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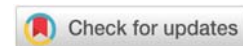
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Literature Review

Unravelling the impact of COVID-19 on mental health: A scoping review on traumatogenic events using the phases of response to disaster model

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Abstract

Background: Disease outbreaks such as the COVID-19 pandemic give rise to high levels of psychological distress in people worldwide. Since this is the first pandemic of its kind, the best available evidence is needed on what psychological needs could be expected during and after the pandemic.

Objectives: In this scoping review existing research on traumatogenic events is examined in order to identify the potential impact on mental health of the COVID pandemic. The research findings are organized using the the phases of disaster response model.

Results: A total of 34 longitudinal studies, 2 studies with multiple waves of data collection and 92 cross-sectional studies met the inclusion criteria. The studies included in this scoping review could be classified as: 87 studies on COVID-19, 2 on SARS, 19 on wars, 19 on terrorist attacks and 1 on a nuclear accident. Results indicate that stress, anxiety, depressive symptoms, insomnia, denial, anger, grief and fear can be anticipated as common reactions. The longer a pandemic continues, the higher the psychological strain is expected to be.

Conclusions: The phases of response to disaster model offers a valid frame to unravel the impact of the pandemic on mental health over time. Specific attention must be given to vulnerable groups, whereby specific risk factors include age, gender, pre-existing mental health problems, healthcare profession, migration background, isolation and low socio economic status. However, these may change over time, and a delayed manifestation of psychosocial problems needs to be considered too. Mental health governance is, therefore, warranted throughout and even up to 6 months after the pandemic.

Introduction

The COVID-19 pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has had an enormous impact on healthcare and economic systems but also on (public) mental health. The entire world has struggled with an emergency that has been unusually challenging, ubiquitous and cataclysmic for health and wellbeing [1], including a significant case fatality rate - albeit lower than SARS (Severe Acute Respiratory Syndrome) and MERS (Middle East respiratory Coronavirus syndrome) [2]. To date, with

more than 14 million infected worldwide and a spread that is far from contained, monitoring the psychological impact of this pandemic on the general population as well as in at-risk groups has become increasingly important [2]. While the context and the specific approaches for dealing with the pandemic vary across the globe, there are at least two common denominators that make the pandemic a traumatic experience for all involved. Firstly, people are confronted with serious illness on a vast scale and also with (mostly untimely and sudden) death, both of which are linked to an array of long-lasting negative psychological effects [3]. Secondly, some

degree of confinement measures have been adopted to stop the virus from spreading. COVID-19 is not only a highly contagious disease that has spread over vast areas, but it also took the world by storm, which necessitated drastic measures. The DSM-5 [4] indicates that “experiencing repeated or extreme exposure to aversive details of the traumatic event(s)” can be considered as a distinct type of exposure to trauma (Criterion A4). Indeed, one third of the world’s population was subjected to varying degrees of lockdown, whereby society needed to abide by an array of different restrictive measures. Some lockdowns included a total movement control or stay-at-home order, only leaving essential shops open, whilst others consisted of more limited and time-bound restrictions, for example, a curfew. A significant number of people also experienced quarantine, which involves separating out and restricting the movement of those people who have potentially and/or effectively been exposed to COVID-19 in order to stop the virus from spreading further [5].

Traumatic experiences are known to have an impact on body, mind and relationships with others, sometimes even over a longer period of time. According to DeWolfe [6] there are two types of trauma: individual, and community or universal trauma. While individual trauma focuses on the traumatic experience – both singular and multiple or chronic events – of an individual (ex. robbery, rape, life threatening illness, ...), community trauma involves entire communities and is, thereby, characterized by mutual recognition and shared experience within a group of people, which can often put a strain on social support systems [7]. This latter kind of trauma is common in disasters (e.g., mass shooting, war, flooding, ...), in which anyone who has lived through the disaster is at risk of experiencing trauma-related reactions. It is, therefore, also referred to as a universal trauma, breaching the generally accepted norms within a society, although the specific impact of the trauma on the people involved may differ based on characteristics of the individual, the type and characteristics of the disaster, developmental processes, and sociocultural factors. Direct exposure and proximity to a disaster are generally linked to an increased risk of traumatic impact [8]. All these elements create groups of people at different levels of risk, for example, direct victims, families of victims, carers, and so forth. COVID-19 has all the characteristics of a universal trauma. Nevertheless, it remains unclear what can be expected of the specific impact on the psychosocial needs within society, since it is the first contagious outbreak of its kind.

COVID-19 is, indeed, the first major disaster of this amplitude in the 21st century. Emergency and/or pandemic preparedness is, currently, strongly focused on fast-burning [9] or situational crises [10] characterized by an immediate threat which – if responded to appropriately – is of a short-term nature. The current strategies for emergency and/or pandemic planning and response are, thereby, anchored in “policy as routine” [11] contributing to homeostasis: a known intervention when a sudden anomaly occurs in a structured world or rather clearly delineated system (e.g., a factory fire, flooding of a village), with the purpose of fixing the problem, after which the situation returns to the norm and business

continues as usual (apart from minor adjustments based on incremental learning). COVID-19 challenges the homeostasis principle within society, because there is no standard fix or readily available intervention for this kind of complex challenge that could serve to quickly restore society’s stability, but rather it is chronic in nature. While this is true for society and emergency and/or pandemic preparedness in general, it is particularly applicable to the specific domain of psychosocial health.

The current scoping review aims to create order in chaos and uncertainty, by better understanding what can be expected regarding the psychosocial impact of COVID-19 looking at it as a disaster and traumatogenic experience. A theoretical model that can be of use when looking into the possible psychosocial impact of disasters on people is the phases of response to disaster model [12].

According to DeWolfe [6] a disaster can be divided into seven phases. It starts with the *threat or warning phase*, which refers to the time before a potential disaster. Responses to a warning or threat of a disaster vary from active response to ignoring the warning. While ignoring a warning may lead to feelings of guilt, receiving no warning at all may result in feelings of vulnerability and fearfulness [6]. Accurate information about what to expect and how to act must be provided by trustworthy and recognized authorities [13]. The moment of the disaster is called the *impact phase*. The specific impact on the individual and the community depends on the type and severity of the disaster. Common responses are confusion, disbelief, shock or panic. The time immediately after the disaster is referred to as the *rescue or heroic phase*, in which survival and safety are the steering concepts. Levels of altruism, but also anxiety are high [6]. In this phase it is important for members of the community to help each other, to form groups and to take on active roles to reduce feelings of helplessness and powerlessness. Furthermore, it is important for authorities to make psychological first aid available, estimate short- and long-term effects and to arrange for human and other resources [13]. Giving and receiving help; and bonding with the community results in the *remedy and honeymoon phase*, in which individuals tend to feel optimistic. Next, in the *inventory phase*, people reflect upon what happened. It is in this moment that the extent of losses and the limits of received or perceived lack of assistance may become clear, and unrealistic optimism can give way to exhaustion and discouragement. This phase is, thereby, followed by the *disillusionment phase*, in which individuals are prone to chronic stress because of the number and variety of stressors they face, while bonds with the community tend to weaken [6]. This phase is also referred to as the *second disaster* due to its negative effect on individuals’ emotional well-being, which makes it important to further strengthen social networks and enable individuals to take on an active role. In addition, it is important that authorities provide practical and psychological support and set up communication systems to correct and prevent circulation of myths and other false information [13]. These interventions continue to be required during the final phase [13], the *reconstruction* or

recovery phase, in which the recovery of physical and emotional well-being, growth and opportunity are central concepts [6].

The phases of response to disaster model has been validated in data-driven studies [7,14]. The timing of the different phases and the specific transition between the phases is, however, less well-defined and likely depends on the type of disaster in question. This is also seen in crisis management, where several authors refrain from using “phases” and instead use “stages”, since there is an increasing recognition that there can and even should be a considerable time overlap in order to manage the disaster as well as possible [15,16]. In the case of COVID-19, society is currently confronted with a contagious disease, spreading around the world with a highly visible impact and a realistic risk of reoccurrence. The pandemic, therefore, features several factors known to prolong and worsen the psychological implications of a disaster [6,7]. The specific experience and impact of a disaster can, logically, differ amongst individuals and subgroups. However, although disasters are not uniform events with guaranteed universal, standardized experiences; the macro perspective provided by the phases of response to disaster model can help to facilitate community preparedness, development of interventions and, in this specific case, organization of research findings over time.

