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Review article

Suicide during COVID-19 and other major international respiratory outbreaks: A systematic review

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ARTICLE INFO

Keywords:
Suicide
Outbreak
Epidemic
Pandemic
COVID-19
Mental health.

ABSTRACT

Coronavirus disease 2019 (COVID-19) was recently declared a pandemic by the WHO. This outbreak threatens not only physical health but also has significant repercussions on mental health. In recent world history, major infectious outbreaks were associated with severe mental health sequelae, including suicide. In this study, we systematically review the literature on suicidal outcomes during major international respiratory outbreaks, including COVID-19. We reviewed descriptive and analytic articles addressing suicide during major international respiratory outbreaks. We searched PubMed, Medline, Embase, Scopus, and PsycInfo databases and then utilized an independent method for study selection by a pair of reviewers. Two reviewers completed data abstraction and conducted a narrative summary of the findings. Our search generated 2,153 articles. Nine studies (three descriptive, five analytical, and one with mixed methodology) were eligible. The included studies were heterogeneous, divergent in methods, and with a low degree of evidence. Deducing an association between pandemics, suicide, and suicide-related outcomes remains thus poorly supported. Future research with better methodological characteristics, the use of longitudinal studies, and a focus on suicide as the primary outcome would allow for an in-depth understanding and formulation of the scope of this problem.

1. Introduction

Coronavirus disease 2019 (COVID-19) is a respiratory illness caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The disease was first reported in December 2019 in Wuhan, central China (CDC, 2020; WHO, 2020a). It has rapidly spread since then and was declared a pandemic by WHO on March 11, 2020 (WHO, 2020b). In addition to its morbid effects on physical health, its impact on mental health might also be severe (Holmes et al., 2020).

Mental illness is a strong predictor of suicide (Gili et al., 2019; Harris and Barraclough, 1997). Most suicides worldwide are related to psychiatric diseases, depression constituting one of the most significant risk factors (Bachmann, 2018; Hawton et al., 2013). Alternatively, in recent

world history, major infectious outbreaks were associated with severe mental health sequelae, including suicide. For instance, there is evidence that deaths by suicide increased in the USA during the 1918–19 influenza pandemic (Wasserman, 1992) and among older people in Hong Kong during the 2003 Severe Acute Respiratory Syndrome (SARS) epidemic (Cheung et al., 2008). Additionally, during the 2003 SARS outbreak in Singapore, almost one-quarter of medical workers reported psychiatric symptoms of depression, anxiety, and posttraumatic morbidity (Sim et al., 2004). Likewise, in 2015, Lee et al. showed that medical staff who performed tasks related to the Middle East Respiratory Syndrome (MERS) in Korea exhibited symptoms of post-traumatic stress disorder (PTSD) (Lee et al., 2018).

It can be hypothesized, in line with reports from previous respiratory

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outbreaks, that the current COVID-19 outbreak might cause a significant and global surge of mental health problems. Recent studies described emotional distress and psychiatric symptoms of depression and anxiety during the COVID-19 outbreak (Qiu et al., 2020; Wang et al., 2020). Some cases of suicidal acts related to the COVID-19 quarantine have also been reported (Ho et al., 2020). It is acknowledged that mental health deterioration during pandemics can stem from numerous factors. These include the constant fear of contracting the virus, contracting the virus, losing loved ones to the illness, as well as the impact of being quarantined. These factors can go on to precipitate mental illness in those without prior psychiatric history or can exacerbate the symptoms in those with a pre-existing mental illness (Ho et al., 2020).

We hypothesize that during outbreaks, including the current pandemic, individuals might be at increased risk of suicide. We set out to conduct a systematic review to test this hypothesis. Our goal was to synthesize descriptive and analytic evidence of suicide and suicide-related outcomes (ideations, intent, attempt, or completion) during major international respiratory outbreaks (COVID-19, MERS, SARS, and influenza A) in the recent history.

2. Methods

The protocol of this systematic review was registered at the International Prospective Register of Systematic Reviews PROSPERO (ID number 180977).

