.	Positive correlation exists between Anxiety and social media exposure. (OR = 1.72, CI1.3–2.3) No difference between male and female. Higher anxiety in younger people (under 40yrs), lower level of education, living in Hubei vs other provinces, self-rated poor health.	Not reported	Not reported	Not reported	Medium
NR; submitted to journal Feb	3881	Anxiety, depression (validated measures), COVID-19 awareness (non-validated measures)	General Anxiety Disorder Scale (GAD-7)	Anxiety prevalence 26.6% (mild=23.2%, moderate= 2.7%, severe=0.7%).	Higher anxiety in students in rural areas, non-medical majors, and reporting half of their information concerning the epidemic being negative. Higher anxiety in females for mild group only.	Patient Health Questionnaire 9 (PHQ-9)	Depression prevalence 21.2% (mild 17.0%, moderate 3.2%, and moderate-to-severe depression 1.0%).	Higher depression scores in female gender, residence in suburbs, a drinking history, and excessive negative information concerning the epidemic.	Low
NR; submitted to journal March	7143	Anxiety (validated measure)	General Anxiety Disorder Scale (GAD-7)	Anxiety prevalence 24.9% (mild=21.3%, moderate=2.7%, severe=0.9%).	Anxiety levels higher when relatives or acquaintances had Covid-19. (OR = 3.0, CI 2.4-3.8,P<0.001), living alone (P<0.05), rural students (OR 0.9 CI 0.8-1.1 for urban, P<0.001), unsteady family income (OR=0.7 CI 0.6-0.8 for steady income,P<0.001). No significant different between genders and regions of residence including Hubei vs non-Hubei areas.	Not reported	Not reported	Not reported	Low

NR; submitted to journal March	8079	Anxiety, depression (validated measures), COVID-19 knowledge (non-validated measure)	General Anxiety Disorder Scale (GAD-7)	Anxiety prevalence 34.4% (mild=27.0%, moderate 7.4%, severe 0%)	Anxiety higher in rural students vs city students (p<0.001), those living in Hubei province(OR = 1.64, CI 1.4–1.9p<0.001), females vs males (OR=1.1,CI 1.0–1.2p<0.05). Also higher anxiety in older students (OR 3.1, CI 2.4–3.9 p<0.001). Lower anxiety with better COVID-19 awareness (OR 0.97, 0.9–0.99 CI p<0.001).	Patient Health Questionnaire 9 (PHQ-9)	Depression prevalence 43.7% (mild 26.4%, moderate 10.1%, severe 2.7%),	Higher depression scores in female vs male, (OR 1.2 , CI 1.1–1.3 p=0.001), rural students vs city students, p<0.001), especially in Hubei province (OR 1.6 CI 1.3–1.9p<0.001). Depression prevalence increased with older school grades 32.0% in Junior grades to 59.9% in senior grades (OR 3.3 CI 2.54–4.15,p<0.001).	Medium
March	202	Anxiety, depression (validated measures)	General Anxiety Disorder Scale (GAD-7)	Prevalence NR Mean GAD-7 score 15.05(SD 5.82, (just above the cut-off for severe anxiety)	Study evaluated likelihood to self-isolate to prevent COVID infection. Higher anxiety levels were not correlated with intention to self-isolate. Hypothesis: coping mechanism, aiming to maintain a normal lifestyle	Beck Depression Inventory II (BDI-II)	Prevalence NR Mean depression score 47.62 (SD11.82, severe depression)	Correlation between depression and anxiety. Correlation between depression and intention to self-isolate.	Medium
March	3480	Anxiety, depression, post-traumatic stress, day-to-day discrimination, loneliness, social support, spiritual well-being, self-compassion (validated measures)	General Anxiety Disorder Scale (GAD-2)	Anxiety prevalence 21.6% (only one category in GAD-2). Mean GAD-2 score=1.79, SD = 1.63, normal range).	Higher anxiety in female, previous medical conditions, previous COVID illness in self or relative, 'over-informed' compared to good information or not enough information, more loneliness. Lower anxiety with higher level of education, older age groups, higher 'sense of belonging' score, higher 'self-compassion' score, higher 'spiritual well-being' score, higher 'social support' score.	Patient Health Questionnaire 2 (PHQ-2)	Depression prevalence 18.7% . Mean depression score= 1.60 (SD = 1.50, normal range).	Higher risk in female. Lower depression with higher level of education, older age groups, score, higher 'self-compassion' score, higher 'spiritual well-being' score, higher 'social support' score.	Medium