Therefore, this scoping review will use the phases of response to disaster model in order to define and organize specific mental health needs within society over time in response to a contagious disease outbreak and to analyze any differences from the currently available clinical knowledge on acute disasters in delineated communities. As this review will also aim to identify specific groups at higher risk of developing mental health problems, it can also offer useful insights to policymakers and mental health practitioners in the field who are attempting to provide effective and efficient psychological support for the public, especially where and when it is needed the most.

Method

The current report was written using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews [17].

Eligibility criteria

Studies were included if they reported on the impact on mental health of a chronic and/or recurrent traumatogenic event, such as an infectious disease outbreak, war, or technological disaster. A traumatogenic event was defined as an occurrence in which people were confronted with the finite nature of life. Events with a chronic effect and/or a significant ripple effect were included. Single events, such as fireworks explosions, were not considered eligible. Only studies examining healthy populations, that is, no diagnosis of mental/behavioral disorders or severe medical problems, were included in the review. For cross-sectional studies, only reports with a total number of participants of ≥ 1000 were included. In order to ensure the highest quality of evidence, only original articles were included. Additional inclusion criteria were: peer-reviewed journal articles published in English with availability of the full text. Research describing the impact of natural disasters, intervention studies, expert opinions, letters to the editor and (systematic) reviews were excluded Figure 1.

Information sources and search methods

Two electronic databases were searched from January 2000 to July 11, 2021: PubMed and PsycInfo. The search strategy was designed by E.V.H. and refined and implemented by P.H and E.P. The final search query for PubMed can be found in supplementary material. The search results from the two databases were exported to EndNote and duplicate articles were removed.

Selection of sources of evidence

The flowchart of the scoping review process is shown

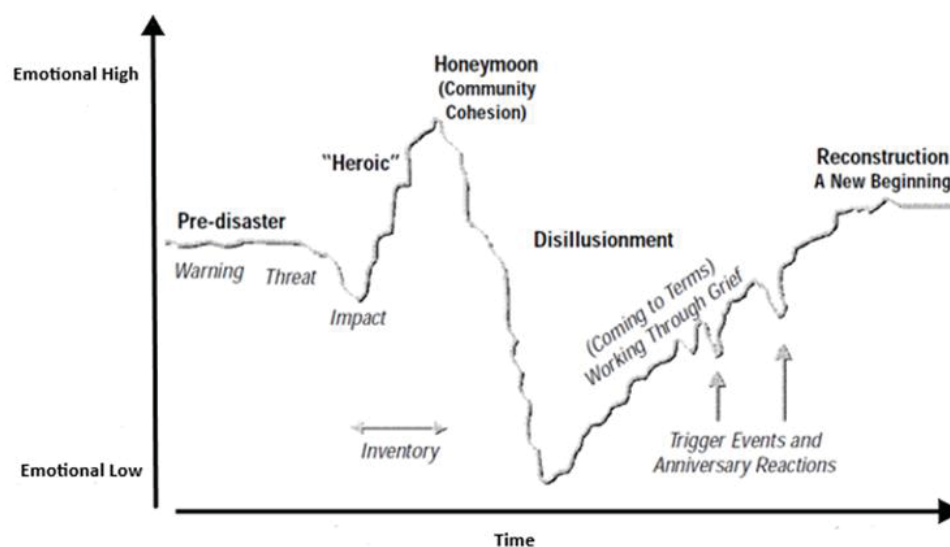


Figure 1: Macro view phases of response to disaster based on DeWolfe [6].

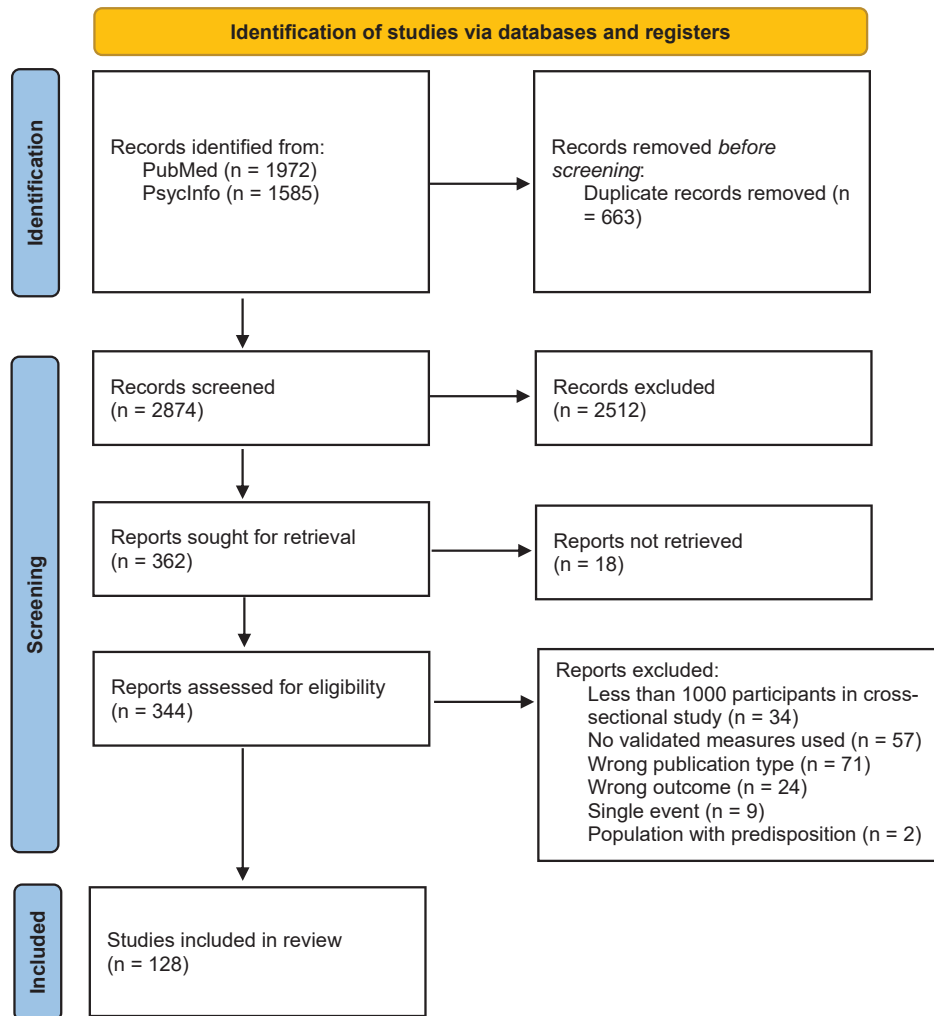


Figure 2: Flow-chart of the scoping review process.

in Figure 2. As a first step, two authors, H.D.L. and S.H., independently screened the articles for eligibility based on title and abstract. Articles which did not meet inclusion criteria were excluded from the review. Subsequently, the full texts of the remaining articles were retrieved and four reviewers, working in pairs, evaluated the records. Disagreements in one pair were resolved through discussion and consensus with a reviewer from another pair.

Data extraction

After analyzing the full texts, two main categories of studies were created: COVID-19-related studies and other disaster-related studies. The following data were extracted: first author, year of publication, study design, sample size, mean age of participants, country, date of study/study duration, outcome variables related to common mental health disorders (such as anxiety, PTSD) and to coping, types of questionnaires used (for a detailed overview, see Table 1). Since the current review aimed to attain the highest level of evidence, only reports using a solid research methodology (i.e., using validated measures), were considered.

Synthesis of results

In the first part of the review, an overview of the findings from COVID-19 research conducted in the last year will be presented. This information can give us an impression of the initial impact of COVID-19 on mental health and identify specific groups at risk of developing mental health problems. The second part of the review organizes the remainder of the studies according to the phases of response to disaster model, enabling predictions of expected mental health impacts of COVID-19 over time.

Results

Selection and characteristics of sources of evidence

An overview of the study selection process is displayed in Figure 2. Of the 3,557 articles identified for this review, only 128 were included. A total of 34 longitudinal studies, 2 studies with multiple waves of data collection and 92 cross-sectional studies met the inclusion criteria for this scoping review. The included research comprised 87 studies on COVID-19, 2 on SARS, 19 on war, 2 on terrorist attacks and 1 on a nuclear



Table 1: Characteristics of included studies.

