Mental health outcomes of quarantine and isolation for infection prevention: A systematic umbrella review of the global evidence

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Abstract

Background: Transmission of infectious diseases is often prevented by quarantine and isolation of the populations at risk. These approaches restrict the mobility, social interactions, and daily activities of the affected individuals. In recent novel coronavirus disease (COVID-19) pandemic, quarantine and isolation are being adopted in many contexts, which necessitates an evaluation of global evidence on how such measures impact the mental health outcomes among populations. This umbrella review aimed to synthesize the available evidence on mental health outcomes of quarantine and isolation for preventing infectious diseases.

Materials and methods: We searched nine major databases and additional sources and included articles if they were systematically conducted reviews, published as peer-reviewed journal articles, and reported mental health outcomes of quarantine or isolation in any population.

Results: Among 1364 citations, only eight reviews met our criteria. Most of the primary studies in those reviews were conducted in high-income nations and in hospital settings. These articles reported a high burden of mental health problems among patients, informal caregivers, and healthcare providers who experienced quarantine or isolation. Prevalent mental health problems among the affected individuals include depression, anxiety, mood disorders, psychological distress, posttraumatic stress disorder, insomnia, fear, stigmatization, low self-esteem, lack of self-control, and other adverse mental health outcomes.

Conclusion: This umbrella review found severe mental health problems among individuals and populations who have undergone quarantine and isolation in different contexts. This evidence necessitates multipronged interventions including policy measures for strengthening mental health services globally and promoting psychosocial wellbeing among high-risk populations.

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Introduction

Quarantine and isolation are public health measures used for preventing the transmission of infectious diseases among individuals and communities [1,2]. Conceptually, quarantine and isolation share the same purpose of infection prevention; however, these terms have distinguished roles in practice. Isolation aims to separate the infected individuals from those who did not get the infection, whereas quarantine takes a different approach by separating and restricting the movements of people who have been exposed to an infectious disease to monitor if they develop the disease over time [1].

Historically, quarantine became one of the fewest known measures to protect lives and cities during the plague epidemics in the 14th century [3]. Port cities like Venice required all newly arrived ships to sit at anchor for at least 40 days before landing on the port [2,3]. The word "quarantine" came from the Italian words *"quaranta giorni,"* which mean 40 days. As a public health measure, quarantine became increasingly used in other parts of Europe as well as around the world [3]. In the United States (U.S.), the increasing burden of different infectious diseases, including yellow fever, resulted in the 1878 National Quarantine Act [3,4]. In later years, quarantine became relevant in addressing the cholera epidemics and many other historical events related to infectious diseases globally [2,3].

In December 2019, an outbreak of a novel strain of coronavirus occurred in Wuhan, Hubei Province, China, which spread across the world within a short time [5,6]. On February 11, 2020, the World Health Organization (WHO) named it as Coronavirus Disease 2019 (COVID-19) [7]. China adopted quarantine for 14 days to prevent the transmission of COVID-19 [8]. The toll of death continued to grow rapidly across the world. With more than 118,000 cases and 4,291 deaths in 114 countries, COVID-19 became a major concern for global health [9]. The WHO acknowledged this crisis and declared COVID-19 as a pandemic [9,10]. Italy has the highest number of deaths, which announced a nationwide quarantine to address COVID-19 [11]. These events brought the attention of the scientific community to quarantine, isolation, and other preventive measures that may protect health and save lives around the world.

Although quarantine and isolation are adopted for protecting the physical health from infectious diseases, it is essential to consider the mental health implications for those individuals who experience such restrictions. People quarantined in earlier outbreaks of infectious diseases have

reported adverse mental health outcomes following the quarantine period. A study evaluated the mental health status of 398 parents of children who experienced disease containment and found 30% of isolated or quarantined children, and 25% of quarantined or isolated parents met the criteria for posttraumatic stress disorder [12]. Another study assessed the mental health status of individuals who were isolated during the Middle East Respiratory Syndrome (MERS) epidemic. This study found the prevalence of anxiety symptoms and feelings of anger as 7.6% (95% confidence interval [CI], 6.3 to 8.9%) and 16.6% (95% CI, 14.8 to 18.4%), respectively [13]. A cohort study evaluated the psychological impact of the 2003 SARS outbreak in Canada among 1912 adults, which found a high burden of psychological distress and symptoms of posttraumatic stress disorder (PTSD) ($p < .001$) among the healthcare providers [14]. Similar studies inform how different mental health conditions may appear when an individual is quarantined or isolated. However, evidence on such problems would be useful to inform the policymakers and practitioners about the mental health outcomes associated with quarantine and isolation. Such evidence can facilitate further research and informed decision-making to ensure that the infectious disease or condition is addressed without doing any harm to the mental health and wellbeing of the affected individuals.

