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Global overview of suicidal behavior and risk factors among the general population during the COVID-19 pandemic: a scoping review

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Abstract

Background The COVID-19 pandemic, declared by the World Health Organization in early 2020, rapidly escalated from a global health crisis to a significant public health issue worldwide. This scoping review aims to provide a comprehensive global overview of suicidal behavior and associated risk factors during the COVID-19 pandemic.

Methods Adhering to the PRISMA 2020 guidelines, literature searches were conducted across five databases: Embase, MEDLINE, CINAHL, Web of Science, and Academic Search Complete. The review encompassed studies published from January 1, 2019, to November 29, 2023. A total of 286 studies met the inclusion criteria, offering a broad perspective on suicidal behaviors during the pandemic. The studies underwent quality assessment using the Joanna Briggs Institute (JBI) Critical Appraisal for Checklist for Prevalence Studies Scale (CACPSS).

Results The highest rates of suicidal behavior were observed in the Americas, Europe, and the Western Pacific Region, with China and the United States reporting significant cases. Key risk factors included demographic characteristics, mental health conditions, and social support factors. Suicidal ideation prevalence rates ranged significantly, with the highest in some regions exceeding 50%. Suicide attempts and completed suicides also showed considerable variation across different countries and regions.

Conclusion The findings emphasize the need for targeted mental health interventions and policies to reduce suicide risk, highlighting the multifaceted nature of suicidal behaviors during the COVID-19 pandemic. Comprehensive, multidisciplinary approaches are necessary to address this pressing concern, and understanding the interplay among diverse risk factors is crucial for developing effective prevention and intervention strategies.

Keywords COVID-19, Suicidal behavior, Suicidal ideation, Suicide attempts, Suicide

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Introduction

The COVID-19 pandemic, declared by the World Health Organization (WHO) in early 2020, rapidly transcended its role as a global health crisis to impact various facets of human life. As the world grappled with the direct health implications of the virus, an emerging concern gained a prominent impact on mental health. Individuals worldwide have experienced unprecedented levels of stress, anxiety, and social disruption, prompting an urgent need to explore the associated risks, particularly in terms of suicidal behavior [1–4].

The significance of this study lies in its ambition to offer a global perspective on the prevalence and correlates of suicidal behavior during the ongoing COVID-19 pandemic. Although our previous research has shed light on the mental health challenges posed by emerging diseases, such as people living with HIV, a systematic and inclusive overview of suicidal behaviors, encompassing a multitude of risk factors among HIV patients [5, 6], is crucial for informing targeted interventions and policy decisions.

The implications of this study extend beyond academia to public health practitioners, policymakers, and mental health professionals worldwide. By synthesizing and categorizing findings from diverse studies, we aim to provide a nuanced understanding of the interconnected demographic, psychological, physiological, economic, social support, and environmental factors influencing suicidal behaviors [1, 7–11]. A scoping review highlighted various factors that contributed to heightened suicide risk during the pandemic. These factors include increased stress due to lockdowns, social isolation, economic downturns, and fear of infection, which exacerbated symptoms of anxiety, depression, and other mental disorders. In longitudinal studies from countries like the USA, Spain, and Denmark, findings indicated that patients with mental health conditions, such as obsessive-compulsive disorder and post-traumatic stress disorder, were more vulnerable to suicidal ideation. The study also noted that, while suicide rates did not consistently rise in all regions, the pandemic's influence on mental health, along with reduced access to psychiatric services, may have worsened outcomes for those already at risk [12]. Such insights are invaluable for tailoring interventions and support systems to the specific needs of diverse populations, ultimately contributing to the global effort to address the mental health ramifications of the pandemic.

Despite the wealth of studies examining mental health during the COVID-19 pandemic, there is a notable gap in the literature concerning a consolidated global overview of suicidal behavior and its associated risk factors [13]. While individual studies provide valuable insights, the scattered nature of existing research hampers a comprehensive understanding of the broader landscape [14, 15]. Our scoping review aims to bridge this gap by systematically analyzing and categorizing findings from a diverse range of studies, offering a holistic view of the prevalence and correlates of suicidal behavior globally.

Furthermore, existing research often exhibits regional biases, with a disproportionate number of studies originating from specific countries, particularly China [16] and the United States [1]. This potential bias limits the generalizability of the findings to a global context. Our study addresses this limitation by encompassing a broad spectrum of countries and regions, ensuring a more representative and nuanced understanding of suicidal behaviors during the pandemic.

Therefore, our scoping review not only fills a critical gap in the literature but also contributes a holistic and globally inclusive perspective on suicidal behavior during the COVID-19 pandemic. The findings are expected to inform evidence-based interventions, policies, and mental health support systems on a global scale. We employ a scoping review methodology to encompass a wide array of studies conducted across diverse regions, aiming to identify and categorize the intricate web of risk factors associated with suicidal behaviors.

The aim of this scoping review is to provide a global overview of suicidal behaviors and risk factors during the COVID-19 pandemic.

Methods

Study design

This systematic review was conducted per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The protocol of this review has been registered on INPLASY (INPLASY202390101).

Search strategy

A literature search was conducted across six databases: Embase, MEDLINE, CINAHL, Web of Science, and Academic Search Complete. This comprehensive search strategy was developed through consultations with a public health librarian and five research team members to clarify the research goals and refine the selection criteria. The review included studies published from January 1, 2019, to March 29, 2023.

In each database, we used English synonyms such as coronavirus, acute respiratory disease, 2019-nCoV, COVID-19, and SARS-CoV to identify instances of suicidal behavior during the COVID-19 pandemic. We also included control phrases derived from the Emtree and Medical Subject Headings (MeSH) databases. In Emtree, these control phrases included 'SARS-related coronavirus', 'suicidal behavior', 'automutilation', and 'suicide.' The

MeSH control phrases included "Wuhan seafood market pneumonia virus", "Wuhan coronavirus", "SARS coronavirus", "MERS-CoV", and "self-injurious behavior."

To enhance the comprehensiveness of the search, we supplemented the results with the EndNote X9 bibliographical database. Finally, the search results underwent manual screening, which included reviewing the reference lists of relevant articles and previous systematic reviews to ensure the sensitivity and completeness of the search strategy.

The eligibility criteria

The inclusion criteria were as follows: (1) studies providing primary data on the prevalence or incidence of suicidal ideation, suicide attempts, or completed suicides, assessed using validated measurement tools or coded medical records, within the context of a population-based investigation; (2) studies involving participants during the COVID-19 pandemic; and (3) reports that were original, peer-reviewed articles. The exclusion criteria were as follows: (1) studies in which the study population did not encompass the period of the COVID-19 pandemic; (2) studies unrelated to suicide; and (3) case reports and review studies.

Quality assessment

All eligible studies were assessed for quality using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Prevalence Studies Scale (CACPSS) [17]. This tool includes nine items, each with four possible responses: yes, no, unclear, and not applicable [17]. Studies that scored eight points or higher were classified as having high-quality evidence and were included in this systematic review. Five researchers independently evaluated the quality and risk of bias of each study, resolving any disagreements through consultation with a sixth researcher.

Data extraction

The data extraction process was documented using a standardized Excel sheet, which recorded the following details: author names, publication year, journal name, country, study setting, study design, sample size, risk factors for suicide, available measurement tools, and prevalence rates for suicidal ideation, suicide attempts, and completed suicides (Table 1).

Qualitative synthesis

A qualitative synthesis was conducted to analyze the findings from the data extraction and explore the main themes of the selected studies. Six researchers independently carried out this synthesis, concentrating on the baseline risk factors for participants, as well as the rates of suicidal ideation, suicide attempts, and completed suicides (Table 1). After reaching a unanimous agreement, all authors collaboratively developed a structural model to represent the consistent risk factors (Fig. 3).

Results

Study identification

After conducting searches across five databases, a total of 4,694 articles published between January 1, 2019, and March 29, 2023, were initially identified (Ovid Medline, 595; Embase, 1,740; CINAHL, 172; Web of Science, 1,484; Academic Search Complete, 685; supplemented by 18 articles from manual searches). After removing 1,645 duplicate reports, the titles and abstracts of the remaining 3,049 articles were screened. Among these, 1,725 were excluded during abstract screening, including 420 lacking relevant information, 1,058 being theses, 170 being reviews, 55 being case studies, and 22 being qualitative studies.

In this systematic review, 1,324 articles met the inclusion criteria and were deemed eligible for seven-year consideration. The remaining 1,038 articles were excluded based on the following criteria: 76 did not reference COVID-19, 819 did not address suicidal behavior, 88 did not assess the outcome variables, and 55 were unavailable in full-text format. After undergoing quality assessment, 286 articles met the inclusion criteria for this scoping review (Fig. 1). All included studies were published as full articles in peer-reviewed journals.

Study characteristics

A total of 286 articles were published during the past four years (2020–2023). Studies were conducted in 48 countries (China, the United States, Spain, Japan, Canada, the Republic of Korea, Italy, Bangladesh, France, the United Kingdom, Greece, Mexico, Australia, Brazil, Ireland, Türkiye, Uganda, Germany, Poland, Austria, India, Iran, Malaysia, Norway, Pakistan, Belgium, Chile, Colombia, Czech Republic, Israel, the Russian Federation, Sweden, Switzerland, Thailand, Arabia, Argentina, Czechia, Eswatini, Georgia, Latvia, Lebanon, Lithuania, the Netherlands, New Zealand, Peru, Saudi Arabia, Slovenia, Taiwan). Forty-four studies were conducted in China (Western Pacific Region), 43 in the United States (Region of the Americas), 16 in Spain (European Region), and 15 in Japan, yielding the highest number of publications for these countries (Fig. 2). According to the WHO regions, 95 studies were conducted in the European Region, followed by 81 in the Western Pacific Region, 73 in the Region of the Americas, 15 in the Southeast Asia Region, 9 in the Eastern Mediterranean Region, 6 in the African Region, and 7 in multiple other regions (Fig. 2).

The studies were published between 2020 and 2023, with 142 published in 2022 (Fig. 2). In terms of study