First author (year of publication)	N	Mean age (SD)	Country	Date/ duration	Event	Design	Outcome	Questionnaire
Achterberg, et al. [87]	257		The Netherlands		COVID-19	Longitudinal	Depression, anxiety, stress, coping	BSI, PSS-10, CERQ
Büssing, et al. [20]	1277	50.9 (14.9)	Germany	June 9 – 21, 2020	COVID-19	Cross-sectional online survey	Wellbeing	WHO-5
Banerjee, et al. [86]	1520		101 countries, worldwide	April - May, 2020	COVID-19	Cross-sectional online survey	Wellbeing	eWBI
	272			July - August, 2020		Follow up of the first survey		
Barzilay, et al. [18]	1350	41(13)	USA	April 6 - 15, 2020	COVID-19	Cross-sectional online survey	Anxiety, depression	GAD-7, PHQ-2
Ben-Zur, et al. [104]	701		Israel	T1: 26 – 34 days before the event of the disengagement, which took place during August 15 –22, 2005	Disengagement from Gaza and Second Lebanese War	Longitudinal; telephone interviews	Anxiety	BSI
	462			T2: 21 – 41 days after the event of the disengagement				BSI
	366			T3: 19 – 37 days after the end of the Second Lebanese War, which took place between July 12 and August 14, 2006			PTSD	BSI, PSS-SR
Birkeland, et al. [105]	256		Norway	April - May, 2012, 2013 and 2014	Oslo bombing	Longitudinal	PTSD	PCL
Birkeland, et al. [105]	1970		Norway	April 2012	Oslo bombing	Cross-sectional survey	PTSD	PCL
Birkeland, et al. [106]	1970		Norway	April 2012	Oslo bombing	Cross-sectional survey	Depression, anxiety	SCL
Biron, et al. [136]	2072		Israel	July 23 -August 10, 2006	Second Lebanon war	Longitudinal; telephone interviews	Negative affect	PANAS
Blix, et al. [108]	229		Norway	April - May, 2012, 2013	Oslo bombing	Longitudinal	PTSD	PCL-S
Bowler, et al. [109]	4017		USA	September 2003 – November 2004	Terrorist attacks of 9/11	Cross-sectional; telephone interview	PTSD	PCL
Butler, et al. [131]	1281		USA	T1: September 21 – December 4, 2001 T2: March 12 - May 19, 2002	Terrorist attacks of 9/11	Longitudinal; online survey	Wellbeing, global distress, coping	Scales of Psychological Well-Being, BSI, Brief COPE
Cai, et al. [21]	1521		China		COVID-19	Cross-sectional	Depression, anxiety, resilience	SLC-90, CD-RISC
Cardeña, et al. [135]	3134	43.1	USA	September 20 - October 4, 2001	Terrorist attacks of 9/11	Cross-sectional; online survey	Post-traumatic reactions, coping	SASRQ, Brief COPE
Carriedo, et al. [22]	1795	40.54 (15.68)	Spain	March 21 - 25, 2020	COVID-19	Cross-sectional; online survey	Resilience	CD-RISC
Cauberghe, et al. [23]	2165	15.51 (1.59)	Belgium	April 16 -30,2020	COVID-19	Cross-sectional; online survey	Anxiety, coping	GAD-7, Brief COPE
Cheng, et al. [69]	1270		UK and USA	T1: March 16 - 22, 2020 T2: May 18 -24, 2020	COVID-19	Longitudinal; online survey	Generic anxiety	STAI-Y1
Cheng, et al. [69]	1047		UK and USA	T1: March 16 - 22, 2020 T2: May 18 -24, 2020	COVID-19	Longitudinal; online survey	Coping, depression	Brief COPE, CES-D
Chen, et al. [24]	12596	33.1 (7.5)	China and Taiwan	April 2020	COVID-19	Cross-sectional; (online) survey	Trauma, burnout	TSQ, MBI-GS
Chen, et al. [24]	18171		35 countries, world-wide	April 9 - 20, 2020	COVID-19	Cross-sectional; online survey	Depression, psychological distress	DASS-21, K6
Chong, et al. [27]	9565		78 countries, world-wide	April - June, 2020	COVID-19	Cross-sectional; online survey	Coping	Brief COPE
Cénat, et al. [79]	1267		Haiti, DRC, Rwanda, Togo	March - May 2020	COVID-19	Cross-sectional	Anxiety, resilience	SCL-A, CD-RISC2
Daly, et al. [89]	7319		USA	March 10 -July 20, 2020	COVID-19	Longitudinal	Psychological distress	PHQ-2
Daly, et al. [90]	10918		UK	2019, April – September, 2020	COVID-19	Longitudinal	Psychological distress	GHQ-12



DeLisi, et al. [137]	1009	36 (13.4)	USA	December 15, 2001 – February 28, 2002	Terrorist attacks of 9/11	Cross-sectional; in-person interviews	PTSD	DTS
Dong, et al. [28]	4618		China	March 2 – 13, 2020	COVID-19	Cross-sectional; online survey	Anxiety, depression	HEI
Duan, et al. [29]	1390	30.72 (8.86)	China	T1: January 31 – February 9, 2020 T2: March 15 – 28, 2020	COVID-19	Longitudinal; online survey	Stress, coping	PSS-10, SCSQ
Duan, et al. [29]	3613		China		COVID-19	Cross-sectional; online survey	Anxiety, depression	SCAS, CDI, CSS
Eshel, et al. [110]	1022	46.56 (16.09)	Israel		Lebanon War, Gulf war	Cross-sectional; online survey	Distress symptoms	BSI
Fancourt, et al. [83]	36520		UK	March 23 – August 9, 2000	COVID-19	Longitudinal	Anxiety, depression	GAD-7, PHQ-9
Fernandez, et al. (2020)	4408		Argentina	April 1 – 17, 2020	COVID-19	Cross-sectional; online survey	Anxiety, depression	BSI-53
Fluharty, et al. [92]	26505		UK	March 21 – August 14, 2020	COVID-19	Longitudinal	Depression, anxiety, coping	PHQ-9, GAD-7, Brief COPE
Freitag, et al. [111]	1659		Germany		World War I	Longitudinal	PTSD, depression	PDS, PHQ-9
Fukase, et al. [85]	2708	49.16 (16.32)	Japan	July 17 - 22, 2020	COVID-19	Cross-sectional; online survey	Depression, coping	PHQ-9, Brief COPE
Fu, et al. [31]	1242		China	February 18 – 28, 2020	COVID-19	Cross-sectional; online survey	Anxiety, depression, coping	GAD-7, PHQ-9, SCQS
Gabórczy, et al. (2021)	1289		Hungary		COVID-19	Cross-sectional; online survey	Stress, coping, anxiety	PSS, WCQ, SHAI
Germani, et al. (2020)	1011	24.18 (3.6)	Italy	March 17 – 24, 2020	COVID-19	Cross-sectional; online survey	Anxiety, stress	STAI-Y, PSS
Gori, et al. [33]	1102	34.91 (11.9)	Italy	March 15 – 25, 2020	COVID-19	Cross-sectional; online survey	Stress, coping	PPS-10, COPE
Guo, et al. [34]	2441		China	February 1 – 10, 2020	COVID-19	Cross-sectional; online survey	Depression, PTSS, coping	CES-D, PCL, SCSQ
Hadi, et al. [112]	151	T1: 10.06 T2: 21.2	Kuwait	T1: 1993 T2: 2003	Gulf crisis	Longitudinal	Depression, anxiety	CDI, RCMAS
Halevi, et al. [113]	148		Israel		Palestinian – Israeli war	Longitudinal	Depression, anxiety	BDI, STAI
Hamama-Raz, et al. [128]	1745		Israel	May, 2005	Al Aqsa Intifada	Cross-sectional	PTSD	CPTS-RI
Harris, et al. [35]	4008		Norway	March, 2020	COVID-19	Cross-sectional; online survey	Depression, anxiety	SCL-10
Hennein, et al. [36]	1092	40.44 (11.52)	USA	May, 2020	COVID-19	Cross-sectional; online survey	Depression, anxiety, PTSD	PHQ-9, GAD-7, PC-PTSD
Hobfoll, et al. [114]	1511		Israel	August – September, 2004	Al Aqsa Intifada	Cross-sectional; telephone interview	PTSD	PSS
Hou, et al. [69]	1472		China	February 1 – 7, 2020	COVID-19		Resilience, mental health	CD-RISC, SCL-90
Hou, et al. [84]	6029		China	T1: February 25 - March 19, 2020 T2: April 15 – May 1, 2020	COVID-19	Longitudinal; telephone survey	Anxiety, depression	GAD-7, PHQ-9
Hou, et al. [84]	4021		China	February 25 – March 19, 2020	COVID-19	Cross-sectional; telephone interview	Resilience, anxiety	CD-RISC2, GAD-7
Jacques-Aviñó, et al. [38]	7053	44.8 (13.8)	Spain	April 8 – May 28, 2020	COVID-19	Cross-sectional; online survey	Depression, anxiety	PHQ-9, GAD-7
Justo-Alonso, et al. [40]	3524	39.24 (12)	Spain	March 23 – 28, 2020	COVID-19	Cross-sectional; online survey	Depression, anxiety, psychological distress	DASS-21, IES-R
Jungmann, et al. [39]	1615	33.36 (13.18)	Germany	March 15 – 22, 2020	COVID-19	Cross-sectional; online survey	Anxiety, coping	SHAI, CERQ-short
Kavcic, et al. [73]	2722	36.4 (13.1)	Slovenia	five days after Slovenia declared epidemics	COVID-19	Cross-sectional; online survey	Resilience, stress, wellbeing	CD-RISC, PSS, MHC-SF
Kaye-Kauderer, et al. [115]	579		Japan	July 2017	Fuku-shima disaster	Cross-sectional; paper survey	Resilience, post-traumatic growth	CD-RISC, PTGI-X
Kazan Kizilkurt, et al. [42]	1046		Turkey	March 28 – April 02, 2020	COVID-19	Cross-sectional; online survey	Anxiety, resilience	HAS, RSA
Kimhi, et al. [43]	906		Israel	T1: May 4 – 7, 2020 T2: July 12 – 15, 2020	COVID-19	Longitudinal; online survey	Anxiety, depression	BSI