Jan-Feb	1210	Anxiety, depression, stress, post-traumatic stress (validated measures), COVID-19 anxiety and knowledge (non-validated measure)	Depression, Anxiety and Stress Scale (DASS-21)	Anxiety prevalence 36.4% (mild=7.5%, moderate=20.4%, severe or extremely severe=8.4%)	Higher anxiety in males, students vs employed people, those reporting symptoms, poor health and history of chronic illness	Depression, Anxiety and Stress Scale (DASS-21)	Depression prevalence 30.3% (mild=13.8%, moderate=12.2%, severe or extremely severe=4.3%)	Higher depression scores in males, lower education level, poor health and history of chronic illness; No difference in age, parental status, marital status, and household size.	Medium
Jan-Mar	1738	Anxiety, depression, stress, post-traumatic stress, COVID-19 anxiety (validated measures)	Depression, Anxiety and Stress Scale (DASS-21)	Two cohorts completed questionnaire 4 weeks apart. Prevalence NR Mean DASS anxiety score 6.16 (1st) and 6.15 (2nd). Corresponds to 'moderate' anxiety levels. No significant difference between two groups.	Higher anxiety in poor health, history of illness associated with higher anxiety. Presence of physical symptoms associated with anxiety in 2nd but not 1st survey. Lower anxiety if confidence in doctor's ability to diagnose COVID-19, very low perceived likelihood of contracting COVID-19, very high likelihood of survival and high satisfaction with health information	Depression, Anxiety and Stress Scale (DASS-21)	Two cohorts completed questionnaire 4 weeks apart. Prevalence NR Mean DASS depression score 6.25 (1st) and 6.38 (2nd). Corresponds to 'moderate' anxiety levels. No significant difference between two groups/time intervals.	Higher depression scores in female. Higher depression levels in poor health, history of illness. Chronic illness associated with depression in first but not second survey. Depression associated with recent quarantine in second survey. Depression associated with lack of confidence in doctor's ability to diagnose COVID. At both times, less depression if considered self to have high likelihood of surviving COVID and if satisfied with health information about COVID.	Medium

March/ April	649	Anxiety, depression, COVID-19 anxiety (validated measures)	Depression, Anxiety and Stress Scale (DASS-21)	DASS score and anxiety sub-scale prevalence and scores NR.	Study focus on developing and validating Fear of Covid scale in Israeli population. Showed strong correlation with COVID anxiety and high DASS score, especially anxiety sub-scale (stronger correlation than stress or depression sub-scales)	Depression, Anxiety and Stress Scale (DASS-21)	DASS score and depression sub-scale prevalence and scores NR.	Study focus on developing and validating Fear of Covid scale in Israeli population. Showed strong correlation with COVID anxiety and high DASS score, but lower correlation with depression sub-scale compared with anxiety.	Medium
March	249	Anxiety, depression, phobia (validated measures), COVID-19 anxiety (validation study)	Hospital Anxiety and Depression Scale (HADS)	HADS results not reported separately.	Study designed to validate Fear of COVID scale in Italian population. Found strong correlation between Fear of COVID scores and HADS scores.	Hospital Anxiety and Depression Scale (HADS)	HADS results not reported separately.	Study designed to validate Fear of COVID scale in Italian population. Found strong correlation between Fear of COVID scores and HADS scores.	High
NR; submitted to journal March	717	Development and validation of Fear of Covid scale. Anxiety, depression, perceived vulnerability (validated measures).	Hospital Anxiety and Depression Scale (HADS)	Prevalence NR Significant correlation between anxiety and COVID-19 anxiety (p < 0.001).	Study focus on developing and validating Fear of Covid scale.	Hospital Anxiety and Depression Scale (HADS)	Prevalence NR Significant correlation between depression and COVID-19 anxiety (p < 0.001)	Study focus on developing and validating Fear of Covid scale.	Low
March	650	Anxiety, COVID-19 fear and knowledge (non-validated measures)	Questionnaire developed for the study	No standardised measure of anxiety.	General fear of COVID 'yes'=80.3%. Fear of treating coughing patients= 90%, Fear of talking to patients yes= 72%, fear of infecting family yes=92%	Not reported	Not reported	Not reported	High

