REVIEW

Prevalence of loneliness and social isolation among older adults during the COVID-19 pandemic: A systematic review and meta-analysis

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ABSTRACT

Objectives: Pandemics and their public health control measures have generally substantially increased the level of loneliness and social isolation in the general population. Because of the circumstances of aging, older adults are more likely to experience social isolation and loneliness during pandemics. However, no systematic review has been conducted or published on the prevalence of loneliness and/or social isolation among the older population. This systematic review and meta-analysis aims to provide up-to-date pooled estimates of the prevalence of social isolation and loneliness among older adults during the COVID-19 pandemic and other pandemics in the last two decades.

Design: EMBASE, PsychoINFO, Medline, and Web of Science were searched for relevant studies from January 1, 2000 to November 31, 2021 published in a variety of languages. Only studies conducted during the COVID-19 pandemic were selected in the review.

Results: A total of 30 studies including 28,050 participants met the inclusion criteria. Overall, the pooled period prevalence of loneliness among older adults was 28.6% (95% CI: 22.9–35.0%) and 31.2% for social isolation (95% CI: 20.2–44.9%). Prevalence estimates were significantly higher for those studies conducted post 3-month from the start of the COVID-19 pandemic compared to those conducted within the first 3 months of the pandemic.

Conclusions: This review identifies the need for good quality longitudinal studies to examine the long-term impact of pandemics on loneliness and social isolation among older populations. Health policymaking and healthcare systems should proactively address the rising demand for appropriate psychological services among older adults.

Key words loneliness, social isolation, prevalence, elderly, COVID-19, systematic review, meta-analysis

Introduction

The COVID-19 outbreak and its public health control measures have generally substantially increased the prevalence of social isolation and loneliness among older adult populations since the beginning of the pandemic (Savage *et al.*, 2021). Although loneliness and social isolation can co-occur, they are distinct concepts. Loneliness refers to a subjective psychological state or feeling of being alone, whereas social isolation is an objective observable state which is inferred by the lack of social proximity and engagement with others even though the individuals involved may not feel lonely (Cacioppo and Cacioppo, 2018; McClelland *et al.*, 2020). Loneliness has been found to have a weak correlation with social isolation that can occur without one another (Coyle and Dugan, 2012). Individuals can have feelings of loneliness despite having frequent social involvement, whereas others without frequent social interactions may not feel lonely. It is important to distinguish between loneliness and social isolation.

The literature has accumulated ample evidence on the negative consequences of loneliness and social isolation on a wide range of physical and mental health problems (Hwang *et al.*, 2020; Smith and Victor, 2019). Lonely individuals in comparison to others have been found to have increased all-cause morbidity and mortality (Cacioppo and Cacioppo, 2018), increased risk of cardiovascular diseases (Barth *et al.*, 2010; Thurston and Kubzansky, 2009), impaired functional status and quality of life (Lee *et al.*, 2019). Similarly, being socially isolated has been found to have negative consequences on well-being, including increased risk of morbidity and mortality (Holt-Lunstad *et al.*, 2010), coronary heart diseases (Lee *et al.*, 2019), impaired cognitive function (Wilson *et al.*, 2007), and major depression (Cacioppo *et al.*, 2010).

The literature on loneliness/social isolation during COVID-19 in the *general population* has been synthesized (Buecker and Horstmann, 2021). However, to our knowledge, no systematic review has been published on the prevalence of loneliness and/or social isolation among *those aged 65+* during pandemics, such as COVID-19. Because of the circumstances of aging involving relationship losses, medical morbidities, and functional declines, older adults are more likely to experience loneliness and social isolation (Bryant *et al.*, 2004). The COVID-19 and its related public health measures have significantly increased the likelihood of social isolation and loneliness among older adults living in care facilities and the general community (Gorenko *et al.*, 2021; Plagg *et al.*, 2020; Schmitz *et al.*, 2020). It has had negative consequences on the mental health of older adults (Sarbadhikari and Sarbadhikari, 2020). The COVID-19 pandemic has also led to significant changes in the delivery of physical and mental health care (i.e., virtual care by phone or video). It is important to have a timely update on the prevalence of social isolation and loneliness among older adults during this current COVID-19 pandemic.

As countries each have their own manner and pace in dealing with the pandemic, it is possible that the pandemic may affect people differently in different jurisdictions (Varga *et al.*, 2021). Indeed a substantial variation in the prevalence of loneliness across different regions of the world has been reported (Dean *et al.*, 2021). Furthermore, the prevalence of loneliness and social isolation among the elderly has varied during different periods of the pandemic and is closely linked to the duration of the pandemic, public health control measures, and the severity of the pandemic (Harden *et al.*, 2020; O'Shea *et al.*, 2021). A detailed and comprehensive overview of the impact of the COVID-19 pandemic on loneliness and social isolation is warranted to understand how the prevalence of loneliness and social isolation is related to different phrases of the COVID-19 pandemic, different global regions, as well as the severity of the pandemic and the restrictiveness of public health control measures taken.

This present systematic review and meta-analysis aim to address the knowledge gap on social isolation and loneliness among older adults during the COVID-19 pandemic by providing up-to-date pooled estimates of the prevalence of social isolation and loneliness among older adults during the COVID-19 pandemic. This review also provides quantitative syntheses on subgroup differences in the pooled prevalence of social isolation and loneliness, in terms of geographical regions, phases of the pandemic, prevalence estimate period, and the severity level of the Covid-19 pandemic in the study region. The findings of the review offer the best available current evidence on the issues of loneliness and social isolation among older adults during the COVID-19 pandemic and identify the major correlates of these attributes among older adults.

Methods

Searching strategy

This systematic review and meta-analysis were conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher *et al.*, 2009). This review was registered prospectively with PROSPERO (CRD42021259103). Four electronic databases, EMBASE, PsychoInfo, Medline, and Web of Science, were comprehensively searched from January 2000 to November 2021 to identify potentially relevant studies. The search strategies were developed and tailored for each database by YS, WR, ML, GC, and XM. Grey literature resources including National Technical Information Service (NTIS) and publications in the King's Fund were also searched. In addition, we manually searched the reference lists of selected articles, and review articles on relevant topics.