Kimhi, et al. [93]	1346	42 (16.35)	Israel		COVID-19	Cross-sectional; online survey	Anxiety, depression, resilience	BSI, CD-RISC10
Koh, et al. [130]	15025		Singapore		SARS	Cross-sectional; paper survey	Psychological distress	IES
Kung, et al. [116]	33886		USA	T1: 2003-2004 T2: 2006-2007	Terrorist attacks of 9/11	Longitudinal	PTSD	PCL-C
Kuterovac-Jagodic, et al. [117]	252	10.2 (1.19)	Croatia	T1: December, 1994 T2: May, 1997	Yugoslav wars	Longitudinal	Post-traumatic stress reactions, war traumata and stressors, coping	QPTSR-C, QSTWE, SCSI-R
Lahiri, et al. [44]	1249		India	April 17 – May 16, 2020	COVID-19	Cross-sectional; online survey	Coping, psycho-logical distress	BRCS, K6
Le Vigouroux, et al. [45]	1297	21.27 (4.72)	France	April 23 – May 8, 2020	COVID-19	Cross-sectional; online survey	Anxiety, depression, coping	HADS, Brief COPE
Levine, et al. [118]	T1: 2908 T2: 588		Israel	T1: ? T2: 1 year after Second Lebanon War	Second Lebanon War	Longitudinal	PTS	CPTS-RI, PCL
Li, et al. [46]	23192	41.58 (14.63)	China	March 25 – April 1, 2020	COVID-19	Cross-sectional; online survey	Resilience	CD-RISC2
Li, et al. [1]	1109		China	March, 2020	COVID-19	Cross-sectional; online survey	Anxiety, depression, PTSD, coping	GHQ-28, IES-R-22, Brief COPE
Li, et al. [46]	2640		China	February 21 – 24, 2020	COVID-19	Cross-sectional; online survey	Coping, anxiety	CSQ, SAS
Lorenzo, et al. [94]	291+		USA	T1: April 20 – May 15, 2020 T2: one month after T1	COVID-19	Longitudinal	Anxiety, depression, coping	GAD-7, PHQ-8, Brief COPE
Luceño-Moreno, et al. [47]	1422	43.88 (10.82)	Spain	April 1 – 30, 2020	COVID-19	Cross-sectional ; online survey	PTSD, depression, anxiety, burnout, resilience	IES-R, HADS, MBI, BRS
Makhashvili, et al. [48]	2088		Republic of Georgia	May 25 – June 25, 2020	COVID-19	Cross-sectional; online survey	Anxiety, depression, PTSD	GAD-7, PHQ-9, ITQ,
Marchetti, et al. [49]	1226		Italy	April 3 – 14, 2020	COVID-19	Cross-sectional; online survey	Psycho-logical distress, resilience	GHQ-12; PAPP-PR
Martinez-Cao, et al. (2021)	21207	39.7 (14)	Spain	March 19 – 26, 2020	COVID-19	Cross-sectional; online survey	Depression, anxiety	DASS-21, IES
Matt, et al. [119]	7605		USA	Mid February, Mid September, 2000, 2001, 2002	Terrorist attacks of 9/11	Longitudinal	Depression, anxiety, PTSD	BDI, STAI, PCL-C
McCracken, et al. [50]	1102		Sweden	May 14 th – June 11, 2020	COVID-19	Cross-sectional; online survey	Depression, anxiety	PHQ-9, GAD-7
McFadden, et al. [51]	3425		UK	May 7 – July 3, 2020	COVID-19	Cross-sectional; online survey	Wellbeing, coping	SWEMWBS, Brief COPE
McIntosh, et al. [133]			USA	June, 2001 – November, 2004	Terrorist attacks of 9/11	Longitudinal; online survey	PTS	IES-R, PCL
Mechili, et al. [52]	1112		Albania	March 30 – April 9, 2020	COVID-19	Cross-sectional; online survey	Depression	PHQ-9
Mikocka-Walus, et al. [100]	2110		Australia		COVID-19	Cross-sectional	Depression, anxiety, stress, resilience	DASS-21, BRS
Minahan, et al. [53]	1318	52.42 (17.76)	USA	April 1 – May 17, 2020	COVID-19	Cross-sectional; online survey	Post-traumatic stress, coping, depression, anxiety	IES-R, Brief COPE, PHQ-9, GAD-7
Mosheva, et al. [55]	1106		Israel	March 19 – 22, 2020	COVID-19	Cross-sectional; online survey	Resilience	CD-RISC10
Mohd Fauzi, et al. [54]	1050	33.08 (6.97)	Malaysia	May, 2020	COVID-19	Cross-sectional; online survey	Depression, anxiety	DASS-21
Morina, et al. [120]	3313	42.3	Bosnia Herzegovina, Croatia, Kosovo, Macedonia, and Serbia	2006 - 2007	Yugoslav wars	Longitudinal	Depression, PTSD	MINI, BSI, IES-R
Moya-Lacasa, et al. [80]	21152	39.75 (14.04)	Spain	March 19 – 26, 2020	COVID-19	Cross-sectional; online survey	Depression, anxiety	DASS-21, IES
Nissen, et al. [140]	1881	45.4 (10.9)	Norway	9 – 10 months after the terrorist attack	Oslo bombing	Cross-sectional	PTSD	PCL



