# Suicidality Among People Living With HIV From 2010 to 2021: A Systematic Review and a Meta-regression

Yi-Tseng Tsai, MS, Sriyani Padmalatha, KM, MS, Han-Chang Ku, MS, Yi-Lin Wu, MS, Tsung Yu, PhD, Mu-Hong Chen, PhD, and Nai-Ying Ko, RN, PhD

## ABSTRACT

**Objective:** The association between human immunodeficiency virus (HIV)/AIDS and suicidality is not well understood, partly because of variability in results. This meta-analysis aimed to investigate the predictive value of HIV/acquired immune deficiency syndrome for incident suicidality.

**Methods:** A literature review was conducted of articles published between January 1, 2010, and October 31, 2021. The following databases were searched: Embase, MEDLINE, CINAHL, Web of Science, and Scopus. The search terms included human immunodeficiency virus (HIV), suicidal behavior, auto mutilation, and self-injurious behavior. Observational studies were screened following a registered protocol, and eligible ones were meta-analyzed and followed by meta-regression.

**Results:** A total of 43 studies were included in this systematic review, and a meta-regression included 170,234 participants. The pooled prevalence estimates of suicidal ideation, attempted suicide, and deaths by suicide were 22.3%, 9.6%, and 1.7%, respectively. The following significant risk factors for suicide ideation were found: substance use, depression, low quality of life, low social support, without HIV status disclosure, living alone, low level of memory problems, family history of suicide, and stage III of HIV. Risk factors for suicide attempts were depression and family history of suicide. An elevated risk for suicide-related death was found for people living with HIV (PLHIV) who had a psychiatric disorder and in studies conducted in hospital-based settings (versus national database studies or HIV clinic settings).

**Conclusions:** The risk of suicidality is high among PLHIV within all six World Health Organization regions during the modern antiretroviral therapy era. Assessment of socioeconomic and psychological factors is recommended for further management to prevent suicide among PLHIV. The present findings are useful for design of intervention protocols and development of clinical practice guidelines intended to manage the well-being of PLHIV worldwide.

**Key words:** suicidal behavior, suicidal ideation, suicide attempts, deaths by suicide, people living with HIV.

## INTRODUCTION

Suicide is a serious global public health problem. The World Health Organization (WHO) reported that approximately 800,000 people worldwide die from suicide every year (an average of one death every 40 seconds) (1). The incidence of suicidal behavior of people living with human immunodeficiency virus (PLHIV) is three times higher than that of the general population (2). Furthermore, suicide mortality rates among PLHIV have continued to increase annually from 0.15 per 100 person-years (PY) in 1988 to 2008 to 0.47 per 100 PY in 2011 to 2012, whereas deaths from suicide have increased threefold (3,4). However, these data are derived from official registries and death certificate information (e.g., the Human Cause of Death Database and records on suicide hospitalizations) and do not include details of risk factors, suicidal ideation, and suicide attempts (4–7). Therefore, these aspects should be explored using scientific research.

Studies have found that poor social support, stigma associated with PLHIV, and associated comorbidities may influence the increase in suicide rates (8–11). A study conducted in Taiwan found that, because of stigma and a lack of social care or support, suicide is the second leading cause of death among PLHIV in Taiwan (12). As such, suicide has become a major health issue among PLHIV in the era of antiretroviral therapy (ART). A study conducted in the pre–highly active ART (pre-HAART; 1988–1995) and HAART (1996–2008) eras reported that the suicide rate was lower at those times than in the modern ART era (2005–2014). However, the relationship between antiviral therapy and suicidal behaviors remained unclear in the modern ART era (4,13–17). Despite this, to our knowledge, no studies have referenced previous studies

ART = antiretroviral therapy, **CI** = confidence interval, **HAART** = highly active antiretroviral therapy, **HIV** = human immunodeficiency virus, **PLHIV** = people living with HIV, **PY** = person-years, **WHO** = World Health Organization

and reported the global prevalence of suicidal behavior and associated risk factors among PLHIV.

Suicidal behavior is a complicated process with varying degrees of severity, from suicidal ideations to suicide attempts and ultimately death by suicide. Suicidal ideation is defined as thinking about, considering, or planning suicide, whereas a suicide attempt is defined as a failed attempt to commit suicide wherein the person survives (18,19). Death by suicide represents the extreme end of the spectrum; it is a complex interrelationship between behavior and suicide attempts that end in death (18,20).

There is a lack of studies evaluating the global suicidal behavior of PLHIV. Some studies in developing countries and settings have reported and a possibly high prevalence of suicidal behavior (2,20–22). Some have shown that suicidal ideation is more common than suicide attempts and suicide, and that the presence of suicidal ideation influences the high risk of suicide attempts and completion (20,23). Three methods used to commit suicide across countries/regions, races, social statuses, and risk factors have been investigated, whereas several primary studies (24–27) focused on specific at-risk populations (e.g., postpartum women, men who have sex with men, and prisoners). However, no studies have systematically included all at-risk populations and risk behaviors, and no systematic review studies have been conducted using primary research data from multiple countries.

Therefore, this systematic review and meta-analysis was conducted to determine the global prevalence of suicidal ideation, suicide attempts, and suicides, as well as the associated risk factors among PLHIV.

## Objective of This Study

The aim of this study was to estimate the global prevalence and risk factors associated with suicidal ideation, suicide attempts, and suicides among PLHIV.

## Research Question

What is the global prevalence of, and what are the risk factors associated with, suicidal ideation, suicide attempts, and suicides among PLHIV?

## METHODS

### Search Strategy

This study came from five databases (Embase, MEDLINE, CINAHL, Scopus, and Web of Science) searched for studies on the prevalence of suicidal behavior among PLHIV published between January 1, 2010, and October 31, 2021. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were followed (28–30). English synonyms such as AIDS, T-lymphotropic virus, human T-cell lymphotropic virus, type III human T-cell leukemia virus, type III lymphadenopathy-associated virus, LAV-HTLV-III, HTLV-III-LAV, type III infection, and HTLV III infection were used to search each database. We also used several control phrases for the Emtree and MeSH databases. For Emtree, they included "human immunodeficiency virus," "human immunodeficiency virus infection," "suicidal behavior," "automutilation," and "suicide." For MeSH, they included "HIV infections," "HIV," and "self-injurious behavior." We supplemented the search results with the Endnote X9 bibliographical database. Publications that cited the articles identified during the search were manually screened, as well as the reference lists of relevant articles and previous systematic reviews to confirm the sensitivity of the search strategy (31).

### Eligibility Criteria

The inclusion criteria were as follows: a) the study provided primary data on the prevalence or incidence of suicidal ideation, suicide attempts, or suicides measured using validated assessment tools or coded medical report data within a population-based study; b) the participants were 15 years or older; c) the participants were diagnosed with human immunodeficiency virus (HIV)/AIDS; and d) observational studies (including cohort and cross-sectional studies) published in English, Chinese, or Sinhala, and published from 2010 to 2021 (the modern ART era within recent 10-year publications). The following types of studies were excluded: those in which the study population did not include PLHIV, and qualitative research and review studies.

Titles and abstracts were independently screened by three researchers based on the inclusion and exclusion criteria after removing duplicates using the Endnote X9 bibliographical database. Then, the full text of the selected studies was reviewed by three researchers independently, with any disagreement resolved by a fourth researcher to avoid selection bias.

### Quality Assessment

All eligible studies were assessed for quality of evidence using the Joanna Briggs Institute Critical Appraisal for Checklist for Prevalence Studies Scale, which contains nine items and four responses (yes, no, unclear, and not applicable) (32). Studies with a total score of 8 and higher were considered to have high-quality evidence and were included in this systematic review. Study quality and risk of bias were independently assessed by three researchers, with any disagreement resolved by a fourth researcher.

### Data Extraction

The following data were extracted: names of authors, year of publication, country, settings, study design, sample size, and participant ethnicity, age, sex, prevalence of suicidal ideation, suicide attempts, and suicides. Three authors independently assigned quality scores for the included studies according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (28), and any disagreements were resolved via a discussion among all four authors.

### Statistical Analysis

A meta-analysis was conducted to identify statistical outcomes for three selected suicidal behaviors among PLHIV using the eligible studies. The pooled prevalence of either suicidal ideation, suicide attempt, or suicide was analyzed using number of events converted to the risk ratio (RR) of 95% confidence interval (CI) and $p$ value and based on a fitted model based on the degree of heterogeneity. The random-effects model or a fixed-effects model was used based on the heterogeneity results for suicidal behavior among PLHIV. We transformed the proportions with the Freeman-Tukey double arcsine method before pooling the data for incident rate of suicide, and the heterogeneity value was assessed using DerSimonian-Laird estimator by $I^2$, the Cochran $Q$ test, and $\tau^2$ for the included studies (33–37). A value of zero indicated the absence of heterogeneity, 25% indicated no significance or low significance, 50% indicated moderate heterogeneity, and 75% indicated significant heterogeneity. In the present study, 75% to 100% indicated significant heterogeneity, where the $Q$ statistic and $p$ value were used to validate the heterogeneity results. In this meta-analysis, $I^2 > 75\%$ and $p > .05$ indicated statistical significance.