Table 1 Study characteristics of selected 286 studies

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Cheung, T. et al. (2020) [1]	Cross-sectional study	Region of the Americas European Region Western Pacific Region.	United States, Canada, United Kingdom, Brazil, Philippines, Korea, Turkey, China (Hong Kong, Macau).	25,053	M: 5,687 (22.7%) F: 19,366 (77.3%)	Patient Health Questionnaire (PHQ-9)	15.66% (*n* = 3,891)	N/A	N/A	Younger age, male, married, differences in health beliefs.
D'Hondt, F. et al. (2020) [2]	Cross-sectional study	European Region	France	69,054	M: 18,019 (26.1%) F: 50,251 (72.8%) Nonbinary:784 (1.1%)	Self-reported suicidal thoughts and severe distress (IES-R).	11.40% (*n* = 7,891)	N/A	N/A	Female, nonbinary, precariousness income, low-quality housing, history of psychiatric follow-up, symptoms compatible with COVID-19, social isolation, low quality of the information received.
Fisher, J. R. et al. (2020) [3]	Cross-sectional study	Western Pacific Region	Australia	13,829	N/A	PHQ-9	14.60% (*n* = 1,692)	N/A	N/A	N/A
Graell, M. et al. (2020) [4]	Retrospective study	European Region	Spain	365	M: 44 (12.1%). F: 321 (87.94%)	N/A	25% (*n* = 35)	N/A	N/A	N/A
Kim, J. W. et al. (2020) [5]	Cross-sectional study	Western Pacific Region	Republic of Korea	33	N/A	Beck Depression Inventory (BDI)	9% (*n* = 3)	N/A	N/A	N/A
Lim, R. et al. (2020) [6]	Cross-sectional study	Region of the Americas	Canada	371	M: 213 (57.4%) F: 158 (42.6%)	PHQ-9	14.30% (*n* = 53)	N/A	N/A	N/A
Mamun, M. A. et al. (2020) [7]	Cross-sectional study	South-East Asia Region	Bangladesh	3,388	M: 1,634 (48.2%) F: 1,754 (51.8%)	N/A	6.08% (*n* = 206)	N/A	N/A	Female, being divorced, and having no child.
Ren, Y. et al. (2020) [8]	Cross-sectional study	Western Pacific Region	China	1,172	M: 360 (30.7%) F: 812 (69.3%)	PHQ-9	2.90% (*n* = 34)	N/A	N/A	N/A
Sharif, S. et al. (2020) [9]	Cross-sectional study	Western Pacific Region	China	375	N/A	Self-Reporting Questionnairee20 (SRQ-20)	5% (*n* = 19)	N/A	N/A	N/A
Talarowska, M. et al. (2020) [10]	Cross-sectional study	European Region	Poland	443	M: 95 (21.4%) F: 348 (78.6%)	GHQ D depression.	N/A	10.80% (*n* = 48)	N/A	N/A
Tasnim, R. et al. (2020) [11]	Cross-sectional study	South-East Asia Region	Bangladesh	3,331	M: 1,979 (59.4%) F: 1,352 (40.6%)	Depression, Anxiety, and Stress Scale (DASS-21).	12.82% (*n* = 427)	N/A	N/A	Less sleep, excess sleep, cigarette smoking, past suicidal thoughts, suicide attempt history, family history of suicidality, depression, anxiety, and stress.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Winkler, P. et al. (2020) [12]	Cross-sectional study	European Region	Czechia	3,021	M: 1,581 (52.3%) F: 1,440 (47.7%)	N/A	11.88% (*n* = 359)	N/A	N/A	N/A
Al-Humadi, S. et al. (2021) [13]	Cross-sectional study	Region of the Americas	United States	225	M: 96 (42.7%) F: 129 (57.3%)	PHQ-9	6.67% (*n* = 15)	N/A	N/A	Younger age, history of prior depression or anxiety, frequency of on-call in work.
Ammerman, B. et al. (2021) [14]	Cross-sectional study	Region of the Americas	United States	472	M: 263 (55.7%) F: 205 (44.3%)	PHQ-9	27.33% (*n* = 129)	N/A	N/A	N/A
Antonelli-Salgado, T. et al. (2021) [15]	Cross-sectional study	Region of the Americas	Brazil	8,104	M: 1,094 (13.5%) F: 7,010 (86.5%)	PHQ-9	22.60% (*n* = 1,831)	N/A	N/A	Living alone, number of days practicing social distancing, loneliness.
Arsandaux, J. et al. (2021) [16]	Cross-sectional study	European Region	France	1,919	M: 480 (25%) F: 1,439 (75%)	PHQ-9	10.11% (*n* = 194)	N/A	N/A	N/A
Auny, F. M. et al. (2021) [17]	Cross-sectional study	South-East Asia Region	Bangladesh	324	M: 213 (65.7%) F: 111 (34.3%)	PHQ-9	6.48% (*n* = 21)	N/A	N/A	N/A
Ayuso-Mateos, J. L. et al. (2021) [18]	Cross-sectional study	European Region	Spain	1,103	M: 437 (39.6%) F: 666 (60.4%)	Composite International Diagnostic Interview (CIDI 3.0)	2.18% (*n* = 24)	N/A	N/A	N/A
Bond, Allison E. et al. (2021) [19]	Cross-sectional study	Region of the Americas	United States	3,499	N/A	Self-Injurious Thoughts and Behaviors Interview-Revised	3.20% (*n* = 462)	N/A	N/A	Black, indigenous, and people of color (BIPOC).
Bonsaksen, T. et al. (2021) [20]	Cross-sectional study	European Region	Norway	4,527	N/A	N/A	3.60% (*n* = 163)	0.20% (*n* = 9)	N/A	Suicide attempts, lower age, daily alcohol use, being in the risk group for COVID-19 complications, and having economic concerns related to the pandemic.
Briggs, R. et al. (2021) [21]	Longitudinal study	European Region	Ireland	8,174	M: 3,746 (45.8%) F: 4,428 (54.2%)	Centre for Epidemiological Studies Depression Scale	3.50% (*n* = 279)	N/A	N/A	Both persistent loneliness and depressive symptoms.
Bruffaerts, R. et al. (2021) [22]	Cross-sectional study	European Region	Belgium	6,409	N/A	PHQ-9	1.50% (*n* = 96)	N/A	N/A	Depression.
Bryant-Genevier, J. et al. (2021) [23]	Cross-sectional study	Region of the Americas	United States	26,174	N/A	PHQ-9	8.40% (*n* = 2,199)	N/A	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Canzi, G. et al. (2021) [24]	Retrospective study	European Region	Italy	181	N/A	N/A	N/A	17.13% (*n* = 31)	N/A	N/A
Chakrabarti, S. et al. (2021) [25]	Observational study	South-East Asia Region	India	590	M: 355 (60.1%) F: 235 (39.9%)	PHQ-9	5.08% (*n* = 30)	N/A	N/A	Separated or divorced, cancer, suburban residence, graduates.
Chen, Y. et al. (2021) [26]	Cross-sectional study	Western Pacific Region	China	2,700	M: 673 (24.9%) F: 2,027 (75.1%)	Positive and Negative Suicidal ideation (PANSI) Social Support Scale (SSRS).	5.40% (*n* = 146)	N/A	N/A	Residence before returning to school, lower objective support, poorer relationship with the mother.
Chodkiewicz, J. et al. (2021) [27]	Cross-sectional study	European Region	Poland	618	M: 118 (19.1%) F: 500 (80.9%)	N/A	23.62% (*n* = 146)	N/A	N/A	N/A
Czeisler, M. E. et al. (2021) [28]	Cross-sectional study	Region of the Americas	United States	1,648	M: 838 (50.8%) F: 789 (47.9%)	N/A	30.58% (*n* = 504)	N/A	N/A	N/A
Czeisler, M. E. et al. (2021) [29]	Cross-sectional study	Region of the Americas	United States	1,362	M: 679 (49.9%) F: 683 (50.1%)	PHQ-4	33.33% (*n* = 454)	N/A	N/A	Young people.
DeVylder, J. et al. (2021) [30]	Cross-sectional study	Region of the Americas	United States	16,315	M: 6,549 (40.1%) F: 9,212 (56.5%) Trans/other: 553 (3.4%)	N/A	13.42% (*n* = 2,190)	1.30% (*n* = 209)	N/A	COVID-19.
Du, N. et al. (2021) [31]	Retrospective study	Western Pacific Region	China	609	M: 77 (12.6%) F: 532 (87.4%)	N/A	N/A	51.23% (*n* = 312)	N/A	Female, older age, having a single parent, having experienced trauma, having experienced social isolation from peers, having experienced body-focused bullying, overuse of a mobile phone in the parents' opinions, having attempted suicide during the pandemic.
Efstathiou, V. et al. (2021) [32]	Longitudinal study	European Region	Greece	811	M: 202 (24.91%) F: 607 (74.85%) Other: 2 (0.10%)	PHQ-9	4.32% (*n* = 35)	N/A	N/A	Anxiety, depression, suicidal ideation, living with a person with frail health and vulnerable to severe COVID-19 infection emerged.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Eleftheriou, A. et al. (2021) [33]	Cross-sectional study	European Region	Greece	559	M: 164 (30.4%) F: 389 (69.6%)	PHQ-9	9.84% (*n* = 55)	N/A	N/A	N/A
Fountoulakis, K. N. et al. (2021) [34]	Cross-sectional study	European Region	Greece	3,399	M: 621 (18.27%). F: 2,756 (81.08%) Other: 22 (0.64%)	N/A	N/A	6.10% (*n* = 207)	N/A	N/A
Gesi, C. et al. (2021) [35]	Retrospective study	European Region	Italy	195	N/A	N/A	17.95% (*n* = 35)	2.05% (*n* = 4)	N/A	N/A
Greenberg, N. et al. (2021) [36]	Cross-sectional study	Western Pacific Region	Korea	709	N/A	PHQ-9	13% (*n* = 93)	N/A	N/A	N/A
Habu, H. et al. (2021) [37]	Cross-sectional study	Western Pacific Region	Japan	47,770	M: 16,864 (35.30%) F: 23,336 (48.85%)	N/A	N/A	0.98% (*n* = 467)	N/A	Female, aged 25–49 years.
Han, J. M. et al. (2021) [38]	Cross-sectional study	Western Pacific Region	Korea	54,948	M: 28,353 (51.9) F: 26,595 (48.1)	N/A	10.90% (*n* = 5,989)	N/A	N/A	Lower perceived household economic status.
Hermosillo-de-la-Torre, A. E. et al. (2021) [39]	Cross-sectional study	Region of the Americas	Mexico	8,033	M: 3910 (487%) F: 4123 (51.3%)	The suicidal behaviors schedule (CCS)	N/A	11.17% (*n* = 897)	N/A	Female sex, depression, hopelessness, anxiety, alcohol and tobacco use, childhood trauma, and having to self-rely are issues affecting attachment and low self-esteem.
Hou, T. et al. (2021) [40]	Cross-sectional study	Western Pacific Region	China	761	N/A	PHQ-9	36.40% (*n* = 277)	10.38% (*n* = 79)	N/A	Suicidal ideation: parental educational level, maladaptive strategies, anxiety, depression. Suicidal attempts: Age, maladaptive strategies, anxiety, depression.
Imran, N. et al. (2021) [41]	Cross-sectional study	Eastern Mediterranean Region	Pakistan	1,100	M: 344 (31.3%) F: 756 (68.7%)	PHQ-9	22.45% (*n* = 247)	13.36% (*n* = 147)	N/A	N/A
Jarrett, B. A. et al. (2021) [42]	Cross-sectional study	South-East Asia region European Region.	Thailand (20.6%) Turkey (27.4%) Russia (11.5%)	928	N/A	PHQ-4	17.67% (*n* = 164)	N/A	N/A	N/A
Katyal, J. et al. (2021) [43]	Cross-sectional study	South-East Asia Region	India	317	M: 162 (51.10%) F: 155 (51.10%)	Mini International Neuropsychiatric Interview (MINI).	5.36% (*n* = 17)	N/A	N/A	Polytherapy, seizures during pandemic.
Keshavarzi, F. et al. (2021) [44]	Cross-sectional study	Western Pacific Region	Malaysia	383	M: 166 (43.3%), F: 217 (56.7%)	Overall Perceived Stress Scale-10 (PSS).	11.23% (*n* = 43)	N/A	N/A	Loneliness, feeling social isolation.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Khosravani, V. et al. (2021) [45]	Cross-sectional study	Eastern Mediterranean Region	Iran	304	M: 126 (41.4%) F: 178 (58.6%)	PHQ-4	N/A	22.70% (*n* = 69)	N/A	Obsessive-compulsive disorder (OCD).
Killgore, W. D. S. et al. (2021) [46]	Cross-sectional study	Region of the Americas	United States	1,013	N/A	PHQ-9 BDI	17.57% (*n* = 178)	N/A	N/A	N/A
Kim, S. Y. et al. (2021) [47]	Cross-sectional study	Western Pacific Region	Korea	92,659	M: 48,020 (51.8%) F: 44,639 (48.2%)	N/A	11.45% (n= 10,609)	2.20% (n= 2,043)	N/A	N/A
Knudsen, A. K. S. et al. (2021) [48]	Cross-sectional study	European Region	Norway	2,154	M: 899 (39.2%) F: 1255 (60.8%)	N/A	3.67% (*n* = 79)	N/A	N/A	N/A
Ko, M. et al. (2021) [49]	Cross-sectional study	Western Pacific Region	Korea	1,151	M: 380 (33.0%) F: 771 (67.0%)	PHQ-9	18.85% (*n* = 217)	N/A	N/A	N/A
Kohls, E. et al. (2021) [50]	Cross-sectional study	European Region	Germany	3,382	M: 967 (28.6%) F: 2374 (70.2%) Divers: 41 (1.2%)	PHQ-9	14.49% (*n* = 409)	N/A	N/A	N/A
Kuo, L. W. et al. (2021) [51]	Observational study	Western Pacific Region	Taiwan	1,955	M: 1,211 (61.9%) F: 744 (38.1%)	N/A	N/A	0.97% (*n* = 19)	N/A	N/A
Landi, G. et al. (2021) [52]	Cross-sectional study	European Region	Italy	652	M: 161 (24.7%) F: 491 (75.3%)	PHQ-9	15.34% (*n* = 100)	N/A	N/A	Mental pain intensity.
Le, S. et al. (2021) [53]	Cross-sectional study	Western Pacific Region	China	56,679	M: 27,149 (47.9%) F: 29,530 (52.1%)	PHQ-9	16.45% (*n* = 9,322)	N/A	N/A	Experience of quarantine, unemployment, psychological stress.
Liu, L. et al. (2021) [54]	Cross-sectional study	Region of the Americas	Canada	11,324	M: 5,574 (49.22%) F: 5,750 (50.78%)	N/A	2.44% (*n* = 276)	N/A	N/A	Under 65 years, a frontline worker, job loss, loneliness, isolation, highly stressful or traumatic event, lower household income, lower educational attainment.
Lopez Steinmetz, L. C. et al. (2021) [55]	Cross-sectional study	Region of the Americas	Argentina	1,202	N/A	Self-reported suicidal thoughts and severe distress (IES-R).	43.09% (*n* = 518)	8.15% (*n* = 98)	N/A	N/A
Lu, X. et al. (2021) [56]	Cross-sectional study	Western Pacific Region	China	1,630	M: 639 (39.2%) F: 991 (60.8%)	PHQ-9	11.72% (*n* = 191)	N/A	N/A	N/A
Lueck, J. A. et al. (2021) [57]	Cross-sectional study	Region of the Americas	United States	5,001	M: 2,486 (49.7%) F: 2,515 (50.3%)	PHQ-9	48.35% (*n* = 2,418)	N/A	N/A	Worsening mental health overall.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Mamun, M. A. et al. (2021) [58]	Cross-sectional study	South-East Asia Region	Bangladesh	756	M: 446 (59%) F: 310 (41%)	PHQ-4	8.20% (*n* = 62)	0.70% (*n* = 5)	N/A	Taking drugs, performing less physical activity, poor self-reporting health condition, comorbid, higher COVID-19 risk, fear of COVID-19 infection, depression, anxiety.
Mamun, M. A. et al. (2021) [59]	Cross-sectional study	South-East Asia Region	Bangladesh	10,067	M: 5650 (56.1%) F: 4406 (43.9%)	PHQ-4	5.03% (*n* = 506)	N/A	N/A	Young, female, smoker, comorbid diseases, fear of COVID-19 infection, insomnia.
Matovu, Joseph K. B. et al. (2021) [60]	Cross-sectional study	African Region	Uganda	2,500	N/A	N/A	1.24% (*n* = 31)	N/A	N/A	N/A
McAuliffe, C. et al. (2021) [61]	Cross-sectional study	European Region	United Kingdom	7,002	M: 3,350 (47.8%) F: 3,577 (51.1%) Transgender: 29 (0.5%) Other: 46 (0.6%)	N/A	6.18% (*n* = 433)	N/A	N/A	Financial, relationship, substance use, COVID-19 exposure.
Menculini, G. et al. (2021) [62]	Retrospective study	European Region	Italy	447	N/A	N/A	9.17% (*n* = 41)	9.84% (*n* = 44)	N/A	Living with marital family, suicidality-related phenomena, and adjustment disorders.
Moderato, L. et al. (2021) [63]	Cross-sectional study	European Region	Italy	858	M: 132 (15.4%) F: 724 (84.4%). Missing: 2 (0.2%)	PHQ-9	3.03% (*n* = 26)	N/A	N/A	N/A
Mortier, P. et al. (2021) [64]	Cross-sectional study	European Region	Spain	3,500	M: 1,538 (48.5%) F: 1,962 (51.5%)	Columbia Suicide Severity Rating Scale.	1.83% (*n* = 64)	0.10% (*n* = 5)	N/A	Mental disorders, major depressive disorder, generalized anxiety disorder, post-traumatic stress disorder, panic attacks, alcohol or substance use disorder.
Mortier, P. et al. (2021) [65]	Cross-sectional study	European Region	Spain	5,450	N/A	PHQ-8	2.74% (*n* = 96)	0.14% (*n* = 5)	N/A	Anxiety disorder.
Mosolova, E. et al. (2021) [66]	Cross-sectional study	European Region	Russian Federation	1,105	N/A	PHQ-9	14.39% (*n* = 159)	N/A	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Murata, S. et al. (2021) [67]	Cross-sectional study	Region of the Americas	United States	4,909	M: 978 (20%) F: 3,931 (80%)	Non-suicidal self-injury (NSSI).	20.07% (*n* = 985)	15.67% (*n* = 769)	N/A	Loneliness.
Mushtaque, I. et al. (2021) [68]	Cross-sectional study	Eastern Mediterranean Region	Pakistan	241	M: 108 (44.8%) F: 133 (55.2%)	Suicidal behavior questionnaire (SBQ-R).	22.41% (*n* = 54)	9.13% (*n* = 22)	N/A	N/A
Nichter, B. et al. (2021) [69]	Prospective study	Region of the Americas	United States	2,746	M: 2,467 (89.8%) F: 279 (10.2%)	N/A	2.99% (*n* = 82)	N/A	N/A	Low social support, suicide attempt history, lifetime posttraumatic stress disorder, depression, alcohol use disorder, COVID-19 infection, worsening of social relationships.
Nomura, K. et al. (2021) [70]	Cross-sectional study	Western Pacific Region	Japan	2,449	M: 1,308 (53.8%) F: 1,119 (46.2%)	PHQ-9	6.61% (*n* = 162)	N/A	N/A	alcohol use.
O'Connor, R. C. et al. (2021) [71]	Cross-sectional study	European Region	United Kingdom	3,077	M: 1,382 (44.9%) F: 1,695 (55.1%)	PHQ-9	9.78%	0.71% (n=)	N/A	N/A
Oh, T. H. et al. (2021) [72]	Retrospective study	Western Pacific Region	Korea	138	M: 1,38 (100%)	N//A	4.35%	N/A	N/A	N/A
Okubo, R. et al. (2021) [73]	Cross-sectional study	Western Pacific Region	Japan	24,819	M: 12,394 (49.9%) F: 12,425 (51.1%)	Kessler Psychological Distress Scale (K6).	3.49%	N/A	N/A	Higher urbanization level and greater neighborhood deprivation (lower neighborhood-level socioeconomic status).
Papadopoulou, A. et al. (2021) [74]	Cross-sectional study	European Region	Greece	5,748	M: 1,434 (24.9%) F: 4,217 (73.4%) Other: 5 (0.1%)	PHQ-2	4.63%	N/A	N/A	Unmarried or divorced marital status, mental health history, poor perceived quality of physical health, impaired family functioning, anxiety, and depression.
Pelissier, C. et al. (2021) [75]	Cross-sectional study	European Region	France	699	N/A	General Health Questionnaire (GHQ).	15.59%	N/A	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Peng, X. D. et al. (2021) [76]	Cross-sectional study	Western Pacific Region	China	39,751	M: 18,966 (47.7%) F: 20,785 (52.3%)	PHQ-9	20.30%	N/A	N/A	Female, junior high school, poor overall sleep quality, poor academic performance, worried about being infected during COVID-19, depression, anxiety.
Rahman, M. E. et al. (2021) [77]	Cross-sectional study	South-East Asia Region	Bangladesh	1,415	M: 875 (61.8%) F: 540 (38.2%),	Suicide behaviors questionnaire-revised (SBQ-R).	33.50%	N/A	N/A	Females, divorced or widowed, low educational attainment.
Rodríguez De A. et al. (2021) [78]	Cross-sectional study	Region of the Americas	Colombian	484	N/A	Okasha's Suicidality Scale (OSS).	40.08%	N/A	N/A	Females, and under 20 years.
Rodriguez De A. et al. (2021) [79]	Cross-sectional study	Region of the Americas European Region	Colombia Brazil Portugal	998	M: 875 (22.5%) F: 540 (77.5%)	Okasha's Suicidality Scale (OSS).	57.00%	N/A	N/A	N/A
Sahimi, H. M. S. et al. (2021) [80]	Cross-sectional study	Western Pacific Region	Malaysia	171	N/A	PHQ-9	11.11%	N/A	N/A	Depression.
Sasaki, N. et al. (2021) [81]	Cross-sectional study	Western Pacific Region	Japan	875	M: 463 (52.9%) F: 412 (47.1%)	N/A	28.69%	N/A	N/A	Younger people (aged < 39 years) and mental health conditions.
Schou-Bredal, I. et al. (2021) [82]	Cross-sectional study	European Region	Norway	4,527	N/A	Life Orientation Test-Revised (LOT-R).	3.56%	N/A	N/A	N/A
Shongwe, M. C. et al. (2021) [83]	Cross-sectional study	African Region	Eswatini	933	Male: 275 (27.7%), Female: 718 (72.3%),	Kessler 6-item Psychological Distress Scale (K6).	1.71%	N/A	N/A	N/A
Soto-Sanz, V. et al. (2021) [84]	Cross-sectional study	European Region	Spain	595	M: 164 (27.60%) F: 430 (72.40%)	PHQ-9	1.71%	N/A	N/A	N/A
Sun, S. et al. (2021) [85]	Cross-sectional study	Western Pacific Region	China	1,912	M: 578 (30.23%) F: 1334 (69.77%)	PHQ-4	19.52%	N/A	N/A	N/A
Tong, Y. et al. (2021) [86]	Case-control study	Western Pacific Region	China	7,337	M: 2414 (32.9%) F: 4923 (67.1%)	N/A	N/A	7.78%	N/A	Suicide attempt history.
Travis-Lumer, Y. et al. (2021) [87]	Quasi experimental study	European Region	Israel	852,233	M: 424,240 (49.8%) F: 427,993 (50.2%)	N/A	N/A	N/A	0.13% (n = 1,148) 2. 134.7/ per 100,000.	COVID-19
Tsai, J. et al. (2021) [88]	Cross-sectional study	Region of the Americas	United States	6,607	N/A	PHQ-2	31.24% (n = 2,064)	N/A	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Vassalini, P. et al. (2021) [89]	Cross-sectional study	European Region	Italy	115	M: 62 (54%) F: 53 (46%)	PHQ-9	6.09% (*n* = 7)	N/A	N/A	N/A
Vrublevska, J. et al. (2021) [90]	Cross-sectional study	European Region	Latvia	2,609	M: 1,260 (48%) F: 1,344 (51%) Other: 4 (1%)	RASS	N/A	6.13% (*n* = 160)	N/A	N/A
Wang, D. et al. (2021) [91]	Case-control study	Western Pacific Region	China	67,905	M: 21,270 (31.3%) F: 46,635 (68.7%)	PHQ-9	17.65% (*n* = 11,984)	N/A	N/A	Sleep disturbance, short sleep duration.
Wang, M. et al. (2021) [92]	Case-control study	Western Pacific Region	China	460	M: 163 (35.43%) F: 297 (64.57%)	PHQ-9	23.26% (*n* = 107)	N/A	N/A	Lower education levels and abnormal body temperature.
Wang, Q. et al. (2021) [93]	Case-control study	Western Pacific Region	China	1,397	M: 163 (36.1%) F: 297 (63.9%)	PHQ-9	10.45% (*n* = 146)	N/A	N/A	N/A
Wojahn, A. L. et al. (2021) [94]	Retrospective study	Region of the Americas	United States	1,486	M: 913 (61.4%) F: 573 (38.6%)	N/A	43.27% (*n* = 643)	N/A	N/A	N/A
Xu, L. Z. et al. (2021) [95]	Case-control study	Western Pacific Region	China	18,521	M: 3,909 (21.1%) F: 14,612 (78.9%)	PHQ-9	0.53% (*n* = 99)	N/A	N/A	N/A
Xu, X. et al. (2021) [96]	Cross-sectional study	Western Pacific Region	China	11,507	N/A	PHQ-9	6.47% (*n* = 744)	N/A	N/A	The infection of family members or relatives, poor marital status, poor self-rated health, the need for psychological intervention, perceived high stress, low support, depression, and anxiety.
Xu, Y. et al. (2021) [97]	Cross-sectional study	Western Pacific Region	China	11,254	M: 4,054 (36.02%) F:7,200 (63.98%)	PHQ-9	2.03% (*n* = 229)	N/A	N/A	Distant relationship with parents, changes in lifestyle, alcohol use, mental health symptoms.
Yalcin, M. et al. (2021) [98]	Retrospective study	European Region	Türkiye	5,839	M: 2,962 (50.7%) F: 2,877 (49.3%)	N/A	N/A	2.79% (*n* = 163)	N/A	N/A
Yang, X. et al. (2021) [99]	Cross-sectional study	Western Pacific Region	China	19,515	F: 19,515 (100%)	PHQ-9	7.39% (*n* = 1,442)	N/A	N/A	N/A
Yang, X. et al. (2021) [100]	Cross-sectional study	Western Pacific Region	China	1,070	M: 346 (32.3%) F: 724 (67.7%)	PHQ-9	1.59% (*n* = 17)	N/A	N/A	N/A
Young, K. P. et al. (2021) [101]	Cross-sectional study	Region of the Americas	United States	1,326	N/A	PHQ-9	4.83% (*n* = 64)	N/A	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Zhao, L. et al. (2021) [102]	Cross-sectional study	Western Pacific Region	China	1,154	N/A	Chinese Depression Screening Scale.	60.31% (*n* = 696)	N/A	N/A	N/A
Zheng, Y. G. et al. (2021) [103]	Cross-sectional study	Western Pacific Region	China	266	M: 69 (25.94%) F: 197 (74.06%).	Beck Suicide Ideation Scale (SSI).	36.09% (*n* = 96)	N/A	N/A	N/A
Zhou, S. J. et al. (2021) [104]	Cross-sectional study	Western Pacific Region	China	11,133	M: 4,195 (37.7%) F: 6,938 (62.3%).	PHQ-9	7.28% (*n* = 810)	N/A	N/A	N/A
Zhu, S. et al. (2021) [105]	Cross-sectional study	Western Pacific Region	China	1,381	M: 634 (45.9%) F: 747 (54.1%).	PHQ-9	32.46% (*n* = 484)	N/A	N/A	Anxiety, trait anxiety, life satisfaction.
Zilinskas, E. et al. (2021) [106]	Cross-sectional study	European Region	Lithuania	1,001	M: 225 (22.5%) F: 776 (77.5%)	HADS.	45.55% (*n* = 456)	1.69% (*n* = 17)	N/A	Anxiety, depression.
Agyapong, B. et al. (2022) [107]	Cross-sectional study	Region of the Americas	Canada	146	N/A	PHQ-9	17.81% (*n* = 26)	N/A	N/A	Alcohol abuse.
Ali, M. et al. (2022) [108]	Cross-sectional study	South-East Asia Region	Bangladesh	731	M: 376 (51.44%) F: 355 (48.56%)	N/A	16.28% (*n* = 119)	N/A	N/A	Sociodemographic factors, illness, behavior, institution, and subject-related issues.
Alleaume, C. et al. (2022) [109]	Cross-sectional study	European Region	France	1,736	M: 826 (47.59%) F: 910 (52.41%)	PHQ-9	8.31% (*n* = 231)	N/A	N/A	Posttraumatic stress disorder (PTSD).
Ansari, S. K. et al. (2022) [110]	Cross-sectional study	Eastern Mediterranean Region	Pakistan	510	N/A	Coronavirus Reassurance-Seeking Behaviours Scale (CRBS).	23.53% (*n* = 120)	N/A	N/A	Anxiety.
Arnon, S. et al. (2022) [111]	Cross-sectional study	Region of the Americas	United States	10,414	M: 5,452 (52.4%) F: 4,962 (47.6%)	N/A	7.24% (*n* = 785)	1.45% (*n* = 152)	N/A	Cyberbullying.
Batterham, P. J. et al. (2022) [112]	Cross-sectional study	Western Pacific Region	Australia	1,296	M: 645 (49.8%) F: 649 (50.1%)	PHQ-9	30.48% (*n* = 395)	N/A	N/A	Higher pandemic-related work and social impairment, recent adversity, loneliness, younger.
Bell, C. et al. (2022) [113]	Cross-sectional study	Western Pacific Region	New Zealand	3,389	M: 1461 (43.1%) F: 649 (56.9%)	Kessler Psychological Distress Scale (K10).	4.16% (*n* = 188)	1.46% (*n* = 49)	N/A	Alcohol use.
Benatov, J. et al. (2022) [114]	Cross-sectional study	European Region	Germany, Israel, Poland, Slovenia	1,723	M: 789 (46%) F: 935 (54%)	PHQ-8	36.74% (*n* = 633)	N/A	N/A	Student, depression.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Benavente-Fernandez, A. et al. (2022) [115]	Cross-sectional study	European Region	Spain	36	M: 19 (52.78%) F: 17 (47.22%)	Beck Hopelessness Scale (BHS) Columbia-Suicide Severity Rating Scale (C-SSRS).	N/A	8.33% (*n* = 3)	N/A	Active treatment of a psychiatric illness, active smoking.