Evidence synthesis is recognized as a rigorous process where the best possible information is identified and critically appraised to inform decision-making in the health sciences [15,16]. As observational or experimental studies may provide a partial understanding of how quarantine and isolation impact human minds, it is essential to combine the findings of multiple primary studies to inform scientific community and policymakers through systematic reviews and meta-analysis. This process often becomes more challenging when continued intellectual discourses in a topic result in the development and publication of multiple reviews with similar or conflicting findings. Such differences across studies are acknowledged and analyzed in umbrella reviews or review of the reviews [17,18], which aims to find the best possible evidence from existing reviews in a systematic way and inform evidence-based decision-making.

Since 2015, many umbrella reviews have been conducted evaluating the evidence base on the psychosocial epidemiology of mental health in diverse populations [19–24]. However, no umbrella review or review of the reviews was found, which can inform the mental health implications of quarantine and isolation for infection prevention at the global landscape. The

objective of this umbrella review is to evaluate the mental health outcomes associated with quarantine and isolation from existing reviews. Such evidence may offer detailed insights into the psychosocial aftermaths of COVID-19 and empower the decision-makers to adopt evidence-based policies to protect the physical and mental health during and after infectious disease outbreaks.

Materials and methods:

Guidelines, sources, and processes of collecting the literature

In this umbrella review, we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and the recommendations by the Joanna Briggs Institute (JBI) Umbrella Review Methodology Working Group [18,25]. We searched the MEDLINE, Embase, PubMed, Academic Search Ultimate, Health Source: Nursing/Academic Edition, Health Policy Reference Center, American Psychological Association (APA) PsycInfo, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Web of Science databases using a set of keywords as listed in Table 1.

These keywords were used to capture the scientific literature on several domains. First, quarantine and isolation may appear interchangeably in the literature. Also, different types of isolation are described in global studies. Several keywords were used to capture this variety of keywords in the existing literature. Second, several keywords were used to identify literature on infectious diseases, including the past outbreaks and contemporary COVID-19 pandemic. Third, to assess the global literature in an inclusive manner, we adopted a broader definition of mental health in this review. We considered any mental disorders listed in the International Classification of Diseases or Diagnostic and Statistical Manual of Mental Disorders [26,27]. Also, we included psychological and behavioral conditions that are integral to mental health and wellbeing. The inclusion of conditions is consistent with the WHO definition of health [28], which enabled this review to include broader outcomes and determinants associated with mental health alongside evaluating

Table 1: Keywords used for searching databases

Search query	Keywords (searched within titles, abstracts, subject headings like MeSH, and general keywords)
1	"quarantine" OR "isolation" OR "source isolation" OR "contact isolation" OR "patient isolation" OR "confinement"
2	"infection" OR "infected" OR "infective" or "infectious" or "communicable" OR "COVID" OR "COVID-19" OR "nCoV" OR "coronavirus" OR "MERS" OR "SARS" OR "outbreak" OR "epidemic" OR "pandemic"
3	"mental health" OR "mental disorders" OR "mental illness" OR "psychiatric" OR "psychological" OR "psychosocial" OR "adverse outcomes" OR "unintended consequences" OR "depression" OR "depressive" OR "sleep disorder" OR "insomnia" OR "anxiety" OR "PTSD" OR "suicide" OR "self-harm" OR "suicidal" OR "distress" OR "affective" OR "fear" OR "phobia"
4	"systematic review" OR "systematic literature review" OR "evidence-based review" OR "meta-analysis" OR "meta-analytic" OR "meta-regression" OR "pooled effect" OR "pooled estimate" OR "scoping review" OR "rapid review" OR "evidence-based practice" OR "systematized review" OR "literature review" OR "review of the literature"
Final search query	1 AND 2 AND 3 AND 4

the mental disorders. Lastly, we used keywords for including systematically conducted reviews with different names. A review reported the existence of at least 14 types of reviews [29], which informed our choice of keywords to identify all review articles that had a systematic methodology of searching the literature for the respective review question. We combined these keywords with appropriate Boolean operators (OR/AND) and searched within the titles, abstracts, subject heading (like Medical Subjects Heading [MeSH]), and other search fields.

Moreover, we performed manual searching of the reference lists of selected articles, published studies that were highly cited in the field, and newer articles that cited the earlier articles. This manual searching was conducted in the Google Scholar database. Furthermore, we reached out to subject matter experts to identify potential studies that may have met our criteria. The entire search process was conducted since the inception of the respective databases and has been updated until March 10, 2020.

Inclusion and exclusion criteria

We included an article in this umbrella review if it fulfilled all the following inclusion criteria: a) published in a peer-reviewed journal, b) the language of the full-text article was English, c) was a review articles with a clearly stated methodology of searching the literature (for example, systematic reviews, meta-analyses, systematic scoping reviews etc.), d) reported any mental health-related conditions (for example, mental disorders like posttraumatic stress disorder or mental health conditions like fear or loneliness), e) the participants of the primary studies in respective reviews had experienced quarantine or any forms of isolation for infection prevention in any capacity (for example, patients, their informal caregivers, or healthcare providers who were involved in the quarantine or isolation process), f) populations from any sociodemographic background or participants with known medical conditions were included (for example, children, adults, elderly, or individuals with any diseases or infections were included in this review), and g) articles published anytime within the search period were included. Lastly, we excluded an article if it did not meet at least one of the above-mentioned criteria.