Publication bias was determined using funnel plots, and $Q$ statistic for Egger's was used to determine the correlation between the effect estimate and the variances in the results for suicidal behavior among PLHIV via Comprehensive Meta-Analysis Software (Biostat, Englewood, New Jersey) and a visual examination of the funnel plots (38,39). A subgroup analysis and a meta-regression were performed to investigate potential sources of heterogeneity. For the meta-regression, we used the pool of effects size data as a single coverable that was introduced individually into the models. A simultaneous test was conducted to determine if all coefficients were zero in the model test. We used a null hypothesis model for the effect size comparison. Statistical analyses were conducted using Comprehensive Meta-Analysis Software version 3.0 (Biostat) (40).

## RESULTS

### Study Identification

Searching the five databases resulted in 4199 articles being identified that were published between January 1, 2010, and October 31, 2021. After removing 843 duplicate articles using the Endnote X9 bibliographical database, the titles and abstracts of 3356 articles were screened, and 1854 articles met the inclusion criteria. The full text of each article was read to determine eligibility, and 1784 articles were excluded for the following reasons: 1166 articles did not have any relationship to HIV/AIDS, 488 articles did not mention suicidal behavior among PLHIV, 99 articles did not clearly assess the outcome variables, and 31 articles were not available in a full-text format. After the quality assessment, 27 articles were removed because of a low-quality score in the peer review. Thus, 43 articles were included in the systematic review and meta-regression (Figure 1). Studies with quality scores of 8 and higher were accepted as high quality (Supplemental Digital Content, Table S1, http://links.lww.com/PSYMED/A865).

### Study Characteristics

The characteristics of the 43 studies included in this work are shown in Table 1. Studies were conducted in 21 countries (Argentina, Brazil, Canada, China, Estonia, Ethiopian, France, Indonesia, Iran, Japan, Kazakhstan, Korea, Lesotho, Nigeria, South Africa, Spain, Switzerland, Taiwan, Tanzania, Uganda, and the United States). Of all the included studies, seven were conducted in China (8,20,26,41,43,52,54), five were conducted in South Africa (11,24,25,45,63), four were conducted in Ethiopia (42,44,47,50), four were conducted in the United States (23,31,51,60), three were conducted in Nigeria (9,58,59), and two were conducted in Switzerland (4,6), France (33,57), Canada (3,13), and Brazil (10,64) Single studies were conducted in each of the other countries. Regarding the study design, 33 were cross-sectional studies, 9 were cohort studies, and 1 was a retrospective study. In terms of the study setting, 18 studies were conducted in a hospital, another 19 studies had participants recruited from HIV clinics/community centers, and 6 studies used national data from a database. The studies were published between 2010 and 2021, with 32 studies published in the past 5 years (2015 and later) and the remaining 11 studies published before 2015 (Table 1).

### Participant Characteristics

The total number of participants within the 43 studies was 170,234 individuals; 114,335 were male and 33,538 were female. Also, 26 studies included both sex (2,4,6,8–11,13,20,24,26,41–46,48,51,54,55,58,60,63,65), 2 (26,63) had only male participants, 4 studies (24,25,45,65) had only female participants, and 13 studies (3,5,7,23,31,33,47,49,56,59,61,62,64) did not mention participant sex. The participant age range in 10 studies (2,8,20,33,41,44,46,47,49,65) was 20 to 55 years, and 27 studies (3–7,11,13,23–26,31,43,45,48,50,52,53,55–63) did not mention participant age.

In terms of ethnicity, three studies conducted in the United States (23,31,51) included Black, White, Hispanic, and other participants. Badiee et al. (31) included Black, Hispanic, White, and other as the ethnicities, and the two other studies used one ethnic group for their study population based on popularity norms. One

study from the United States (51) and Brazil (64) also mentioned two ethic groups (Black and White).

The studies were conducted in all the WHO regions: Eighteen studies were conducted in the African Region (11,26,49–55,59–61,67,71,72,74). Seven studies were conducted in the European Region (4,6,7,13,33,57,65). Eight studies were conducted in the region of the Americas (3,10,23,31,51,55,60,64). Ten studies were conducted in the Western Pacific region (5,8,20,26,41,43,52,54,56,62). One study was conducted in each of the Eastern Mediterranean region (53) and Southeast Asian region (48).

In terms of suicidal behavior among PLHIV, 14 studies (2,11,31,43,44,47,50,52,55,56,58,59,61,62) assessed both suicidal ideation and suicide attempts, 33 studies (2,8–11,20,23–26,31,33,42–45,47–56,58,59,61–65) measured only the prevalence of suicidal ideation, 17 studies (2,11,31,43,44,46,47,50,52,55–62) measured the prevalence of suicide attempts, 8 studies (3–7,13,41,57) measured the incidence of death by suicide, and 1 study (57) focused on suicide attempts and suicides.

### Prevalence and Incidence of Suicidal Behavior Among PLHIV

#### Prevalence of Suicidal Ideations

Within 16 countries (the Argentina, Brazil, China, Estonia, Ethiopia, France, Iran, Indonesia, Korea, Kazakhstan, Nigeria, South Africa, Tanzania, Taiwan, the United States, and Uganda), 33 studies analyzed the prevalence of suicidal ideations among PLHIV. Suicidal ideation events were reported in 4221 of 24,939 participants, and nine studies in the Western Pacific region showed the highest rates of suicidal ideation events (Table 1; Supplemental Digital Content Table S2, http://links.lww.com/PSYMED/A865). After conducting a meta-analysis, we found that the pooled prevalence of suicidal ideation among PLHIV was 22.3% (95% CI = 17.3%–28.2%, $p = .001$) with a high level of heterogeneity within the 33 studies ($I^2 = 98.69$, $Q = 2450.617$, $\tau^2 = 0.911$, $p < .001$; Figure 2).

#### Prevalence of Suicide Attempts

A total of 17 studies conducted in 16 countries (the Argentina, Brazil, China, Estonia, Ethiopia, France, Iran, Indonesia, Korea, Kazakhstan, Nigeria, Tanzania, Taiwan, the United States, South Africa, and Uganda) reported the prevalence of suicide attempts (2,11,31,43,44,46,47,50,52,55–62). There were 1035 of 9149 participants in this category, and studies conducted in the region of the Americas countries showed the highest attempted suicide rates (Table 1; Supplemental Digital Content Table S3, http://links.lww.com/PSYMED/A865). The meta-analysis identified the pooled prevalence of suicide attempts among PLHIV as 9.6% (95% CI = 6.3%–14.6%, $p = .001$), with high heterogeneity across the 17 studies ($I^2 = 97.68$, $Q = 692.458$, $\tau^2 = 0.965$, and $p < .001$; Figure 3).

#### Prevalence and Incidence of Suicides

Eight studies conducted in six countries (Canada, China, France, Japan, Switzerland, and Spain) reported the prevalence of suicides. There were 2780 of 144,723 participants included in this category, and studies in European countries showed the highest suicide rates (Table 1; Supplemental Digital Content Table S4, http://links.lww.com/PSYMED/A865). Among the included studies, four reported that 635 of 51,060 participants from four countries (Canada, France, Japan, Switzerland) had suicide events (3–6,13,57), and studies in
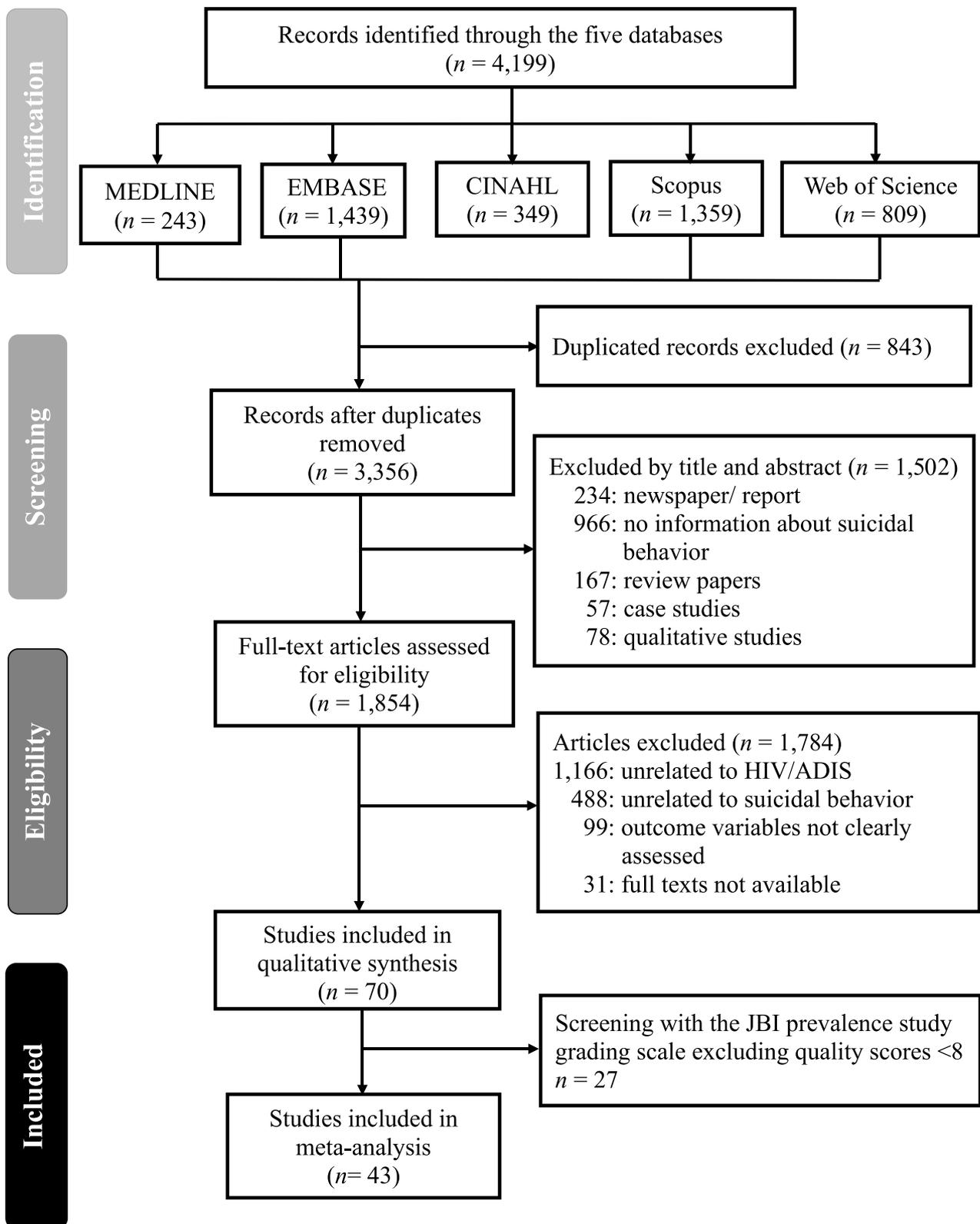
**FIGURE 1.** PRISMA flow diagram of the included studies. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses; JBI = Joanna Briggs Institute; HIV = human immunodeficiency virus.