Berger, G. et al. (2022) [116]	Retrospective study	European Region	Switzerland	250	M: 97 (38.80%) F: 153 (61.20%)	N/A	79.60% (*n* = 199)	N/A	N/A	N/A
Beymer, M. R. et al. (2022) [117]	Cross-sectional study	Region of the Americas	United States	22,982	N/A	PHQ-2	11.89% (*n* = 2,734)	N/A	N/A	N/A
Bi, K. W. et al. (2022) [118]	Cross-sectional study	Western Pacific Region	China	381	N/A	PHQ-2	28.60% (*n* = 109)	N/A	N/A	N/A
Bismark, M. et al. (2022) [119]	Cross-sectional study	Western Pacific Region	Australia	7,795	M: 1,452 (19%) F: 6,300 (81%). Prefer not to say: 43 (1%)	PHQ-9	10.46% (*n* = 815)	N/A	N/A	Who had friends or family infected with COVID-19, were living alone, were younger, male, had increased alcohol use, poor physical health, increased income worries, or prior mental illness.
Bismark, M. et al. (2022) [120]	Cross-sectional study	Western Pacific Region	Australia	7,795	M: 1,452 (19%) F: 6,300 (81%). Prefer not to say: 43 (1%)	PHQ-9	3.36% (*n* = 262)	N/A	N/A	N/A
Blomqvist, S. et al. (2022) [121]	Cohort study	European Region	Sweden	65,530	M: 30,857 (47.08%) F: 34,473 (52.92%)	N/A	N/A	1.37% (*n* = 896)	N/A	Job insecurity.
Brady, C. et al. (2022) [122]	Cross-sectional study	European Region	Ireland	390	M: 50 (12.8%) F: 337 (86.4%) Prefer not to say: 3 (0.8%)	C-SSRS.	13.85% (*n* = 54)	N/A	N/A	N/A
Brady, C. et al. (2022) [123]	Cross-sectional study	European Region	Ireland	377	N/A	C-SSRS	13.26% (*n* = 50)	N/A	N/A	N/A
Brailovskaia, J. et al. (2022) [124]	Cross-sectional study	European Region	Germany	406	N/A	Suicide Behaviors Questionnaire – Revised (SBQ-R).	30.00% (*n* = 122)	N/A	N/A	N/A
Brewer, A. G. et al. (2022) [125]	Retrospective study	Region of the Americas	United States	3,454	N/A	N/A	44.30% (n= 15,086)	N/A	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Caballero-Dominguez, C. C. et al. (2022) [126]	Cross-sectional study	Region of the Americas	Colombia	700	M: 224 (32%) F: 476 (68.0%)	N/A	7.57% (*n* = 53)	N/A	N/A	A depressive episode, insomnia.
Caravaca-Sanchez, F. et al. (2022) [127]	Cross-sectional study	European Region	Spain	517	N/A	SBQ-R	25.53% (*n* = 132)	N/A	N/A	Anxiety, alcohol use, cannabis use.
Caycho-Rodriguez, T. et al. (2022) [128]	Cross-sectional study	Region of the Americas	Bolivia, Brazil, Chile, Colombia, Ecuador, El Salvador, Guatemala, Mexico, Paraguay, Peru, Brazil	2,536	N/A	N/A	15.33% (*n* = 389)	N/A	N/A	Depression.
Cena, L. et al. (2022) [129]	Cross-sectional study	European Region	Italy	505	N/A	N/A	N/A	14.30% (*n* = 72)	N/A	N/A
Dale, R. et al. (2022) [130]	Cross-sectional study	European Region	Austria	1,257	N/A	PHQ-9	45.74% (*n* = 682)	N/A	N/A	N/A
de Moura, P. T. et al. (2022) [131]	Cross-sectional study	Region of the Americas	Brazil	70	M: 46 (66.7%) F: 24 (33.3%)	PHQ-9	58.57% (*n* = 41)	N/A	N/A	Alcohol use.
Demenech, L. M. et al. (2022) [132]	Cross-sectional study	Region of the Americas	Türkiye	5,720	M: 1902 (33.3%) F: 3818 (66.7%)	N/A	19.58% (*n* = 1,002)	N/A	N/A	Female, poorer individuals.
Dogan, F. S. et al. (2022) [133]	Retrospective study	European Region	United States	4,296	M: 3,286 (76.5%) F: 1,010 (23.5%)	N/A	N/A	N/A	2.77% (*n* = 119)	N/A
Dolsen, E. A. et al. (2022) [134]	Cross-sectional study	Region of the Americas	United States	837	M: 168 (20.1%) F: 616 (73.6%) Other: 53 (2.5%)	BDI	27.96% (*n* = 234)	N/A	N/A	Younger age, lower income, single relationship status, sexual orientation other than heterosexual specifically identifying as bisexual, non-full-time employment, living in a town.
Dominguez-Gonzalez, A. D. et al. (2022) [135]	Cross-sectional study	Region of the Americas	Mexico	247	M: 78 (31.6%) F: 169 (68.4%)	Plutchik Suicidal Risk Scale (PSRS).	18.62% (*n* = 46)	N/A	N/A	Depression.
Doran, N. et al. (2022) [136]	Retrospective study	Region of the Americas	United States	771,570	M: 678,210 (87.9%) F: 93,360 (12.1%)	N/A	N/A	0.22% (*n* = 1,722)	0.01% (*n* = 89)	N/A
Duarte, F. et al. (2022) [137]	Retrospective study	Region of the Americas	Chile	20,760	N/A	N/A	N/A	N/A	7.57% (*n* = 1,571) 8.07/100,000	N/A
Eden, C. et al. (2022) [138]	Retrospective study	Region of the Americas	United States	18	M: 14 (78%) F: 4 (22%)	N/A	N/A	22.22% (*n* = 4)	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Efstathiou, V. et al. (2022) [139]	Cross-sectional study	European Region	Greece	720	M: 189 (26.2%) F: 531 (73.8%)	PHQ-2	4.72% (*n* = 34)	N/A	N/A	Depression, anxiety.
El Frenn, Y. et al. (2022) [140]	Cross-sectional study	Eastern Mediterranean Region	Lebanon	402	M: 125 (31.1%) F: 277 (68.9%)	C-SSRS	18.20% (*n* = 73)	N/A	N/A	Depression, fear of COVID-19, older age.
Essadek, A. et al. (2022) [141]	Cross-sectional study	European Region	France	19,150	M: 6282 (32.28%) F: 12,968 (67.72%)	PHQ-9	20.90% (*n* = 4,002)	N/A	N/A	Depression, anxiety.
Fadhli, S. A. M. et al. (2022) [142]	Cross-sectional study	Western Pacific Region	Malaysia	1,290	M: 385 (29.8%) F: 905 (70.2%)	PHQ-9	11.94% (*n* = 154)	8.37% (*n* = 108)	N/A	Cyberbullying victimization.
Fogarty, A. et al. (2022) [143]	Cross-sectional study	Western Pacific Region	Australia	103	M: 385 (32.28%) F: 905 (67.72%)	PHQ-A	52.43% (*n* = 54)	N/A	N/A	N/A
Gainza Perez, M. A. et al. (2022) [144]	Cross-sectional study	Region of the Americas	United States	159	M: 82 (51.6%) F: 77 (48.4%)	Suicidal Ideation Attributes SScale (SIDAS).	27.67% (*n* = 44)	N/A	N/A	Low adherence.
Galletta, M. A. K. et al. (2022) [145]	Cross-sectional study	Region of the Americas	Brazil	182	M: 0 (0%). F: 182 (100%)	Edinburgh Postnatal Depression Scale (EPDS).	14.29% (*n* = 26)	N/A	N/A	N/A
Geda, N. et al. (2022) [146]	Cross-sectional study	Region of the Americas	Canada	4,005	M: 1,930 (48.2%) F: 2059 (51.4%) Other: 16 (0.4%)	N/A	12.01% (*n* = 481)	N/A	N/A	Social isolation, depression, anxiety, and substance use (cannabis).
Grover, S. et al. (2022) [147]	Exploratory study	South-East Asia Region	India	1,065	M: 549 (51.5%) F: 516 (48.5%)	Clinical Global Rating (CGI) scale.	2.44% (*n* = 26)	1.69% (*n* = 18)	N/A	N/A
Guerrero, M. D. et al. (2022) [148]	Cross-sectional study	Region of the Americas	Canada	22,721	M: 9,757 (43.08%) F: 12,935 (56.92%)	PHQ-9	2.91% (*n* = 662)	N/A	N/A	N/A
Gutierrez-Sacristan, A. et al. (2022) [149]	Cohort study	European Region. Region of the Americas.	France United States	11,101	M: 3,498 (31.5%) F: 7,603 (68.5%)	N/A	42.10% (*n* = 4,673)	N/A	N/A	N/A
Hagerty, S. L. et al. (2022) [150]	Cross-sectional study	Region of the Americas.	United States	1,122	M: 3,498 (11.2%) F: 7,603 (88.8%)	PHQ-9	15.42% (*n* = 173)	N/A	N/A	Moral injury, loneliness.
Holler, I. et al. (2022) [151]	Cross-sectional study	European Region	Germany	1,311	M: 41 (3.1%) F: 1,270 (96.9%)	The German version of Suicide Ideation and Behaviour Scale (SSEV).	21.74% (*n* = 285)	0.53% (*n* = 7)	N/A	Depression, agitation, perceived burdensomeness, previous suicide attempt.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Hyland, P. et al. (2022) [152]	Retrospective study	European Region	Ireland	1,032	N/A	PHQ-9	29.46% (*n* = 304)	11.24% (*n* = 116)	N/A	Suicidal ideation: male, unemployed, higher loneliness, and lower religiosity. Suicide attempt: ethnic minority status, lower education, lower income, PTSD, depression, and history of mental health treatment.
Hyland, P. et al. (2022) [153]	Retrospective study	European Region	Ireland	1,110	N/A	PHQ-9	N/A	11.17% (*n* = 124)	N/A	N/A
Ide, K. et al. (2022) [154]	Cross-sectional study	Western Pacific Region	Japan	2,813	M: 735 (3.1%) F: 2,078 (73.87%)	PHQ-9	8.64% (*n* = 243)	N/A	N/A	Mental health.
Iftene, F. et al. (2022) [155]	Cross-sectional study	European Region	Greece	508	N/A	N/A	N/A	5.91% (*n* = 30)	N/A	N/A
Jadir, D. S. et al. (2022) [156]	Cross-sectional study	Region of the Americas. European Region. Eastern Mediterranean Region. South-East Asia Region.	United States Italy Spain Saudi Arabia India	2,482	M: 1,251 (50.4%) F: 1,231 (49.6%)	PHQ-9	39.69% (*n* = 985)	N/A	N/A	Racial/ethnic minorities.
Jahlan, B. et al. (2022) [157]	Retrospective study	Eastern Mediterranean Region	Saudi Arabia	2,326	M: 1,091 (46.9%) F: 1,235 (53.1%)	N/A	N/A	0.06% (*n* = 14)	N/A	N/A
Jones, L. B. et al. (2022) [158]	Cross-sectional study	Region of the Americas	Canada	4,693	M: 1,628 (34.69%) F: 1,235 (63.05%)	WHO World Mental Health-Composite International Diagnostic Interview	18.88% (*n* = 886)	N/A	N/A	Chinese or as another non-Indigenous ethnic minority; experiencing current symptoms of depression or anxiety; having a history of suicidal planning or attempts.
Jones, S. E. et al. (2022) [159]	Cross-sectional study	Region of the Americas	United States	7,705	N/A	Adolescent Behaviors and Experiences Survey (ABES).	19.90% (*n* = 1,533)	9.00% (*n* = 693)	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Joshi, S. S. et al. (2022) [160]	Prospective study	European Region	Austria, Belgium, Brazil, Bulgaria, Croatia, Egypt, Finland, France, Georgia, Germany, Greece, Hungary, Iran, Ireland, Italy, Latvia, Lithuania, Mexico, Myanmar, the Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Slovenia, Spain, Tanzania, Turkey, United Kingdom of Great Britain and Northern Ireland	2863	M: 1,628 (49%) F: 1,235 (51%)	N/A	5.60% (*n* = 7)	N/A	N/A	N/A
Kaggwa, M. M. et al. (2022) [161]	Cross-sectional study	African Region	Uganda	540	F: 177 (32.78%) M: 363 (67.22%).	General Health Questionnaire.	31.85% (*n* = 172)	N/A	N/A	Suicidal ideation: having difficulty paying university tuition fees. Suicide attempts: having a history of sexual abuse, having difficulty paying university tuition fees.
Kaggwa, M. M. et al. (2022) [162]	Cross-sectional study	African Region	Uganda	540	M: 363 (67.22%) F: 177 (32.78%)	PHQ-9	13.89% (*n* = 75)	N/A	N/A	Smoking cigarettes and marijuana and having financial tuition constraints.
Kaggwa, M. M. et al. (2022) [163]	Retrospective study	African Region	Uganda	215,427	N/A	N/A	N/A	0.06%. Per 60/100,000 people (*n* = 130)	0.01% Per 3/100,000 people (*n* = 26)	N/A
Kajai, C. et al. (2022) [164]	Cross-sectional study	South-East Asia Region	Thailand	447	M: 180 (40.27%) F: 267 (59.73%)	Psychiatric Inpatient Suicide Risk Assessment (PISRA).	0.22% (*n* = 1)	N/A	N/A	Stress, stress-coping behaviors.
Kaltschik, S. et al. (2022) [165]	Cross-sectional study	European Region	Austria	599	M: 122 (20.36%) F: 477 (79.63%)	PHQ-9	6.01% (*n* = 36)	N/A	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Kang, S. et al. (2022) [166]	Cross-sectional study	Western Pacific Region	Korea	54,948	M: 28,353 (51.59%) F: 26,595 (48.41%)	N/A	10.88% (*n* = 5,979)	2.04% (*n* = 1,121)	N/A	Economic deterioration, low socioeconomic status.
Kaniuka, A. R. et al. (2022) [167]	Cross-sectional study	Region of the Americas	United States	156	N/A	PHQ-2. Suicidal Ideation Attributes Scale (SIDAS).	40.38% (*n* = 63)	N/A	N/A	Mental health.
Kantorski, L. P. et al. (2022) [168]	Cross-sectional study	Region of the Americas	Brazil	890	M: 135 (15.2%) F: 755 (84.8%)	PHQ-9	7.42% (*n* = 66)	N/A	N/A	Use of psychotropic drugs.
Kasal, A. et al. (2022) [169]	Cross-sectional study	European Region	Czechia	3,115	N/A	Mini International Neuropsychiatric Interview (M.I.N.I.).	25.55% (*n* = 796)	N/A	N/A	Mental disorders.
Keyworth, C. et al. (2022) [170]	Cross-sectional study	European Region	United Kingdom	1,029	M: 340 (33.0%) F: 671 (62.5%) Prefer not to say: 18 (1.8%)	History of non-suicidal self-harm (NSSH).	7.77% (*n* = 80)	0.38% (*n* = 4)	N/A	Higher levels of perceived symptomatic (or physiological) reactions to COVID-19.
Kim, D. et al. (2022) [171]	Cross-sectional study	Western Pacific Region	Korea	46,475	N/A	N/A	10.30% (*n* = 4,789)	N/A	N/A	N/A
Kim, H. Y. et al. (2022) [172]	Cross-sectional study	Western Pacific Region	Korea	300	N/A	PHQ-9	N/A	2.33% (*n* = 7)	N/A	Fear of COVID-19, depression.
Kim, S. et al. (2022) [173]	Cross-sectional study	Western Pacific Region	Korea	973,711	M: 550,983 (56.6%) F:422,728 (43.4%)	N/A	N/A	0.30% (*n* = 2,962)	N/A	N/A
Kirič, B. et al. (2022) [174]	Retrospective study	European Region	Slovenia	1,966	M: 604 (30.7%) F: 1,362 (69.3%)	N/A	54.48% (*n* = 1,071)	28.99% (*n* = 570)	N/A	N/A
Knowles, J. R. P. et al. (2022) [175]	Cross-sectional study	European Region	United Kingdom	12,989	F: 10,391 (80.0%) M: 2490 (19.2%) Other: 25(0.2%). Prefer not to say: 83 (0.6%).	Kessler Distress Scale.	9.28% (*n* = 1,205)	0.63% (*n* = 83)	N/A	Food insecurity, domestic abuse, relationship problems, redundancy, social isolation, financial problems.
Kone, A. et al. (2022) [176]	Cross-sectional study	Region of the Americas	United States	23,317	N/A	PHQ-9	8.40% (*n* = 1.959)	N/A	N/A	Feeling isolated.
Kone, A. et al. (2022) [177]	Cross-sectional study	Region of the Americas	United States	22,862	M: 3,853 (16.4%) F: 19,397 (82.6%) Transgender: 220 (0.9%)	PHQ-9	8.11% (*n* = 1,853)	N/A	N/A	N/A
Korkmaz, S. A. et al. (2022) [178]	Cross-sectional study	European Region	Türkiye	573	M: 182 (31.8%) F: 391 (68.2%) Transgender: 220 (0.9%)	PHQ-9	19.72% (*n* = 1113)	N/A	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Korkut, S. et al. (2022) [179]	Cross-sectional study	European Region	Türkiye	114	M: 60 (52.6%) F: 54 (47.4%)	Suicide Probability Scale (SPS).	17.54% (*n* = 20)	N/A	N/A	N/A
Kundu, A. et al. (2022) [180]	Cross-sectional study	Region of the Americas	Canada	1,414	N/A	N/A	60.61% (*n* = 857)	N/A	N/A	Mental disorders, substance use, insulted by parents or adults in childhood, age in years, past week feeling depressed, lifetime diagnosis of mental illness, lifetime diagnosis of depressive disorder, past week feeling sad, ever pretending to be straight or cisgender to be accepted, urban areas, unemployed.
Lantos, J. D. et al. (2022) [181]	Cross-sectional study	Region of the Americas	United States	9,984	M: 4,443 (44.5%) F: 5,540 (55.5%) Missing:1 (0.0%)	Ask Suicide-Screening Questions (ASQ).	12.25% (*n* = 1,223)	N/A	N/A	Older age, female, public versus private insurance.
Leaune, E. et al. (2022) [182]	Cross-sectional study	European Region	France	1,765	M: 318 (18.2%) F: 1,433 (81.8%)	BDI-SF	4.42% (*n* = 78)	N/A	N/A	N/A
Lee, B. et al. (2022) [183]	Cross-sectional study	Western Pacific Region	Republic of Korea	109,796	N/A	N/A	13.43% (n= 12,154)	1.94% (*n* = 2,132)	N/A	N/A
Li, G. et al. (2022) [184]	Cross-sectional study	Western Pacific Region	China	1,609	M: 588 (36.5%) F: 1021 (63.5%)	Suicidal Behaviors Questionnaire-Revised (SBQ-R)	31.57% (*n* = 322)	N/A	N/A	Daytime sleepiness, depression.
Li, Y. et al. (2022) [185]	Cross-sectional study	Western Pacific Region	China	67,905	M: 21,270 (31.3%) F: 46,635 (68.7%)	PHQ-9	7.63% (*n* = 5,178)	N/A	N/A	Short sleep.
Li, Y. C. et al. (2022) [186]	Cross-sectional study	Western Pacific Region	China	905	M: 269 (29.73%) F: 636 (70.27%)	PHQ-2	47.40% (*n* = 429)	30.27% (*n* = 274)	N/A	Younger age, experience of cyberbullying, a history of suicide ideation among family or friends, fatigue, physical pain, inpatient status, depression.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Liang, Y. J. et al. (2022) [187]	Cross-sectional study	Western Pacific Region	China	1,159	M: 412 (35.5%) F: 747 (64.5%)	Common mental health problems (CMHPs).	4.06% (*n* = 47)	N/A	N/A	Marital status of 'others' disagreement regarding the successful containment of the pandemic, physical health problems, and common mental health problems (CMHPs).
Lin, C. Y. et al. (2022) [188]	Cross-sectional study	Eastern Mediterranean Region	Iran	10,843	M: 4,092 (52.3%) F: 6,751 (62.3%)	PHQ-9	20.77% (*n* = 2,252)	N/A	N/A	N/A
Liu, R. et al. (2022) [189]	Cross-sectional study	Western Pacific Region	China	1,063	M: 347 (32.6%) F: 716 (67.4%)	PHQ-9	11.76% (*n* = 125)	N/A	N/A	Poor treatment adherence, perceived illness worsening during the COVID-19 outbreak, major depressive disorder, PHQ-9 total score, NPRS total score.
Lixia, W. et al. (2022) [190]	Cross-sectional study	Western Pacific Region	China	33,706	M: 7,846 (23.3%) F: 25,860 (76.7%)	PHQ-9 PHQ-15 SSI	1.33% (*n* = 447)	N/A	N/A	Female, psychological assistance needs, contact with severe COVID-19 patients, high stress at work, single or divorced marital status, insufficient social support, depression, anxiety, PTSD.
Llistosella, M. et al. (2022) [191]	Longitudinal study	European Region	Spain	2,005	M: 965 (48.5%) F: 1,040 (51.5%)	Suicidal Thoughts and Behaviours (STB).	13.77% (*n* = 276)	N/A	N/A	Individuals with very low resilience.
Llorca-Bofí, V. et al. (2022) [192]	Retrospective study	European Region	Spain	342	N/A	N/A	13.16% (*n* = 45)	13.45% (*n* = 46)	N/A	Female, living with relatives, depression.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Ma, Z. et al. (2022) [193]	Cross-sectional study	Western Pacific Region	China	5,670	M: 2,978 (52.5%) F: 2,692 (47.5%)	PHQ-9	13.32% (*n* = 755)	N/A	N/A	Suicidal ideation: mental disorders, longer time since cancer diagnosis, regional and distant tumor stage, depression, anxiety, hostility, Fear of COVID-19. Suicide attempts: mental disorders.
Ma, Z. et al. (2022) [194]	Cross-sectional study	Western Pacific Region	China	67,905	M: 21,270 (31.33%) F: 46,635 (68.67%)	PHQ-2	10% (*n* = 6,791)	N/A	N/A	Depression, mental disorders.
MacDonald, B. V. et al. (2022) [195]	Retrospective study	Region of the Americas	United States	3,609	M: 21,270 (31.33%) F: 46,635 (68.67%)	PHQ-9 C-SSRS	1.47% (*n* = 53)	N/A	N/A	Depression.
Mallhi, T. H. et al. (2022) [196]	Cross-sectional study	Eastern Mediterranean Region	Arabia	1,074	M: 276 (25.7%) F: 798 (74.3%)	PHQ-9	32.03% (*n* = 344)	N/A	N/A	N/A
Mamun, M. A. et al. (2022) [197]	Cross-sectional study	South-East Asia Region	Bangladesh	490	M: 228 (46.5%) F: 262 (53.5%)	PHQ-2	33.06% (*n* = 162)	1.83% (*n* = 9)	N/A	Males, lower age, lower educational grade, low-earning jobs, living in a government-provided house, family history of mental health and suicide, anxiety, insomnia.
Mensi, M. M. et al. (2022) [198]	Cross-sectional study	European Region	Italy	481	M: 184 (38.25%) F: 297 (61.75%)	N/A	26.90% (*n* = 144)	N/A	N/A	N/A
Mucci, M. et al. (2022) [199]	Retrospective study	European Region	Italy	241	N/A	C-SSRS	10.37% (*n* = 25)	19.90% (*n* = 40)	N/A	N/A
Nadareishvili, I. et al. (2022) [200]	Cross-sectional study	European Region	Georgia	984	M: 280.0 (28.5%) F: 698.0 (70.9%) Other: 6.0 (0.6%)	RASS	17.89% (*n* = 176)	N/A	N/A	History of self-harming.
Nakanishi, M. et al. (2022) [201]	Cohort Study	European Region	United Kingdom	3,927	N/A	N/A	N/A	7.21% (*n* = 283)	N/A	N/A
Niederkrotenthaler, T. et al. (2022) [202]	Cross-sectional study	European Region	Austria	12,029	M: 5,861 (48.7%) F: 6,144 (51.1%) Diverse: 24 (0.2%)	PHQ-9	13.85% (*n* = 1,666)	N/A	N/A	N/A
Nomura, K. et al. (2022) [203]	Cross-sectional study	Western Pacific Region	Japan	1,564	M: 824 (52.7%) F: 617 (39.5%) Unknown 123 (7.9%)	PHQ-9	7.29% (*n* = 114)	N/A	N/A	Financial insecurity, academic performance.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Park, J. Y. et al. (2022) [204]	Cross-sectional study	Western Pacific Region	Korea	784	M: 372 (47.4%) F: 412 (52.6%)	N/A	9.18% (*n* = 72)	2.29% (*n* = 18)	N/A	Sexual intercourse experience, depressive mood, unhappiness.
Port, M. S. et al. (2022) [205]	Cross-sectional study	Region of the Americas	United States	412	M: 156 (37.9%). F: 239 (58.0%) Transgender: 4 (1.0%) Questioning: 1 (0.2%) Others: 12 (2.9%)	N/A	13.20% (*n* = 54)	51.96% (*n* = 212)	N/A	N/A
Que, J. Y. et al. (2022) [206]	Cross-sectional study	Western Pacific Region	China	16,220	M: 3401 (21%) F: 12,819 (79%)	PHQ-9	13.35% (*n* = 2,165)	N/A	N/A	Nightmares but not insomnia, depression, anxiety.
Rahman, Q. M. et al. (2022) [207]	Cross-sectional study	South-East Asia Region	Bangladesh	2,100	M: 1176 (56%) F: 924 (44%)	Suicidal Behaviors Questionnaire-Revised (SBQ-R) scale.	47.90% (*n* = 1,006)	N/A	N/A	Females, keep their distance from friends or family, have relationship problems, are a burden to families, and are stressed about lockdown.
Raifman, J. et al. (2022) [208]	Cross-sectional study	Region of the Americas	United States	1,415	M: 708 (50%) F: 707 (50%)	PHQ-9	16.33% (*n* = 231)	N/A	N/A	Difficulty paying rent, feeling alone.
Raviv, G. et al. (2022) [209]	Retrospective study	European Region	Israel	15,175,791	N/A	N/A	N/A	N/A	0.001% (*n* = 233) per 18.424 100,000/year	N/A
Reyniers, T. et al. (2022) [210]	Cross-sectional study	European Region	Belgium	965	M: 700 (72.5%) F: 162 (16.8%) Transman: 33 (3.4%) Other: 70 (7.3%)	PHQ-2	21.04% (*n* = 203)	N/A	N/A	N/A
Richardson, J. D. et al. (2022) [211]	Cross-sectional study	Region of the Americas	Canada	1,136	M: 862 (75.9%) F: 247 (21.7%) Other: 6 (0.5%) Prefer not to say: 4 (0.4%) Missing: 17 (1.5%)	PHQ-9	22.01% (*n* = 250)	N/A	N/A	N/A
Rolland, F. et al. (2022) [212]	Cross-sectional study	European Region	France	11,754	M: 3387 (29%) F: 8268 (71%) Unknown: 61 (0%)	Mini International Neuropsychiatric Interview (MINI).	18.96% (*n* = 2,229)	N/A	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Roy, N. et al. (2022) [213]	Cross-sectional study	South-East Asia Region	Bangladesh	410	M: 276 (67.3%) F: 134 (44.5%)	N/A	23.90% (*n* = 98)	N/A	N/A	Age above 35 years, female, acquiring a disability later in life, lack of sleep, and current substance use.
Rozental, A. et al. (2022) [214]	Cross-sectional study	European Region	Sweden	4,513	M: 1,072 (23.7%) F: 3,210 (71.1%) Non-binary: 231 (5.2%)	PHQ-9	54.72% (*n* = 2,335)	0.02% (*n* = 1,384)	N/A	N/A
Rutkowska, A. et al. (2022) [215]	Cross-sectional study	European Region	Poland	753	M: 365 (48.47%) F: 388 (51.53%)	BDI	18.02% (*n* = 137)	N/A	N/A	N/A
Sacco, D. L. et al. (2022) [216]	Retrospective study	Region of the Americas	United States	615	M: 331 (53.8%) F: 284 (46.2%)	N/A	31.38% (*n* = 193)	N/A	N/A	N/A
Sarı Doğan, F. et al. (2022) [217]	Retrospective study	European Region	Türkiye	1,285	M: 950 (73.9%) F: 335 (26.1%)	N/A	N/A	3.58% (*n* = 46)	N/A	N/A
Sasaki, N. et al. (2022) [218]	Cross-sectional study	Western Pacific Region	Japan	12,249	M: 7,095 (57.9%) F: 5,154 (42.1%)	N/A	8.50% (*n* = 1,041)	N/A	N/A	Temporary employment.
Schluter, P. J. et al. (2022) [219]	Cross-sectional study	Region of the Americas European Region: Western Pacific Region	Canada, the United States, England, Switzerland, Belgium, Hong Kong, Philippines, and New Zealand	17,883	M: 8,629 (48.4%) F: 9,204 (51.6%)	PHQ-9	25.82% (*n* = 4,617)	N/A	N/A	N/A
Shankar, L. G. et al. (2022) [220]	Retrospective study	Region of the Americas	United States	2,849	M: 1,142 (40.1%) F: 1,706 (59.9%)	N/A				N/A
Shiraly, R. et al. (2022) [221]	Cross-sectional study	Eastern Mediterranean Region	Iran	803	M: 408 (50.8%) F: 395 (49.2%)	PHQ-2 Ask Suicide-Screening Questionnaire (ASQ).				Depression, not being married, inability to pay medical bills, low perceived social support, and limited social network.
Smirnova, D. et al. (2022) [222]	Cross-sectional study	European Region	Russian Federation	7,777	M: 2,836 (36.47%) F: 4,736 (60.90%) Other: 205 (2.64%)	RASS	16.63% (*n* = 1,293)	N/A	N/A	N/A
Stickley, A. et al. (2022) [223]	Cross-sectional study	Western Pacific Region	Japan	1,452	M: 704 (48.5%) F: 748 (51.5%)	PHQ-9.	11.71% (*n* = 170)	N/A	N/A	Attention deficit hyperactivity disorder (ADHD).
Suarez-Soto, E. et al. (2022) [224]	Cross-sectional study	European Region	Spain	160	M: 53 (33.1%) F: 107 (66.9%)	The DetectaWeb-Distress scale.	20.63% (*n* = 33)	7.50% (*n* = 12)	N/A	N/A