Inclusion criteria and exclusion criteria

Articles were included in this review according to the following inclusion criteria: (a) studies of human subjects; (b) had a measure of loneliness or social isolation; (c) provided statistical estimates to be able to calculate the prevalence of loneliness and/or social isolation during pandemics; (d) studied older adults aged 65+; (e) published in English, Chinese, Danish, French, German, Italian, Norwegian, Portuguese, Spanish and Swedish. Articles were excluded if: (a) the study had no data that could be used to calculate the prevalence of loneliness or

social isolation; (b) the study was not conducted during pandemics in the past two decades.

The study protocol initially called for a wider search for any pandemic occurring in the last two decades, so the search terms included Ebola or influenza or flu or grippe or orthomyxovirus or myxovirus*or plague or MERS or middle east respiratory syndrome, however, no relevant studies were found, only studies on COVID-19 pandemic. So we proceeded with the systematic review and meta-analysis of these studies.

Study selection and data extraction

Two reviewers (YS and WR) independently reviewed and screened the titles and abstracts of all retrieved literature. The full texts of potentially eligible studies were then reviewed independently, and any discrepancies between reviewer selections were resolved by a group discussion. The extraction form recorded study data on the first author, publication year, study country, study setting, sample size, sample collection, sampling methods, study period, phases of a pandemic, sex proportion, age range, the severity of a pandemic, mean age, study design, instruments used to measure social isolation and/or loneliness, cut-offs used to define the presence of loneliness or social isolation, the prevalence of social isolation or loneliness, and measurement of prevalence estimates. The study information was extracted independently by two authors (YS and WR); also a colleague was used to help with articles not published in English, French, or Chinese (GC). In addition, we contacted the authors of articles for further information when the prevalence was not reported in the original articles.

Quality assessment

The study quality of each selected article was assessed by the Loney's 8-item scale (Loney *et al.*, 1998). The scale includes eight items: definition of the target population, sampling method, response rate, non-responder description, representativeness of samples, data collection method, diagnostic criteria, and precision of prevalence estimates. The total score ranged from zero to eight. The study quality was assessed by two reviewers (YS and WR), independently. The quality assessment of each reviewed study is shown in Supplementary Table S1.

Meta-analysis

A random-effects (DerSimonian and Laird method) model was used to pool the prevalence and 95% confidence intervals (CI). Heterogeneity across the included studies was assessed using the Cochran Q test and Higgins and Thompson I^2 statistic, which indicates the percentage of total heterogeneity due to variations in studies (Higgins and Thompson, 2002). Publication bias was evaluated with the funnel plots and Egger's and Begg's tests, and the significance level was set at 0.05 (two-sided). The trim and fill procedure was used to detect and adjust for publication bias (Duval and Tweedie, 2000). Subgroup analyses of loneliness and social isolation were conducted for different geographical regions, phases of the COVID-19 pandemic, prevalence estimate period, and a severity level of COVID-19 spread. The severity level of the COVID-19 was grouped based on the newly confirmed COVID-19 cases per million population (low "<10/1M", moderate "10–100/1M", and high ">100/1M") in specific countries at the time of the individual study was conducted. Meta-regression analyses were used to further assess the influence of different study characteristics including mean age, male proportions, sample size, mode of data collection, sampling methods, study design, and each item in the study quality assessment criteria. Sensitivity analysis was used to assess the influence of each individual study on the pooled prevalence estimate by recalculating the pooled estimates, excluding this particular study at a time. Statistical analyses were performed by Comprehensive Meta-Analysis (CMA) Version 3.0 (Biostat, Inc., Englewood, NJ, USA).

Results

Selection of articles

The initial search produced 4467 titles, from which 2256 abstracts were reviewed, 524 articles were then retrieved for a full evaluation. A total of 30 original articles that provided the period prevalence data at different time points were included, including 27 articles on loneliness and 6 articles on social isolation. Since the experience of loneliness and social isolation can vary in intensity and frequency during an individual's different life stages therefore all eligible studies reported period prevalence of the loneliness and social isolation which was measured over an interval of time for easy interpretation. Figure 1 shows the process of the study selection. All articles were published during the COVID-19 pandemic. These articles were from 15 countries of four continents: Europe (14 studies: four in UK, three in German, two in Spain, and one each in Austria, Ireland, Denmark, Norway, and Finland), North America (five studies in the USA and three studies in Canada), South America (one study in Brazil), and Asia (four studies in Japan and one each in China, Korea, and Turkey). Twenty-eight of the articles were published in English and two were
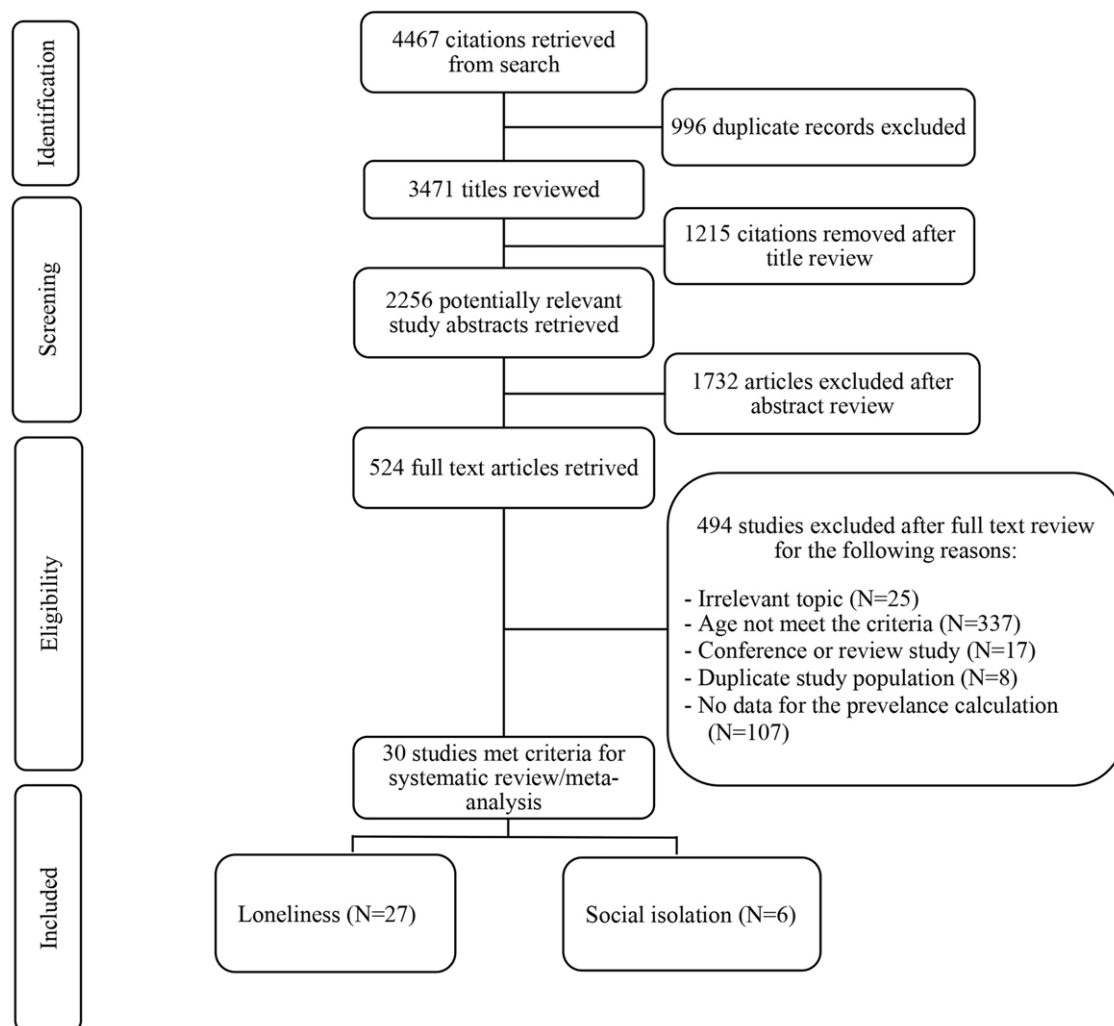
4467 citations retrieved
from search