Screening and selection of the literature

All the citations found through searching the databases and additional sources were uploaded to RefWorks software [30], which was used to manage the citations data and exclude duplicate citations from the total collection of literature. Further, these citations were exported to Rayyan

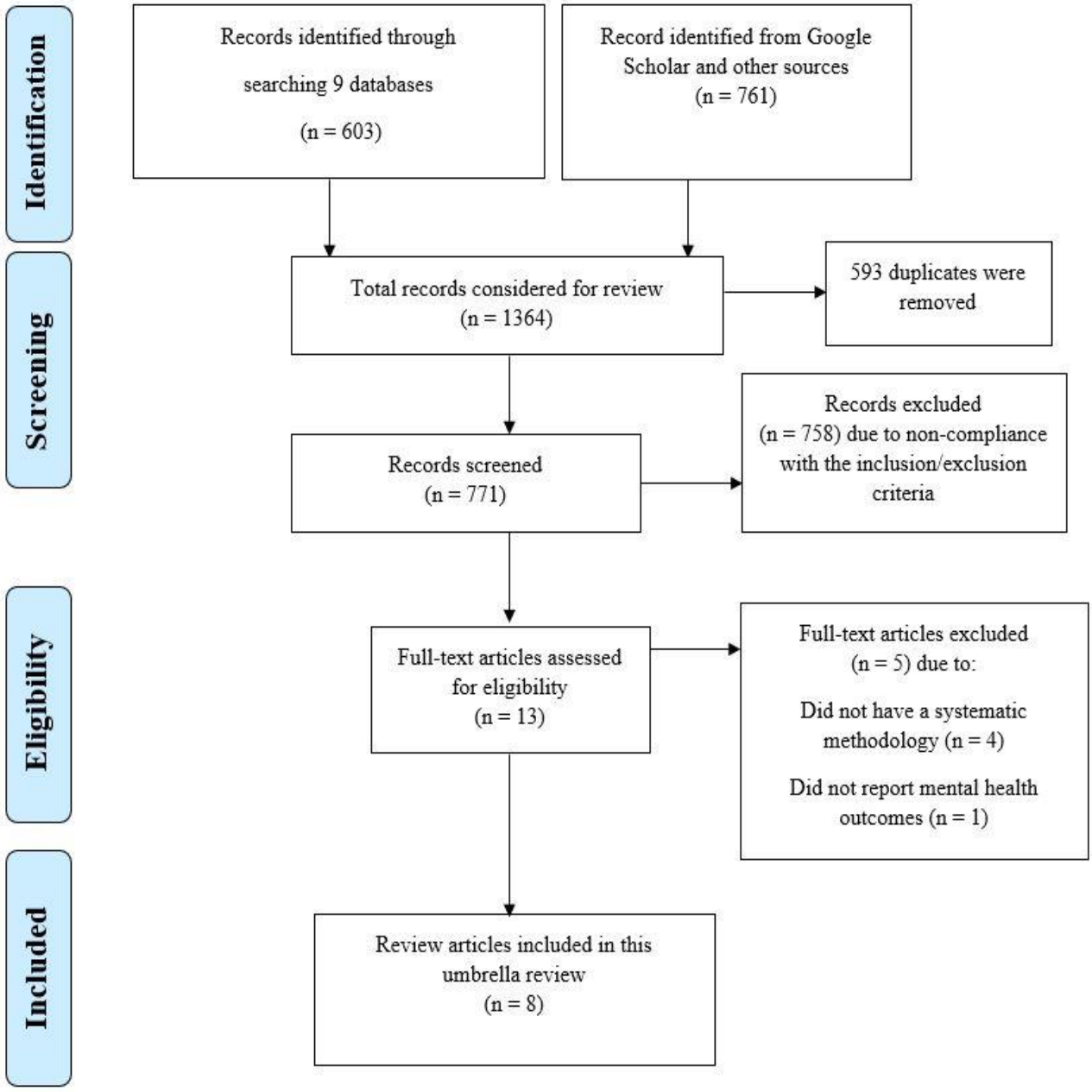

Figure 1: Flow diagram of the literature search process

software [31], which is a cloud-based platform for screening citations data. Two authors independently screened all the citations according to the inclusion and exclusion criteria of this review. At the end of the primary screening, any discrepancies during the screening process were

resolved based on discussion at the presence of the third author. Further, the full texts of the preliminarily selected articles were reviewed to evaluate their eligibility in this review and excluded in they did not meet all criteria as stated earlier.