*Based on score derived using criteria by Joanna Briggs Institute [9].

There was heterogeneity in the reporting of anxiety prevalence and severity, with some reporting overall prevalence of 'any level' anxiety (mild, moderate or severe, 11 studies [4, 5,16-22,24,32]), and others reporting a mean anxiety score. In the studies reporting prevalence, three reported prevalence rates under 15%, all measured with SAS: 6.3% (study of 600 participants across China in February32), 8.3% (study of over 1500 participants in the general population in Wuhan in January [22]) and 12.5% (study of 512 health professionals across China in February [24]). All the remaining studies reported prevalence rates over 20%. These ranged from 21–27% (4 studies [16-18,20]) to the higher levels of

34% (study of over 8000 adolescents across China before March measured with GAD-7 [5]), 36% (study of over 1200 participants in the general population in Wuhan in January, measured with DASS-21 [4]) and 45% (study of over 1200 health professionals in Wuhan in January, measured with GAD-7 [21]). The highest quality studies reported prevalence rates of 8.3 [22], 24.9 [16] and 26.6% [17], representing results toward the middle of the overall range.

In 10 of the 11 prevalence studies, the proportion of mild, moderate and severe anxiety was also reported [3-5, 17,20-22,24,28,32]. The vast majority of participants had 'mild' anxiety

and the higher-quality studies reported 'mild' anxiety in 21[16] and 23% [17]. The proportion in the 'severe/high anxiety' category was typically low. Seven of the 10 studies had a rate of severe anxiety in ≤2%, with the other 3 studies reporting 5% [21], 6% [14] and 8% [4].

Higher anxiety scores were reported in females in six studies [5, 19-22,32], in males in one study [31] with no difference in six studies [3, 16,18,19,24,28]. Younger age (<40 years) was associated with higher anxiety in three studies [3,18,32], and age had no effect in one study [24]. The exception to the younger age trend was the only study in adolescents, and this showed higher anxiety in older adolescents (senior high school years) than younger students [5].

In the studies of health professionals, nurses had higher anxiety levels than doctors in two studies [20,21], and no different in one study [3]. In China, anxiety was highest among workers in Wuhan and provinces adjacent to Hubei compared to other provinces, higher in front-line workers compared to others [21,24] and high in a population of nurses subject to hospital-based residential lockdown for work [28].

In the general population and students, associations with high anxiety levels were high stress and depression scores [12,14,29], poor sleep [34], poor self-perception of health [4,18,19,22,30], lower level of education [18,19], social media exposure [18], knowing someone with COVID-19 [16,19], living in Hubei province [5,18] or rural areas [5,16,17], affected by quarantine [22,34], economic loss [16,22] living alone/lonliness [16,19] Higher anxiety was reported where more than half of COVID-19 media information was negative [17] and self-perception of being 'over-informed' compared to 'good' or 'not enough' information [19].