996 duplicate records excluded

3471 titles reviewed

1215 citations removed after
title review

2256 potentially relevant
study abstracts retrieved

1732 articles excluded after
abstract review

524 full text articles retrieved

494 studies excluded after full text review
for the following reasons:

- Irrelevant topic (N=25)
- Age not meet the criteria (N=337)
- Conference or review study (N=17)
- Duplicate study population (N=8)
- No data for the prevalence calculation
  (N=107)

30 studies met criteria for
systematic review/meta-
analysis

Loneliness (N=27)

Social isolation (N=6)

Identification | Screening | Eligibility | Included

Figure 1. PRISMA flow diagram.

published in German. The sample size of the study cohorts ranged from 10 to 4840. These studies covered a total of 20,188 participants for loneliness and 7862 subjects for social isolation. Table 1 provides detailed data on the characteristics of the included articles.

The total score of quality assessment ranged from 2 to 8, with a median score of 4. Sixteen studies had good quality with their quality scores greater than the median score. All studies had a clear definition of a target population and a standardized data collection approach. Nine studies (30%) used a random sampling method and adequately described their sampling frame, and thirteen studies (43%) had information on the response rate. Fourteen studies (47%) used reliable and validated measurement methods to assess loneliness or social isolation according to standardized criteria. Supplementary Table S1 reports on the quality assessments of the studies included in the review.

Evaluation of the publication bias

We ran the Egger's test and Begg's test to assess whether there was any potential publication bias for loneliness studies (Egger linear regression: $t = 0.552$, $P = 0.586$; Begg rank correlation: $z = 0.553$, $P = 0.580$) as well as social isolation studies (Egger linear regression: $t = 0.041$, $P = 0.969$; Begg rank correlation: $z = 0.188$, $P = 0.851$). Both the Egger's test and Begg's test and the funnel plots did not identify any publication bias (Figure 2a and b).

The pooled period prevalence of loneliness and social isolation among elderly people during the COVID-19 pandemic

A total of 27 studies were included to quantify the pooled period prevalence of loneliness and six studies for the pooled period prevalence of social isolation. Figure 3 presents forest plots of the

prevalence of loneliness (Figure 3a) and social isolation (Figure 3b) among older adults during the COVID-19 pandemic. The pooled prevalence of loneliness was 28.6% (95% CI: 22.9–35.0%, P = 0.001, I^2 = 98.5%) based on the random-effects model. The pooled prevalence of social isolation was 31.2% (95% CI: 20.2–44.9%, P = 0.008, I^2 = 99.0%).

Subgroup analyses

The pooled prevalence of loneliness and social isolation was further compared by different subgroups, including whether studies were conducted during the first 3-month of the pandemic, measurement of prevalence estimates, geographical regions, and the severity level based on the new COVID-19 positive cases at the time each study was conducted (per 1 million population). Table 2 presents subgroup analyses of the pooled prevalence of loneliness and social isolation. For both loneliness and social isolation, studies conducted after the third month of the pandemic reported higher prevalence rates than those conducted within the first 3 months: 31.3% vs. 25.6% for loneliness; 41.5% vs. 15.9% for social isolation. No significant differences on the pooled prevalence of loneliness or social isolation were found for different measurements of prevalence estimates, geographical regions, and the severity levels of the COVID-19 pandemic.

Meta-regression and sensitivity analysis

Meta-regression was used to evaluate the impact of study characteristics as well as the quality assessment items on the pooled estimates. For loneliness, none of the study characteristics (age, male proportion, sample size, mode of data collection, sampling methods, and study design) was associated with the pooled estimates (P > 0.05). Only two quality assessment items (sample selection (probability sampling or total population surveyed), and the representativeness of the target population) were associated with the pooled prevalence of loneliness. For social isolation, only the male proportion was statistically associated with the prevalence estimates (P < 0.01) with a higher proportion of males associated with greater reported isolation. Table S2 provides the details on all the variables analyzed in meta-regression.