2.1. Eligibility criteria

Studies were considered eligible if they met the following criteria:

- Population: Any individual who lived during a resolved or continuing major international respiratory outbreak, regardless of their age, gender, race, ethnicity, geographical location, profession, or other characteristics.
- Exposure: Living during a major international respiratory outbreak over the past two decades (COVID-19, SARS, MERS, and Influenza A-H1N1, H2N2, and H3N2).
- Outcomes: Suicide-related outcomes (suicidal ideation, intent, attempt, or completion).
- Study design: Analytical (cross-sectional, case-control, or cohort) and descriptive (case report or case series) studies.

Studies assessing other outbreaks, studies having non-suicidal self-harm or self-mutilation and other-directed violence as outcomes, and studies that include reviews, letters, or correspondences were excluded. Studies not available in English or reported as abstracts for which the authors could not identify a full text after consultation with a medical librarian or contact with the corresponding author were also excluded.

2.2. Search strategy

PubMed, Medline, Embase, Scopus, and PsycInfo databases were searched from the day of inception until April 20, 2020. Filters were restricted to studies with a full text published in the English language. The search strategy and its relevant MESH terms are outlined in **Supplementary Appendix 1**. The search also included the references lists of reviews of interest identified during the preliminary search. The authors also hand-searched the reference lists of the final included studies and used Google Scholar to find articles that cited these studies.

2.3. Selection process

EndNote software version X9.2 was used to import all studies obtained from the literature search. After removing duplicate references, a pair of reviewers (KK and SEH) independently conducted the title and abstract screening of the obtained articles using a standardized

screening guide. Any disagreement in this step was resolved by including the article in the full-text screening stage. The title and abstract screening step was followed by a full-text screening done by another pair of reviewers (MAC and SEH) using a standardized screening guide. Any disagreement was resolved by consensus and, if unsuccessful, by a discussion with a third reviewer (KK).

2.4. Data abstraction

Two reviewers (MAC and SEH) independently extracted and compared the data of interest from the full texts of the eligible studies. Studies were stratified according to their design (descriptive versus analytical). For each eligible descriptive study, the reviewers extracted the following information: design of the study, country of origin, contemporary outbreak, sample characteristics (number of cases, gender, age, and psychiatric history), and suicide characteristics (method and alleged reason). For each eligible analytical study, the reviewers extracted the following information: design of the study, country of origin, contemporary outbreak, methodology (recruitment strategy, recruitment site, and eligibility criteria), sample characteristics (number of cases, gender, and age), outcomes (suicide and suicide-related outcomes), and conflict of interest.

2.4.1. Risk of bias assessment

Two reviewers (MAC and SEH) independently assessed the risk of bias in each eligible quantitative study. They resolved any disagreement by consensus or, if unsuccessful, by a discussion with a third reviewer (KK). The criteria evaluated were based on the GRADE system for observational non-randomized studies (Guyatt et al., 2011).

2.5. Data synthesis

Although the authors planned to include a quantitative synthesis (meta-analysis) of the results from analytical studies, it was not possible to conduct it due to the heterogeneity and scarcity of the included studies. Instead, a qualitative synthesis of the study designs, populations, exposures, and outcomes was conducted.

3. Results

3.1. Search results

A total of 2,153 potentially eligible studies were obtained after the electronic search of the five databases. One additional record was obtained through the manual search of reference lists of included articles. After the removal of duplicates, a total of 1,247 records were processed via title and abstract screening. A total of 1,205 records were excluded. Of the remaining 42 articles, another 33 were further excluded after full-text screening for different reasons, as outlined in **Fig. 1**. Nine studies remained for qualitative synthesis.

3.2. Study characteristics

Of the included studies, three were descriptive case reports (Goyal et al., 2020; Mamun and Griffiths, 2020) and case series (Sahoo et al., 2020). Five studies were analytical with a cross-sectional design (Chan et al., 2006; Cheung et al., 2008; Huang et al., 2005; Lee, 2020; Okusaga et al., 2011) and one had both descriptive (case series) and analytical (cross-sectional) methods (Yip et al., 2010). The studies were carried out in five countries, with most of them originating from Mainland China and Hong Kong, while the remaining studies came from the USA, India, Bangladesh, and Taiwan.