Protective effects against anxiety were high 'social capital'/ social support [19,34], spirituality [19],being employed [4], better 'COVID awareness [5,14], higher education level [19], confidence in doctor's ability to diagnose/ treat COVID-19 and perceived low likelihood of contracting/ dying from COVID-19 [30].

No trends emerged in prevalence rates between general and health professional populations, between times of studies (month) of studies, sizes of studies or measurement tools (Table 2).

Depression

Fourteen studies reported depression are (Table 2) [3-5,12-14,16,17,19,21,22,28-30,32]. A variety of validated measurement tools were used: Zung Self-Rating Depression Scale (three studies [22,28,30]), Patient Health Questionnaire (PHQ-9, four studies [3,5,17,21] and PHQ-2, one study [19]), Depression, Anxiety and Stress Scale (3 studies [4,14,30] Hospital Anxiety and Depression Scale (2 studies [12,29]), and Beck Depression Inventory II (one study) [13].

There was heterogeneity in the reporting of depression prevalence and severity, with some reporting overall prevalence of 'any level' depression (mild, moderate or severe, six studies [4,5,17,19,22,32]), and others reporting a mean or median depression score [13,21,28,30]. In the studies reporting prevalence, the reported rates were ≤21% in four studies [17,19,22,32], 30.3% (study of 1210 participants in general population in China in January/February [4]) and 43.7%(study of over 8000 adolescents across China) [5]. There was only one 'low risk of bias' study to report depression and this showed a prevalance of 14.6% [22].

In five of the six prevalence studies, the proportion of mild, moderate and severe depression was also reported [4,5,17,22,32]. In all of these studies, the majority of participants had 'mild' depression. The proportion in the 'severe depression category was low, with the highest being 4.3% with severe depression in the same study in China that had an overall high prevalence of depression at 30.3% [4].

Females had higher prevalence of depression than males in five studies [5,17,19,22,30], lower in one [4] and no different in two [28,32]. Higher rate of depression was associated with younger age [19], financial loss [22], being affected by quarantine [22,30], drinking alcohol [17], rural residence [5], and personal poor health [4,22,30]. Higher level of education was a risk factor in one study [32] and a protective factor in two others [4,19]. In adolescents, depression was higher in the older high school age group [5]. Health professionals working on the front-line (versus 'second-line') had a higher rate of depression, as did those working in Wuhan (versus other provinces in China) and working in a secondary (versus tertiary) hospital [32].

Lower rates of depression were associated with industrial occupations (compared to professionals) [32], having more social support and higher 'spiritual well-being [19], having confidence in doctor's ability to diagnose COVID-19 and feeling likely to survive COVID-19 [30].

Receiving information about COVID-19 had an effect on depression; excessive negative information about COVID-19 was associated with a higher rate of depression [17] and feeling satisfaction with information about COVID-19 was associated with a lower rate of depression [30]. COVID-19 related fear was strongly correlated with depression in one study [29] and weakly correlated in another [14].

COVID-19-related anxiety and other outcomes

Ten studies reported COVID-19-related anxiety and/or knowledge (Table 3) [4, 11,17,22,30,32]. A new 'Fear of COVID' scale (seven-item Likert scale) was developed [12] then validated in general populations in Iran [12], Italy [29] and Israel [14]. It showed suitable properties for ongoing use [12]. Fear of COVID-19

was correlated with high levels of anxiety and depression measured by HADS [12,14] and DASS-21 [29]. The remaining seven studies used non-validated questionnaires to assess specific issues related to COVID-19. A study of medical professionals in China also showed that the biggest concern for doctors and nurses was being responsible for their family becoming infected [33].

The other psychological outcomes reported were: sleep disturbance(9 studies) [3,5,21,25,28,32,34-36], distress/ post-traumatic stress (8 studies) [3,19,21,26,30,31,37], stress [15,25,24,35], social support [19,34,35], coping [15,31], vulnerability [12], attachment [26], self-efficacy [35], burnout [33] and spiritual well-being [19]. These outcomes were not analysed in detail in this review but were included in the analysis of anxiety, depression and fear of COVID-19 where they also reported these (Table 3).