To assess the impact of an individual study on the pooled estimates, sensitivity analysis was conducted by excluding one study at a time. For both loneliness and social isolation, sensitivity analyses yielded similar results, indicating no individual study influenced the pooled prevalence of loneliness or social isolation (Supplementary Figure S1–S2).

Discussion

This systematic review and meta-analysis are the first to provide a timely update on the prevalence of loneliness and social isolation among the older population aged 65 years and over during pandemics. All the studies included in this review were conducted during the COVID-19 pandemic. By synthesizing a total of 30 observational studies covering 28,050 participants, the meta-analysis found that the overall period prevalence of loneliness and social isolation for the elderly people during the COVID-19 pandemic was 28.6% and 31.2%, respectively. Significant differences in the pooled prevalence of loneliness and social isolation were identified for studies conducted within the first 3 months of the COVID-19 pandemic versus those conducted after 3 months into the pandemic. The pooled prevalence of loneliness was also associated with sample selection as well as the representativeness of the target population, whereas the pooled prevalence of social isolation was associated with male proportion.

The pooled period prevalence of loneliness and social isolation during the pandemic substantially increased compared to similar rates before the COVID-19 pandemic. The prevalence of loneliness among the older population was estimated between 5% and 10% across Australia, Northern Europe, and North America, and ranged from 10% to 18% in Southern Europe (Yang and Victor, 2011). Studies from Asia had reported a much higher prevalence, which was up to 30% (Chen et al., 2014). The global prevalence of social isolation among persons aged 60 years and above ranged from 7% to 24% (Chen and Schulz, 2016). Many countries have reported an increase in the prevalence of loneliness and social isolation after the outbreak of the COVID-19 pandemic (Robb et al., 2020). The elevated prevalence of loneliness and social isolation is partially associated with various public health control measures (Rodney et al., 2021). The negative consequences of public health control measures (i.e., masking, physical distancing, and limited contacts) may reduce social interactions and decrease the buffering effect of social support during the COVID-19 pandemic (Lee, 2020).

This review reiterates the vulnerability of older adults during the pandemic not only because of their high likelihood of physical diseases and are more prone to the severity of the COVID-19 symptoms, but also because they are more susceptible to psychological issues, in particular, loneliness and social isolation (Hoogendijk et al., 2020). Interestingly, recent studies have found that, compared to younger age groups, older adults tended to report lower

Table 1. Characteristics of studies included in the meta-analysis

FIRST AUTHOR	YEAR OF PUBLICATION	COUNTRY	SURVEY SETTING	SAMPLE SIZE	MODE OF DATA COLLECTION	SAMPLING METHODS	STUDY PERIOD	PHASE OF COVID PANDEMIC (SINCE THE BEGINNING OF THE COVID-19)
Loneliness								
Bailey	2021	Ireland	Hospital	150	On site	Convenience	10/2020–12/2020	8–10 months
Brandt	2021	Germany	Community	80	Online	Convenience	05/2020–07/2020	3–5 months
Brown	2021	UK	Community	142	Telephone	Convenience	05/2020–06/2020	3–4 months
Eliasen	2021	Denmark	Community	227	Telephone	Convenience	06/2020–07/2020	4–5 months
Emerson	2020	USA	Community	310	Online	Convenience	03/2020–04/2020	1–2 months
GroarkeI	2020	UK	Community	61	Online	Convenience	03/2020–04/2020	1–2 months
Hansen	2021	Norway	Community	2366	Online	Convenience	06/2020	4 months
Herron	2021	Canada	Community	26	Telephone	Convenience	05/2020–07/2020	3–5 months
Horst	2021	Canada	Community	927	Online	Convenience	NA	NA
Kim	2021	Korea	Hospital	10	On site	Convenience	05/2020–07/2020	3–5 months
Koivunen	2021	Finland	Community	685	On site	Convenience	NA	NA
Kotwal	2021	USA	Mixed	122	Telephone	Convenience	04/2020–06/2020	2–4 months
Koyama	2021	Japan	Community	166	On site	Random	06/2020–07/2020	4–5 months
Leese	2021	USA	Community	59	Online	Convenience	03/2020–05/2020	1–3 months
Li	2020	UK	Community	3993	Online	Random	04/2020	2 months
Lippke	2021	Germany	Community	198	Online	Convenience	06/2020	4 months
Machon	2021	Spain	Community	35	Telephone	Convenience	04/2020–05/2020	2–3 months
Muller	2020	Germany	Community	993	Telephone	Random	04/2020	2 months
Okelly	2020	UK	Community	137	Online	Convenience	05/2020–06/2020	3–4 months
O'Shea	2021	USA	Community	3767	Online	Convenience	04/2020–05/2020	2–3 months
Savage	2021	Canada	Community	4840	Online	Convenience	05/2020	3 months
Sobrado	2021	Spain	Community	38	Telephone	Convenience	04/2020–05/2020	2–3 months
Torres	2021	Brazil	Community	943	Telephone	Random	05/2020–06/2020	3–4 months
Tutzer	2021	Austria	Community	29	Online	Convenience	06/2020–08/2020	4–6 months
Walker	2020	USA	Community	124	Telephone	Convenience	04/2020	2 months
Wang	2020	China	Community	54	Online	Convenience	04/2020	2 months
Yildirim	2021	Turkey	NA	556	Online	Convenience	NA	NA
Social isolation								
Kotwal	2021	USA	Mixed	122	Telephone	Convenience	04/2020–06/2020	2–4 months
Koyama	2021	Japan	Community	166	On site	Random	06/2020–07/2020	4–5 months
Muller	2020	Germany	Community	993	Telephone	Random	04/2020	2 months
Murayama	2021	Japan	Community	4205	Online	Random	08/2020–09/2020	6–7 months
Noguchi	2021	Japan	Community	955	Online	Random	03/2020	1 month
Sugaya	2021	Japan	Community	1421	Online	Convenience	05/2020	3 months

NA: not available.

[a] The cutoff of 50th percentile was defined.