3.3. Risk of bias

There was considerable bias in the methodological quality of the

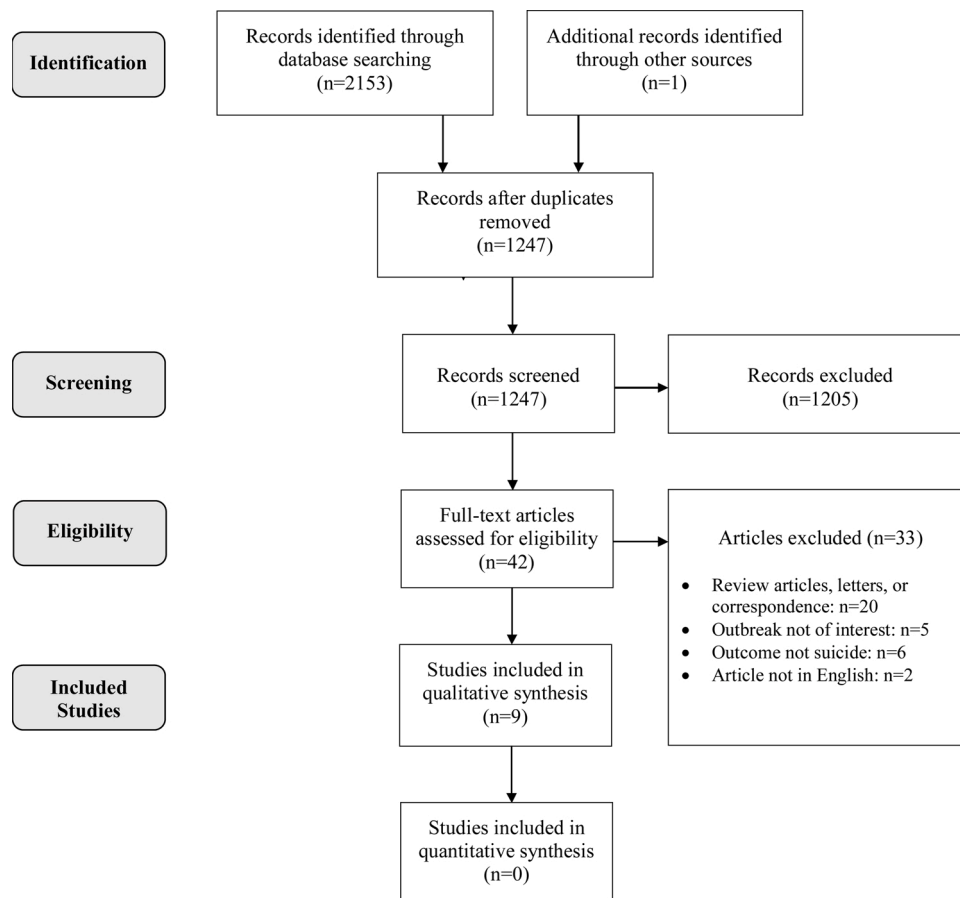


Fig. 1. Systematic review flowchart. Nine studies were included in the qualitative synthesis.

included non-randomized observational studies (see **Supplementary Appendix 2**). Based on GRADE 4 guidelines (Guyatt et al., 2011), only two out of the six quantitative studies were considered to have a low risk of bias, whereas the remaining four had moderate risk.

3.4. Synthesis of results

3.4.1. Descriptive studies

Descriptive studies tackling suicide during major international respiratory outbreaks included two major pandemics: COVID-19 and SARS. In the former, three cases from India (Goyal et al., 2020; Sahoo et al., 2020) and one from Bangladesh (Mamun and Griffiths, 2020) described middle-aged men who committed suicide either by hanging or using a gun. Three of these studies did not report on previous psychiatric history. On the other hand, in the SARS outbreak case series (Yip et al., 2010), 22 cases of suicide in older males and females occurred; three had a past psychiatric history. The major themes that emerged as alleged reasons for committing suicide included fear of contracting the infection, fear of transmitting it, fear of having a painful death secondary to it, and fear of social isolation. A summary of the descriptive studies is presented in Table 1.