Data extraction and analysis

We extracted data from finally selected articles using a manual data extraction form. Two authors independently extracted data on the following domains: titles and objectives of the reviews, number of databases searched, the timeframe of conducting the search process, types of the primary studies included in those reviews, countries of origin of those studies, sample sizes, characteristics of the study participants, infectious conditions or agents which were the primary reasons for quarantine or isolation in the respective studies, and mental health outcomes reported in those reviews. A narrative synthesis was conducted due to heterogeneity in methods, population characteristics, reasons for quarantine or isolation, and mental health outcomes in the respective reviews.

Quality assessment

We used the JBI critical appraisal checklist for systematic reviews and research synthesis checklist [18] to assess the methodological quality of studies included in this umbrella review. This checklist consists of ten items on different methodological aspects of a review article, which include the appropriateness of the search strategies, the approach to synthesizing evidence, potentials sources of biases, and prospects for future research and policymaking. In this review, two authors independently evaluated each of the included articles. On this ten-items checklist, each item can receive one point, and the overall quality score of a study can range from zero to ten. In this umbrella review, studies receiving zero to four, five to seven, and eight to ten were categorized as the low, medium, and high-quality studies, respectively.

Results

Characteristics of the included articles

Among 1364 citations retrieved from searching the databases and additional sources, 771 unique records were screened after removing 593 duplicate records (Figure 1). At the end of full-text screening, a total of eight reviews were included in this umbrella review (Table 2) [32–39].

Table 2: Characteristics of the articles included in this review

Authors/ Sources	Name and timeframe of databases searched	Number and types of primary studies	Country or locations of the primary studies	Sample size and characteristics
Morgan et al. (2009) [32]	MEDLINE, PubMed, Google Scholar, and additional sources; 1970 - 2008	7 studies on mental health outcomes; 5 cohort studies, 2 cross-sectional and series interviews	Not specified	Sample size ranged from 8 to 43; participants in 7 selected studies; most (n = 6) studies recruited hospitalized patient populations, one study included both patients and providers
Abad et al. (2010) [33]	MEDLINE and CINAHL; 1966 - 2009	8 cohort studies and 7 case-control studies	Not specified	Sample size ranged from 16 to 156; most studies had adult participants; two studies recruited children; samples were recruited from hospital wards
Barratt et al. (2011) [34]	MEDLINE, CINAHL, PsycINFO, and Cochrane Library Databases; 1990 - 2010	Studies were qualitative (n = 7), cohort (n = 7), cross-sectional (n = 6), case studies (n = 2), and review (n = 1)	Most studies were from the UK (n = 6) followed by the US (n = 4), Hong Kong (n = 1), and Canada (n = 1)	Sample size ranged from 7 to 300; samples were recruited from different clinical settings
Gammon and Hunt (2018) [35]	PubMed and Applied Social Sciences Index and Abstracts (ASSIA); 1990 - 2017	Not specified	Not specified	Sample size ranged from 13 to 41 among studies reporting sample sizes; participants were recruited from different hospital wards
Gammon et al. (2019) [36]	MEDLINE and Applied Social Sciences Index and Abstracts (ASSIA); 1990 - 2017	14; only one study was cohort-based; most studies were cross-sectional, and 10 studies had qualitative design	Most studies were from the UK (n = 6), followed by the US (n = 2), Sweden (n = 2), and one study each from the Netherlands, New Zealand, Ireland, and Brazil	Sample size ranged from 1 to 528; most studies recruited patients and providers from clinical settings, whereas two samples included nursing students

Brooks et al. (2020) [37]	MEDLINE, PsycINFO, Web of Science; timeframe not specified	25; Cross sectional (n = 11), qualitative (n = 7), longitudinal (n = 1), observational (n = 2), mixed methods (n = 3), psychological evaluation (n = 1)	Most studies were conducted in Canada (n = 8) and China (n = 4); two studies each from Taiwan, Australia, South Korea, and Liberia; one study each from Sierra Leone, Senegal, Hong Kong, and Sweden; one study has participants both from the US and Canada	Sample size ranged from 10 to 6231; diverse samples including patients, providers, students, institutional stakeholders, and community members were recruited
Purssell et al. (2020) [38]	Embase, MEDLINE, and PsycINFO; from the inception of the databases till December, 2018	26; cohort (n = 12), case-control (n = 6), cross sectional (n = 4), and quasi-experimental (n = 2) studies	Most studies were from the US (n = 14), followed by the UK (n = 3), Canada (n = 3), and one study each from Spain, Turkey, Netherlands, Singapore, France, and one study had participants both from the US and Canada	Sample size ranged from 14 to 9684; patients were recruited from diverse clinical settings
Sharma et al. (2020) [39]	Embase, PubMed, and Google Scholar; studies published till March, 2019	7; cohort (n = 4), quasi- experimental (n = 2), not specified (n = 1)	Not specified	Sample size ranged from 16 to 148; participants were recruited from diverse clinical settings