**TABLE 1.** Characteristics of the Selected Studies

| Author, Country (Year) | WHO Region | Study Design | Setting | Exposure of Antiviral therapy | Ethnicity, n | Age Range, y | Sample Size, n | Sex, n | Suicide Ideation, n (%) | Suicide Attempts, n (%) | Completed Suicides, n % | JBI Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zhang et al., China (2021) (41) | Western Pacific Region | Cohort study | National database | N/A | White: 92,518 | 41 | 92,518 | M: 75,699 F: 16,819 | N/A | N/A | 2138 (2.31) | 8 |
| Zewdu et al., Ethiopia (2021) (42) | African region | Cross-sectional | HIV clinics | Modern ART eras | Black: 414 | 45 | 414 | F: 414 | 34 (8.20) | N/A | N/A | 8 |
| Wang et al., China (2021) (43) | Western Pacific region | Cross-sectional | Hospital | Modern ART eras | Asian: 494 | 30 | 494 | M: 494 | 161 (32.59) | 60 (12.15) | N/A | 8 |
| Tamirat et al., Ethiopia (2021) (44) | African region | Cross-sectional | Hospital | Modern ART eras | Black: 395 | 35 | 395 | M:153 F:242 | 37 (9.40) | 13 (3.30) | N/A | 9 |
| Mandell South Africa (2021) (45) | African region | Cross-sectional | HIV clinics | N/A | Black: 217 | 28.5 | 217 | F: 217 | 82 (37.8) | N/A | N/A | 8 |
| Mahlomaholo Lesotho (2021) (46) | African region | Cross-sectional | HIV clinics | Modern ART eras | Black: 395 | N/A | 402 | M: 355 F: 47 | N/A | 33 (8.20) | N/A | 8 |
| Tina et al., Kazakhstan (2021) | European region | Cross-sectional | HIV clinics | N/A | Asian: 237 | N/A | 237 | F: 237 | 97 (40.5) | N/A | N/A | 8 |
| Gizachew et al., Ethiopia (2021) (47) | African region | Cross-sectional | Hospital | Modern ART eras | Black: 326 | 39.2 | 326 | M:131 F:195 | 52 (16) | 23 (7.10) | N/A | 9 |
| Ophinni et al., Indonesia (2020) (48) | Southeast Asian Asian region | Cross-sectional | HIV clinics | Modern ART eras | Asian: 86 | 38 | 86 | M: 56 F: 30 | 20 (23.30) | N/A | N/A | 9 |
| Knettel et al., Tanzania (2020) (49) | African region | Cross-sectional | HIV clinics | Modern ART eras | Asian: 200 | 34.1 | 200 | F: 200 | 28 (12.80) | N/A | N/A | 8 |
| Kindaya et al., Ethiopia (2020) (50) | African region | Cross-sectional | Hospital | Modern ART eras | Black: 412 | 40.45 | 412 | M:160 F:252 | 122 (24.30) | 52 (12.60) | N/A | 9 |
| Nishijima et al., Japan (2020) (5) | Western Pacific region | Cohort study | Hospital | Modern ART eras | Asian: 2797 | 30–44 | 2797 | M:2577 F:220 | N/A | N/A | 14 (0.5) 0.074 per 100 PY | 8 |
| Durham et al., United States (2020) (51) | Region of the Americas | Cohort study | HIV clinics | Modern ART eras | White: 3306 Black: 2318 Other: 1085 | <40–≥50 | 6706 | M: 5228 F: 1478 | 224 (3.30) | 80 (1.20) | N/A | 9 |
| Ruffieux et al., Switzerland (2019) (6) | European region | Cohort study | National database | Pre-HAART, HAART | White: 20,136 | N/A | 20,136 | M: 14,584 F: 5552 | N/A | N/A | 204 (1) 1.106 per 100 PY | 8 |
| Zeng et al., China (2018) (52) | Western Pacific region | Cross-sectional | Hospital | Modern ART eras | Asian: 411 | 20–76 | 411 | M: 286 F: 125 | 124 (29.70) | 37 (9) | N/A | 8 |

| Study | Region | Study design | Setting | ART era | Race: N | Age range | Sample size | Sex | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zarei et al., Iran (2018) (53) | Eastern Mediterranean region | Cross-sectional | HIV clinics | N/A | White: 351 | 32–47 | 351 | M: 241 F: 110 | 54 (15.38) | N/A | N/A | 9 |
| Wang et al., China (2018) (20) | Western Pacific region | Cross-sectional | Hospital | HAART | Asian: 465 | N/A | 465 | M: 442 F: 23 | 147 (31.60) | N/A | N/A | 9 |
| Tang et al., China (2018) (54) | Western Pacific region | Cross-sectional | Hospital | Modern ART eras | Asian: 504 | N/A | 504 | M: 409 F: 95 | 137 (27.20) | N/A | N/A | 8 |
| Rodriguez et al., Argentina (2018) (55) | Region of the Americas | Cross-sectional | HIV clinics | Modern ART eras | White: 118 | 31–49 | 118 | M: 59 F: 57 | 33 (27.96) | 3 (2) | N/A | 8 |
| Rodriguez et al., South Africa (2018) (24) | African region | Cohort study | HIV clinics | Modern ART eras | Black: 681 | 22–34 | 681 | F: 681 | 266 (39) | N/A | N/A | 9 |
| Lu et al., Taiwan (2018) (56) | Western Pacific region | Cross-sectional | Hospital | Modern ART eras | Asian: 114 | 24–39 | 114 | M: 113 F: 1 | 31 (27.20) | 16 (14) | N/A | 8 |
| Hentzien et al., France (2018) (57) | European region | Cohort study | Hospital | HAART | Black: 349 | N/A | 349 | M: 248 | N/A | 27 (7.73) | 70 (20.1) | 9 |
| Rodriguez et al., South Africa (2017) (25) | African region | Cross-sectional | Hospital | Modern ART eras | Black: 673 | 22–34 | 673 | F: 673 | 261 (38.78) | N/A | N/A | 9 |
| Oladeji et al., Nigeria (2017) (58) | African region | Cross-sectional | Hospital | HAART | Black: 828 | 31–51 | 828 | M: 240 F: 588 | 173 (20.90) | 32 (3.90) | N/A | 9 |
| Liu et al., China (2017) (8) | Western Pacific region | Cross-sectional | HIV clinics | Modern ART eras | Asian: 557 | N/A | 557 | M: 15 F: 42 | 139 (24.96) | N/A | N/A | 9 |
| Lemsalu et al., Estonia (2017) (2) | African region | Cross-sectional | Hospital | N/A | White: 800 | 26–42 | 800 | M: 471 F: 329 | 288 (36.30) | 306 (38.60) | N/A | 9 |
| Egbe et al., Nigeria (2017) (59) | African region | Cross-sectional | HIV clinics | Modern ART eras | Black: 1187 | N/A | 1187 | M: 398 F: 789 | 170 (14.32) | 62 (5.20) | N/A | 8 |
| Carrieri et al., France (2017) (33) | European region | Cross-sectional | Hospital | Modern ART eras | White: 2973 | N/A | 2973 | M: 1982 F: 991 | 188 (6.30) | N/A | N/A | 9 |
| Walter et al., United States (2017) (60) | Region of the Americas | Cross-sectional | Hospital | HAART | White: 170 | 41.2 | 170 | M: 104 F: 66 | N/A | 60 (35.3) | N/A | 8 |
| Rukundo et al., Uganda (2016) (61) | African region | Cross-sectional | HIV clinics | N/A | Black: 543 | 27–47 | 573 | M: 131 F: 442 | 48 (8.80) | 54 (10) | N/A | 9 |
| Kang et al., Korea (2016) (62) | Western Pacific region | Cross-sectional | HIV clinics | Modern ART eras | Asian: 422 | N/A | 422 | M: 392 F: 30 | 193 (44) | 47 (11) | N/A | 8 |
| Cheung et al., Canada (2016) (3) | Region of the Americas | Cohort study | National database | HAART | White: 8185 | N/A | 8185 | N/A | N/A | N/A | 115 (1.41) 0.47 per 100 PY | 8 |
| Wu et al., China (2015) (26) | Western Pacific region | Cross-sectional | HIV clinics | N/A | Asian: 184 | N/A | 184 | M: 184 | 57 (31) | N/A | N/A | 9 |
| Peltzer et al., South Africa (2015) (63) | South African region | Cross-sectional | Hospital | N/A | Black: 580 | N/A | 580 | M: 580 | 239 (41.20) | N/A | N/A | 8 |
| Ogundipe et al., Nigeria (2015) (9) | African region | Cross-sectional | HIV clinics | HAART | Black: 295 | N/A | 295 | M: 115 F: 180 | 40 (13.60) | N/A | N/A | 9 |