3.4.2. Analytical studies

Analytical studies assessing suicidal outcomes during major international respiratory outbreaks mostly addressed SARS. Three studies were based on a chart review of either death or suicide cases in Hong Kong (Chan et al., 2006; Cheung et al., 2008; Yip et al., 2010). In contrast, the fourth assessed the emergency department visits at a tertiary hospital in Taiwan (Huang et al., 2005). Both Chan et al. and Cheung et al. showed a statistically significant increase in the older

adults' suicide rate in 2003, the year of the SARS outbreak, compared to prior years (Chan et al., 2006; Cheung et al., 2008). This was maintained in 2004, suggesting that the suicide rate did not return to its baseline before the SARS epidemic (Cheung et al., 2008). Along the same lines, in Taiwan, the mean numbers of patients presenting to the emergency department for a suicide attempt with drug overdose were greater, although not significantly, during the peak-outbreak stage compared to all other stages (Huang et al., 2005). While comparing SARS-related to non-SARS related suicides, Yip et al. showed no difference in psychiatric profiles. Nonetheless, higher social disconnection and fear of contracting the illness were detected in the former group (Yip et al., 2010). One study that aimed to validate a scale for anxiety towards COVID-19 reported on an individual expressing passive death wishes (Lee, 2020). Lastly, one cross-sectional study assessed for an association between seropositivity to influenza A, B, and coronaviruses and suicidality in patients with mood disorders (Okusaga et al., 2011). Results showed that a significantly greater percentage of individuals who attempted suicide were seropositive for influenza A, influenza B, and coronavirus in comparison to healthy controls. However, among individuals with a history of mood disorder, only seropositivity for influenza B was significantly associated with a history of suicide attempt (Okusaga et al., 2011). A summary of the analytical studies is presented in Table 2a and b.

4. Discussion

In this systematic review, we investigated scientific literature reporting cases of suicide and suicide-related outcomes during major international respiratory outbreaks. Most of the generated studies emanated from two outbreaks: the current COVID-19 pandemic and

Table 1

Summary of descriptive studies tackling suicide-related outcomes during major international outbreaks of respiratory viruses.

Study	Type	Country	Outbreak	Number	Gender	Age (years)	Suicide method	Reason for suicide	Psychiatric history
Mamun and Griffiths (2020)	Case report	Bangladesh	COVID-19	1	Male	36	Hanging from a tree	Moral duty of not passing the suspected COVID-19 infection to the inhabitants of the village	Not mentioned
Goyal et al. (2020)	Case report	India	COVID-19	1	Male	50	Hanging from a tree	Fear and panic of having acquired COVID-19 infection	Not mentioned
Sahoo et al. (2020)	Case series	India	COVID-19	2	Male	52	Shooting self in the abdomen	Worries of being infected by COVID-19 from a friend carrying the virus, followed by the development of depressive symptoms after two weeks of isolation to prevent the spread of any infection to family members, and excessive fear of having a painful death from COVID-19	No previous psychiatric history
					Male	40	Hanging with a rope	Worries of being infected by COVID-19 from foreigners, followed by the development of depressive symptoms over two weeks period, self-isolation, and excessive fear of having a painful death from COVID-19	Not mentioned
Yip et al. (2010)	Case series	China	SARS	22	11 males	74.9 ± 5.72 (Mean ± standard deviation)	Jumping from a height (n = 2)	Fear of contracting SARS (n = 12): negative news about SARS (especially the death toll among elderly) causing worries about getting infected, avoiding hospital admission due to fear of a higher risk of infection, and feelings of a burden and risk to family	Depression and anxiety (n = 2)
					11 females		Otherwise not specified	Fear of social isolation (n = 7): reduced contact with others and disruption of normal life	Schizophrenia (n = 1)
							Disease burden among those with long-term illnesses (n = 6): associated unpleasant emotions and feelings of burden from the chronic illness		

SARS. We have postulated that, in such difficult circumstances, the risk of suicide might increase. The included studies were heterogeneous and divergent in methodologies: descriptive studies of case reports and series described instances of suicide during outbreaks; these included either middle-aged or older adults. Of the alleged reasons for suicide, fear from the infection, worries about others, and social isolation were reported. Some of the analytical studies, on the other hand, hinted towards older adults being at higher risk for suicide. However, due to the limited nature of these studies, all being cross-sectional, the evidence for this argument is rather limited. As such, deducing an association between outbreaks and suicide remains, so far, unwarranted.