Table 3: Different conditions of quarantine/isolation and associated mental health outcomes

Authors/ Sources	Type and reasons for quarantine, isolation or other measures to infection prevention	Mental health impacts
Morgan et al. (2009) [32]	Contact precaution; Multiple Drug Resistant Organisms (MDROs)	Patients expressed feeling neglected, isolated, angry ($p < .037$), depression (up to 77%, p value ranged from $< .01$ to $< .001$), anxiety ($p < .001$), low self-esteem ($p < .005$), perception of less control ($p < .001$); less patient-provider contact was reported
Abad et al. (2010) [33]	Isolation; multiple infectious conditions including VRE, MRSA, HAI, MDRO, SARS, and mixed infections	Most studies reported higher scores from depression, anxiety, anger-hostility, fear, loneliness, boredom, and low self-esteem; one study reported higher freedom and privacy perceived by the patients; higher anxiety scores were associated with history of mental illness; most studies found that providers visited less frequently and spent lesser time with isolated patients compared to the controls
Barratt et al. (2011) [34]	Source isolation; VRE, MRSA, SARS, and mixed infections	Studies reported stress, anxiety, depression, loneliness, anger, neglect, abandonment, boredom, stigmatization, low sense of control and self-esteem, negative emotions
Gammon and Hunt (2018) [35]	Source isolation; MRSA, TB, and other non-specified infections	Participants experienced limited visiting, lack of attention and lesser interaction with providers, and disruption of routine. Also, feelings of loneliness, abandonment, social exclusion, stigmatization, anxiety, depression, mood changes, stress, negative effects on coping and psychological functioning, low self-esteem and sense of control, emotional problems, anger, perceived feeling of dirtiness, and a lack of clarity on the isolation process. Moreover, studies have found many psychosocial issues were attributable to the primary cause(s) of hospitalization

Gammon et al. (2019) [36]	Source isolation; MRSA and other non-specified infectious conditions	Patients reported a lack of control and feeling lonely in isolation, which lead to a perceived state of social exclusion. Along with poor mental health (33%), about 32% of MRSA carriers reported stigma; of these, 14% reported 'clear stigma' and 42% reported 'suggestive for stigma'. Also, patients reported suboptimal patient-provider communication, lack of understanding facial expression due to masks, and procedures which provoked anxiety and stresses of isolation
Brooks et al. (2020) [37]	Quarantine; SARS (n = 15), Ebola (n = 5), H1N1 influenza (n = 3), MERS (n = 2), and Equine influenza (n = 1)	Patients reported general psychological problems, emotional disturbance, depression, stress, low mood (up to 73%), irritability (up to 57%), anger, guilt, nervousness, sadness, fear, numbness, vigilant handwashing and avoidance of crowd even after quarantine period. The parents and children who were quarantined had higher prevalence of trauma related mental disorders (28% parents had such symptoms compared to 6% control parents). Also, the healthcare providers reported acute stress disorder, exhaustion, detachment, anxiety, depression, irritability, insomnia, poor concentration, deterioration of work performance, alcohol use, avoidance behavior, and posttraumatic stress-related symptoms even after 3 years of quarantine period
Purssell et al. (2020) [38]	Contact precaution and isolation; MRSA and MDROs	The pooled standardized mean difference was 1.28 (95% CI 0.47 to 2.09) for depression and 1.45 (95% CI 0.56 to 2.34) for anxiety among the study participants
Sharma et al. (2020) [39]	Isolation precaution; MRSA, MDROs, and other infections	The pooled mean difference estimates for Hospital Anxiety and Depression Scales (HADS)-A was - 1.4 (p = .15) and that for HADS-D was - 1.85 (p = .09) for anxiety and depression, respectively. Most studies (n = 6) reported negative effects in psychological burden scales in the empirical analysis

These reviews have been published between 2009 and 2020, whereas most (number of reviews, n = 5) reviews were published since 2018. These reviews used different scholarly sources ranging from 2 to 4 databases. The number of primary studies in those reviews, which ranged from 7 to 26. Most reviews included cohort studies (n = 6; number/range of primary studies in each review, s = 1 to 12), followed by cross-sectional studies (n = 5, s = 2 to 11), qualitative studies (n = 3, s = 2 to 10), case-control studies (n = 1, s = 6), quasi-experimental studies (n = 2, s = 2), case studies (n = 1, s = 2), mixed method studies (n = 1, s = 2), reviews (n = 1, s = 1), and psychological evaluation (n = 1, s = 1). In quality assessment (Appendix 1), three reviews were found to have high quality [36,38,39], whereas most (n = 5) studies had a medium quality [32–35,37].