*Continued on next page*

**TABLE 1.** *(Continued)*

| Author, Country (Year) | WHO Region | Study Design | Setting | Exposure of Antiviral therapy | Ethnicity, n | Age Range, y | Sample Size, n | Sex, n | Suicide Ideation, n (%) | Suicide Attempts, n (%) | Completed Suicides, n % | JBI Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gurm et al., Canada (2015) (13) | European region | Retrospective study | National database | HAART | White: 4381 | 42 | 4381 | M: 3527 F: 791 | N/A | N/A | 82 (1.57) 0.028 per 100 PY | 8 |
| Passos et al., Brazil (2014) (10) | Region of the Americas | Cross-sectional | Hospital | Modern ART eras | White: 211 | N/A | 211 | M: 101 F: 110 | 72 (34.12) | 49 (23.20) | N/A | 9 |
| Ceccon et al., Brazil (2014) (64) | Region of the Americas | Cross-sectional | HIV clinics | Modern ART eras | White: 82 Black: 79 | N/A | 161 | N/A | 82 (50) | N/A | N/A | 8 |
| Kinyanda et al., South Africa (2012) (11) | African region | Cross-sectional | HIV clinics | Modern ART eras | Black: 618 | N/A | 618 | M: 169 F: 449 | 48 (8) | 24 (4) | N/A | 9 |
| Badiee et al., United States (2012) (31) | Region of the Americas | Cross-sectional | Hospital | Modern ART eras, HAART | Black: 676 Hispanic: 171 White: 674 Other: 39 | 35–52 | 1560 | M: 1195 F: 365 | 204 (13.07) | 204 (13.07) | N/A | 9 |
| Aldaz et al., Spain (2011) (7) | European region | Cohort study | National database | N/A | White: 1145 | N/A | 1145 | N/A | N/A | N/A | 7 (0.61) | 8 |
| Lawrence et al., United States (2010) (23) | Region of the Americas | Cross-sectional | HIV clinics | Modern ART eras | Black: 570 White: 646 | 34–54 | 1216 | M: 959 F: 257 | 170 (14) | N/A | N/A | 8 |
| Keiser et al., Switzerland (2010) (4) | European region | Cohort study | National database | Pre-HAART, HAART | White: 15,275 | N/A | 15,275 | M: 10,857 F: 4418 | N/A | N/A | 150 (0.98) 0.16 per 100 PY | 9 |

WHO = World Health Organization; JBI = Joanna Briggs Institute; N/A = not applicable; M = male; F = female; HIV = human immunodeficiency virus; ART = antiretroviral therapy; HAART = highly active antiretroviral therapy; PY = person-years.
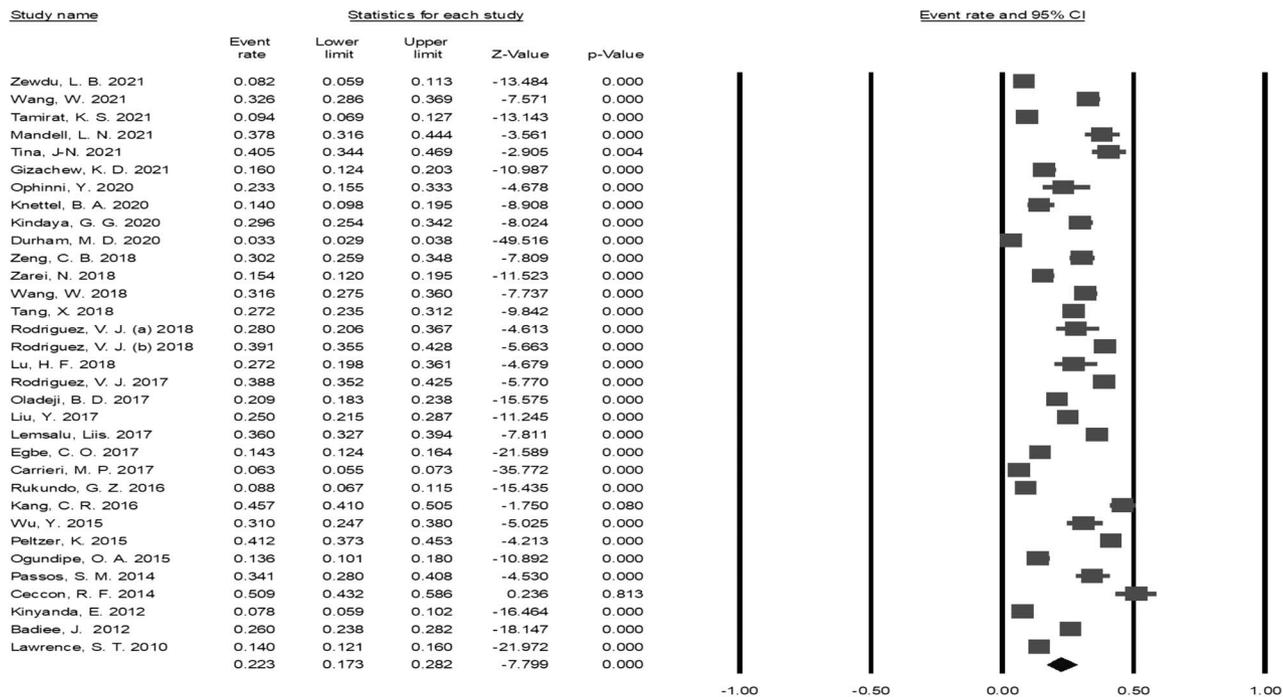
**FIGURE 2.** Prevalence rate of suicidal ideations among PLHIV. Total (95% CI) = 33, ER = 0.22 (0.17–0.28), $p$ = .000, events = 4221/24,939. Heterogeneity = random model, $Q$ = 2450.617, $p < .001$, $I^2$ = 98.69, $\tau^2$ 0.911. PLHIV = people living with HIV; CI = confidence interval; ER = event rate.

European countries showed the highest suicide rates (Table 1; Supplemental Digital Content Table S4, http://links.lww.com/PSYMED/A865). According to the meta-analysis results, the pooled prevalence of suicide among PLHIV was 1.7% (95% CI = 1.0%–2.8%, $p < .001$), with heterogeneity across the eight studies ($I^2$ = 98.86%, $Q$ = 67.365, $\tau^2$ = 0.756, $p < .001$; Figure 4). The pooled incidence rate calculated using PY for six studies was 0.35% (95% CI = 0.18%–0.53%, $p < .001$) per

100 PY with significant heterogeneity ($I^2$ = 97.07%, $Q$ = 170.953, $\tau^2$ = 0.215, $p < .001$; Figure 5).

### Meta-regression Analysis to Identify Factors Affecting Heterogeneity

Based on the meta-analysis results, we identified significant heterogeneity for all the outcome variables. A meta-regression analysis was then conducted to identify factors affecting heterogeneity and
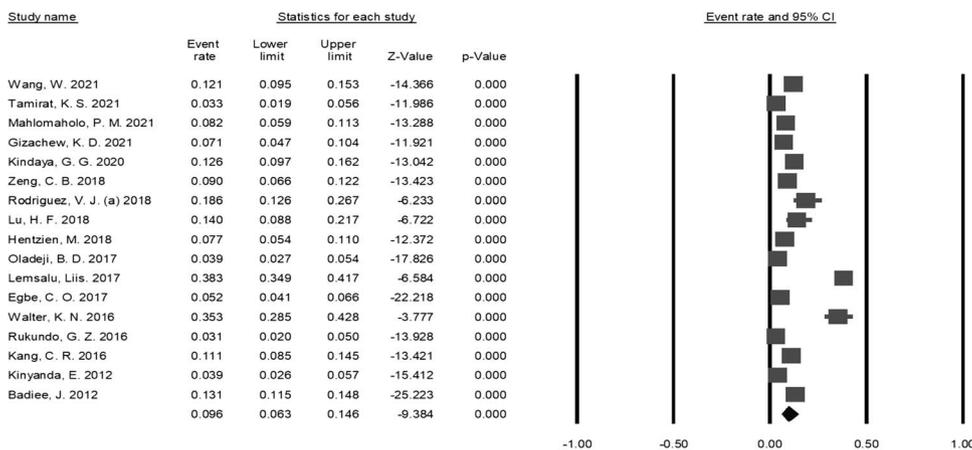