[b] The cutoff of 80th percentile was defined.

| SEX (MALE/ FEMALE)	AGE	COVID SEVERITY	MEAN AGE (SD)	STUDY DESIGN	MEASUREMENT OF LONELINESS	PREVALENCE OF LONELINESS	MEASUREMENT OF PREVALENCE ESTIMATES
68/82	≥ 70 years	High	79.8	Cohort	Study specific questionnaire	57.3% (49.3%, 65.0%)	Period estimate (8–10 months)
32/48	≥ 70 years	Low	75.5 (4.5)	Cross-sectional	Single global question	82.5% (72.6%, 89.4%)	Period estimate (3–5 months)
71/71	≥ 75 years	Moderate	82.4 (4.4)	Cross-sectional	Study specific questionnaire	27.5% (20.8%, 35.4%)	Past week
109/118	≥ 75 years	Low	84.4 (1.0)	Cohort	Single global question	21.1% (16.3%, 26.9%)	Period estimate (4–5 months)
80/230	≥ 70 years	Moderate	NA	Cross-sectional	Single global question	43.5% (38.1%, 49.1%)	Period estimate (1–2 months)
NA	≥ 65 years	Moderate	NA	Cross-sectional	UCLA Loneliness Scale (cut-off of >6)	3.3% (0.8%, 12.2%)	Period estimate (1–2 month)
1387/979	≥ 65 years	Low	NA	Cross-sectional	Single global question	9.6% (8.5%, 10.9%)	Past week
6/20	≥ 65 years	Moderate	NA	Cohort	Single global question	73.1% (53.3%, 86.6%)	Past week
449/478	≥ 65 years	NA	NA	Cross-sectional	Single global question	65.2% (62.0%, 68.2%)	NA
0/10	≥ 65 years	Moderate	82 (5.9)	Cohort	Revised UCLA Loneliness Scale (cut-off of >29)	10.0% (1.40%, 46.7%)	Period estimate (3–5 months)
290/ 3950.42	≥ 75 years	NA	NA	Cohort	Single global question	41.2% (37.5%, 44.9%)	NA
44/78	≥ 65 years	Moderate	NA	Cohort	UCLA Loneliness Scale (cut-off of >3)	22.1% (15.6%, 30.4%)	Period estimate (2–4 months)
NA	≥ 65 years	Low	NA	Cohort	UCLA Loneliness Scale[b]	18.1% (12.9%, 24.7%)	Period estimate (4–5 months)
33/26	≥ 65 years	Moderate	73.5 (5.8)	Cohort	Single global question	10.2% (4.60%, 20.8%)	Past week
NA	≥ 65 years	Moderate	NA	Cross-sectional	Single global question	26.5% (25.2%, 27.9%)	Last 4 weeks
84/114	≥ 70 years	Low	73.7 (4.2)	Cross-sectional	Single global question	26.8% (21.1%, 33.4%)	Past week
11/27	≥ 70 years	High	83.0 (6.3)	Cross-sectional	De Jong Gierveld Loneliness scale (cut-off of ≥ 2)	40.0% (25.3%, 56.7%)	Period estimate (2–3 months)
433/559	≥ 65 years	Moderate	75.5 (7.1)	Cross-sectional	UCLA Loneliness Scale (cut-off of ≥ 6)	13.1% (11.1%, 15.3%)	Period estimate (2 months)
71/66	≥ 75 years	Moderate	84	Cohort	Single global question	27.0% (20.2%, 35.0%)	Past week
NA	NA	Moderate	NA	Cohort	UCLA Loneliness Scale (cut-off of ≥ 6)	24.7% (23.4%, 26.1%)	Period estimate (2–3 months)
NA	≥ 65 years	Moderate	NA	Cross-sectional	Single global question	43.1% (41.8%, 44.5%)	Past week
11/27	≥ 70 years	High	83.0 (6.3)	Cross-sectional	De Jong Gierveld Loneliness –Scale (cut-off of ≥ 2)	39.5% (25.4%, 55.6%)	Period estimate (2–3 months)
NA	≥ 70 years	HIgh	NA	Cohort	Single global question	27.7% (24.9%, 30.6%)	Past 1 month
NA	≥ 70 years	Low	NA	Cross-sectional	Three-Item Loneliness Scale (TILS) (cut-off of ≥ 7)	13.8% (5.3%, 31.5%)	Period estimate (4–6 months)
38/86	≥ 75 years	Moderate	82.5	Cross-sectional	Single global question	22.6% (16.1%, 30.8%)	Period estimate (2 months)
NA	≥ 70 years	Low	NA	Cross-sectional	Single global question	42.6% (30.2%, 56.0%)	Period estimate (1 month)
225/331	≥ 65 years	Low	NA	Cross-sectional	Single global question	5.4% (3.8%, 7.6%)	NA
44/78	≥ 65 years	Moderate	NA	Cohort	Berkman-Syme social isolation index	39.3% (31.1%, 48.3%)	Past week
NA	≥ 65 years	Low	NA	Cohort	The number of social roles[a]	48.8% (41.3%, 56.4%)	Period estimate (4–5 months)
433/559	≥ 65 years	Moderate	75.5 (7.1)	Cross-sectional	Two questions	13.4% (11.4%, 15.7%)	Past week
1945/2260	≥ 70 years	Low	NA	Cross-sectional	Study specific questionnaire	27.9% (26.6%, 29.3%)	Period estimate (6–7 months)
433/522	≥ 70 years	Low	79.6	Cohort	Social Isolation Index	18.6% (16.3%, 21.2%)	Past 1 month
1019/402	≥ 65 years	Low	NA	Cross-sectional	Lubben Social Network Scale	51.6% (49.0%, 53.4%)	Period estimate (3 months)

(a)