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Sueki, H. et al. (2022) [225]	Prospective study	Western Pacific Region	Japan	6,683	M: 3,422 (51.2%) F: 3261 (48.8%)	N/A	47.36% (*n* = 3,165)	N/A	N/A	Younger, with unstable employment, without children, with low income, receiving psychiatric care.
Tang, N. K. Y. et al. (2022) [226]	Cross-sectional study	European Region	United Kingdom	378	N/A	PHQ-9	36.24% (*n* = 137)	N/A	N/A	Anxiety, depression, substance use.
Taniguchi, Y. et al. (2022) [227]	Cross-sectional study	Western Pacific Region	Japan	23,422	M: 12,673 (49.7%) F: 12,809 (50.3%)	N/A	8.68% (*n* = 2,033)	N/A	N/A	N/A
Tsuno, K. et al. (2022) [228]	Cross-sectional study	Western Pacific Region	Japan	16,384	M: 9,565 (58.6%) F: 6,789 (41.4%)	6-item Kessler Psychological Distress Scale (K6).	11.54% (*n* = 1,890)	N/A	N/A	N/A
Turner, B. J. et al. (2022) [229]	Cross-sectional study	Region of the Americas	Canada	809	M: 353 (44%) F: 453 (56%)	N/A	17.25% (*n* = 139)	N/A	N/A	Youth, transgender, non-binary, or gender fluid, not residing with both parents, psychiatric concerns, frequent cannabis use.
Valdes, J. M. et al. (2022) [230]	Cross-sectional study	Region of the Americas	Chile	5,037	M: 1,491 (29.6%) F: 3,546 (70.4%)	C-SSRS	10.01% (*n* = 504)	N/A	N/A	N/A
Valero-Bover, D. et al. (2022) [231]	Retrospective study	European Region	Spain	14,690	N/A	N/A	71.72% (n= 10,536)	57.83% (*n* = 8,495)	N/A	N/A
Valladares-Garrido, M. J. et al. (2022) [232]	Cross-sectional study	Region of the Americas	Peru	514	M: 492 (95.7%) F: 22 (4.3%)	N/A	14.01% (*n* = 72)	N/A	N/A	Family history of mental health, insomnia, and anxiety.
Villanueva-Silvestre, V. et al. (2022) [233]	Cross-sectional study	European Region	Spain	921	M: 385 (45%) F: 507 (55%)	PHQ-9	6.51% (*n* = 60)	N/A	N/A	N/A
Villarreal Sotelo, K. et al. (2022) [234]	Cross-sectional study	Region of the Americas	Mexico	659	F: 465 (70.5%) Male: 194 (29.5%).	N/A	39.94% (*n* = 262)	18.29% (*n* = 120)	N/A	Female, knowing a person infected with COVID-19, confinement for more than 40 days.
Walther, A. et al. (2022) [235]	Cross-sectional study	European Region	Germany, Switzerland, Austria, Liechtenstein, Luxembourg Belgium	490	M: 490 (100%) F: 0 (0%)	PHQ-9	49.98% (*n* = 240)	23.27% (*n* = 114)	N/A	Status loss, depression.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Wathelet, M. et al. (2022) [236]	Cross-sectional study	European Region	France	44,898	M: 12,429 (27.7%) F: 31,728 (70.7%) Other: 741 (1.6%)	BDI	13.80% (*n* = 6,196)	N/A	N/A	Nonbinary respondents.
Wathelet, M. et al. (2022) [237]	Cross-sectional study	European Region	France	6,346	M: 1,442 (22.7%) F: 4,795 (75.6%) Other: 109 (1.7%)	N/A	13.69% (*n* = 869)	N/A	N/A	Female, a low feeling of integration before the quarantine period, a low quality of social ties during the quarantine, history of psychiatric.
Werling, A. M. et al. (2022) [238]	Cross-sectional study	European Region	Switzerland	454	N/A	N/A	35.68% (*n* = 162)	N/A	N/A	N/A
Wetherall, K. et al. (2022) [239]	Cross-sectional study	European Region	United Kingdom	2,224	N/A	PHQ-9	10.79% (*n* = 240)	0.90% (*n* = 20)	N/A	N/A
Wojahn, A et al. (2022) [240]	Retrospective study	Region of the Americas	United States	1,486	M: 913 (61.4%) F:573 (38.6%)	N/A	43.27% (*n* = 643)	N/A	N/A	N/A
Wong, S. M. Y. et al. (2022) [241]	Cross-sectional study	Western Pacific Region	China	2,540	N/A	C-SSRS Beck's Hopelessness Inventory	20.98% (*n* = 533)	N/A	N/A	Suicidal ideation: suicide-related rumination, poorer cognitive ability, 12-month major depressive disorder. Suicide attempt: COVID-19 stressors, poorer family functioning, personal life stressors, and non-suicidal self-harm.
Wu, O. et al. (2022) [242]	Cross-sectional study	Western Pacific Region	China	686	M: 438 (63.85%) F:248 (36.15%)	N/A	5.25% (*n* = 36)	N/A	N/A	Social avoidance, emotional vulnerability.
Yamashita, T. et al. (2022) [243]	Cross-sectional study	Western Pacific Region	Japan	310	M: 124 (62%) F:248 (38%)	PHQ-9	14.84% (*n* = 46)	N/A	N/A	Age, experience of deprivation about food expenses, deprivation about cellphone bills.
Yamazaki, J. et al. (2022) [244]	Cross-sectional study	Western Pacific Region	Japan	113	M:62 (63.3%) F: 36 (36.7%)	Mini International Neuropsychiatric Interview (MINI).	17.70% (*n* = 20)	N/A	N/A	Less frequent conversations (those with less than one conversation per week).