**FIGURE 3.** Prevalence rate of suicide attempts among people living with HIV. Total (95% CI) = 17, ER = 0.09 (0.06–0.14) $p$ = .000, events = 1035/9149. Heterogeneity = random model, $Q$ = 692.458, $p < .001$, $I^2$ = 97.68, $\tau^2$ 0.965. CI = confidence interval.
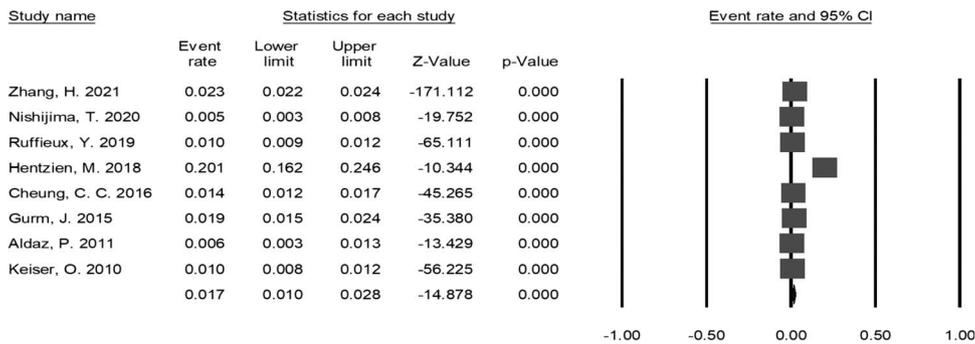
**FIGURE 4.** Prevalence rate of suicides among people living with HIV. Total (95% CI) = 8, ER = 0.01 (0.01–0.02), $p$ = .000, events = 2780/144,723. Heterogeneity = random model, $Q$ = 617.365, $p$ < .001, $I^2$ = 98.86, $\tau^2$ 0.756. CI = confidence interval.

the drivers within the subgroups. The meta-regression model included the following risk factors for the three suicidal behaviors of ideation, attempt, and suicide: sex, age, sexual orientation, marital status, education level, employment status, monthly income, status of HAART exposure, substance use, alcohol abuse, drug abuse, ever use of tobacco, psychiatric disorder, opportunistic infections, depression, anxiety, CD4+ count (in cells per cubic millimeter), viral load, viral copies per milliliter, HIV-related clinical symptoms, quality of life, social support, HIV status disclosure, living alone, residence, having children, high level of internalized stigma, memory problems, family history of suicide, duration since known to have HIV, and country. Also included were results on suicidal behavior among PLHIV for statistical model 1, random effects, $z$ distribution, and the log odds ratio. The model test was a simultaneous test to confirm that all coefficients (excluding the intercept) were zero ($Q$ = 31.98, $df$ = 4, $p$ = .00), and the goodness of fit with unexplained variance was zero ($Q$ = 3.22, $df$ = 4, $p$ = .5224).

The following risk factors were identified as having a significant relationship with suicidal behavior among PLHIV: exposure of antiviral therapy during follow-up of patients in the HAART era (1996–2005; $R$ = 2.57, 95% CI = 0.28–4.86, $p$ = .0273) and

the modern ART era (2005–2014; $R$ = 3.03, 95% CI = 0.93–5.12, $p$ = .0046), patients with no treatments ($R$ = 2.92, 95% CI = 0.69–5.15, $p$ = .0103), substance use ($R$ = 1.01, 95% CI = 0.15–1.87, $p$ = .020), depression ($R$ = 1.72, 95% CI = 0.42–3.01, $p$ = .009), low quality of life ($R$ = 0.90, 95% CI = 0.17–1.63, $p$ = .015), without HIV status disclosure ($R$ = 1.12, 95% CI = 0.45–1.79, $p$ = .001), living alone ($R$ = 0.71, 95% CI = 0.17–1.25, $p$ = .009), without memory problems ($R$ = 1.36, 95% CI = 0.65–2.07, $p$ = .001), family history of suicide ($R$ = 1.15, 95% CI = 0.16–2.06, $p$ = .020), stage III of HIV ($R$ = 1.62, 95% CI = 0.24–3.00, $p$ = .021), region of the Americas ($R$ = 1.53, 95% CI = 0.03–3.03, $p$ = .044), African region ($R$ = 1.77, 95% CI = 0.45–3.08, $p$ = .008), Western Pacific region ($R$ = 1.69, 95% CI = 0.26–3.12, $p$ = .020), hospital setting ($R$ = 3.02, 95% CI = 2.20–3.83, $p$ = .001), and clinic setting ($R$ = 2.91, 95% CI = 2.10–3.72, $p$ = .001; Table 2).

### Risk Factors for Suicidal Ideation

The meta-analysis and meta-regression results showed that the following were risk factors for suicidal ideation among PLHIV: substance use ($R$ = 1.16, 95% CI = 0.01–2.33, $p$ = .048), depression
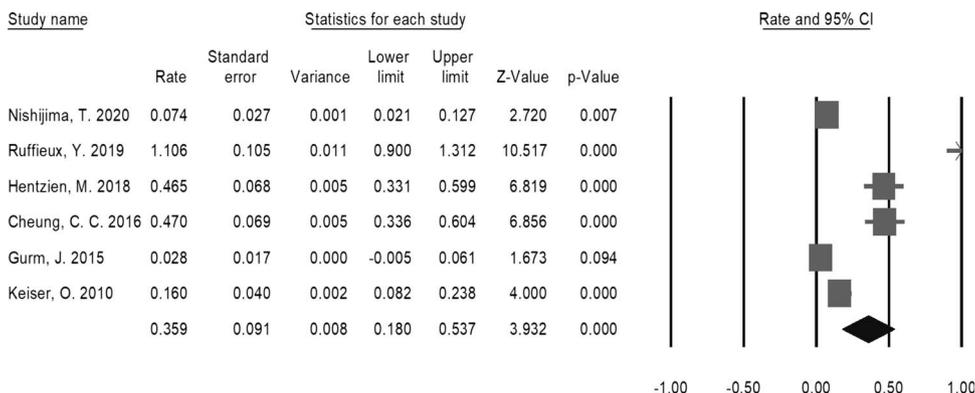


**FIGURE 5.** Incidence rate of suicides among people living with HIV. Total (95% CI) = 6, IR = 0.35 (0.09–0.01), $p$ < .001, events = 2.303 person-years. Heterogeneity = random model, $Q$ = 170.953, $p$ < .001, $I^2$ = 97.07, $\tau^2$ 0.215. CI = confidence interval; IR = incident rate.

**TABLE 2.** Meta-analysis and Meta-regression According to Subgroup Used to Identify Factors Affecting Heterogeneity Within the Selected Studies