A few studies have recently addressed the effect of COVID-19 on psychological distress and psychiatric symptoms. A large-scale survey was designed in China to survey peritraumatic psychological distress during the tumultuous time of the COVID-19 outbreak (Qiu et al., 2020). The COVID-19 Peritraumatic Distress Index, based on the International Classification of Disease (11th revision) and expert opinions from psychiatrists, inquired about the frequency of anxiety, depression, and specific phobias, amongst other symptoms over one week. One-third of the respondents experienced moderate to severe psychological distress. Also, psychological distress was highest among migrant workers and in regions that lacked adequate medical resources or effective governmental control measures (Qiu et al., 2020). In an online survey assessing psychological impact during the COVID-19 outbreak, half of the participants rated the psychological effect of the epidemic as moderate to severe, as per the Impact of Event Scale-Revised (IES-R) (Wang et al., 2020). Besides, about one-quarter of respondents reported moderate-to-severe depressive and anxiety symptoms, as assessed by the Depression, Anxiety and Stress Scale (Wang et al., 2020).

On the other hand, the impact of SARS on mental health has been more widely studied. Wu et al. examined the occurrence rate of PTSD, anxiety, and depression among SARS survivors one month after their discharge from the hospital (Wu et al., 2005). From the sample of 195

participants, 6% met the cutoff for PTSD as per the IES-R. Also, using the Hospital Anxiety and Depression Scale (HADS), 14 % and 18 % met the cutoff for anxiety and depression, respectively (Wu et al., 2005). In a cohort study investigating psychiatric complications among SARS survivors 30 months after the outbreak, the post-SARS cumulative incidence of DSM-IV psychiatric disorders was 58.9 %. As per the IES-R and HADS, one-fourth of the patients had PTSD and 15.6 % had depressive disorders (Mak et al., 2009).

The potential effect of the current COVID-19 outbreak on mental health is likely to be profound. A rise in symptoms of anxiety and depression is expected not only amidst the pandemic but also during the upcoming months and years. One would expect, along these lines, an upsurge in suicide rates, similar to what has been described during the SARS outbreak in Hong Kong. Indeed, both mental health symptoms and diagnoses are well-established risk factors for suicide (Too et al., 2019). Additionally, exacerbation of preexisting mental health symptoms is anticipated during outbreaks, including COVID-19. This can be attributed to anxiety and worry about the infection, prolonged social isolation, and the uncertainty created by the outbreak (Cao et al., 2020; James et al., 2019; Tucci et al., 2017; Xiang et al., 2020).

Other superimposed risk factors might lead to an increase in suicide during the COVID-19 outbreak. A major adverse consequence of this pandemic, just like other outbreaks, is social isolation. Studies have shown an association between suicide rates and social isolation. Those who are single, live alone, or endorse the subjective feeling of loneliness are the most susceptible (Calati et al., 2019; Elovainio et al., 2017; Matthews et al., 2019; Naher et al., 2019). The link between social isolation and suicide was explained by Joiner's psychological model of suicide, in which social isolation results in feelings of thwarted belongingness (Naher et al., 2019). Moreover, social isolation is thought to omit social support stemming from interpersonal relationships, an important protective factor against suicide (Calati et al., 2019). Alternatively, interpersonal risk factors for suicide are likely to be

Table 2
Summary of analytical studies tackling suicide-related outcomes during major international outbreaks of respiratory viruses.