(b)
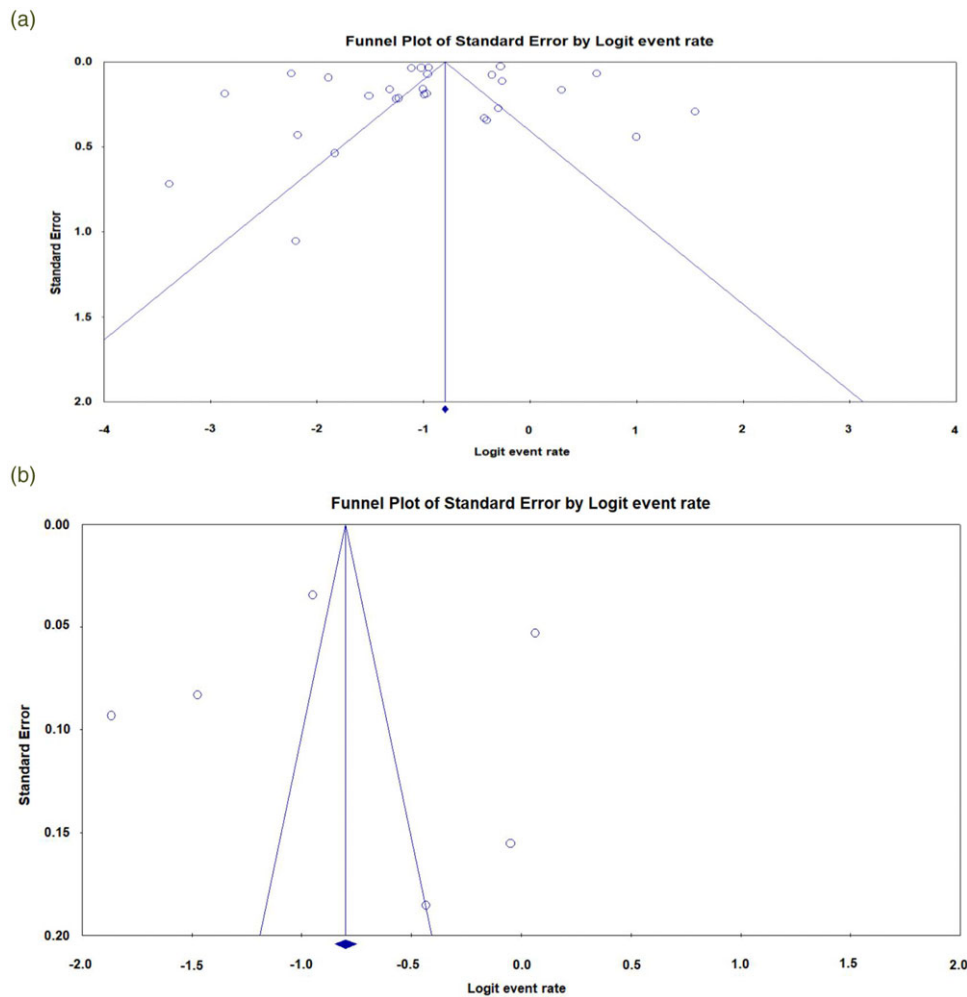
Figure 2. Funnel plots for the prevalence of loneliness (a) and social isolation (b) among older adults during the COVID-19 pandemic.

levels of loneliness and social isolation during the COVID-19 outbreak (Li and Wang, 2020; Teater *et al.*, 2021). This is in part explained by Carstensen's socio-emotional selectivity theory, which posits that older populations require fewer social interactions than younger populations, thus loneliness is not as prevalent among older people (Carstensen, 1992). Future research is warranted to examine whether older populations are more resilient to the issues of loneliness and social isolation than younger people during the medical pandemics.

Evidence has been well established to illustrate the detrimental effects of loneliness on health, in particular, focusing on the stress response. For example, increased cortisol levels could create physiological changes, and potential mechanisms may be related to behavioral changes such as unhealthy lifestyles (Kobayashi and Steptoe, 2018; Xia and Li, 2018). Given the high prevalence of loneliness and social isolation, it is urgent to address these psychological needs and to guide psychological interventions that not only address the negative

consequences of social isolation and loneliness among the elderly but also make interventions accessible and appropriate for older adults.