| Variable | No. studies | Sample | Prevalence (95% CI), % | p | I² | Coefficient | Standard Error | 95% Confidence Interval | p |
|---|---|---|---|---|---|---|---|---|---|
| | | | Meta-analysis | | | | Meta-regression | | |
| Sex | 25 | 147,873 | 12.8 (8.3–19.4) | <.001 | 99.56 | | | | |
| Female | 23 | 33,538 | 13.9 (7.5–24.5) | <.001 | 99.32 | Reference | | | |
| Male | 21 | 114,335 | 11.7 (6.1–21.4) | <.001 | 99.64 | −0.199 | 0.508 | −1.19 to 0.79 | .696 |
| Age, y | 16 | 107,341 | 19.9 (13.7–28.1) | <.001 | 97.77 | | | | |
| ≥65 | 6 | 57,717 | 10.6 (4.7–22.3) | <.001 | 98.28 | Reference | | | |
| ≥45–64 | 12 | 23,748 | 11.6 (6.2–20.7) | <.001 | 98.55 | 0.244 | 0.626 | −0.98 to 1.47 | .696 |
| 25–44 | 16 | 17,878 | 17.0 (10.7–26.1) | <.001 | 98.64 | 0.693 | 0.602 | −0.48 to 1.87 | .249 |
| 15–24 | 11 | 7998 | 16.7 (7.9–31.9) | <.001 | 97.37 | 0.670 | 0.641 | −0.58 to 1.92 | .296 |
| Sexual orientation | 12 | 135,743 | 11.7 (7.5–17.8) | <.001 | 99.35 | | | | |
| Heterosexual | 12 | 95,325 | 11.6 (4.3–27.7) | <.001 | 99.62 | Reference | | | |
| Homosexual | 12 | 25,975 | 10.8 (5.5–20.3) | <.001 | 98.99 | −0.060 | 0.676 | −1.38 to 1.26 | .928 |
| Bisexual/undecided | 10 | 14,443 | 13.1 (5.3–28.9) | <.001 | 98.98 | 0.149 | 0.708 | −1.23 to 1.53 | .833 |
| Marital status | 24 | 101,012 | 25.0 (21.3–29.0) | <.001 | 99.24 | | | | |
| Marriage | 21 | 47,196 | 21.0 (10.6–37.2) | <.001 | 99.25 | Reference | | | |
| Unmarried | 24 | 20,531 | 26.6 (16.3–40.4) | <.001 | 99.02 | 0.317 | 0.531 | −0.72 to 1.35 | .550 |
| Separated/divorced/widowed | 16 | 33,285 | 23.6 (10.4–45.3) | <.001 | 99.25 | 0.152 | 0.589 | −1.00 to 1.30 | .795 |
| Education level | 25 | 112,488 | 17.0 (12.5–22.8) | <.001 | 99.16 | | | | |
| University or higher | 19 | 17,233 | 16.2 (8.8–27.9) | <.001 | 98.98 | Reference | | | |
| Junior college | 20 | 34,347 | 16.4 (9.0–27.9) | <.001 | 98.98 | 0.016 | 0.522 | −1.01 to 1.03 | .976 |
| High school or lower | 25 | 60,908 | 18.2 (10.1–30.5) | <.001 | 99.28 | 0.141 | 0.496 | −0.83 to 1.11 | .775 |
| Employment status | 19 | 109,090 | 18.9 (12.3–27.9) | <.001 | 99.50 | | | | |
| Employment | 19 | 77,681 | 15.9 (8.6–27.6) | <.001 | 99.36 | Reference | | | |
| Unemployment | 19 | 31,409 | 22.3 (11.8–38.2) | <.001 | 99.49 | 0.415 | 0.530 | −0.62 to 1.45 | .433 |
| Monthly income | 9 | 2828 | 28.4 (26.9–30.0) | <.001 | 74.62 | | | | |
| High income | 5 | 823 | 22.6 (16.4–30.3) | .002 | 76.06 | Reference | | | |
| Medium income | 7 | 1108 | 26.5 (20.9–32.9) | <.001 | 79.00 | 0.198 | 0.233 | −0.25 to 0.65 | .394 |
| Low income | 9 | 1488 | 29.2 (26.9–31.6) | <.001 | 70.81 | 0.437 | 0.223 | −0.01 to 0.87 | .051 |
| Exposure of antiviral therapy during follow-up | 43 | 170,234 | 14.1 (9.3–20.9) | <.001 | 99.65 | | | | |
| Pre-HAART | 2 | 35,411 | 1.0 (0.9–1.1) | <.001 | 0.00 | Reference | | | |
| HAART | 7 | 14,610 | 11.7 (3.9–30.1) | <.001 | 99.48 | 2.576 | 1.167 | 0.28 to 4.86 | **.027** |
| Modern ART eras | 25 | 23,638 | 17.3 (12.2–24.1) | <.001 | 98.92 | 3.031 | 1.069 | 0.93 to 5.12 | **.005** |
| No treatments | 9 | 96,575 | 15.6 (4.5–42.0) | <.001 | 99.81 | 2.922 | 1.138 | 0.69 to 5.15 | **.010** |
| Substance use | 4 | 1109 | 30.1 (19.1–44.2) | <.001 | 94.35 | | | | |
| No substance | 4 | 584 | 20.6 (14.0–29.2) | .003 | 78.35 | Reference | | | |
| Substance | 4 | 525 | 41.8 (25.9–59.6) | <.001 | 91.04 | 1.018 | 0.438 | 0.15 to 1.87 | **.020** |
| Alcohol abuse | 12 | 14,487 | 24.6 (15.5–36.7) | <.001 | 99.08 | | | | |
| No alcohol abuse | 12 | 13,201 | 19.4 (9.3–36.1) | .008 | 99.50 | Reference | | | |
| Alcohol abuse | 12 | 1286 | 31.0 (20.2–44.3) | <.001 | 94.65 | 0.618 | 0.589 | −0.53 to 1.77 | .294 |
| Drug abuse | 9 | 14,938 | 14.7 (9.0–23.1) | <.001 | 98.03 | | | | |
| No drug abuse | 9 | 12,543 | 10.4 (5.3–19.3) | <.001 | 98.38 | Reference | | | |
| Drug abuse | 9 | 2395 | 20.7 (10.0–38.0) | <.001 | 96.80 | 0.808 | 0.553 | −0.27 to 1.89 | .144 |
| Ever use of tobacco | 2 | 721 | 15.4 (9.4–24.4) | <.001 | 75.97 | | | | |
| No use of tobacco | 2 | 688 | 11.7 (6.9–19.1) | <.001 | 83.58 | Reference | | | |
| Ever use of tobacco | 2 | 33 | 27.4 (14.9–44.9) | .013 | 0.00 | 1.035 | 0.534 | −0.01 to 2.08 | .053 |

**TABLE 2.** *(Continued)*

| | | Meta-analysis | | | | Meta-regression | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | No. studies | Sample | Prevalence (95% CI), % | $p$ | $I^2$ | Coefficient | Standard Error | 95% Confidence Interval | $p$ |
| Psychiatric | 5 | 42,698 | 6.3 (3.0–12.7) | <.001 | 98.83 | | | | |
| No psychiatric | 5 | 34,728 | 3.5 (1.2–9.8) | <.001 | 99.27 | Reference | | | |
| Psychiatric | 5 | 7970 | 11.8 (2.8–38.9) | <.001 | 98.11 | 1.277 | 0.860 | −0.40 to 2.96 | .138 |
| Opportunistic infections | 2 | 481 | 19.4 (8.6–38.2) | .003 | 89.05 | | | | |
| No opportunistic infections | 2 | 419 | 12.1 (4.3–29.4) | .004 | 88.13 | Reference | | | |
| Opportunistic infections | 2 | 62 | 30.7 (20.5–43.2) | .783 | 0.00 | 1.189 | 0.666 | −0.11 to 2.49 | .075 |
| Depression | 9 | 9842 | 18.3 (10.2–30.6) | <.001 | 98.68 | | | | |
| No depression | 9 | 4125 | 8.6 (4.1–17.1) | <.001 | 97.27 | Reference | | | |
| Depression | 9 | 5717 | 34.5 (16.4–58.6) | .204 | 98.95 | 1.720 | 0.661 | 0.42 to 3.01 | **.009** |
| Anxiety | 5 | 7579 | 21.0 (9.1–41.2) | .007 | 98.78 | | | | |
| No anxiety | 4 | 5809 | 12.3 (3.3–36.3) | .006 | 98.81 | Reference | | | |
| Anxiety | 5 | 1770 | 30.8 (9.9–64.2) | .255 | 98.51 | 1.152 | 1.012 | −0.83 to 3.13 | .255 |
| CD4+ cell count, cells/mm$^3$ | 11 | 13,019 | 18.9 (12.9–27.0) | <.001 | 97.99 | | | | |
| >500 | 11 | 7702 | 15.7 (8.7–26.5) | <.001 | 98.02 | Reference | | | |
| ≤500 | 11 | 5317 | 22.7 (13.3–35.9) | <.001 | 97.89 | 0.457 | 0.473 | −0.47 to 1.38 | .334 |
| Viral load, copies/ml | 4 | 7696 | 13.9 (5.8–29.8) | <.001 | 98.77 | | | | |
| Undetectable | 4 | 4628 | 14.2 (3.3–44.9) | <.001 | 98.95 | Reference | | | |
| Detectable | 4 | 3068 | 13.5 (3.3–41.6) | <.001 | 98.83 | −0.058 | 1.121 | −2.15 to 2.13 | .958 |
| HIV-related clinical symptom | 3 | 1085 | 28.9 (18.0–42.8) | .004 | 93.79 | | | | |
| With HIV-related clinical symptom | 3 | 456 | 35.7 (31.4–40.2) | <.001 | 62.86 | Reference | | | |
| Without HIV-related clinical symptom | 3 | 629 | 24.2 (11.3–44.6) | .015 | 92.31 | 0.580 | 0.459 | −0.32 to 1.48 | .207 |
| Quality of life | 2 | 852 | 20.6 (11.4–34.5) | <.001 | 93.30 | | | | |
| High quality of life | 2 | 519 | 13.7 (11.0–17.0) | <.001 | 66.12 | Reference | | | |
| Low quality of life | 2 | 333 | 32.8 (27.9–38.0) | <.001 | 0.00 | 1.116 | 0.254 | 0.61 to 1.61 | **<.001** |
| Social support | 8 | 3407 | 15.6 (11.2–21.5) | <.001 | 93.61 | | | | |
| High social support | 8 | 1869 | 10.6 (6.9–16.0) | <.001 | 89.87 | Reference | | | |
| Low social support | 8 | 1538 | 22.6 (14.4–33.6) | <.001 | 94.06 | 0.906 | 0.373 | 0.17 to 1.63 | **.015** |
| HIV status disclosure | 4 | 1461 | 17.1 (10.5–26.6) | <.001 | 92.59 | | | | |
| With HIV status disclosure | 4 | 1045 | 11.0 (7.0–17.0) | <.001 | 84.10 | Reference | | | |
| Without HIV status disclosure | 4 | 416 | 31.2 (26.9–35.9) | <.001 | 43.05 | 1.125 | 0.340 | 0.45 to 1.79 | **<.001** |
| Living alone | 6 | 2030 | 27.0 (20.9–34.0) | <.001 | 89.52 | | | | |
| Not living alone | 6 | 1425 | 20.9 (15.9–27.0) | <.001 | 83.58 | Reference | | | |
| Living alone | 6 | 605 | 35.1 (25.6–45.9) | .007 | 83.19 | 0.718 | 0.276 | 0.17 to 1.25 | **<.001** |
| Residence | 8 | 6251 | 13.4 (6.8–24.7) | <.001 | 98.19 | | | | |
| Urban | 7 | 5177 | 13.6 (4.3–35.4) | <.001 | 99.02 | Reference | | | |
| Rural | 8 | 1074 | 15.5 (8.9–25.7) | <.001 | 91.29 | −0.025 | 0.765 | −1.52.1.47 | .973 |
| Having children | 5 | 2560 | 39.1 (37.2–41.0) | <.001 | 75.65 | | | | |
| No children | 4 | 996 | 35.5 (27.7–44.3) | <.001 | 85.69 | Reference | | | |
| Having children | 5 | 1564 | 40.4 (38.0–42.9) | .017 | 53.69 | 0.233 | 0.180 | −0.12 to 0.58 | .197 |
| High level of internalized stigma | 3 | 1045 | 23.0 (13.6–36.2) | <.001 | 94.02 | | | | |
| No internalized stigma | 3 | 619 | 17.7 (9.2–31.3) | <.001 | 91.33 | Reference | | | |
| High internalized stigma | 3 | 426 | 29.5 (11.8–56.8) | .135 | 95.49 | 0.674 | 0.684 | −0.66 to 2.01 | .324 |
| Memory problems | 2 | 852 | 22.1 (11.3–38.6) | <.001 | 94.59 | | | | |
| Memory problems | 2 | 525 | 12.5 (7.30–20.5) | .025 | 80.16 | Reference | | | |