Table 3: COVID-19-related fear and other psychological outcomes (grouped by measurement tool).

FEAR OF COVID-19									
Author	Country and population	Month	N	Outcomes measured	Fear of COVID Measurement tool	COVID-related fear prevalence and score	Associations	Conclusion	Risk of bias*
Ahorsu D [12]	Iran. General population.	NR; submitted to journal March	717	Development and validation of Fear of Covid scale. Also measured anxiety, depression, perceived vulnerability (validated measures). .	Fear of Covid scale (Development and initial validation)	Fear of COVID scores NR.	Significant correlation between COVID-19 anxiety and depression (Hospital Anxiety and Depression Scale (HADS), p< 0.001), anxiety (HADS, p<0.001), perceived infectability Perceived Vulnerability to Disease Scale (PVDS p<0.001) and germ aversion (PVDS, p<0.001).	Fear of COVID is a a good psychometric instrument to be used in assessing and allaying fears of COVID-19 among individuals.	Low
Soraci P [29]	Italy, General population	March	249	Anxiety, depression, phobia (validated measures), COVID-19 anxiety (validation study)	Fear of COVID Scale (validation study in Italian population)	Total score of the Fear of COVID mean = 16.86 (7 item scale, range of possible scores 7-35)	Positive correlations found for both HADS (anxiety and depression) and SMSP-A (phobia) with Fear of COVID	Stable unidimensional structure of the Italian COVID scale, confirming the findings of the original validation study (Ahorsu et al. 2020) and psychometric analyses showed good internal reliability and consistency.	High
Bitan DT [14]	Israel, General population	March and April 2020	649	Anxiety, depression, COVID-19 anxiety (validated measures)	Fear of COVID Scale (first study in Israeli population)	Prevalence of fear NR. Higher rates of fear of COVID in females, SES higher rates of fear, chronic illness and at-risk groups and family member dying of COVID-19	Fear of COVID correlated with stress, depression and anxiety on DASS.	Validity of Fear of COVID scale, Hebrew version, confirmed.	Medium

Wang C [30] (Brain BehavImmun)	China (multiple provinces), General population; two surveys separated by 1 month, mostly different participants	Jan-Mar	1738	Anxiety, depression, stress, post-traumatic stress, COVID-19 anxiety (validated measures)	COVID knowledge and concerns (National University of Singapore COVID-19 validated questionnaire)	Likelihood of contracting COVID-19: (likely) survey 1=40.8%; survey 2=35.9% P=0.058. Likelihood of surviving COVID-19: (likely) survey 1=66.2%; survey 2=74.6% P=0.04. Satisfaction with health info (satisfied) Survey 1=75.1%, survey 2=89.3% P < 0.001	No significant temporal changes in the levels of stress, anxiety and depression between the first and second surveys.	Health information and confidence in diagnosis and treatment associated with lower levels of anxiety, depression and stress.	Medium
Chang J [17]	China (Guangdong) Southern China, University students	NR; submitted to journal Feb	3881	Anxiety, depression (validated measures), COVID-19 awareness (non-validated measures)	Questionnaire about coronavirus awareness and concerns (non-validated)	69.47% of the college students had a high level of awareness of COVID-19 ; older age was associated with a higher level of awareness of COVID-19	NR	Some students require more support, especially non-medical major; information source pos/neg has an effect on both anxiety and depression	Low
Ahmed MA [11]	International, Dentists	March	650	Anxiety, COVID-19 fear and knowledge (non-validated measures)	Questionnaire about coronavirus awareness and concerns (non-validated)	Fear of treating coughing patient=90%, Fear of talking to patients yes=72%, fear of infecting family yes=92%	NR	Dentists have a high level of anxiety about COVID-19, specifically becoming infected at work.	High
Lei L [22]	China (southwestern) Adjacent to Hubei Province, General population in or out of quarantine)	January	1593	Anxiety, depression (validated measures), COVID-19 awareness (non-validated measure)	Questionnaire about coronavirus awareness and concerns (non-validated)	Worry about becoming infected (single item question)= 81.3% (not at all=18.6%, a little worried 52.9%, very worried 28.4%.	NR		Low
Wang C [4]	China (multiple provinces), General population	Jan-Feb	1210	Anxiety, depression, stress, post-traumatic stress (validated measures), COVID-19 anxiety and knowledge (non-validated measure)	Questionnaire about coronavirus awareness and concerns (non-validated)	Perceived likelihood of contracting COVID-19: likely=40.8%, not likely=46.1%, don't know=13.2%; Perceived likelihood of surviving COVID-19 infection: likely=69.2%, not likely=11.9%, don't know=18.9%. Concern about family members getting COVID-19: worried=75.2%, not worried=24.1%, no family members=0.8%.	High levels of concern about family members getting COVID-19 were significantly associated with higher DASS stress subscale scores. Low perceived likelihood of contracting COVID-19 during the current outbreak was significantly associated with low DASS stress and anxiety subscales.	During the initial phase of the COVID-19 outbreak in China, more than half of the respondents rated the psychological impact as moderate-to-severe, and about one-third reported moderate-to-severe anxiety.	Medium