a. General characteristics and methodology of the included analytical studies.							
Study	Type	Country	Outbreak	Methodology			Conflict of interest
				Recruitment strategy	Recruitment site	Eligibility criteria	
Lee (2020)	Cross-sectional	United States	COVID-19	Online survey data collected from March 11 to March 13, 2020	Participants recruited through Amazon MTurk in exchange for payment (\$0.50)	Participants were eligible if they provided consent and complete information, followed the directions to a validity item, had spent at least one hour during the past two weeks thinking about and/or watching media about COVID-19, and had experienced significant anxiety, fear, or worry about the disease outbreak. Patients were eligible if they met criteria for major depressive or bipolar disorder according to the Structured Clinical Interview for DSM-IV Disorders. Suicide attempts were recorded using the Columbia Suicide History Form. Patients meeting criteria for substance dependence, cognitive disorders, or primary psychotic disorders were excluded.	None
Okusaga et al. (2011)	Cross-sectional	United States	Influenza A, B, and coronavirus	Participants recruited from two studies of environmental influences on mood disorders and suicidal behavior (studies not mentioned within the manuscript)	Participants recruited from the University of Maryland, Johns Hopkins University, and the Sheppard Pratt Health System	Case records were eligible if they contained suicide notes and witnesses' descriptions of the suicide deaths (ICD10: X60-X84). Wherever SARS was mentioned as being crucial to the suicide act and was included in the police death investigation, the suicide death was defined as a SARS-related case. Non-SARS-related cases were then randomly selected for comparison. No reported inclusion or exclusion criteria.	None
Yip et al. (2010)	Cross-sectional	China	SARS	Chart review of death case records in the year 2003	Death records obtained from the Coroner's Court in Hong Kong	Case records contained sociodemographic, medical, and psychosocial data gathered from police investigations and medical institutions. Information about suicide was obtained from suicide notes, interviews, and witness reports.	Not mentioned
Cheung et al. (2008)	Cross-sectional	China	SARS	Chart review of suicide case records for the period 1993–2004	Suicide records obtained from the Coroner's Court in Hong Kong	Deaths labeled as "of undetermined cause" were excluded from the analysis.	None
Chan et al. (2006)	Cross-sectional	China	SARS	Chart review of suicide case records for the period 1986–2003	Suicide records obtained from the Census and Statistics Department of the Government of Hong Kong Special Administrative Region	Patients younger than 14 years were excluded.	Not mentioned
Huang et al. (2005)	Cross-sectional	Taiwan	SARS	Retrospective chart review from March 14 to August 31, 2003	Charts obtained from the emergency department of Taipei Veterans General Hospital, a tertiary referral and teaching medical center in northern Taiwan	Patient information was reviewed and compared for different stages of the SARS epidemic (pre-epidemic, early epidemic, peak epidemic, late epidemic, and post-epidemic stages).	Not mentioned
b. Outcomes of the included analytical studies.							
Study	Sample size	Gender	Age	Suicide-related outcomes		Other relevant outcomes	
Lee (2020)	775	446 males		Passive suicidal ideation (measured by the item: "I wished I was already dead, so I did not have to deal with the coronavirus"):		In terms of significant anxiety or worry about the coronavirus during the past two weeks, most participants spent several days feeling elevated anxiety (36.5%), followed by more than seven days feeling elevated anxiety (27.0%), less than a day or two feeling elevated anxiety (22.8%), and nearly every day feeling elevated anxiety (13.7%).	
		329 females		1.58 ± 1.46 (reported as mean ± SD)			
Okusaga et al. (2011)	257	95 males	32.72 ± 9.35 18 to 65	A more significant percentage of individuals in the suicide attempt group were seropositive for influenza A (p = 0.006), influenza B (p < 0.0001), and coronavirus (p < 0.0001) in comparison to healthy controls.		There were statistically significant associations between seropositivity for influenza A, influenza B, coronaviruses, and the diagnosis of a major depressive disorder.	
		162 females		Among individuals with a history of mood disorder, seropositivity for influenza B, but not		The odds of having a history of mood disorder were increased with seropositivity	

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Table 2 (continued)