*Continued on next page*

**TABLE 2.** *(Continued)*

| | Meta-analysis | | | | | Meta-regression | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | No. studies | Sample | Prevalence (95% CI), % | *p* | *I²* | Coefficient | Standard Error | 95% Confidence Interval | *p* |
| Without memory problems | 2 | 327 | 34.3 (29.30–39.6) | .344 | 0.00 | 1.364 | 0.363 | 0.65 to 2.07 | **<.001** |
| Family history of suicide | 2 | 738 | 25.9 (16.1–38.8) | <.001 | 88.60 | | | | |
| Not family history of suicide | 2 | 588 | 17.4 (11.5–25.4) | <.001 | 79.97 | Reference | | | |
| Family history of suicide | 2 | 150 | 42.9 (17.8–72.2) | .651 | 78.27 | 1.115 | 0.482 | 0.16 to 2.06 | **.021** |
| Duration since known to have HIV | 9 | 95,233 | 14.2 (6.9–27.0) | <.001 | 99.52 | | | | |
| >1 y | 9 | 22,585 | 15.3 (4.7–39.9) | <.001 | 99.60 | Reference | | | |
| ≤1 y | 6 | 72,648 | 12.5 (3.6–35.3) | <.001 | 96.33 | 0.234 | 1.048 | –1.81 to 2.28 | .823 |
| Stage of HIV | 2 | 807 | 20.3 (11.9–32.5) | <.001 | 90.11 | | | | |
| Stage I | 2 | 489 | 11.4 (3.9–29.1) | <.001 | 93.55 | Reference | | | |
| Stage II | 2 | 134 | 23.5 (16.9–31.7) | .055 | 72.77 | 0.592 | 0.721 | –0.82 to 2.00 | .411 |
| Stage III | 2 | 103 | 39.8 (30.8–49.5) | .947 | 0.00 | 1.625 | 1.705 | 0.24 to 3.00 | **.021** |
| Stage IV | 2 | 81 | 17.3 (10.5–27.1) | 1.000 | 0.00 | 0.478 | 0.864 | –1.21 to 2.17 | .580 |
| WHO region | 43 | 72,872 | 14.1 (9.3–20.9) | <.001 | 99.65 | | | | |
| European region | 7 | 44,433 | 3.8 (1.2–11.0) | <.001 | 99.56 | Reference | | | |
| Region of the Americas | 8 | 18,327 | 15.5 (6.6–32.3) | <.001 | 99.43 | 1.536 | 0.765 | 0.03 to 3.03 | **.045** |
| Southeast Asian region | 1 | 86 | 23.3 (15.5–33.3) | 1.000 | 0.00 | 2.035 | 1.595 | –1.09 to 5.16 | .202 |
| African region | 16 | 8571 | 19.1 (13.9–25.5) | <.001 | 97.93 | 1.774 | 0.670 | 0.45 to 3.08 | **.008** |
| Eastern Mediterranean region | 1 | 351 | 15.4 (12.0–19.5) | 1.000 | 0.00 | 1.524 | 1.581 | –1.57 to 4.62 | .335 |
| Western Pacific region | 10 | 98,466 | 17.7 (5.9–42.4) | <.001 | 98.80 | 1.695 | 0.729 | 0.26 to 3.12 | **.020** |
| Settings | 43 | 170,234 | 14.1 (9.3–20.9) | <.001 | 99.65 | | | | |
| Database | 6 | 141,577 | 1.3 (0.9–2.0) | <.001 | 97.95 | Reference | | | |
| Hospital | 18 | 14,062 | 20.9 (15.1–28.2) | <.001 | 98.51 | 3.020 | 0.417 | 2.20 to 3.83 | **<.001** |
| Clinics | 19 | 14,595 | 19.2 (19.2–12.6) | <.001 | 98.82 | 2.912 | 0.414 | 2.10 to 3.72 | **<.001** |
| Sample size | 43 | 170,234 | 14.1 (9.3–20.9) | <.001 | 99.65 | | | | |
| >500 | 21 | 163,800 | 7.5 (4.0–13.6) | <.001 | 99.76 | Reference | | | |
| ≤500 | 22 | 6434 | 24.5 (19.8–29.9) | <.001 | 95.30 | 1.108 | 0.441 | 0.24 to 1.97 | **.001** |
| Publication years | 43 | 170,234 | 14.1 (9.3–20.9) | <.001 | 99.65 | | | | |
| >2015 | 21 | 144,671 | 15.5 (9.4–24.3) | <.001 | 99.69 | Reference | | | |
| ≤2015 | 22 | 25,563 | 10.7 (4.4–23.9) | <.001 | 99.51 | −0.424 | 0.568 | −1.53 to 0.68 | .455 |

CI = confidence interval; HAART = highly active antiretroviral therapy; ART = antiretroviral therapy; HIV = human immunodeficiency virus; CD4 = cluster of differentiation 4; WHO = World Health Organization.

Boldface indicates statistical significance (*p* < .001).

($R$ = 1.72, 95% CI = 0.42–3.01, *p* = .009), low quality of life ($R$ = 1.11, 95% CI = 0.61–1.61, *p* = .001), low social support ($R$ = 0.90, 95% CI = 0.17–1.63, *p* = .015), without HIV status disclosure ($R$ = 1.12, 95% CI = 0.45–1.79, *p* = .001), living alone ($R$ = 0.71, 95% CI = 0.17–1.25, *p* = .009), without memory problems ($R$ = 1.36, 95% CI = 0.65–2.07, *p* = .001), family history of suicide ($R$ = 1.11, 95% CI = 0.16–2.06, *p* = .020), and stage III of HIV ($R$ = 1.62, 95% CI = 0.24–3.00, *p* = .021; Supplemental Digital Content Table S2, http://links.lww.com/PSYMED/A865).

### Risk Factors for Suicide Attempts

The risk factors for suicide attempts were analyzed as a subgroup during the meta-analysis, and a meta-regression was conducted to determine the factors affecting heterogeneity. The following risk factors were found to be the most significant: depression (RR = 1.72, 95% CI = 0.70–2.74, *p* = .001) and family history of suicide (RR = 1.11, 95% CI = 0.16–2.06, *p* = .021; Supplemental Digital Content Table S3, http://links.lww.com/PSYMED/A865).

### Risk Factors for Suicide

The risk factors for death of suicide were analyzed as a subgroup during the meta-analysis, and a meta-regression was conducted to identify factors affecting heterogeneity. However, only a few studies were included this subgroup. Psychiatric disorder (RR = 1.71, 95% CI = 0.12–3.31, *p* = .034) and hospital setting (RR = 1.11, 95% CI = 0.03–2.19, *p* = .042) were found to be significant

risk factors for suicide in PLHIV (Supplemental Digital Content Table S4, http://links.lww.com/PSYMED/A865).

### Publication Bias

Publication bias was analyzed using a funnel plot and the Egger test on suicidal behavior among PLHIV for the 43 studies. However, the funnel plot did not show evidence of asymmetry, and there was a minor probability of publication bias. Statistically, possible publication bias was observed based on Egger test results ($Q = 12314.991$, $p < .001$, $I^2 = 99.66\%$; Figure 6) because of the diversity of the sample sizes and the length of the publication time frame (10 years) for the studies.

### DISCUSSION

A total of 43 studies were conducted across six WHO regions (African region, region of the Americas, Southeast Asian region, European region, Eastern Mediterranean region, and the Western Pacific region) from 2010 to 2021. Thirty-two of the 43 studies were conducted in the past 5 years. Furthermore, the pooled prevalence of suicidality, the risk factors, and their effects on heterogeneity identified in this study provide scientific evidence for various stakeholders.

According to this study's findings, the prevalence of suicidal ideation among PLHIV within the included studies was 22.3%. This result was consistent to that obtained in a recent systematic review and meta-analysis based on studies in Africa on persons with HIV/AIDS that reported the prevalence of suicidal ideation as 21.7% (66) and 22.8% according to a study conducted by Pelton et al. (16). However, the results of the present study were lower than those of a meta-analysis that showed that approximately 19.6% of young people with HIV/AIDS had lifetime suicidal ideation and that the global prevalence of suicidal ideation was 24.38% during the study period (67). Our study also indicated a higher incidence of suicide than in studies conducted in the European region and a lower prevalence of suicidal ideation (17.6%) (33,65) because of the labeling that increases negative perceptions of PLHIV, which may become widespread in society and lead to social problems for PLHIV (68,69). Because of this, they experience social isolation, employment difficulties, and economic distress. Because of all the criticism and public rejection, they begin to exhibit suicidal behavior (69,70).

The prevalence of suicidal ideation among PLHIV with depression in the included studies was 36.4% (2,8,10,26,42,44,47,50,51,58).

People with HIV and depression were found to have a higher suicidal ideation and attempt risk. Worldwide, most suicides occur in the young population. In addition, most people who die by suicide have a mental or emotional disorder, and the most common underlying disorder is depression (71,72). In this study, it was found that the significant risk factors for suicide among PLHIV included substance use (6,73–76), low quality of life (8,9,53), low social support (8–11,42,44,47,50), HIV status disclosure (8,9,42,49), living alone (8,20,26,47,48,50), a lack of memory problems (8,9), family history of suicide (47,50), and living in a rural area (42–44,47,50).