Characteristics of the study populations

The reviews had included primary studies ranging from case studies with one sample to larger samples like 9,648. Three reviews did not specify the origin of the primary studies [32,33,35]; among the remaining reviews, most of the primary studies were from the US, UK, and Canada, whereas fewer studies were conducted in Sweden, Australia, Netherlands, South Korea, Senegal, New Zealand, Ireland, Brazil, Liberia, Turkey, France, Spain, Sierra Leone, Hong Kong, Taiwan, China, and Singapore [34,36–39]. Most reviews recruited primary studies conducted in healthcare settings. For example, Gammon and colleagues reviewed 14 studies with samples ranging from 1 to 528 [36], whereas Purssell and colleagues reviewed 26 studies with samples ranging from 14 to 9,648 [38]. Both reviews evaluated studies that recruited participants from clinical settings, including healthcare providers and clinical students. In contrast, a review by Brooks and colleagues included studies that recruited participants, including patients, providers, students, institutional stakeholders, and community members from diverse settings [37].

Infectious diseases or conditions for quarantine and isolation

Different types of measures for infection prevention and associated causes were reported across reviews (Table 3). Abad and colleagues evaluated studies focusing on isolation [33], whereas three studies specified source isolation across the primary studies [34–36]. Moreover, three reviews focused on contact precaution or isolation [32,38,39]. One study by Brooks and colleagues emphasized on primary studies conducted on quarantine [37].

Several infectious agents or conditions were found to be associated with quarantine or isolation across the study populations. Methicillin-resistant Staphylococcus aureus (MRSA) was the most commonly reported (number of reviews, n =6) reason for isolating the patients [33–36,38,39]. Moreover, four reviews reported Multi-drug resistant organisms (MDRO) as the primary reason for isolation [32,33,38,39]. Several reviews reported Severe acute respiratory syndrome (SARS) (n = 3) and Vancomycin-resistant Enterococcus (VRE) (n = 2) as reasons for isolation [33,34,37]. Other infectious agents or conditions associated with isolation or quarantine included Healthcare-associated infections (HAI), tuberculosis, Ebola, H1N1 influenza, equine influenza, and Middle East Respiratory Syndrome (MERS) [33,35,37].

Mental health outcomes of quarantine and isolation

Reviews reported a high burden of mental health conditions among individuals who experienced isolation or quarantine [36,37,39]. For example, Gammon and colleagues found 33% of the participants who had undergone source isolation had poor mental health status [36]. Among specific mental health outcomes, all reviews reported a high prevalence of anxiety among study participants [32–39]. For example, Purssell and colleagues found the pooled standardized mean difference for anxiety was 1.45 (95% CI 0.56 to 2.34) among participants who experienced contact precaution and isolation [38].

Six reviews reported varying levels of depression among the study participants [33–35,37–39]. For example, Sharma and colleagues found the pooled mean difference estimates for Hospital Anxiety and Depression Scale (HADS-D) AS -1.85 (p = .09) [39], whereas Purssell and colleagues found the pooled mean difference as 1.28 (95% CI 0.47 to 2.09) for depression among the study participants [38]. Four reviews reported anger and irritability among the study participants [32–34,37]. For example, a review found up to 57% of the participants reported irritability alongside other mental conditions following the quarantine [37]. Psychological distress associated with suboptimal patient-provider communication was reported in four reviews [32,33,35,36]. Moreover, four reviews found varying levels of stress among the study participants who experienced quarantine or isolation [34–37].

Several psychosocial conditions affected the mental health and wellbeing of the individuals during and after quarantine or isolation. Three reviews found the participants perceived social exclusion or felt neglected [32,34,35]. Often, psychological and emotional disturbances were

reported by the affected individuals, as found in three reviews [34,35,37]. Stigmatization was reported in three reviews, which impacted the mental health and wellbeing among the study participants [34–36]. For example, Gammon and colleagues found 32% of MRSA carriers reported stigma, among which 14% of the participants reported 'clear stigma' and 42% reported 'suggestive for stigma' [36].

Quarantine and isolation for infection prevention also impacted the mental health and wellbeing among healthcare providers [36,37]. For example, Brooks and colleagues found several mental health conditions among the healthcare providers who worked under quarantine, which included acute stress disorder, exhaustion, detachment, anxiety, depression, irritability, insomnia, poor concentration, deterioration of work performance, alcohol use, avoidance behavior, and posttraumatic stress-related symptoms, even after three years of quarantine period [37]. Moreover, the mental health of informal caregivers was affected due to quarantine and isolation. Brooks and colleagues reported 28% of parents of children who were quarantined had trauma-related mental disorders, which was higher than comparison parents who had a prevalence of 6% for the same condition [37].