Nuttman-Shwartz, et al. (2018)	1054		Israel	2012	Missile attacks and military operation between Israel and Gaza	Cross-sectional	Resilience, stress	CYRM-28, BSI
Palmieri, et al. [114]	1200		Israel	August 15 – October 5, 2006	Israel-Hezbollah War	Cross-sectional; telephone survey	PTSD	SCL
Papadopoulou, et al. [56]	5116		Greece	April 7 – May 3, 2020	COVID-19	Cross-sectional; online survey	Anxiety, depression, resilience	GAD-2, PHQ-2, CD-RISC2
Park, et al. [57]	1015	38.9	USA	April 7 – 9, 2020	COVID-19	Cross-sectional; online survey	Coping, General distress	DERS-18, Brief COPE, DASS-21,
Pat-Horenczyk, et al. (2006)	1336	14.92 (1.62)	Israel	2002 - 2003	Al Aqsa uprising	Cross-sectional	PTSD	PTSD Child Reaction Index – Adolescent version
Pollari, et al. [121]	4934		USA	T1: 2003 – 2004 T2: 2006 – 2007 T3: 2011 – 2012 T4: 2015 - 2016	Terrorist attacks of 9/11	Longitudinal	Post-traumatic growth stress	PTGI
Prati, et al. [59]	1569	31.30 (12.42)	Italy	April, 2020	COVID-19	Cross-sectional; online survey	Mental health	GHQ-12
Pérez-Fuentes, et al. [58]	1014	40.87 (12.42)	Spain		COVID-19	Cross-sectional	Anxiety, depression	EVEA
Ran, et al. [60]	1770		China	February 23 – March 2, 2020	COVID-19	Cross-sectional	Resilience, depression, anxiety	CD-RISC, PHQ-9, GAD-7
Ren, et al. [61]	1172		China	February 14 – March 29, 2020	COVID-19	Cross-sectional	Depression, anxiety, stress, resilience, PTSD	PHQ-9, GAD-7, PSS-10, CD-RISC10, PCL-5
Riehm, et al. [96]	6008		USA	T1: March 10 – 31, 2020 T2: April 1 – August 4, 2020	COVID-19	Longitudinal; online survey	Resilience, mental distress	BRS, PHQ-4
Rodriguez-Rey, et al. (2020)	3055	32.15 (12.95)	Spain	March 17 – 24, 2020	COVID-19	Cross-sectional	Psycho-logical distress	IES-R
Ryu, et al. [63]	1500		South Korea	April 24 – May 5, 2020	COVID-19	Cross-sectional	Stress	PSS-10
Saxon, et al. [134]	3600		Republic of Georgia		Armed conflicts in the Rep. of Georgia in 1992 and 2008	Cross-sectional	PTSD, depression, anxiety, coping	TSQ, PHQ-9, GAD-7, Brief COPE
Schäfer, et al. [82]	1591	55.03 (13.90)	Germany, Austria, Switzerland	T1: February 17 – 23, 2020 T2: March 16 – 22, 2020	COVID-19	Longitudinal	Traumatic distress	PDI
Schmitt, et al. [64]	3274		Brazil		COVID-19	Cross-sectional; online survey	Depression, resilience	PHQ-9; CD-RISC
Scott, et al. [122]	2240		USA	3 years following 9/11	Terrorist attacks of 9/11	Longitudinal	PTSD, general distress	IES-R, PCL, SCL-25, BSI-18
Serafim, et al. [65]	3000	39.8	Brazil	May 22 – June 5, 2020	COVID-19	Cross-sectional; online survey	Depression, anxiety, coping	DASS-21, CSI
Serrão, et al. [66]	2008	38 (10)	Portugal	May 9 – June 8, 2020	COVID-19	Cross-sectional; online survey	Resilience, depression, burnout	RS, DASS-21, CBI
Shalhub, et al. [67]	1609		58 countries	April 14 – 24, 2020	COVID-19	Cross-sectional; online survey	Anxiety, coping	GAD-7, Brief COPE
Shoshani, et al. [123]	1078	13.74 (0.84)	Israel		Israeli-Palestinian coonflict	Cross-sectional	Psycho-logical distress, depression	BSI-18
Silver, et al. [124]	3496		USA	T1: Septem-ber 20 – October 4, 2001 T2: Novem-ber 10 – December 3, 2001 T3: 6 months after the attacks	Terrorist attacks of 9/11	Longitudinal; online survey	Coping, stress	Brief COPE, SASRQ
Sinawi, et al. [68]	1538		Oman	March – April, 2020	COVID-19	Cross-sectional; online survey	Anxiety, depression	GAD-7, PHQ-9
Solomon, et al. [125]	349		Israel	1991, 2003, 2008, 2014	Yom Kippur War	Longitudinal	PTSD	PCL
Stene, et al. [139]	281	19.3 (4.3)	Norway	T1: 4-5 months after the attack T2: 14-15 months after the attack	Uttoya attack	Longitudinal	PTSD, mental distress,	UCLA PTSD-RI, SCL-8



Su, et al. [129]	102	25.4 (3.7)	Taiwan	a one-month study during a 7-week period ending June 30, 2003	SARS	Longitudinal	PTSD, depression, anxiety	DTS, BDI, STAI
Sweeny, et al. [69]	5115	21.36 (4.39)	China	February 12 – 19, 2020	COVID-19	Cross-sectional; online survey	Depression, anxiety	BSI
Tsai, et al. [132]			USA	2000, 2001	Terrorist attacks of 9/11	Cross-sectional	Mental health	HRQOL
Taylor, et al. [70]	6854	49.8 (16.2)	USA, Canada	March 21 - April 1, 2020	COVID-19	Cross-sectional; online survey	Anxiety, depression	PHQ-4
Updegraff, et al. [126]	931		USA	T1: Septem-ber 20 – October 4, 2001 T2: Novem-ber 10 – December 3, 2001 T3: Septem-ber 20 – October 4, 2002 T4: Septem-ber 20 – October 4, 2003	Terrorist attacks of 9/11	Longitudinal	Stress, coping, PTS	SASRQ, Brief COPE, PCL
Varma, et al. [71]	1653		63 countries, worldwide	April 9 and May 25, 2020	COVID-19	Cross-sectional; Online survey	Depression, anxiety, stress, resilience	PHQ-9, STAI, PSS, BRCS
Veldhuis, et al. [103]	1567		USA, 50+ countries	T1: April 5 – 19, 2020 T2: August 28 -Septem-ber 11, 2020	COVID-19	Longitudinal; online survey	Depression, stress, anxiety	CES-D, IES, GAD-7
Veronese, et al. (2017)	1276	8.8 (1.42)	Palestine	Two months after military operation "Pillar of Defense" ended	Israeli military peration "Pillar of Defense"	Cross-sectional	Positive and negative affect, traumatic response	PANAS-C, CRIES-13
Veronese, et al. (2019)	143	12.02 (2.05)	Palestine	T1: January 2018 T2: June – Septem-ber 2018	Palestinian – Israeli conflict	Longitudinal	Traumatic response	CRIES-13
Wang, et al. [149]	1210		China	January 31 – February 2, 2020	COVID-19	Cross-sectional; online survey	Psycho-logical impact, depression, anxiety, stress	IES-R, DASS-21
Wang, et al. [149]	1599		China	February 1–4, 2020	COVID-19	Cross-sectional	Psycho-logical distress, coping	K6, SCSQ
Welch, et al. [127]	17062		USA	T1: 2003 - 2004 T2: 2006 - 2007 T3: 2011 – 2012	Terrorist attacks of 9/11	Longitudinal	PTSD	PCL
Yang, et al. [74]	1638		China	February 1 – 4, 2020	COVID-19	Cross-sectional; online survey	Stress, coping	PSS-10, SCSQ
Yan, et al. [73]	3233	31.71 (9.78)	China	January 31 – February 9, 2020	COVID-19	Cross-sectional; online survey	Stress, coping	PSS-10, SCSQ
Yan, et al. [73]	3088	37.5 (13.5)	China	February, 2020	COVID-19	Cross-sectional	Resilience	CD-RISC10
Ye, et al. [99]	7800	20.54 (2.11)	China	January 31 – February 11, 2020	COVID-19	Cross-sectional; online survey	Resilience	CD-RISC10
Yu, et al. [75]	1588	33.68 (11.96)	China	February 1 -February 4, 2020	COVID-19	Cross-sectional; online survey	Psycho-logical distress, coping	K6, SCSQ
Zager Kocjan, et al. [76]	2722	36.40 (13.10)	Slovenia	five days after Slovenia declared the COVID-19 epidemics	COVID-19	Cross-sectional	Coping, stress	CD-RISC10, PSS
Zarrouq, et al. [102]	1435		Morocco	April 3 – 30, 2020	COVID-19	Cross-sectional	Coping, depression	Brief COPE, HADS
Zhou, et al. [150]	442	45.3 (16.46)	USA	April – May, 2020	COVID-19	Longitudinal	Depression, anxiety, stress, PT growth	DASS-21, PTGI
Zoorob, et al. [77]	1115		USA	April, 2020	COVID-19	Cross-sectional	Burnout, depression, resilience	RSWBI, BRS