The review identified a slightly higher prevalence of social isolation compared to loneliness among older adults during the COVID-19 pandemic. Social isolation and loneliness assessed the objective and subjective aspects of being alone, respectively (Wenger and Burholt, 2004). Social isolation and loneliness were generally non-overlapping social experiences, with only 5% of older adults experiencing both (Kotwal *et al.*, 2021). The higher prevalence of social isolation in part may be associated with social distancing which adds difficulties to connect others among the older population (Sepúlveda-Loyola *et al.*, 2020), whereas loneliness may occur through pathways unrelated to the frequency of social network interaction, including from existing distress and anticipatory grief (Kotwal *et al.*, 2021). In the situation of a pandemic, older adults may downgrade their subjective perception of what constitutes adequate feelings of companionship
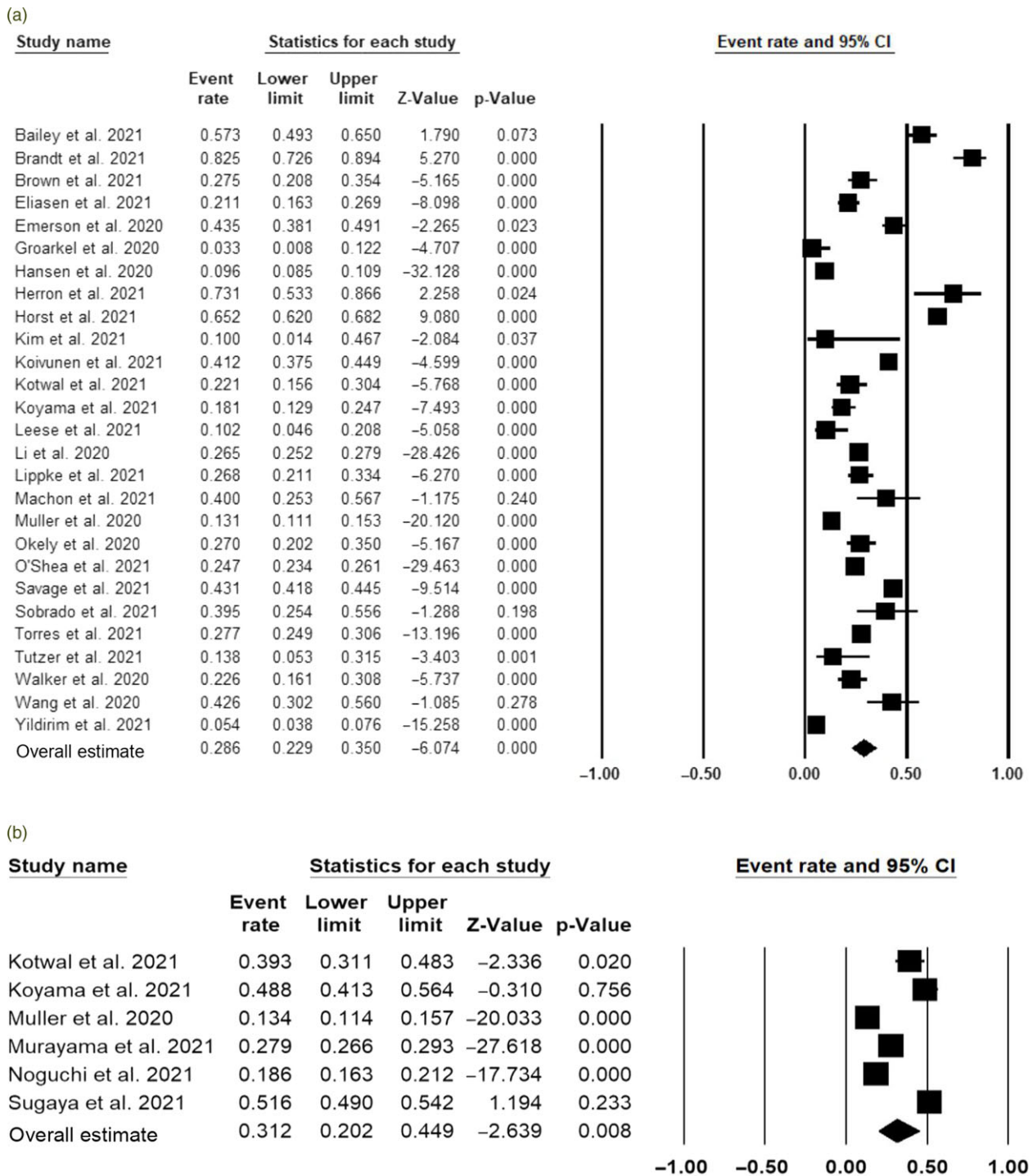
(a)

Study name	Statistics for each study					Event rate and 95% CI
	Event rate	Lower limit	Upper limit	Z-Value	p-Value	
Bailey et al. 2021	0.573	0.493	0.650	1.790	0.073	
Brandt et al. 2021	0.825	0.726	0.894	5.270	0.000	
Brown et al. 2021	0.275	0.208	0.354	−5.165	0.000	
Eliasen et al. 2021	0.211	0.163	0.269	−8.098	0.000	
Emerson et al. 2020	0.435	0.381	0.491	−2.265	0.023	
Groarkel et al. 2020	0.033	0.008	0.122	−4.707	0.000	
Hansen et al. 2020	0.096	0.085	0.109	−32.128	0.000	
Herron et al. 2021	0.731	0.533	0.866	2.258	0.024	
Horst et al. 2021	0.652	0.620	0.682	9.080	0.000	
Kim et al. 2021	0.100	0.014	0.467	−2.084	0.037	
Koivunen et al. 2021	0.412	0.375	0.449	−4.599	0.000	
Kotwal et al. 2021	0.221	0.156	0.304	−5.768	0.000	
Koyama et al. 2021	0.181	0.129	0.247	−7.493	0.000	
Leese et al. 2021	0.102	0.046	0.208	−5.058	0.000	
Li et al. 2020	0.265	0.252	0.279	−28.426	0.000	
Lippke et al. 2021	0.268	0.211	0.334	−6.270	0.000	
Machon et al. 2021	0.400	0.253	0.567	−1.175	0.240	
Muller et al. 2020	0.131	0.111	0.153	−20.120	0.000	
Okely et al. 2020	0.270	0.202	0.350	−5.167	0.000	
O'Shea et al. 2021	0.247	0.234	0.261	−29.463	0.000	
Savage et al. 2021	0.431	0.418	0.445	−9.514	0.000	
Sobrado et al. 2021	0.395	0.254	0.556	−1.288	0.198	
Torres et al. 2021	0.277	0.249	0.306	−13.196	0.000	
Tutzer et al. 2021	0.138	0.053	0.315	−3.403	0.001	
Walker et al. 2020	0.226	0.161	0.308	−5.737	0.000	
Wang et al. 2020	0.426	0.302	0.560	−1.085	0.278	
Yildirim et al. 2021	0.054	0.038	0.076	−15.258	0.000	
Overall estimate	0.286	0.229	0.350	−6.074	0.000	

(b)

Study name	Statistics for each study					Event rate and 95% CI
	Event rate	Lower limit	Upper limit	Z-Value	p-Value	
Kotwal et al. 2021	0.393	0.311	0.483	−2.336	0.020	
Koyama et al. 2021	0.488	0.413	0.564	−0.310	0.756	
Muller et al. 2020	0.134	0.114	0.157	−20.033	0.000	
Murayama et al. 2021	0.279	0.266	0.293	−27.618	0.000	
Noguchi et al. 2021	0.186	0.163	0.212	−17.734	0.000	
Sugaya et al. 2021	0.516	0.490	0.542	1.194	0.233	
Overall estimate	0.312	0.202	0.449	−2.639	0.008	

Figure 3. Forest plots of prevalence of loneliness (a) and social isolation (b) among older adults during the COVID-19 pandemic.

(Shiovitz-Ezra *et al.*, 2018). Identification of differences in social isolation and loneliness can better prepare health care systems to address these needs and make interventions accessible and appropriate for older adults.