Several other mental disorders and psychological conditions were found across study populations, which included low self-esteem [32,33,35], mood disorders [35,37], fear [33,37], guilt [37], loneliness [33–36], boredom [33,34], feeling a lack of control [34–36], insomnia [37], posttraumatic stress disorders [37], perceived dirtiness [35], vigilant handwashing [37], and avoiding crowds and social gatherings even after quarantine or isolation [37]. One study in the review by Abad and colleagues reported a few participants acknowledged privacy and freedom during isolation, whereas remaining studies reported higher scores from depression, anxiety, anger-hostility, fear, loneliness, boredom, and low self-esteem [33].

Discussion

To the best of our knowledge, this is the first umbrella review that evaluated global evidence on mental health outcomes associated with quarantine and isolation measures for infection prevention. Most reviewed included cohort studies as well as qualitative studies, which enabled to explore how times of restricted mobility not only addressed the transmission of infectious diseases but affected the mental health and wellbeing among the study participants. Some of the reviews found such impacts continued over a longer period, highlighting how acute exposure to

psychosocial stressors during quarantine and isolation can exert prolonged impacts on the human mind, psychological processes, and mental health outcomes. Such effects were found among the patients, informal caregivers, and healthcare providers, which indicate the complex psychosocial dynamics among the key stakeholders in the process of quarantine or isolation are likely to be affected and result in negative mental health outcomes. These findings are consistent across most reviews and primary studies included in respective reviews. However, several issues should be considered to further evaluate these findings and draw meaningful insights for future research, policymaking, and practice.

First, most studies in the included reviews originated from high-income countries, which may affect the generalizability of the findings in the context of low- and middle-income countries (LMICs). These countries are often under-represented in terms of generating evidence through empirical studies [40], which remains a major concern for strengthening the global evidence base on psychosocial epidemiology. Therefore, this review informs the need for conducting more studies in LMICs to better understand how quarantine or isolation may affect mental health and wellbeing in those contexts.

Second, the patients and their informal caregivers experience a high burden of mental disorders, which necessitates integrating psychosocial care and mental health support alongside physical health services during quarantine or isolation for infection control. Existing models of care may need human contact to deliver such services. However, recent advancements in digital health interventions may address such issues and facilitate delivering mental health interventions using digital platforms with minimal human involvement [41–43]. Future research and implementation strategies should explore such avenues to improve mental health outcomes during infectious disease outbreaks.

Third, healthcare providers have reported experiencing various mental health problems, including emotional exhaustion, which may result in suboptimal performance in workplaces, as found in this umbrella review. Several evidence-based reviews have reported a high burden of professional burnout among healthcare providers [44–46], which may exacerbate during quarantine and isolation for infection prevention. Such evidence suggests academic and professional approaches to sensitize the clinical students and healthcare providers to be aware of such issues in practical settings and adopt protective mental health measures before working in

such stressful conditions. Moreover, evidence-based psychosocial interventions for improving mental health and wellbeing among healthcare providers should be adopted [47].

Fourth, most of the reviews synthesized evidence from populations in clinical settings. This highlights the significance of healthcare organizations during isolation and quarantine. Such examples have become evident during the COVID-19 pandemic, where healthcare organizations in China have played critical roles in treating the infected individuals and preventing the outbreak within their scope [48]. It is necessary to revisit existing protocols and resources in health services organizations so that their preparedness for providing mental health care in quarantine and isolation can be ensured.

Fifth, the profile of infectious conditions that were associated with quarantine and isolation in this review informs a variety of agents without much opportunity to reach conclusions on how different agents may have required different levels of isolation or impacted mental health among the participants differently. Moreover, little insights can be drawn from the previous conditions, which can be relevant to the recent COVID-19 pandemic. Also, the global research trends on COVID-19 have not adequately explored the psychosocial impacts of this ongoing crisis [49], which informs a critical need for more research in this domain. However, studies on SARS and MERS outbreaks provide some insights on how coronaviruses had affected mental health in earlier outbreaks. The current evidence base should be considered to design future studies and interventions for COVID-19 as well as other infectious conditions.

Sixth, the current evidence informs different mental health problems associated with quarantine and isolation, which may also need psychosocial perspectives to assess the way these preventive measures are enforced globally. Rather than mandating such approaches, altruistic social behavior and practices should be promoted [37]. Moreover, early engagement of infected individuals, caregivers, or populations at risk may allow all to make informed decisions and address anxiety and distress related to uncertainty about potential risks and benefits [50,51].

Seventh, interpersonal relationships, networks, and social capital appear to have critical significance during major health events, including quarantine and isolation [52]. Such ties must be explored and leveraged to improve mental health outcomes during infection prevention. For example, one study reported a few participants who acknowledged higher privacy and freedom during isolation [33]. This highlights how perceptions can be different and how individual ideas

and perceived stressors may result in diverse mental health outcomes. Therefore, individual psychosocial factors should be thoroughly evaluated to identify risk and protective factors among individuals, which may guide the development and adoption of personalized mental health measures. Other opportunities to strengthen mental health care may include interventions for improving patient-provider communication, social media interventions, online support groups, and other resources appropriate to the contexts and psychosocial preferences of the affected individuals. Moreover,

Eighth, awareness is one of the key determinants of mental health among individuals and populations [53]. It is essential to acknowledge the role of knowledge and attitude about mental health, especially during quarantine and isolation, which may reduce stigmatization as well as promote resilience to psychosocial problems. The presence of cooccurring physical or mental health problems may exacerbate the psychological challenges during quarantine and isolation. It is recommended that infection control measures should be included in the existing health promotion programs so that the psychosocial preparedness can be developed at the population level, which may profoundly help during unforeseen infectious crises.