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Yao, Y. et al. (2022) [245]	Cross-sectional study	Western Pacific Region	China	5,211	M:62 (63.3%) F: 36 (55.1%)	Beck scale for suicide ideation.	9.61% (*n* = 501)	N/A	N/A	N/A
Yu, Y. et al. (2022) [246]	Cross-sectional study	Western Pacific Region	China	1,248	F: 831 (66.59%) M: 417 (33.41%)	N/A	14.34% (*n* = 179)	8.17% (*n* = 102)	N/A	Suffered family hurt, junior and senior school, and sexism.
Zhang, L. et al. (2022) [247]	Cross-sectional study	Western Pacific Region	China	1,718	M: 479 (29.9%) F:1,239 (70.1%)	N/A	33.35% (*n* = 577)	39.35% (*n* = 676)	N/A	Urban, unemployed, cyberbullying, history of suicide among family or friends, fatigue, physical pain, depression.
Zhu, J. et al. (2022) [248]	Cross-sectional study	Western Pacific Region	China	5,175	M: 2,673 (51.65%) F:2,502 (48.35%)	N/A	20.83% (*n* = 1,078)	11.79% (*n* = 610)	N/A	All: Female, quarreling with parents, insomnia. Male: Quarreling with parents, insomnia, previous suicide attempt history, previous SI history, and feeling depressed during the lockdown pandemic. Female: having emptiness inside, quarreling with parents, insomnia, feeling anxious, and longing for father's emotional warmth.
Alberto Gómez-García, J. et al. (2023) [249]	Cross-sectional study	Region of the Americas	Mexico	79,665	M: 31,258 (39.3%) F:48,407 (60.7%)	N/A	16.22% (n= 12,918)	N/A	N/A	Female, young women, education, single, unemployment, social distancing, living alone, loss of family member due to COVID-19, depression, physical violence, excessive alcohol consumption, drug use, suspicion or diagnosis of COVID-19.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Bowersox, N. W. et al. (2023) [250]	Retrospective study	Region of the Americas	United States	52,916	M: 46,938 (88.7%) F: 5,978 (11.3%)	N/A	1.09% (*n* = 579)	N/A	N/A	N/A
Cai, H. et al. (2023) [251]	Cross-sectional study	Western Pacific Region	China	1,009	N/A	PHQ-9	14.07% (*n* = 142)	7.82% (*n* = 79)	N/A	Depression, anxiety.
Castellvi Obiols, P. et al. (2023) [252]	Longitudinal study	European Region	Spain	1,357	N/A	Suicidal thoughts and behaviors (STB).	7.66% (*n* = 104)	0.36% (*n* = 5)	N/A	N/A
Chen, X. et al. (2023) [253]	Cross-sectional study	Western Pacific Region	China	1,297	M: 563 (56.60%) F: 734 (43.40%)	N/A	6.71% (*n* = 87)	N/A	N/A	History of psychological or emotional counseling before COVID-19 infection, fatigue, higher self-reported COVID-19 related stigma, sleep disorder.
Davies, Helena L. et al. (2023) [254]	Cross-sectional study	European Region	United Kingdom	36,715	M: 10,874 (29.6%) F: 25,728 (70.1%) Missing: 113 (0.3%)	N/A	49.14% (n= 18,040)	N/A	N/A	Having a lifetime psychiatric disorder, not being in paid employment, higher pandemic worry scores, and being racially minoritized.
de la Vega Sanchez, D. et al. (2023) [255]	Cross-sectional study	European Region	Spain	3,140	M: 1,990 (63.4%) F: 1,140 (36.3%) Not specified: 10 (0.3%)	N/A	17.32% (*n* = 544)	N/A	N/A	Female, presence of previous suicide attempts, taking a psychotropic drug, working in a different area during the pandemic.
Gibb, K. et al. (2023) [256]	Cross-sectional study	Region of the Americas	United States	21,949	M: 1,990 (63.4%) F: 1,140 (36.3%) Not specified: 10 (0.3%)	N/A	33.0% (*n* = 7,243)	N/A	N/A	Production and service workers were the priority occupation groups for depressed mood.
González-Blanco, L. et al. (2023) [257]	Cross-sectional study	European Region	Spain	18,180	N/A	Paykel Suicide Scale (PSS).	6.78% (*n* = 1,228)	N/A	N/A	N/A
Hall, B. J. et al. (2023) [258]	Cross-sectional study	Western Pacific Region	China	3,230	M: 1,657 (55.5%) F: 1,563 (44.3%)	PHQ-9 Ask Suicide-Screening Questions (ASQ).	4.49% (*n* = 145)	N/A	N/A	Lockdown stressors: food insecurity, job and income loss, lockdown-related fears.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Hannan, C. et al. (2023) [259]	Cross-sectional study	Region of the Americas	United States	121,380	M: 50,750 (50.1%) F: 50,531 (49.9%)	PHQ-9 M	5.79% (*n* = 7,029)	N/A	N/A	Depression.
He, Z. et al. (2023) [260]	Cross-sectional study	Western Pacific Region	China	10,388	M: 3,032 (29.2%) F: 7,356 (70.8%)	PHQ-9	8.84% (*n* = 918)	N/A	N/A	Moral injury, medical error, workplace violence, depression, anxiety, PTSD.
Jones, S. E. et al. (2023) [261]	Cross-sectional study	Region of the Americas	United States	7,379	M: 3,763 (51%) F: 3,616 (49%)	N/A	N/A	9.09% (*n* = 671)	N/A	Parent job loss, having gone hungry.
Kasal, A. et al. (2023) [262]	Cross-sectional study	European Region	Czech	6,021	M: 2,906 (48.3%) F: 3,115 (51.7%)	Mini International Neuropsychiatric Interview (MINI).	13.22% (*n* = 796)	N/A	N/A	Mental disorders.
Katta-Charles, S. et al. (2023) [263]	Cross-sectional study	Region of the Americas	United States	2,009	M: 1,452 (72.3%) F: 557 (27.7%)	PHQ-9	6.77% (*n* = 136)	N/A	N/A	N/A
Koenig, J. et al. (2023) [264]	Cross-sectional study	European Region	Germany	324	M: 99 (30.6%) F: 225 (69.4%)	Patient Health Questionnaire modified for Adolescents (PHQ-A).	2.16% (*n* = 7)	0.30% (*n* = 1)	N/A	N/A
Kulak-Bejda, A. et al. (2023) [265]	Cross-sectional study	European Region	Poland	350	M: 0 (0%) F: 350 (100%)	BDI	11.14% (*n* = 39)	N/A	N/A	N/A
Landi, G. et al. (2023) [266]	Cross-sectional study	European Region	Italy	652	M: 161 (24.7%) F: 491 (75.3%)	PHQ-9	15.31% (*n* = 100)	N/A	N/A	Mental pain intensity.
Li, S. et al. (2023) [267]	Cross-sectional study	Western Pacific Region	China	14,690	M: 6,271 (42.69%) F: 8,419 (57.31%)	PHQ-9	9.04% (*n* = 1,328)	N/A	N/A	Ethnic minority, age, history of mental disorders, daily life disturbance due to health problems, being around someone with COVID-19, being uncertain about effective disease control, and having depressive symptoms, insomnia symptoms, and psychological distress.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Liu, L. et al. (2023) [268]	Cross-sectional study	Region of the Americas	Canada	18,936	M: 8,082 (49.2%) F:10,818 (50.6%)	N/A	3.06% (*n* = 579)	N/A	N/A	Adverse experiences related to the pandemic, alcohol or cannabis use, violence in their home, depression, anxiety, and post-traumatic stress disorder.
Martínez-Arriaga, R. J. et al. (2023) [269]	Cross-sectional study	Region of the Americas	Mexico	626	M: 106 (17%) F: 515 (82.7%) Other: 2 (0.3%)	N/A	49.20% (*n* = 308)	1.75% (*n* = 11)	N/A	Secondary traumatic stress, high depressive affect, low positive affect, emotional insecurity, interpersonal problems, and medication use.
Martinez-Nicolas, I. et al. (2023) [270]	Cross-sectional study	European Region	Spain	433	M: 153 (35.3%) F:279 (64.4%) Transgender: 1 (0.2%)	C-SSRS PHQ-9	6.24% (*n* = 27)	N/A	N/A	Mental disorders, alcohol use, substance use.
Merkle, S. L. et al. (2023) [271]	Cross-sectional study	Region of the Americas	United States	7,971	N/A	PHQ-9	3.84% (*n* = 306)	N/A	N/A	N/A
Narita, Z. et al. (2023) [272]	Cross-sectional study	Region of the Americas	United States	1,071	M: 509 (48.6%) F: 538 (51.4%)	PHQ-9 C-SSRS	30.16% (*n* = 323)	N/A	N/A	Consistently self-isolated.
Narita, Z. et al. (2023) [273]	Cross-sectional study	Western Pacific Region	Japan	2,862	M: 856 (29.9%) F: 2,006 (70.1%)	PHQ-9	3.77% (*n* = 108)	N/A	N/A	COVID-19-related discrimination, depression.
Nguyen, T. H. et al. (2023) [274]	Retrospective study	Region of the Americas	United States	13,605	M: 856 (50.6%) F: 2,006 (49.4%)	N/A	18.50% (*n* = 2,517)	8.90% (*n* = 1,211)	N/A	Bullied.
Ori, A. P. S. et al. (2023) [275]	Cross-sectional study	European Region	Netherlands	36,106	F: 22,339 (61.9%) M: 13,767 (38.1%)	Mini-International Neuropsychiatric Interview	5.56% (*n* = 2,007)	N/A	N/A	Female, young, depression, anxiety.
Reinke, M. et al. (2023) [276]	Cross-sectional study	Region of the Americas	United States	172,113,599	F: 99,028,073 (57.5%) M: 73,085,526 (38.1%)	N/A	0.09% (n= 160,320)	0.01% (n= 19,719)	N/A	COVID + patients.