Note. BDI: Beck Depression Inventory; BRCS: Brief Resilient Coping Scale; BRS: Brief Resilience Scale; BSI: Brief Symptom Inventory; CBI: Copenhagen Burnout Inventory; CD-RISC: Connor-Davidson Resilience Scale; CDI: Child Depression Inventory; CDI: Children's Depression Inventory; CERQ-short: Short Cognitive Emotion Regulation Questionnaire; CES-D: Center for Epidemiological Studies-Depression Scale; CPTS-R: Child Post-Traumatic Stress Reaction Index; CRIES: Children's Impact of event scale; CSI: Coping Strategies Inventory; CSQ: Coping Strategy Questionnaire; CSS: Coping Style Scale; CYRM: Child and Youth Resilience Measure; DASS: Depression, Anxiety and Stress Scale; DERS: Difficulties in Emotion Regulation Scale; DRC: Democratic Republic of Congo; DTS: Davidson Trauma Scale; EVEA: Mood Evaluation Scale; EWBI: expanded Well-being Index; GAD: Generalized Anxiety Disorder; GHQ: General Health Questionnaire; HADS: Hospital Anxiety and Depression Scale; HAS: Health Anxiety Scale; HEI: Huaxi Emotional-Distress Index; HRQL: Health-Related Quality of Life; IES-R: Impact of Event Scale-Revised; ITQ: International Trauma Questionnaire; K6: Kessler Psychological Distress Scale; MBI-GS: Maslach Burnout Inventory-General Survey; MHC-SF: Mental Health Continuum; MINI: Mini-International Neuropsychiatric Interview; PANAS: Positive and Negative Affect Schedule; PAPP-PR: Parents' Assessment of Protective Factors Parental Resilience subscale; PC-PTSD: Primary Care-PTSD; PCL: PTSD Checklist; PDI: Peritraumatic Distress Inventory; PDS: Post-traumatic Diagnostic Scale; PHQ: Patient Health Questionnaire; PSS-SR: Post-traumatic Symptom Scale - Self-Report; PSS: Perceived Stress Scale; PTGI: Posttraumatic Growth Inventory; PTGI: Posttraumatic Growth Inventory; QPSTR-C: Questionnaire for Examination of Posttraumatic Stress Reactions in Children; QSTWE: Questionnaire on Children's Stressful and Traumatic War Experiences; RCMAS: The Revised Children's Manifest Anxiety Scale; RS: Resilience Scale; RSA: Resilience Scale for Adults; RSWBI: The Resident/Fellow Well-Being Index; SAS: Self-Rating Anxiety Scale; SASRQ: Stanford Acute Stress Reaction Questionnaire; SCAS: Spence Child Anxiety Scale; SCL: Symptom Check-List; SCSL-R: Revised School-Agers' Coping Strategies Inventory; SCSQ: Simplified Coping Style Questionnaire; SHA1: Short Health Anxiety Inventory; STAI: State-Trait Anxiety Inventory; SWEMWBS: Short Warwick Edinburgh Mental Wellbeing Scale; TSQ: Trauma Screening Questionnaire; UCLA PTSD-RI: University of California at Los Angeles PTSD Reaction Index; WCQ: Ways of Coping Questionnaire.

accident. The number of studies were relatively equally distributed over European (33%), Asian (37%), and American countries (22%). Additionally, studies from Oceania (1%) and Africa (1%) were also represented, as well as studies spanning multiple countries and continents (5%). Most studies focused on the impact of disasters on the general public (62%), but research on healthcare workers (14%), specific age categories (18%) (children, adolescents, elderly, etc.) and survivors of a disaster (6%) were also included.

Results of individual sources of evidence

COVID-19 studies: Almost all studies included in this review pertain to the first few weeks of the pandemic and lockdowns [18-77]. For most countries in the world, lockdowns and relaxations went on for much longer and still continue today. Attention should be paid to the fact that the chronic character of COVID-19 and its impact on mental health is not yet accounted for in these studies. Moreover, different measures to combat the virus were taken across the globe which in their own right may impact mental health differently. However, it was recently demonstrated that findings from specific countries can be generalized across international borders [78].

Overall, the studies pertaining to the first weeks of lockdown report a decline in mental health in the general population [16,20,22,25-30,32,33,35-41,43,45,50,51,53,54,56,58,61,65-70,74,76,78-82]. More specifically, high anxiety [16,22,28,30,36,40,46,53,62,76] and depressive symptoms [16,27,38,43,45,51,58,61-63,83-85] were reported in most studies. Furthermore, a substantial number of individuals scored above clinical cut-off points for both depression and anxiety [68], as well as for other mental disorders in general [1,57]. Moreover, high levels of stress and psychological distress were found [18,31,32,47,55,57,68,70,71,73,74]. Post-traumatic stress scores [46,57] and suicidal thoughts [56] increased in the general population. Other studies described a decrease in sleep duration and quality, which was found to negatively impact anxiety and depression [71,81]. The main worries that negatively impacted mental health for individuals during those first few weeks were the difficulty of obtaining daily necessities and concerns about harming others [63]. Since most studies were cross-sectional, it is not possible to compare the mental health data with any other point in time: even among the longitudinal studies, only one study included

data gathered before and after the start of the pandemic. This study found, that mental health was stable overall, but that significant changes were observed in 20% of the individuals with increases or decreases in well-being compared to before the lockdown [82]. Interestingly, one study was carried out at the same time in different countries which were at different stages of lockdown and relaxations in the measures taken to control the pandemic. The authors demonstrated that in the first few weeks of the pandemic there were no mental health differences across the different countries [71]. However, at a later stage of the pandemic, countries which were more affected also reported higher rates of mental health problems, such as anxiety and depression [79,86].

Thirteen out of 87 COVID-19 studies collected data in multiple waves during the first few weeks or months of the pandemic [42,46,58,65, 82,83,86-94]. In keeping with the results of the cross-sectional studies, these studies found increased anxiety, depression and stress scores at the beginning of the lockdown and the pandemic in general [42,46,58,65,82,83,86-94]. Furthermore, more weeks spent in lockdown and isolation corresponded with less well-being, as well as an increase in unhealthy behaviors like overeating or alcohol use [64,69,93] and even suicidal ideation [56]. However, many studies also found a decrease in anxiety and depression rates as time went by and the reopening of society was announced [88,89,91,92,94]. This decrease was even found to constitute a relative rapid return to pre-pandemic rates after relaxations [89,90]. One study reported dips in the daily mental health in relation to announcements of negative COVID-19 news [61]. However, the study by Fukase and colleagues [85], which was conducted during the second wave, found that depression scores increased steeply again at the start of the second wave, representing a return to similar levels of well-being as during the first wave.

People who came in very close contact with COVID-19 patients most often are healthcare workers. Shalhub and colleagues [67] found that this group feared infecting their own family and suffered from high levels of stress linked to lack of available equipment in the first few weeks. It is, therefore, not surprising that higher levels of anxiety and depression were found among healthcare workers [67]. Moreover, higher levels of PTSD and trauma symptoms were also reported [24]. More



close contact with COVID-19 patients was related to lower well-being scores [24]. Overall, it is reported that many healthcare workers had to work longer hours indicating high levels of fatigue and exhaustion, and even burnout [86,54,66]. Longer working hours were also found to be related to less sleep and lower sleep quality which, in turn, negatively impacted anxiety [55]. Additionally, Cai and colleagues [21] demonstrated that, among healthcare workers, less work experience correlated with lower well-being scores, while the most important protective factors for healthcare workers were resilience and social support.

Besides healthcare workers, other groups and factors were also associated with a poorer mental health. Being female, unmarried [42,56,75] unemployed [73], having smaller living quarters ([38,20] or living in more adverse economic circumstances [48,85], as well as having a migration background [35], were all risk factors found to negatively impact well-being. Moreover, individuals with pre-existing health conditions, for example a chronic disease [42,59,64] or a mental health diagnosis [56,71], also reported lower well-being scores during the pandemic compared to the general population. Living with someone at risk for a COVID-19 infection [42] as well as a close relationship with an infected individual [29,34] was equally reported to be a risk factor. Furthermore, following the news was related to more psychological stress [88,59,74] and increased sleep problems [88]. The evidence concerning educational levels is contradictory. Some studies found that higher educational levels were related to lower well-being [65] while others found that lower educational levels were related to higher well-being [35,40,64,95,96]. See Table 2 for a clear overview of the different risk factors, vulnerability factors and protective factors.

Different age groups also responded differently to lockdowns and the pandemic. While older individuals are at greater risk for contracting COVID-19, their mental health appears to be less affected by the pandemic [40,97] compared to younger people and students whose mental health seems to be more affected by the pandemic. International students who were not able to return home were even more affected than other students [32]. With regards to children, the evidence is

not conclusive. The study by Achterberg and colleagues [87] reported that children are spared from distress while another study found children to have lower well-being [98]. For parents on the other hand, the first few weeks of the pandemic seemed to be really demanding as many of them had to work from home while children were also present. High levels of psychological distress as well as parenting-related exhaustion were reported [49,87]. Interestingly, younger people and women showed more rapid improvements in wellbeing when measures were relaxed again [83].

Although COVID-19 has a significant impact on mental health, as demonstrated by the results discussed above, many people still display great resilience [18,22,43,60,76,86,96,97,99]. However, longer lockdowns correspond with less overall resilience [43]. At the individual level, greater resilience was related to higher well-being and lower stress [55,76, 100]. Furthermore, individuals with high resilience show a more stable trajectory over the lockdowns compared to individuals with less resilience. In line with previous research, elderly adults seem to have more resilience overall compared to the general population [22].