Ninth, the effectiveness of isolation or quarantine may depend on the structure and functions of different organograms in a health system. Although these measures often focus on crude indicators like incidence or mortality rate, little is known about how the levels of preparedness of health systems contribute to assure the citizens during major infectious diseases. This may impact the way an outbreak or potential infection is perceived by people across societies. The ongoing COVID-19 pandemic has resulted in diverse responses from health systems in different countries. The current review found varying levels of mental health outcomes globally, which necessitates strengthening health systems capacities to improve mental health among the affected populations. Moreover, future research is necessary to understand how different health systems react to small to large scale outbreaks, and how such responses determine mental health status across populations.

Last but not least, infection prevention requires stricter measures to standardize the processes and ensure the quality of such services globally. During large scale crises like COVID-19, this need is perceived strongly across scientific communities, which is reflected in extensive collaborative research since the COVID-19 outbreak [49]. However, global mental health remains a

developing domain in health sciences, which provides little information on how global institutions and stakeholders can contribute together to improve mental health outcomes among diverse population groups around the world. It is necessary to develop a global alliance, perhaps an institution under the leadership of major global health stakeholders, which may work on improving global mental health with a focus on providing support to regional and local institutions for building capacities and resources for mental health. Such efforts may create and strengthen mental health support networks allowing timely actions to respond to infectious conditions, promote psychosocial resilience, and protect mental health among individuals and populations simultaneously.

This review has several limitations, which must be acknowledged. We did not include articles beyond the strategy outlined in this review. This may have resulted in selection bias as there are many more databases with potential studies that could have met our criteria. Another limitation is publication bias, which may have a limited synthesis of evidence from unpublished studies. Last but not least, umbrella review evaluates reviews rather than synthesizing study-level evidence [18], such meta-epidemiological analyses may have different objectives or outcomes, which were beyond the scope of this review. These limitations should be considered in translating the evidence of this review into practice and conducting future research in this area.

Conclusion

This umbrella review synthesized the global evidence on mental health outcomes of quarantine and isolation for infection prevention. The current evidence informs a high burden of different mental health problems among patients, informal caregivers, and healthcare providers. These challenges must be recognized for strengthening mental health services during quarantine and isolation. Moreover, risk and protective factors of mental health among individuals and populations should be evaluated to inform future development and implementation of multilevel interventions, which ensures optimal mental health and wellbeing when individuals experience complex psychosocial stressors due to restricted mobility and social interactions. Lastly, humane caregiving should be placed at the center of infection control, ensuring scientific standards to achieve collective goals in protecting physical and mental health among populations at risk.

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Appendix 1: Critical appraisal of the included reviews

Authors/ Sources	Is the review question clearly and explicitly stated?	Were the inclusion criteria appropriate for the review question?	Was the search strategy appropriate?	Were the sources and resources used to search for studies adequate?	Were the criteria for appraising studies appropriate?	Was critical appraisal conducted by two or more reviewers independently?	Were the methods used to combine studies appropriate?	Was the likelihood of publication bias assessed?	Were recommendations for policy and/or practice supported by the reported data?	Were the specific directives for new research appropriate?	Overall score and quality rating
Morgan et al. (2009) [32]	Yes	Yes	CD	Yes	CD	CD	Yes	No	Yes	Yes	6 (Medium)
Abad et al. (2010) [33]	Yes	Yes	Yes	Yes	CD	Yes	Yes	No	CD	Yes	7 (Medium)
Barratt et al. (2011) [34]	Yes	CD	Yes	Yes	No	CD	Yes	No	Yes	No	5 (Medium)
Gammon and Hunt (2018) [35]	Yes	Yes	Yes	CD	No	CD	Yes	No	Yes	Yes	6 (Medium)
Gammon et al. (2019) [36]	Yes	Yes	Yes	Yes	Yes	CD	Yes	No	Yes	Yes	8 (High)
Brooks et al. (2020) [37]	Yes	Yes	Yes	CD	No	CD	Yes	No	Yes	Yes	6 (Medium)
Purssell et al. (2020) [38]	Yes	Yes	Yes	Yes	Yes	CD	Yes	No	Yes	Yes	8 (High)
Sharma et al. (2020) [39]	Yes	Yes	Yes	Yes	CD	Yes	Yes	No	Yes	Yes	8 (High)

(Abbreviations: CD= could not determine)