Table 1 (continued)

Author, Year of publication	Type of study	WHO region	Country	Sample size	Gender	Measurement tool for suicide for suicide	Suicide ideation rate	Suicide attempts rate	Deaths by suicide rate	Risk factor
Rogers, M. L. et al. (2023) [277]	Cross-sectional study	Region of the Americas European Region South-East Asia Region Western Pacific Region	Brazil, Canada, Germany, India, Israel, Poland, Russia, Korea, Türkiye, United States	5,528	M: 1,204 (21.8%) F: 4,247 (76.8%) Transmale: 7 (0.1%) Trans female: 13 (0.2%) Nonbinary: 38 (0.7%) Not sure: 8 (0.1%) Decline to state: 11 (0.2%)	Suicide Crisis Inventory–2 Columbia–Suicide C-SSRS.	46.82% (*n* = 2,588)	10.31% (*n* = 570)	N/A	N/A
Rukundo, G. Z. et al. (2023) [278]	Cross-sectional study	African Region	Uganda	431	M: 120 (27.8%) F: 311 (72.2%)	Self-reported suicidal thoughts and severe distress (IES-R).	22.04% (*n* = 95)	N/A	N/A	Depression.
Smith, N. E. et al. (2023) [279]	Cross-sectional study	Region of the Americas	United States	1,050	N/A	PHQ-9	42.57% (*n* = 447)	N/A	N/A	N/A
Sotelo, K. V. et al. (2023) [280]	Cross-sectional study	Region of the Americas	Mexico	659	M: 194 (29.5%) F: 465 (70.5%)	Severity Rating Scale.	39.94% (*n* = 262)	18.29% (*n* = 120)	N/A	Female, knowing a person infected with COVID-19, Confinement for more than 40 days.
Tachikawa, H. et al. (2023) [281]	Cross-sectional study	Western Pacific Region	Japan	11,816	M: 6,436 (54.4%) F: 5,380 (45.6%)	Kessler Psychological Distress Scale (K6).	15.66% (*n* = 1,850)	N/A	N/A	Female, loneliness.
Tantirattanakulchai, P. et al. (2023) [282]	Cross-sectional study	South-East Asia Region	Thailand	314	M: 130 (41.4%) F: 184 (58.6%)	C-SSRS	32.48% (*n* = 102)	N/A	N/A	Diabetic retinopathy, depression.
Turner, B. J. et al. (2023) [283]	Cross-sectional study	Region of the Americas	Canada	16,972	N/A	PHQ–9	5.06% (*n* = 859)	N/A	N/A	Suspected or confirmed COVID-19 exposure, potential COVID-19 exposure at work, medical vulnerability toward COVID-19, insecure employment or unemployment, income loss.
Valentini, E. et al. (2023) [284]	Retrospective study	European Region	Italy	850	M: 430 (49.4%) F: 420 (50.6%)	N/A	14.12% (*n* = 120)	N/A	N/A	Females, separated, personality disorders, borderline personality disorder.
Varin, M. et al. (2023) [285]	Cross-sectional study	Region of the Americas	Canada	14,689	N/A	PHQ-9	2.57% (*n* = 316)	N/A	N/A	Alcohol use.
Zhang, X. et al. (2023) [286]	Retrospective study	Western Pacific Region	China	674	N/A	N/A	N/A	33.83% (*n* = 228)	N/A	N/A