The reviewed research studied different coping mechanisms used by individuals and their effectiveness at mitigating mental health complaints [20,23,88,26,27,92,31,85,32,33,34,39,40,44,46,101,51,57,99,75]. Having social support, a sense of togetherness and looking for social support was found to be the most effective way of coping with lockdowns and the pandemic [20,27,92,97,46,51,53,56,57,82]. Moreover, a positive attitude towards the preventive measures taken to restrict the spread of the virus, trust in the government [35,52,56,59] as well as psychological flexibility [27,50] and grit [50] were related to greater well-being. Other positive coping strategies were religious coping [20,56,102], mindfulness [20,57,69], actively seeking help [51], cognitive restructuring and wishful thinking [32], doing physical exercise [71], having a routine [40,95] and spending time cooking [22].

On the other hand, it was found that alcohol consumption and smoking increased during the pandemic as a coping mechanism [101,61,103]. Moreover, overeating [70] and social media use increased significantly [20]. For some individuals,

Table 2: Overview of all the vulnerability -, risk- and protective factors.

Vulnerability factors	Risk factors	Protective factors
Healthcare workers	Unemployment	Living together as a couple
Females	Living with a risk patient	Social support
Smaller living space	Being close to an infected person	Psychological flexibility
Low social economic status	Following the news closely	Having a routine and doing activities
Migrants	Isolation	Having a positive attitude
Pre-existing chronic disease	Low social support	
Pre-existing mental health problems		
Pre-existing addiction		
Youngsters		
(International) Students		
Parents with young children		

this was a useful way to cope and self-regulate positive mood [92] while for others this resulted in excessive information-seeking behaviors and less effective coping [88,92]. Overall, avoidant coping was found to be related to more depression, anxiety, and loneliness [27,42,45,53,83].

Other disaster-related studies: Phases of disaster management

In the next paragraph, the non-COVID-19 studies will be structured according to the phases of disaster management [6] in order to extrapolate conclusions on the possible future impact on mental health. Some studies have data on different phases and will thus be mentioned several times in different sections. Since most disasters are unpredictable and unfold quickly while research tends to proceed more slowly, most of the studies in this review were conducted several months after a disaster, hence, providing information about the recovery phase [104-127] Accordingly, the initial phases of disasters are represented in far less studies.

Warning or threat phase: The warning or threat phase describes the time period before a disaster occurs, when there already is a recognition (threat) or a warning that a disaster may occur. This might, for example, be the case in politically unstable countries before a war breaks out. In a longitudinal study, data was collected during a first war, between wars and after a second war. It was found that between wars, the distress was significantly lower. However, due to the politically unstable environment and the uncertain conditions, high levels of anxiety were reported [104].

Impact phase: The impact phase describes the moment of the disaster itself and varies depending on the type of disaster. Only a few studies were able to gather data right at the start of a disaster. At the moment of impact, it was found that being closer to the disaster resulted in significantly more post-traumatic symptoms [128,129] Moreover, for the SARS outbreak specifically, during the outbreak, nurses were found to have very high levels of anxiety, stress, fear, symptomatic depression, and insomnia [129,130]. The main source of anxiety for these nurses was the fact of being subjected to conflicting demands of not endangering family members whilst at the same time carrying out their duty providing healthcare [130].

Rescue or heroic phase: This phase refers to the time immediately after a disaster. Many studies report high levels of PTSD symptoms immediately after a disaster strikes [122,124,125,127,131] as well as a decline in mental health [132]. Different coping strategies were identified that could be used during this phase. Active coping was related to higher levels of well-being, as were having a large social network and religion as a coping mechanism [131,133,134] Drinking, on the other hand, was related to lower well-being levels [131,134]. Similarly, (over)actively following the news about the disasters was related to greater distress [135]. Having a routine and continuing normal activities to the extent possible, for example going to work, reduces negative mental health consequences [136]. Overall, women [119,135,137], young adults [135], migrants [135], and individuals with pre-existing conditions

[137] experience more distress and PTSD as a result of the disaster [135]. For children, PTSD symptoms immediately after a disaster are related to the proximity to the disaster while later on this relationship diminishes [117]. Overall, it was found that younger children are better able to cope with a disaster compared to school-age children [138].

Remedy or honeymoon phase: This phase takes place rather soon after the disaster, when the initial shock has settled down and there is a lot of solidarity within the community. This phase is mentioned ephemerally in many studies, but it is rarely systematically studied. Only one study included in the current review really focuses on examines this phase. This study found that students who did volunteer work after a disaster were able to see greater future possibilities for their lives. Moreover, many of them decided to start a career in medicine due to their volunteer experience [115].

Inventory phase: Not unlike the *remedy or honeymoon phase*, only a few studies shed light on the inventory phase in which people weigh their experience against the - perceived or actual - available help and support. In this review it was found that there was a sharp increase in visits to primary and secondary healthcare after a disaster, although this care could not always be provided [139]. Similarly, it was reported that some individuals who met the diagnostic criteria for mental health problems did not seek help as it was simply not widely available [137].

Disillusionment phase: In this phase, the mental health of many individuals returns to normal, while others continue to suffer from negative effects. This can create a divide in the community. Some studies found that this might depend on whether effective coping occurs immediately after the disaster and also on the levels of distress already reported at the initial phase [131,135,133,134] Adults who used an avoidant coping style, emotional suppression and/or self-blame showed decreased well-being [131,134]. For individuals who experienced the disaster close by a more enduring negative impact on mental health is reported, while others who were at a greater distance from the disaster showed mitigation of mental health problems already at an earlier moment in time [140].

Recovery phase: Most people turn out to be very resilient after a disaster, and their mental health and stress levels return to normal [104,115,119,122-124,127] However, this is not the case for everyone and, influenced by several factors, significant differences exist in the mental health of individuals over time [107]. For PTSD symptoms it was found that the decrease after a disaster is very rapid [119] and that optimism is a very important factor facilitating this decrease [107]. Even though mental health mostly returns to normal, it was found that even 60 years after a disaster higher levels of PTSD were reported for people who experienced the disaster compared to those who did not [111]. Also, some individuals showed delayed-onset PTSD, an effect which is not detectable immediately after the disaster [125]. This is also influenced by more indirect impacts of the disaster, such as reduction of household income, employment

status, etc. [116]. Individuals who were diagnosed with both PTSD and major depressive episodes also experienced more trauma compared to individuals who were only diagnosed with either PTSD or major depressive disorder [120]. Workplace conditions can also contribute to the mitigation of mental health impacts. Employees with high role clarity and low-level role conflict were for example found to have lower stress levels after the disaster [106,140]. Moreover, trying to find meaning in the disaster [126] and feeling satisfied with life [138] was related to a better adjustment over time.

Specific target groups exist for which the mental health effects and their development deviate from those found in the general population. Police responders, for example, had the lowest rates of PTSD prevalence compared to all of the other responders [109]. For children, it was found that, when being compared with younger children, school-age children experience a greater impact on their mental health in the long term due to a disaster [113]. As in adults, PTSD symptoms in children decrease over time, but for some children these symptoms were still prevalent after quite some time [117]. Moreover, trauma from a disaster is related to poorer educational and occupational outcomes [112]. Older adults on the other hand, even though they may have experienced much more trauma throughout their life, show greater resilience, which protects them from mental health problems [110]. Consequences of a disaster in some cases are not exclusively negative. Post-traumatic growth has been documented among individuals who have experienced a disaster. The individuals who have experienced more distress during and right after the disaster are usually those who display more post-traumatic growth afterwards [114,118,121]. The more central the disaster was to an individual's life, the more post-traumatic growth is reported [108].

Discussion

This scoping review focused on identifying the impact of the COVID-19 pandemic on mental health, including what can still be expected in the months to come. Of the 3,557 articles identified for this review, only 128 were included. More than half of the excluded studies pertained to COVID-19. Many research papers on COVID-19 attempt to describe the impact of the pandemic, but the urgency of the matter led researchers to make compromises on quality. Therefore, the current review applied not only thematic criteria to determine eligibility but also took study design and sample size into consideration whilst defining the inclusion criteria. Accordingly, only the highest quality of evidence was included. This in order to avoid that the growing number of papers characterized by a lower level of evidence could create a significant interpretation bias.

For instance, a recurrent cross-sectional study conducted based on a brief mental health survey with few items could report good mental health for a certain region, whereas data on usage of mental healthcare or on waiting lists for that region could indicate poor mental health. By only including studies supported by the highest level of evidence through a thorough examination of the design, questionnaires and sample size; this scoping review provides solid insights on mental health

impact while also having predictive value for possible scenarios for the upcoming months.