We also found that the prevalence of loneliness and social isolation varied according to the phases of the COVID-19 pandemic. The prevalence of loneliness and social isolation was significantly higher after the first 3 months of the pandemic. It is understandable that loneliness and social isolation increased over time as the pandemic and its control measures continue and produce cumulative effects on these psychological issues. As the pandemic is likely to last longer than anticipated, leading to long-term consequences due to its health, economic, and societal impacts (The Lancet Public Health, 2020), the need to tackle the rising tide of social

Table 2. Subgroup analysis of the pooled prevalence of loneliness and social isolation

CHARACTERISTICS	SUBGROUPS	NUMBER OF STUDIES	PREVALENCE (%)	95% CI (%)	I^2 (%)	Q (P ACROSS SUBGROUPS)
Loneliness						
Whether studies were conducted during the first 3 months of the COVID-19 pandemic or post third month	Within the first 3 months	11	25.6	18.9, 33.7	98.0	**34.73 (p < 0.01)**
	More than 3 months	13	31.3	23.0, 41.0	97.3	
Measurement of prevalence estimates	Period estimate (Less than 1 month)	8	27.2	17.7, 39.4	99.1	0.49 (0.92)
	Period estimate (1–2 months)	8	28.2	19.7, 33.9	95.4	
	Period estimate (More than 2 months)	8	32.4	17.9, 51.2	95.0	
Geographical regions	Asia	3	24.4	10.1, 48.0	85.4	2.56 (0.32)
	Europe	15	25.5	18.2, 34.6	98.0	
	North and South America	9	35.0	25.6, 45.7	98.8	
The severity level based on the new COVID-19 positive cases at the time each study was conducted (per 1 million population)[a]	Low	8	23.2	12.5, 39.0	97.4	3.00 (0.22)
	Moderate	13	25.8	19.9, 32.6	98.1	
	High	4	40.7	24.4, 59.2	94.0	
Social isolation						
Whether studies were conducted within the first 3 months of the COVID-19 pandemic or not	Within the first 3 months	2	15.9	11.4, 21.7	89.9	**11.44 (p < 0.01)**
	More than 3 months	4	41.5	26.7, 57.9	98.9	
Measurement of prevalence estimates	Period estimate (Less than 1 month)	4	28.3	12.1, 53.0	99.3	0.36 (0.55)
	Period estimate (More than 1 month)	2	37.5	19.9, 59.2	96.9	
Geographical regions	Japan	4	35.3	21.7, 51.8	99.2	0.48 (0.49)
	Others	2	23.9	7.2, 56.1	97.9	
The severity level based on the new COVID-19 positive cases at the time each study was conducted (per 1 million population)[a]	Low	4	35.3	21.7, 51.8	99.2	0.48 (0.49)
	Moderate	2	23.9	7.2, 56.1	97.9	

[a]The source of the estimate is from: https://ourworldindata.org/covid-cases.

isolation and loneliness becomes more important. The findings of the meta-regression analyses also showed that two study quality items (probability sampling methods and whether using representative samples) were linked with the pooled prevalence of loneliness. Sampling procedures are related to selection bias, which negatively influences the interval validity of the results. Our finding also supports the previous studies suggesting that older women tended to report more frequent and greater perceived intensity of social isolation and were more vulnerable than older men in regard to social isolation (Baumeister *et al.*, 2010). This may represent that older women rely more heavily on social connections. Thus, they may be more vulnerable to be socially and emotionally affected by being less connected with their social environment and more likely to use healthcare services for social isolation, especially during the pandemic (Shukla *et al.*, 2020). We did not observe statistical significances in geographical regions, the severity level of COVID-19 spread, or measurements of prevalence estimates for both loneliness and social isolation. The high heterogeneity in the review adds variations across studies, which are linked with wide confidence intervals. The high heterogeneity indicates that period prevalence varied considerably between the included studies. These pooled estimates should be interpreted with caution given to the existence of high heterogeneity. The high heterogeneity across prevalence studies was also expected compared to meta-analyses of other types of data (Migliavaca *et al.*, 2022). Future studies with more consistent study characteristics (including measurements, sampling procedures, and the phrases of the pandemic) are warranted.

There are several limitations to be noted. First, this review identified the high heterogeneity between studies, and the heterogeneity was not associated with study characteristics examined in subgroup analysis and meta-regression analysis, except the phases of the COVID-19 pandemic and study sample selections. Different measurements of loneliness and social isolation, study population, and study design of the included studies could be the sources of heterogeneity. Second, the majority of the included studies were cross-sectional, which provided only a snapshot of the prevalence. It limited us to compare the rates across different phases of the COVID-19 pandemic. Third, although a comprehensive search strategy was used to assess the prevalence of loneliness and social isolation during the last two decades, this review only identified studies published during the COVID-19 pandemic. No comparison on the impact of a pandemic on these psychological issues can be inferred. Lastly, most of the included studies were conducted within the first 6-month of the COVID-19 outbreak. The medium and long-term impact of the COVID-19 pandemic on social isolation and loneliness is not currently available. Future research on the long-term impact of the COVID-19 pandemic or other pandemics on loneliness and social isolation is needed.

Conclusions

Overall, the pooled prevalence of loneliness and social isolation among older adults during the COVID-19 pandemic was striking. As the COVID-19 pandemic continues to last, the pooled prevalence of loneliness and social isolation among the older population is likely to increase as the prevalence of loneliness and social isolation was significantly higher in studies conducted after the third month of the COVID-19 pandemic compared to the similar prevalence reported in studies conducted within the first 3 months of the pandemic. Health policymaking and the healthcare systems need to address the rising demand of psychological needs by applying effective psychological interventions that are tailored to the needs of older adults. The findings of the review also highlighted the need for longitudinal studies to examine the long-term impacts of pandemics, such as COVID-19, on loneliness and social isolation among older populations.

Conflict of interest

None.

Description of authors' roles

All the authors contributed to the planning, development, and editing of the systematic review. XM designed this review. YS and WR conducted the search, together with XM reviewed the articles returned by the search for eligibility and reviewed all data extraction. YS prepared the first manuscript draft. XM, ML, GC, and CD oversaw the project, provided feedback on all steps of the search and data extraction and interpretation. All authors contributed to the writing, revisions, and editing of the final manuscript.

Supplementary material

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