b. Outcomes of the included analytical studies.					
Study	Sample size	Gender	Age	Suicide-related outcomes	Other relevant outcomes
				for influenza A or coronaviruses, was significantly associated with a history of suicide attempt ($p = 0.001$). The odds of having attempted suicide were increased in influenza B seropositive individuals (OR = 2.53, CI 1.33–4.80).	for influenza A, influenza B, and coronaviruses. Seropositivity for influenza B, but not for influenza A or coronaviruses, was significantly associated with the presence of a history of psychotic symptoms in mood disorder patients.
Yip et al. (2010)	66 (SARS-related: 22, Non-SARS-related: 44)	33 males 33 females (For each: SARS-related: 11, Non-SARS-related: 22)	SARS-related: 74.9 ± 5.72 Non-SARS-related: 74.75 ± 6.77	Sociodemographic factors, employment status, and medical and psychiatric profiles were insignificantly different between the SARS and non-SARS groups. Disconnection ($p = 0.002$) and fear of contracting SARS ($p < 0.001$) were significantly more common in the SARS compared to the non-SARS group. There was a decreasing trend of elderly suicide rates from 1993 (39.19 per 100,000) to 2002 (28.44 per 100,000), whereas the rate drastically climbed up to 40.35 per 100,000 in 2003 and maintained a high in 2004 (33.95 per 100,000). The monthly older adult suicide rate in April 2003 was significantly higher than those in April 1993, 1997, 1998, 2001, and 2002. It was also significantly higher than that in June 2003, which suggested the disappearance of the usual summer peak and that some of the suicides might have been brought forward. The annual older adult suicide rate in 2003 was significantly higher than in 1996 and 1998–2002. The annual older adult suicide rate in 2004 was also significantly higher than in 2002 (yet lower than in 2003), suggesting that the suicide rate did not return to the level before the SARS epidemic. Suicide rates of elders aged 65 and above in 1986–1997 were significantly higher than in 2002, with an Incident Rate Ratio (IRR) of 1.34 to 1.61. Suicide rates in 1998–2001 did not differ from 2002, representing the stabilization of rates for four years after 1997. Elderly suicide rate increased to 37.46/100,000 in 2003, with an IRR of 1.32 relative to 2002 ($p < 0.0019$). Such a trend remained significant when female elderly (but not male elderly or the age group below 65) suicide rates in 1993–2003 were analyzed. The mean numbers of patients attending the emergency department with a principal diagnosis of suicide attempt via drug overdose were higher during the peak-epidemic stage than all other epidemic stages. However, these differences were not statistically significant.	None
Cheung et al. (2008)	Not applicable	Not applicable	65 and above		The overall severity of illness ($p < 0.001$), level of dependency ($p < 0.013$), and worrying about having sickness ($p < 0.021$) among the older adult suicides were found to be significantly different in the pre-SARS, peri-SARS, and post-SARS periods.
Chan et al. (2006)	Not applicable	Not applicable	Stratified as below and above 65		The peak number of suicides in elders aged 65 and above occurred in April 2003, a month after the SARS outbreak began.
Huang et al. (2005)	17,586	Reported percentage in males: 62.7 ± 3.8 to 65.6 ± 3.9, according to epidemic stage	54.6 ± 3.2 to 57.0 ± 3.1, according to epidemic stage		The total percentage of patients in the “Psychiatric problem/disease” diagnostic category who attended the emergency department did not significantly change across the various stages of the epidemic.

exacerbated midst of the current outbreak. This is especially notable among vulnerable populations, namely the elderly and immunosuppressed, who may experience greater physical isolation due to concerns about contracting the infection (Leight, 2003; Letvak, 2002), as well as those at risk of domestic violence (Godin, 2020; Lanier and Maume, 2009; MacIsaac et al., 2017). Secondary consequences of social distancing may also increase the risk of suicide. These include economic stress, decreased access to community and religious support, and decreased access to appropriate medical and mental health care (Reger et al., 2020). When it comes to economic stress, one study showed a 20–30% increase in suicide risk following unemployment (Nordt et al., 2015). Following the COVID-19 outbreak, the International Labour Organization expected a worldwide increase in the rate of unemployment that would result in up to 9570 additional suicide cases per year (Kawohl and Nordt, 2020).

Alternatively, quarantine by itself may exacerbate the mental health toll on the individual. Three of the case reports of suicide during the COVID-19 outbreak were allegedly reported to be related to quarantine. Many studies have demonstrated a causal relationship between quarantine and psychological distress. It seems that community anxiety resulting from pandemics is further exacerbated by mass quarantine (Rubin and Wessely, 2020). Barbisch et al. lists incarceration as one of the two major sources of psychological distress in pandemics, alongside the fear and ambiguity of the disease (Barbisch et al., 2015). Quarantine not only contributes to increased anxiety but also feelings of anger, boredom, and loneliness (Park and Park, 2020). Being quarantined is also linked to an increased risk of depression as well as PTSD (Brooks et al., 2020). Major stressors during quarantine include longer duration of confinement, fear of infection, frustration and boredom, inadequate supplies, and insufficient information (Brooks et al., 2020). As for

quarantine within the same family, restricted physical contact results in a loss of intimacy, contributing to further emotional and psychological distress (Johal, 2009). Quarantine is also considered to be an indicator of the severity of the situation; it is associated with a perceived loss of control, as well as a sense of entrapment (Rubin and Wessely, 2020). As a result, confinement creates a sense of “collective hysteria”, which can be a major driving force towards suicide (Barbisch et al., 2015). Finally, quarantine and social isolation might increase drug consumption or relapse into substance misuse, even in long-term abstainers (Ornell et al., 2020; Wei and Shah, 2020). For instance, in an online survey conducted in China, 19 % and 32 % of participants relapsed or increased their alcohol use during the pandemic, respectively (Sun et al., 2020). The misuse of substance can further accentuate the risk of suicide (Carrà et al., 2014; Vijayakumar et al., 2011).