Overall, the results indicate a significant impact on mental health in the general population. These effects are more prominent when strict measures are in place in comparison to time periods with more lenient measures [78]. Furthermore, the chronicity of the pandemic has an important impact on mental health: symptoms increase [93,64,69], unhealthy behaviors [93,64,69] and suicidal ideation [56] become more common. When a pandemic arises, we can expect all involved to be at an increased risk of developing stress, anxiety, depressive symptoms, insomnia, anger, grief and fear [141]. Indeed, this was confirmed by the research results in this scoping review. Furthermore, symptoms of insomnia and an increase in unhealthy behavior patterns became apparent. It is noteworthy that these symptoms interact dynamically with their context, which would indicate that these symptoms are part of an adaptation process rather than a sign of psychological diagnosis. This is in line with the theoretical model of conservation of resources [142]. This model assumes that people strive to maintain, protect, and build resources and that their sense of threat is related to the potential or actual loss of these valued resources. Research supports the hypothesis that current loss of psychosocial resources – for instance social interaction and the ability to continue a daily routine – contributes more to symptomatology than premorbid stressors [141]. Context is key in resilience and post-traumatic growth. Context includes the possibility of maintaining daily routines and roles. For instance, work routines characterized by a consistent pattern of attending work in a regular, predictable manner were found to have positive effects on mental health [136]. The results in this review indicate that females and younger people show more post-traumatic growth after a disaster [114,118,121]. When strict measures were relaxed more rapid improvements in well-being were already detectable among younger people and females [83]. These findings are in line with the theory that post-traumatic growth is more prevalent in individuals who initially struggled more [143].

The elderly are generally found to be more resilient than other age groups, although they are more prone to COVID-19. Their resilience also protects them from mental health problems [110]. This might be due to elderly people being more emotionally stable and having more life experience. Overall, it appears that coping strategies present and used at the moment when a disaster strikes have a significant impact on the level of resilience. Due to their life experiences, the elderly might already know which coping strategies will be most effective for them, while other age groups still need to come up with these effective strategies.

The use of different coping methods in reducing psychological distress differed across studies. Conflicting results could be explained in consideration of the individual's appraisal of the situation. Lazarus and Folkman [144]. suggested that a 'goodness of fit' has to be achieved between the individual's appraisal of the situation and the coping strategy selected in order to maximize its effectiveness. The use



of problem-focused strategies predicts better adjustment in controllable situations while emotion-focused strategies such as optimism are favorable in uncontrollable situations [144]. Returning to the elderly who displayed greater resilience, this could indicate that older adults who may have more experience dealing with health issues and strict measures appraised the situation as more controllable, which perhaps resulted in more resilience due to using the best-fitting coping strategy. Coping could also explain the wide range of effects on mental health. The results in this review indicate coping as a leverage for more positive outcomes [110].

Policymakers should consider the varying impact of the pandemic on mental health and focus on modifiable factors to foster resilience and post-traumatic growth. In targeting at-risk groups, policymakers should focus on risk factors rather than on age groups given the fact that large variations within age groups exist [78,145] and in addition, also take into account the cumulative and multiplicative effect of these risk factors [78,145].

Healthcare workers (HCW) are particularly at risk of traumatic symptoms because of the highly stressful situations to which they are exposed during their work, including management of critical medical situations, frequent witnessing of death and trauma, operating in crowded settings, interrupted circadian rhythm due to shift work [2] as well as the risk of contaminating family with contagions acquired while working [2,67]. HCW include not only medical HCW but also psychosocial care workers [78,145]. Interestingly, research examining the impact of traumatogenic events on healthcare workers describing the immediate impact and even potential delayed effects on their mental health exists, however, there is no data available that would enable us to predict what can be expected in the aftermath as monitoring tends to stop immediately after the event (Carmassi et al., 2020). Young people also require special attention as they seem to be more prone to mental distress. Other risk factors for a long-term, negative impact on well-being include a pre-existing (mental) health condition, isolation, low social support, poorer living conditions, pre-occupation with COVID-related news, unemployment or fear of job loss, or close encounters with cases of Covid-19. Younger people and females were also identified as being more at risk. Vulnerability factors include pre-existing mental health problems, healthcare profession or migration background. Fortunately, there are some protective factors, such as cohabitation with a partner, quality of social contacts and family well-being. These factors are multiplicative and cumulative: when multiple life areas are affected, the risk of long-term distress increases along with its effects on daily life [78]. Previous research has reported PTSD rates to range from 10 to about 20% [2] with even higher rates in healthcare workers [2]. Although most individuals prove to be resilient after being exposed to a traumatic event, several risk factors may hinder effective adaptation, all of which are aligned with the factors mentioned above [2]. Experiencing feelings of helplessness or intensity of emotions when exposed to traumatic events influences the levels of resilience [2]. This again emphasizes the importance of the context for promoting

a sense of control in order to alleviate feelings of helplessness or intense emotions.

The phases of response to disaster model provides insights into what can be expected during the upcoming months of the pandemic. The most significant finding is the importance of maintaining psychosocial monitoring measures, which must continue to be in place for at least 6 months after the pandemic. If a biomedical model were to be applied, pandemic-specific measures might be able to stop after the medical crisis phases. However, the extension of these supportive measures proves to be necessary in order to address the delayed onset of psychosocial problems such as delayed-onset PTSD [2,78,129,130]. Monitoring, detection, triage and referral to professional help when needed is, thereby, essential for providing the best possible care and helping people on their way to optimal resilience. This review clearly demonstrates that psychological crisis intervention can and should play a pivotal role in the implementation of comprehensive disease control and rehabilitation measures after a disaster. Clearly, however, this is not always the case: mental health care is not yet fully integrated within emergency preparedness, let alone pandemic preparedness. As Brewin and colleagues [146] demonstrate, the psychosocial dimension is, indeed, lacking in official pandemic plans around the world. While spontaneous and well-meaning mental health efforts do arise, these are rarely integrated into regular care, leading to different unforeseen, negative effects: lack of quality control, duplication, inconsistency in content, data collection and privacy risks, etc. Unfortunately, this constitutes a missed opportunity for effectively dealing with the pandemic in itself and the consequential mental health needs. As Cullen and colleagues [147] indicate, a prevalence of biomedical concerns is understandable in the immediate acute impact/heroic phase of a new outbreak, as health systems prioritize critical patient care and reducing transmission, but the crucial importance of the psychosocial aspects during a pandemic must never be overlooked. After all, psychosocial factors are also linked to level of adherence to containment measures and, therefore, crucial in stopping the spread of the virus itself. As Campion and colleagues [148-150] mention, the early detection of mental health needs in the general population and in specific target groups can help to implement actions needed to alleviate symptoms before they become problematic. It also ensures that a qualitatively adequate response can be implemented when and wherever necessary, instead of a one-size-fits-all approach which can often be ineffective, inefficient, or even superfluous.

This scoping review has several noteworthy strengths. First and foremost, only studies supported by the highest level of evidence were included to provide insights into the current impact of the pandemic on mental health as well as its possible future impact. Using these strict inclusion criteria avoids interpretation bias (above all by disregarding numerous papers published based on questionable designs and/or limited sample size, most of which are convenience samples). Another strength of this paper lies in its organization of findings using the theoretical model of phases of response to disaster. The model enables a structured presentation of a wide range of



studies and topics while also permitting comparisons between different studies.

This main limitation of our scoping review is the limited availability of COVID-19 data at the time of research, which only exist for the period up to August 2020 and has been mostly collected during the first lockdowns. The phases of response to disaster model was used as a theoretical model in an attempt to compensate for this selection bias. Further follow up research is necessary in order to refine the model and cultivate further knowledge on the impact of a pandemic on mental health needs, especially in the months and years following the pandemic.

Conclusion

This scoping review reveals a dynamic interaction between the individuals' mental health and the context in which they live. Strict measures impacting normal life routines lead to less resilience, whereas more lenient measures which are more or less compatible with daily routines and the upholding of life roles lead to greater resilience in dealing with the pandemic. Several risk factors are identified which lead to a better understanding of the impact of the pandemic on mental health, thereby, providing policymakers with indicators that could enable them to adopt a more proactive approach. Furthermore, the phases of response to disaster model provides an understandable narrative, while also enabling society to make useful predictions about what to expect for the upcoming months. The most important consideration is the risk of delayed onset of psychosocial problems. This justifies the recommendation to policymakers to not only further invest the necessary efforts in order to manage the significant impact of the pandemic on mental health now, but also to continue to do so for the time to come.

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E.V.H. developed the search strategy.

E.V.H., E.P., H.D.L., and S.H. contributed to the acquisition of data.

H.D.L. analyzed and interpreted the data.

E.V.H. and N.V.d.C. drafted the first version of the introduction of this manuscript.

E.V.H. and H.D.L. drafted the revised manuscript.

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