All the included article's references are attached as Supplementary material 1

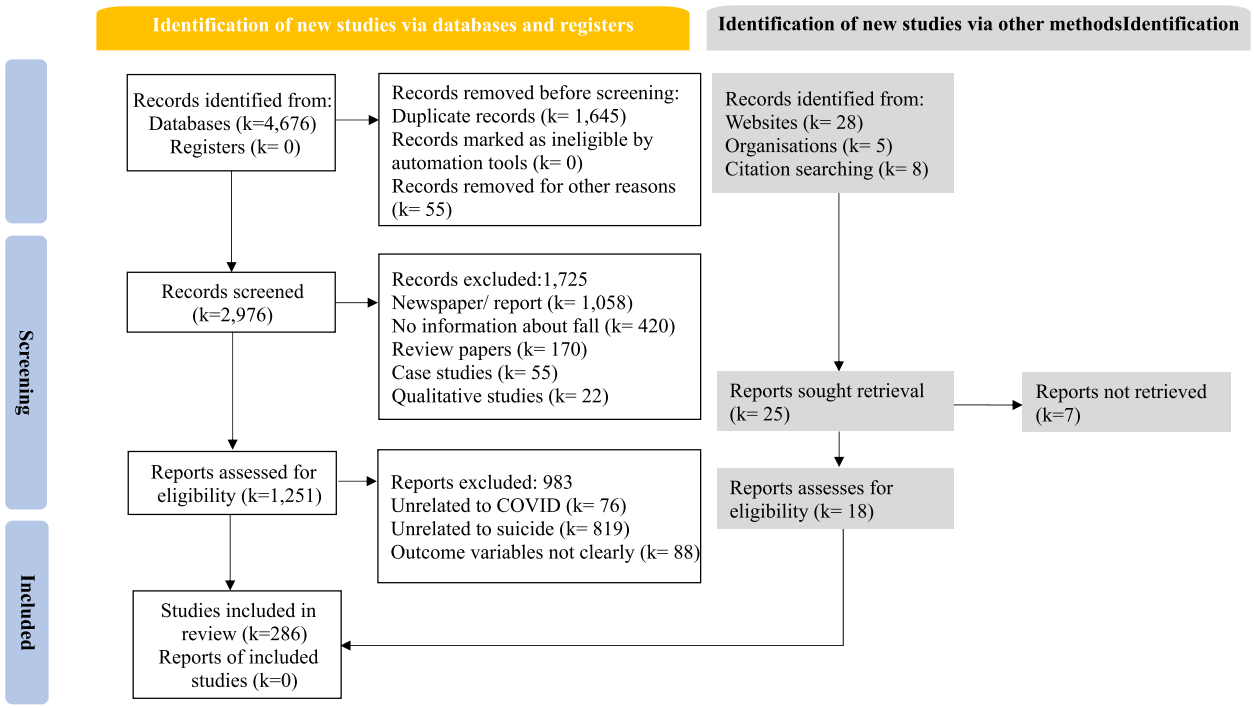

Fig. 1 PRISMA flow diagram of the included studies

design, there were 235 cross-sectional studies, 32 retrospective studies, five case–control studies, four longitudinal studies, three cohort studies, one prospective study, two observational studies, and one exploratory study or quasi experimental study (Fig. 2).

A total of 197 articles used measurement tools to identify suicidal behavior and risk factors. There were 206 articles on suicidal ideation, 26 on suicide attempts, four on death by suicide, 50 on suicidal ideation and attempts, and two on suicide attempts and deaths by suicide. A total of 186 studies evaluated risk factors; however, 100 did not mention risk factors (Table 1).

Suicidal behaviors during the COVID-19 pandemic

Suicidal ideation around the world within individual countries

During the COVID-19 pandemic from 2020 to 2023, the prevalence of suicidal ideation varied significantly across different countries. In Arabia, the prevalence rate was 32.03%, while in Argentina, it was 43.09%. In Australia, the rates ranged from 3.36 to 52.43%, and in Austria, from 6.04 to 45.74%. In Bangladesh, the rates ranged from 5.03 to 47.90%, while in Belgium, the range was 1.50–21.04%. Brazil reported rates between 7.42% and 58.57%, and in Canada, the rates ranged from 2.44 to 60.61%. Chile reported a rate of 10.01%, and in China, the prevalence ranged from 0.53 to 60.31%. In Colombia, it ranged from 7.57 to 40.08%, and in Czechia, from 11.88 to 25.55%. Eswatini had a rate of 1.71%, while France reported rates ranging from 4.42 to 20.90%. In Georgia, the rate was 17.89%, and in Germany, it ranged from 2.16 to 30%. Greece saw rates between 4.32% and 9.84%, while India's rates ranged from 2.44 to 5.36%. Iran reported rates from 8.59 to 20.77%, while in Ireland, the range was 3.50–29.46%. In Italy, the rates were between 3.03% and 6.90%, and Japan reported rates ranging from 3.49 to 47.36%. Lebanon saw a rate of 18.20%, while Lithuania had a higher rate at 45.55%. In Malaysia, the rates ranged from 11.11 to 11.94%, and in Mexico, the range was 16.22–39.94%. In the Netherlands, the rate was 5.56%, and in New Zealand, it was 4.16%. In Norway, the rates were between 3.56% and 3.67%, while in Pakistan, they ranged from 22.41 to 23.53%. Peru reported a rate of 14.01%, while in Poland, the rates ranged from 10.80 to 23.62%. In the Republic of Korea, rates ranged from 4.35 to 18.85%, while in the Russian Federation, the rates ranged from 14.39 to 16.63%. Slovenia reported a rate of 54.48%, and in Spain, rates ranged from 1.71 to 71.72%. Sweden had a prevalence rate of 54.72%, while Switzerland's rates ranged from 35.68 to 79.60%. In Thailand, the rates ranged from 0.22 to 32.48%, and in Türkiye, they ranged from 17.54 to 19.72%. In Uganda, rates ranged from 1.24 to 31.85%, and in the United Kingdom, they ranged from 6.18 to 49.14%. In the United States, rates ranged from 0.09 to 48.35%, while across multiple countries, the prevalence ranged from 5.60 to 57% (Table 1).

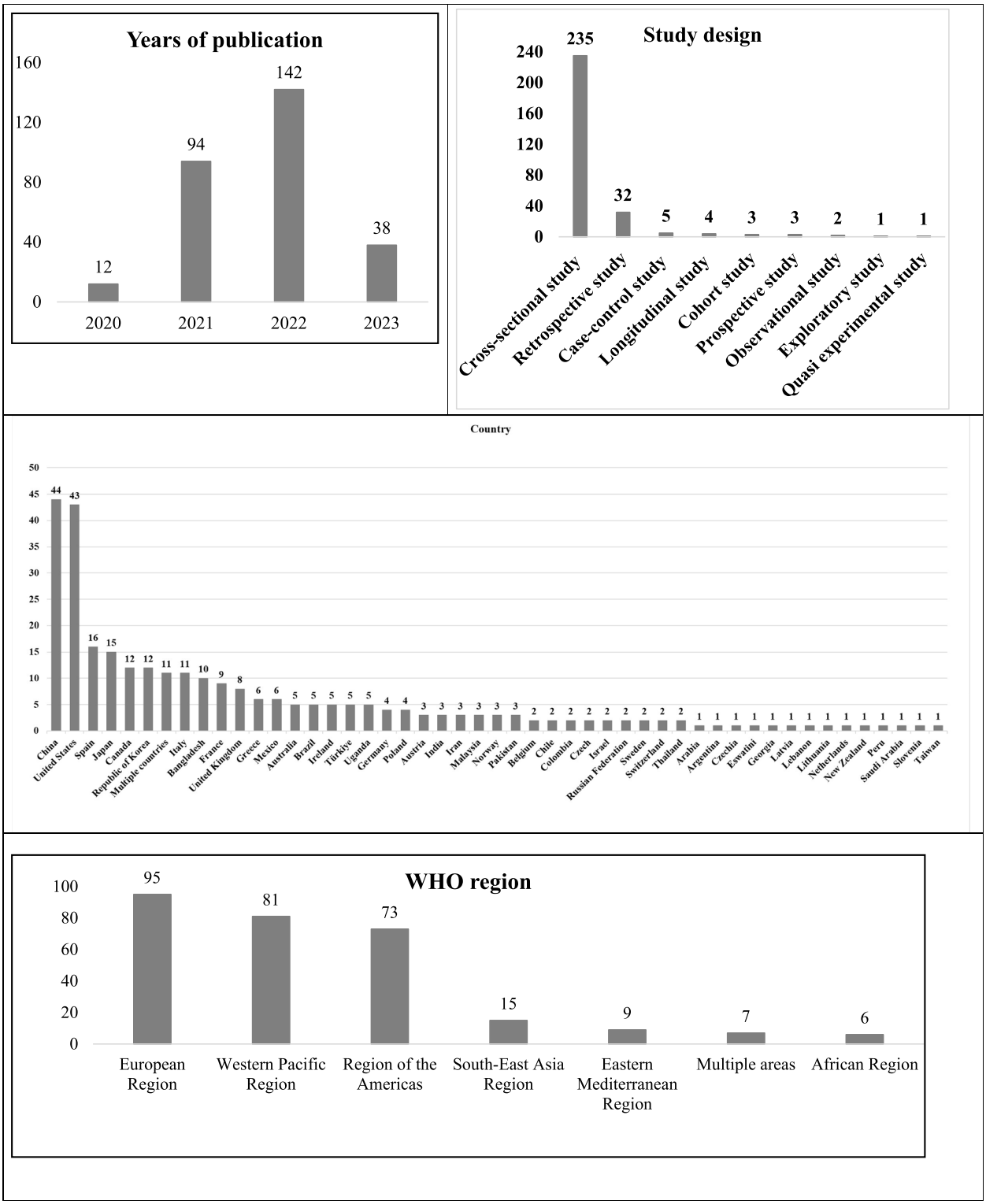

Fig. 2 Publication year, study design, countries and WHO region of included studies

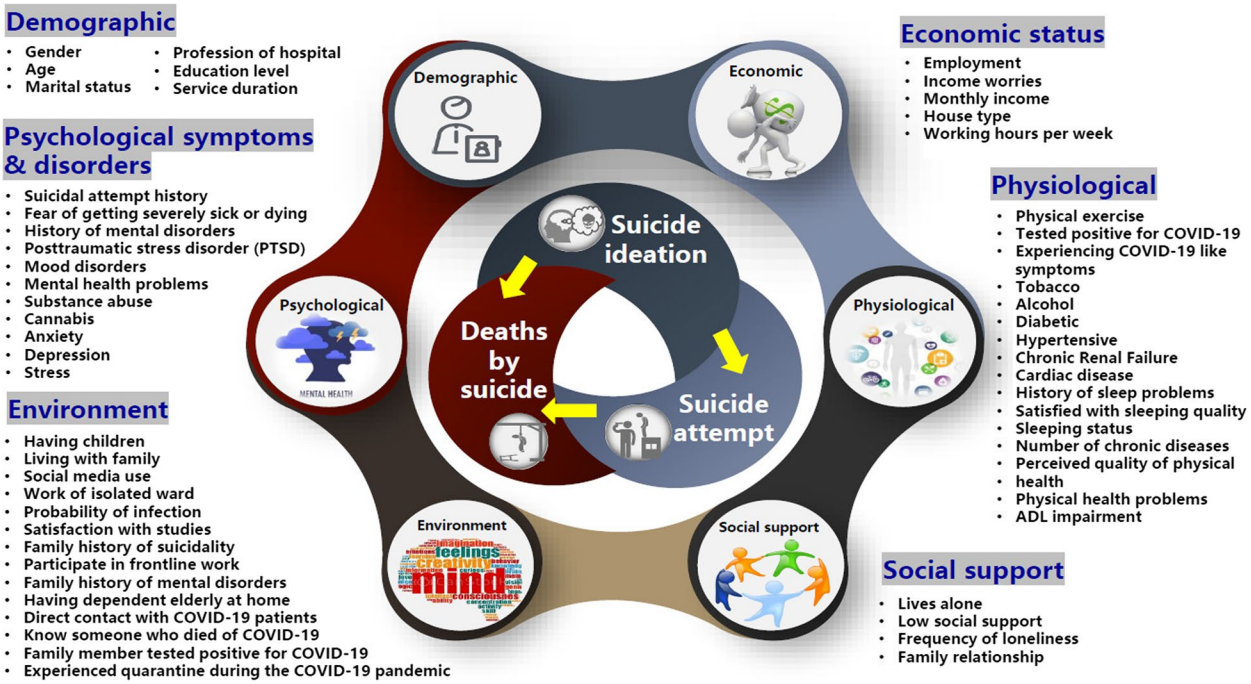

Fig. 3 The relationship between suicide types and risk factors during the COVID-19 pandemic: a model during the COVID-19 pandemic, a model encompassing six variations of suicide types was constructed

In the WHO regions, the prevalence rates of suicidal ideation also showed wide variation. In the European Region, rates ranged from 1.50 to 79.60%, while in the Region of the Americas, they ranged from 0.09 to 60.61%. In the Western Pacific Region, rates varied between 0.53% and 60.31%, while in multiple areas, rates ranged from 15.66 to 57%. In the Southeast Asia Region, the range was 0.22–47.90%, while in the Eastern Mediterranean Region, rates ranged from 8.59 to 32.03%. Finally, in the African Region, rates ranged from 1.24 to 31.85% (Table 1).

Suicide attempts around the globe within individual countries

During the COVID-19 pandemic from 2020 to 2003, the suicide attempt prevalence rates were 8.15% in Argentina; 0.70–1.83% in Bangladesh; 7.78–51.23% in China; 0.30–0.53% in Germany; 5.91–6.10% in Greece; 1.69% in India; 22.70% in Iran; 11.17–11.24% in Ireland; 2.05–19.90% in Italy; 0.98% in Japan; 6.13% in Latvia; 1.69% in Lithuania; 8.37% in Malaysia; 11.17% in Mexico; 1.75–18.29% in Mexico; 1.46% in New Zealand; 0.20% in Norway; 9.13–13.36% in Pakistan; 0.30–2.33% in Korea; 0.60% in Saudi Arabia; 28.99% in Slovenia; 0.10–57.83% in Spain; 0.02–1.37% in Sweden; 0.97% in Taiwan; and 2.79–3.58%.

In the WHO regions, the prevalence rates of suicidal ideation ranged from 0.02 to 57.83% in the European Region, 0.01–51.96% in the Region of the Americas, 0.30–51.23% in the Western Pacific Region, 0.60–22.70% in the Eastern Mediterranean Region, 10.31% in multiple areas, 0.70–1.83% in the Southeast Asia Region, and 0.06% (60 per 100,000 person-years) in the African Region (Table 1).

Distribution of deaths due to suicide around the world

During the COVID-19 pandemic, from 2020 to 2023, the incidence of death by suicide varied across different countries. In Israel, the incidence ranged from 18.4 to 134.7 per 100,000 person-years (0.0015–0.13%); in Chile, it was 8.07 per 100,000 person-years (7.57%); in Uganda, it was 3 per 100,000 person-years (0.01%); in Türkiye, the rate was 2.77%; and in the United States, it was 0.01% (Table 1).