Zhou S [5]	China (multiple provinces) General population (adolescents)	NR; submitted to journal March	8079	Anxiety, depression (validated measures), COVID-19 knowledge (non-validated measure)	Questionnaire about coronavirus awareness and concerns (non-validated)	COVID knowledge and awareness results not reported separately.	Anxiety (GAD-7) and depression (PHQ-9) scores lower in those with more awareness and knowledge about COVID-19.	Awareness of COVID-19 had a protective effect against anxiety and depression	Medium
Wu Y [33]	China (Hubei), Health professionals (nurses and doctors)	March	190	Burn-out (validated measure), personal accomplishment, COVID-19 anxiety (non-validated measures)	Questionnaire about coronavirus awareness and concerns (non-validated)	Worry about becoming infected= 63.7%% (frontline=51% usual ward=76%); worry about family becoming infected =76.3% (frontline=65%; usual ward=87%); Feel burnout=22.6% (frontline=15%; usual ward=31%). No P=values given,	Personal sense of accomplishment was significantly higher in frontline than usual ward (39% vs. 61%; P < 0.002).	Compared with medical staff working in their UW for uninfected patients, Medical staff working on the front line had a LOWER frequency of burnout. Both health care workers on the frontline and those in their usual work setting in the COVID-19 crisis need care.	Low

Discussion

This study has examined the first 30studies assessing psychological outcomes from 43, 634 people around the world during the early stages of the COVID-19 pandemic. Studies were conducted between January and April and published by the end of May 2020. Most of the studies were in Chinese populations.

While it is expected that levels of anxiety and depression would be high in the early stages of a pandemic, the extent of the psychological morbidity found in this review was notable. The anxiety prevalence in this review was 6.3–34% overall [4,5,16-22,24,32], with severe anxiety in up to 8% of cases [22]. However, it should be noted that ideal methodology (random sampling of a population based on census or similar data) was not used in any studies. The higher quality studies reported prevalence rates of 8.3 [22] to 26.6% [17]. These rates are much higher than reported in studies of prevalence in normal Chinese populations of 4-6% [38,39,40], in pre-pandemic times. In this review, depression prevalence was 14.6%–30.3% in adult populations and 43.7% in the adolescent study [5], also much higher than the 7.0% reported in a normal Chinese population [41]. While the overall prevalence is high in this review, in 9 out of the 10 studies that reported severity, all were in the 'mild' category [4,5,17,20-22,24,28,32].