Since the onset of the COVID-19 outbreak, cases of suicide attempts attributed to the outbreak have been reported worldwide via newspapers and social media outlets (Nabbout, 2020; Pavan, 2020; Steinbuch, 2020; Sticking, 2020). Regardless, the direct association between the two events remains overall uncertain (Betz, 2020). This systematic review, a first in the existing literature, carries an invitation for further research into the topic, through the design of evidence-based studies that use large database clinical data. This would allow a better estimation of an underlying association between worldwide outbreaks and the outcome event of suicide. At a clinical level, from the abovementioned results, caution should be particularly directed towards those who are the most vulnerable: the elderly, the immunosuppressed, the inhabitants of rural areas, and the poorly educated, amongst others. Experts and early-career psychiatrists have also called for a global action to prevent suicide amidst this outbreak (Holmes et al., 2020; Ransing et al., 2020). An immediate action that fosters improving monitoring and reporting of anxiety, depression, and suicide amongst other mental health issues has been requested. This would be followed, in the long-term, by efforts to unveil the intricate culprit mechanisms behind the increased risk of suicide during outbreaks (Holmes et al., 2020).

5. Limitations

The strengths of this study mainly lie in its design and the novelty of the topic, as this is the first systematic review addressing the relationship between suicide and major international respiratory outbreaks. Furthermore, this study was based on a thorough search of the literature, which included multiple search engines and a detailed search strategy, thereby ensuring adequate retrieval of data. However, the limitations of this systematic review stem from the sparsity of research related to the topic, particularly to the COVID-19 outbreak, and the relatively low degree of evidence of the retrieved studies. Four of the nine studies include case reports and case series, which lie at the base of the Evidence Pyramid. Besides, eligible quantitative studies were cross-sectional, as we could not find any longitudinal study that fits our inclusion criteria. Also, four out of six cross-sectional studies were found to have a moderate risk of bias, further weakening the level of evidence. Moreover, the studies lacked homogeneity, making it difficult to deduce associations or draw generalizable conclusions. Another limitation of this study involves restricting the analysis to respiratory outbreaks, therefore excluding other epidemics such as those caused by Ebola, Monkeypox, and Zika viruses. Nevertheless, there is data supporting increased suicidality during these outbreaks. In a study conducted in Guinea, suicidal ideations or attempts were documented in four out of 33 Ebola Virus Disease survivors assessed by a psychiatrist (Keita et al., 2017). Another study conducted in Nigeria documented one suicide case out of 21 individuals affected by a Monkeypox outbreak (Ogoina et al., 2018). The current review also excluded studies assessing suicide during the Human Immunodeficiency Virus (HIV) pandemic. The association between acquiring HIV infection and suicide has been well established. A systematic review of 66 studies addressing suicidal behaviors and HIV infection revealed a high suicidal burden among individuals with HIV

(Catalan et al., 2011). Yet, we opted to exclude the HIV outbreak from the current analysis due to the presence of mediators in the association between the infection and suicide. One main confounder is stigma towards vulnerable populations, particularly the LGBTQI community, which can account for the heightened risk of suicidality (Ferlatte et al., 2017).

6. Conclusion

In conclusion, this is the first systematic review to analyze the evidence about suicide and suicide-related outcomes during major international respiratory outbreaks. Deducing an association between pandemics, suicide, and suicide-related outcomes remains poorly supported. Future research with better methodological characteristics, the use of longitudinal studies, and a focus on suicide as the main outcome would allow for an in-depth understanding and formulation of the scope of this problem. However, despite the limitations inherent to the reviewed studies, they still provide insight into the need to improve mental health care during the current COVID-19 outbreak, and to enhance the readiness and aptitude of health care workers in detecting and managing the psychological sequelae of pandemics.

Funding and financial disclosure

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

The authors report no declarations of interest.

Acknowledgment

None.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.ajp.2020.102509>.

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