Within the WHO regions, the prevalence of suicidal ideation also varied. In the Americas Region, it ranged from 0.01 to 7.57% (8.07 per 100,000 person-years), in the European Region, it ranged from 0.0015 to 0.13% (18.4 to 134.7 per 100,000 person-years), and in the African Region, it was 0.01% (3 per 100,000 person-years).

Risk factors for suicide behavior during the COVID-19 pandemic

In this review, our analysis revealed that suicide-related risk factors included demographic factors, psychological

symptoms and disorders, physiological factors, economic status, social support, and environmental factors (Fig. 3). The demographic risk factors included sex, age, marital status, hospital profession, education level, and service duration. The specific psychological symptoms and disorders included a history of suicide attempts, a fear of severe illness or death, a history of mental disorders, posttraumatic stress disorder (PTSD), mood disorders, mental health issues, substance abuse, cannabis use, anxiety, depression, and stress. Among the physiological factors examined were physical exercise, testing positive for COVID-19, experiencing COVID-19-like symptoms, tobacco use, alcohol consumption, diabetes, hypertension, chronic renal failure, cardiac disease, history of sleep problems, satisfaction with sleep quality, sleep status, number of chronic diseases, perceived physical health quality, physical health problems, and ADL impairment.

The economic status factors included employment, income, monthly income, house type, and working hours per week. Social support factors included living alone, low social support, frequency of loneliness, and family relationships. Among the environmental factors examined were having children, living with family, social media use, working in an isolated ward, probability of infection, satisfaction with studies, family history of suicidality, participation in frontline work, family history of mental disorders, having dependent elderly people at home, direct contact with COVID-19 patients, knowing someone who died of COVID-19, being a family member who tested positive for COVID-19 and experiencing quarantine during the COVID-19 pandemic (Fig. 3).

Measurement tools for suicide behaviors and risk factors

Among the 286 included studies, 197 related to suicide assessment instruments were identified. We found that 47 scales were used to measure suicidal behavior and its risk factors. The six most frequently utilized instruments ranked in descending order of usage rate are as follows: 96 studies used the Patient Health Questionnaire-9 (PHQ-9), 14 used the Patient Health Questionnaire-2 (PHQ-2), and Columbia Suicide Severity Rating Scale (C-SSRS), and 6 used the Patient Health Questionnaire-4 (PHQ-4), Mini International Neuropsychiatric Interview (MINI), Beck Depression Inventory (BDI), and the Suicidal Behaviors Questionnaire-Revised (SBQ-R) (Table 2).

Discussion

Approximately 773,449,299 people worldwide were diagnosed with COVID-19 in 2023 [18]. The COVID-19 vaccine has notably enhanced patient longevity, reducing the spread of infection as well as the rates of mobility and mortality [19]. However, individuals who are battled with COVID-19 often suffer from significant, frequently undiagnosed, and untreated psychosocial disturbances. Hence, our comprehensive review of 286 studies delved into the landscape of suicidal behavior during the pandemic. This encompassed an exploration of risk factors and their connections to demographics, economics, physiology, social support, environment, and psychology (Fig. 3). This review compiled eligible articles published between 2020 and 2023 from 48 countries. Our findings highlighted an upward trend in the analysis of suicidal behavior and its risk factors, particularly in 2022. During the COVID-19 pandemic, the bulk of studies on suicidal behaviors and risk factors came from China and the United States. Our inclusive research spanned all WHO regions worldwide, offering a significant advantage in terms of widespread recognition.

The collective incidence of completed suicides amid COVID-19 ranged from 18.4 to 134.7 per 100,000 person-years (equivalent to 0.0015–0.13%). This reflects a notably higher rate of completed suicides compared to the global population of 0.09 per 1000 individuals in 2019 [20]. Many studies have indicated a prevalence of suicidal thoughts among individuals during the pandemic, often attributed to quarantine measures, patterns of social isolation, and fear of the disease. In the European Region, there was a wide range of high suicidal ideation, spanning from 0.02 to 57.83%.

The findings of this scoping review highlight a comprehensive array of suicide-related risk factors during the COVID-19 pandemic. The identified factors can be broadly categorized into demographic, psychological, physiological, economic, social support, and environmental domains. Understanding and discussing these factors is crucial for developing targeted interventions and support systems to mitigate the risk of suicide. This emphasizes the importance of tailoring interventions based on individual characteristics and life circumstances. For instance, specific strategies may be needed for different age groups, genders, or professions [21]. Addressing mental health concerns is paramount, and the findings underscore the need for comprehensive mental health support services during the pandemic [22]. This highlights the interconnectedness of physical and mental health and emphasizes the importance of holistic healthcare approaches in suicide prevention [23]. The economic impact of the pandemic has far-reaching consequences for mental health, and interventions should consider providing financial support, employment assistance, and mental health resources. Strengthening social support networks and addressing feelings of isolation are critical components of suicide prevention strategies. Creating a supportive and understanding environment,

Table 2 Measurement instrument of suicide

Categories	Measurement tool	Number of Studies
47 suicide scales	Patient Health Questionnaire-9 (PHQ-9)	96
	Columbia Suicide Severity Rating Scale (C-SSRS)	14
	Patient Health Questionnaire-2 (PHQ-2)	14
	Beck Depression Inventory (BDI)	6
	Mini International Neuropsychiatric Interview (MINI)	6
	Patient Health Questionnaire-4 (PHQ-4)	6
	Suicidal Behaviors Questionnaire-Revised (SBQ-R)	6
	Kessler 6-item Psychological Distress Scale (K6)	5
	Patient Health Questionnaire-15 (PHQ-15)	4
	Ask Suicide-Screening Questions (ASQ)	3
	Beck Suicide Ideation Scale (SSI)	3
	General Health Questionnaire (GHQ)	3
	Risk Assessment Suicidality Scale (RASS)	3
	Self-reported suicidal thoughts and severe distress (IES-R)	3
	Beck Depression Inventory-II (BDI-II)	2
	Okasha's Suicidality Scale (OSS)	2
	Patient Health Questionnaire-8 (PHQ-8)	2
	Patient Health Questionnaire-Adolescent (PHQ-A)	2
	Suicidal ideation attributes scale (SIDAS)	2
	Suicidal Thoughts and Behaviours (STB)	2
	Adolescent Behaviors and Experiences Survey (ABES)	1
	Beck Hopelessness Scale (BHS)	1
	Centre for Epidemiological Studies Depression Scale (CES-D)	1
	Clinical Global Rating (CGI) scale	1
	Common mental health problems (CMHPs)	1
	Composite International Diagnostic Interview (CIDI 3.0)	1
	Depression, Anxiety and Stress Scale (DASS-21)	1
	Edinburgh Postnatal Depression Scale (EPDS)	1
	German version of the Suicide Ideation and Behaviour Scale (SSEV)	1
	Hospital Anxiety and Depression scale (HADS)	1
	Kessler 10-item Psychological Distress Scale (K10)	1
	Life Orientation Test-Revised (LOT-R)	1
	Non-suicidal self-injurious (NSSI)	1
	Overall Perceived Stress Scale-10 (PSS)	1
	Patient Health Questionnaire-9-Modified (PHQ-9-M)	1
	Paykel Suicide Scale (PSS)	1
	Plutchik Suicidal Risk Scale (PSRS)	1
	Psychiatric Inpatient Suicide Risk Assessment (PISRA)	1
	Self-Injurious Thoughts and Behaviors Interview-Revised	1
	Self-Reporting Questionnairee20 (SRQ-20)	1
	Social Support Scale (SSRS)	1
	Suicide Crisis Inventory–2 (SCI-2)	1
	Suicide Probability Scale (SPS)	1
	The DetectaWeb-Distress scale	1
	The suicidal behaviors schedule (CCS)	1
	WHO World Mental Health-Composite International Diagnostic Interview	1

especially for those directly involved in pandemic-related work, is essential. This scoping review provides a comprehensive overview of the multifaceted risk factors for suicide during the COVID-19 pandemic. The identified factors underscore the need for integrated and multidimensional approaches to suicide prevention that address the diverse challenges individuals face [4, 11, 24, 25]. Tailoring interventions based on demographic, psychological, physiological, economic, social, and environmental considerations is essential for effectively mitigating suicide risk in the context of the ongoing global health crisis.

The extensive analysis of suicide assessment instruments within the 197 studies revealed a rich landscape of tools utilized for measuring suicidal behavior and its associated risk factors during the COVID-19 pandemic. The most frequently used instruments, identified from the 47 scales, shed light on the preferences of researchers in the field. The Patient Health Questionnaire-9 (PHQ-9) emerged as the most widely employed instrument and was utilized in 96 studies. This finding reflects the prominence of the PHQ-9 in capturing various aspects of mental health, particularly depression, which is a known risk factor for suicidal behavior. The Patient Health Questionnaire-2 (PHQ-2) was used in 14 studies. The PHQ-2, a briefer version of the PHQ-9, focuses on the core symptoms of depression. Its use suggests a trend toward efficient and targeted screening for depressive symptoms, aligning with the need for quick assessments in busy clinical settings or large-scale studies. The Columbia Suicide Severity Rating Scale (C-SSRS) is another prominent instrument used in studies spanning various contexts. Its comprehensive approach to assessing suicidal ideation and behavior positions it as a valuable tool for capturing the complexity of suicide risk. The Mini International Neuropsychiatric Interview (MINI), Beck Depression Inventory (BDI), and Suicidal Behaviors Questionnaire-Revised (SBQ-R) have also been utilized in multiple studies, demonstrating their efficacy in evaluating mental health and suicidal tendencies [26]. This diversity in instrument usage suggests the recognition of the multifaceted nature of suicide risk. Researchers and clinicians appear to be employing a range of tools to capture different dimensions of mental health, from broad assessments such as the PHQ-9 to more focused instruments such as the PHQ-2. The inclusion of scales such as the C-SSRS, MINI, BDI, and SBQ-R highlights the importance of evaluating not only depressive symptoms but also the broader spectrum of factors contributing to suicide risk, including specific behaviors and ideation.

Strengths

The strength of this research lies in its global representation, spanning 48 countries across all WHO regions. This broad inclusion enhances the external validity of the findings, offering a more comprehensive understanding of suicidal behaviors during the COVID-19 pandemic on a global scale. The study covers articles published between 2020 and 2023, providing a dynamic perspective on the evolving patterns of suicidal behaviors during the pandemic. Notably, the identification of an upward trend in 2022 underscores the need for continued research to track changing dynamics and emerging patterns over time.

Furthermore, the scoping review's detailed categorization of suicide-related risk factors into demographic, psychological, physiological, economic, social support, and environmental domains offers a holistic perspective. This approach facilitates the identification of interconnected factors, aiding in the development of targeted interventions tailored to individual circumstances. Lastly, the review's recognition and examination of 47 different assessment instruments across the 197 studies highlight a commitment to methodological diversity. This variety allows for a deeper understanding of suicidal behaviors, acknowledging the complex and multifaceted nature of the phenomenon.

Limitations

There are several limitations in the studies included in this review. These studies may vary in data quality and methodologies, with differences in study designs, populations, and assessment methods potentially complicating the synthesis of findings and the ability to draw definitive conclusions. While the review includes studies up to 2023, the long-term impact of the pandemic on suicidal behaviors may not yet be fully understood. Future research should extend the time frame to capture any sustained effects and possible shifts in patterns over a longer period. Although this study highlights the importance of tailoring interventions based on individual characteristics, it offers limited exploration of intersectionality. Considering the interactions between multiple demographic factors simultaneously could provide a more nuanced understanding of suicide risk. Furthermore, the review may be subject to publication bias, as studies reporting statistically significant results are more likely to be published. Unpublished studies or those with non-significant findings may be underrepresented, which could affect the overall interpretation of the results.

Despite these limitations, the comprehensive scope of the review, along with its acknowledgment of potential biases, provides valuable insights into the multifaceted nature of suicidal behaviors during the COVID-19 pandemic. The strengths and limitations together emphasize the need for continued research, methodological diversity, and a more nuanced approach to addressing the complex factors that influence suicide risk.

Future directions

Future research on suicidal behaviors during global crises, like the COVID-19 pandemic, should prioritize longitudinal studies to track the long-term mental health impacts across different populations. Investigating the intersection of demographic, psychological, economic, and social factors will provide a more comprehensive understanding of suicide risk in vulnerable groups. Additionally, standardizing assessment tools for suicidal behaviors can enhance data consistency, enabling more accurate comparisons across studies and regions. Expanding research beyond high-income countries to include low- and middle-income nations is essential for a global perspective, as these areas often face unique social and economic challenges that affect mental health. Finally, future studies should explore the effectiveness of targeted interventions, such as virtual mental health support and community-based programs, to mitigate suicide risks during and after public health emergencies.

Conclusion

This scoping review offers a global overview of suicidal behavior in 48 countries, based on an analysis of 286 primary research studies. Our findings reveal that nations in Europe, the Americas, and the Western Pacific regions have the highest rates of suicidal behavior. The most prevalent risk factors identified include demographic characteristics, psychological symptoms and disorders, physiological conditions, economic status, social support levels, and environmental influences.

The review underscores the complex and multifaceted nature of suicidal behaviors during the COVID-19 pandemic, emphasizing the need for comprehensive and multidisciplinary approaches to address this critical issue. Understanding the interplay among these diverse risk factors is essential for developing effective prevention and intervention strategies to mitigate the pandemic's impact on mental health and well-being globally.

The outcomes of this review serve as a valuable scientific foundation for creating protocols and clinical practice guidelines aimed at enhancing population well-being worldwide. By providing detailed prevalence and incidence rates of suicide, along with associated risk factors in the context of the COVID-19 pandemic, our study's findings have the potential to strengthen suicide prevention efforts.

Abbreviations

ADL	Activity of daily living
BDI	Beck Depression Inventory
CACPSS	Critical Appraisal for Checklist for Prevalence Studies Scale
C-SSRS	Columbia Suicide Severity Rating Scale
INPLASY	International Platform of Registered Systematic Review and Meta-analysis Protocols
HIV	Human Immunodeficiency Virus
JBI	Joanna Briggs Institute
MeSH	Medical Subject Headings
PTSD	Posttraumatic stress disorder
PHQ-9	The Patient Health Questionnaire-9
MINI	Mini International Neuropsychiatric Interview
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SBQ-R	Suicidal Behaviors Questionnaire-Revised
WHO	World Health Organization

Supplementary Information

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Supplementary Material 1.

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Authors' contributions

YTT, and SPKM, with input from ZTL and NYK, conceptualised and planned the study. YHY, and YJT managed and coordinated the research activity planning and execution. YHY, YJT, YHY, and ZTL extracted the data. YTT and ZTL reviewed the data, designed the methods, conducted the statistical analysis, and wrote up the results and appendices. YHY, and YJT prepared the first draft of the manuscript, with important contributions from SPKM and NYK. SPKM, YJT, YHY, ZTL, and NYK critically reviewed and commented on the manuscript. YTT and SPKM helped to prepare, create, and present the published work including table and figures, specifically visualization and data presentation. YTT, SPKM and NYK had oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.

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Data availability

The data analyzed in this study were a reanalysis of existing data, which are openly available at locations cited in the reference section.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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