Populations at higher risk of anxiety and depression were identified. These include women [20,22,32], people in rural areas [5,16,17], those living in areas with high rates of COVID-19 (such as Hubei province) [18,21] or with a family member who has been affected by COVID-19 [16,19] and people with poor general health [4,30]. The negative impact of quarantine on psychological well-being has also been shown in this review [22,30], even in the very early stages of the pandemic. The identification of these risk groups can be used to target specific interventions. Examples of interventions could be the inclusion of family members in the support that is provided for people diagnosed with COVID-19. The specific exclusion of relatives from visiting patients in hospital due to concern about exposing them to infection will provide challenges to providing such support, however remote interventions could be used. People with poor general health are likely to be in contact with health providers, and this interaction for usual health care can be used as an opportunity to provide specific support for COVID-19 related fear and anxiety.

Protective factors were also identified in this review. The presence of a strong social/family network [19,34] was protective against psychological morbidity. Other protective factors were a comfortable level of COVID-19 awareness [5,14] and confidence in the health system to diagnose and treat COVID-19 [30]. These factors can be used in public health messaging to create a sense of security rather than panic around the disease.

Heath professionals, especially nurses [20,21], had high levels of psychological morbidity in this review. This is consistent with previous research that demonstrated anxiety prevalence over 26% in physicians [42] and 40% in nurses [43] in China in non-COVID times. Similarly high rates were found in Australian nurses, who had a prevalence of 32.4% for anxiety and 41.2% for depression [43]. Workers in front line positions during the epidemic may demonstrated high levels of anxiety and depression [21], however, workers in 'less-front-line' positions (such as those working in their normal oncology ward [33] and those in 'secondary' rather

than 'tertiary' hospitals [21]) were also at risk. This may suggest that workers may feel they are well protected with personal equipment when working with COVID-19 patients or that they feel a sense of control or contribution that workers in other areas lack. Therefore, any strategies that target psychological well-being in health professionals must include all, and not just target workers in areas with a high number of COVID-positive patients. Strategies to address the fear that health professionals have of infecting their family members also need to be considered as this was one of their main causes of concern [11,33].

Information about COVID-19 emerged as a factor in both anxiety and depression. People who felt well-informed about the illness had lower levels of both anxiety and depression. However, a feeling of having 'too much' information, or having a majority of negative information about the illness was associated with higher levels. Also, high use of social media was a risk factor for psychological morbidity. This can be considered when public health programs are being developed. It may be possible to provide a limited amount of clear, concise and accurate information that can be repeated often, and to recommend that that people at risk of mental illness avoid using social media and new channels that may be providing a high proportion of 'negative' news stories rather than offering positive stories and hope. 'Confidence in doctors' emerged as a protective factor. It is possible, then, that a strong relationship with a GP can assist in the prevention of mental health problems and encouraging people to see their GP regularly is an important health message.

The strength of this study is the robust systematic review methodology, including PRISMA protocol, broad search strategy, pre-determined inclusion and exclusion criteria and data extraction/checking by two investigators. The limitations include the heterogeneity of the methodology of the included studies, contributed to by the broad inclusion criteria, precluding meta-analysis and limiting generalisable conclusions. The majority of studies were from China and this may limit the applicability of the results to Western countries. Also, as the included studies were conducted in the early part of the pandemic, the results may be less applicable to the current situation where there the world is more experienced in the management of the virus and people have longer experience with the challenges of lock-down. Further research is required to evaluate whether the psychological morbidity identified in this review increases or decreases over the duration of the pandemic.

Conclusion

Studies of psychological outcomes in the early months of the COVID-19 pandemic have demonstrated high levels of anxiety and depression in some populations and have identified risk groups. Women, young adults, older adolescents and people living in and outbreak epicentre are particularly vulnerable. Health professionals, whether or not they are working on the front line,

are at risk of anxiety and depression. The quality and nature of information that people receive also has an effect on psychological outcomes and is an area that could be targeted to reduce morbidity.

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