This review identified that the pooled prevalence of suicide attempts among PLHIV was 9.6% across 17 studies, which was a higher rate than that reported in a systematic review conducted in Africa (66). The reason for the discrepancy is that the participant pool of our study represented the diverse global population. The prevalence of suicide attempts and risk factors in an African population were correlated with psychiatric disorders, partner relationship problems, poor social support, fear of disclosure and stigmatization, socioeconomic pressures, cognitive deficits (problems with cognitive flexibility, concentration, and memory), internalized stigma, perceptions of poor health, physical pain, increased pain due to illness, a new HIV diagnosis, highly negative coping styles (66), and without HIV status disclosure (8,9,42,49). However, this review showed a significant relationship with depression (2,8,10,26,42,44,47,50,51), a CD4+ cell count less than 500 cells/mm$^3$ (8,10,20,33,44,48,50,51,54,58,60), and a family history of suicide (47,50). Also, we found a negative coefficient for the subgroups of male sex, junior college education level, HAART exposure due to well-developed awareness programs, and treatment such as HAART for PLHIV (18,22).

The total suicide prevalence (1.7%) and rate (0.3 per 100 PY) found in this study for PLHIV are higher than the suicide rate reported by the Global Health Observatory for the general population in 2016 (0.1 per 100 PY) (77). Suicidal behavior among PLHIV was associated with significantly lower overall scores and domain scores on the World Health Organization Quality of Life (8,9,58). The relationship between suicide and living alone was found to be high (8,20,26,47,48,50). We found that getting no treatment also highly influences the risk of suicidality, but it is difficult to determine if the statement of "no treatment" is related to medical compliance or not within the included studies in this
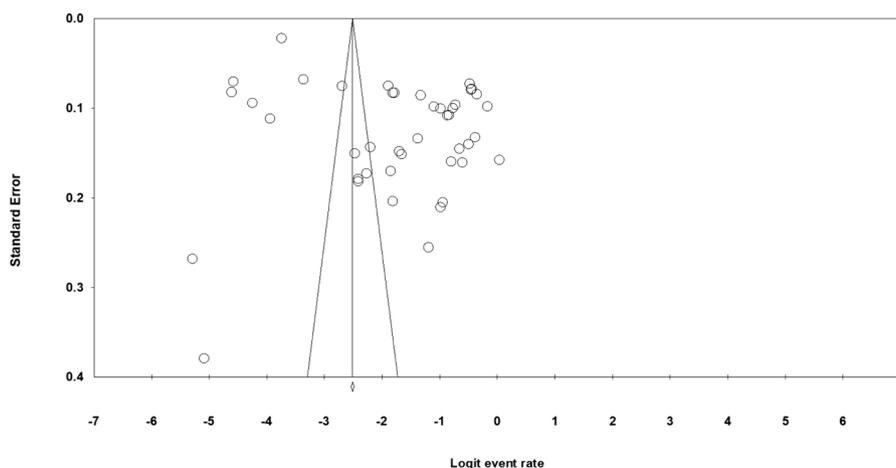


**FIGURE 6.** Funnel plots describing publication bias bases on suicidal behavior among PLHIV. PLHIV = people living with HIV.

review. However, ART is a treatment that can indeed reduce the mortality of HIV/AIDS patients (7). High medical compliance can help the medical team to find the risk of the suicide more easily and applying early intervention.

This study has several strengths. First, the diversity of the selected studies is a strength; studies from All WHO regions were included as well as different population and ethnicities. Previous studies have mostly focused on a single country and one population group (5,51,54,64,78,79). We recommend that studies include more countries in Southeast Asia (e.g., India, Sri Lanka, and Nepal). Second, studies included in this review were published in the previous 11 years (2010–2021). Studies were conducted during the modern ART era, but they have included cohort data for analysis like the pre-HAART era, the HAART era, and the modern ART era. According to our findings, the risk of suicidality in the modern ART era is significantly higher than the pre-HAART era. However, risk of suicidality needs to be tracked as a long-term observation in the modern ATR era separately to see the difference in eras of antiviral therapy. Also, our included suicide-related studies in this review are cross-sectional studies. Furthermore, a long-term observational study or database analysis is recommended for future studies (16,42,43). Third, we assessed the pooled prevalence of suicidal behaviors, including suicidal ideation, suicide attempts, and suicides, as well as risk factors associated with each behavior for PLHIV. Therefore, our findings may motivate actions toward prevention of suicidal behavior among PLHIV at the global level by presenting these review data as an essential resource for investigating the epidemiological findings on suicidal behavior among the PLHIV population systematically reviewed in this study. The findings of this study may also serve as a reference for future research and clinical guidelines or protocols.

However, the present study has several limitations worth considering. First, most of the included studies were a cross-sectional design, which made it difficult to determine long-term causal relationships between risk factors and suicidal behavior. Second, comparing data between countries was difficult because of social, cultural, and environmental differences in ethnicity and sex. In most of the included studies, the male population was three times larger than the female population. Another limitation was the diverse sample and effect sizes, because the large sample may have influenced the $p$ value of each study (it was always significant) and its normal statistical concept (3–6,33,51). However, these limitations may not have affected the study findings if we had been able to include more studies. Future studies should consider more long-term follow-up studies or database analyses rather than single-center studies. We recommend that future studies focus on countries in Southeast Asia, such as India, Sri Lanka, and Nepal, because of the limited research conducted in this region.

## CONCLUSIONS

The findings suggest that PLHIV have higher suicidality rates in the six WHO regions than the general population in the modern ART era. The following are significant risk factors for suicide ideation: substance use, depression, low quality of life, low social support, without HIV status disclosure, living alone, without memory problems, family history of suicide, and stage III of HIV. Risk factors for suicide attempt are depression, and family history of suicide. Psychiatric disorder and hospital setting were found to be significant risk factors for suicide in PLHIV.

This study provides scientific evidence to support clinical practice and the design of protocols to prevent suicidal behaviors in and manage the well-being of PLHIV worldwide. It is also a reference for future researchers who plan to examine suicidal behavior and the risk factors among diverse populations. We recommend that future studies focus on Southeast Asia, people living with low quality of life, and women in developing countries.

## REFERENCES

1. World Health Organization. Suicide. 2019. Available at: https://www.who.int/news-room/fact-sheets/detail/suicide.
2. Lemsalu L, Ruutel K, Laisaar KT, Lohmus L, Raidvee A, Uuskula A, et al. Suicidal behavior among people living with HIV (PLHIV) in medical care in Estonia and factors associated with receiving psychological treatment. AIDS Behav 2017; 21:1709–16.
3. Cheung CC, Ding E, Sereda P, Yip B, Lourenco L, Barrios R, et al. Reductions in all-cause and cause-specific mortality among HIV-infected individuals receiving antiretroviral therapy in British Columbia, Canada: 2001–2012. HIV Med 2016; 17:694–701.
4. Keiser O, Spoerri A, Brinkhof MW, Hasse B, Gayet-Ageron A, Tissot F, et al. Suicide in HIV-infected individuals and the general population in Switzerland, 1988–2008. Am J Psychiatry 2010;167:143–50.
5. Nishijima T, Inaba Y, Kawasaki Y, Tsukada K, Teruya K, Kikuchi Y, et al. Mortality and causes of death in people living with HIV in the era of combination antiretroviral therapy compared with the general population in Japan. AIDS 2020; 34:913–21.
6. Ruffieux Y, Lemsalu L, Aebi-Popp K, Calmy A, Cavassini M, Fux CA, et al. Mortality from suicide among people living with HIV and the general Swiss population: 1988–2017. J Int AIDS Soc 2019;22:e25339.
7. Aldaz P, Moreno-Iribas C, Egues N, Irisarri F, Floristan Y, Sola-Boneta J, et al. Mortality by causes in HIV-infected adults: comparison with the general population. Bmc Public Health 2011;11:300.
8. Liu Y, Niu L, Wang M, Chen X, Xiao S, Luo D. Suicidal behaviors among newly diagnosed people living with HIV in Changsha, China. AIDS Care 2017;29: 1359–63.
9. Ogundipe OA, Olagunju AT, Adeyemi JD. Suicidal ideation among attendees of a West African HIV clinic. Arch Suicide Res 2015;19:103–16.
10. Passos SM, Souza LD, Spessato BC. High prevalence of suicide risk in people living with HIV: who is at higher risk? AIDS Care 2014;26:1379–82.
11. Kinyanda E, Hoskins S, Nakku J, Nawaz S, Patel V. The prevalence and characteristics of suicidality in HIV/AIDS as seen in an African population in Entebbe district, Uganda. BMC Psychiatry 2012;12:63.

12. Lu TH, Chang HJ, Chen LS, Chu MH, Ou NM, Jen I. Changes in causes of death and associated conditions among persons with HIV/AIDS after the introduction of highly active antiretroviral therapy in Taiwan. J Formos Med Assoc 2006; 105:604–9.

13. Gurm J, Samji H, Nophal A, Ding E, Strehlau V, Zhu J, et al. Suicide mortality among people accessing highly active antiretroviral therapy for HIV/AIDS in British Columbia: a retrospective analysis. CMAJ open 2015;3:E140–8.

14. Bloch M, John M, Smith D, Rasmussen TA, Wright E. Managing HIV-associated inflammation and ageing in the era of modern ART. HIV Med 2020;21(Suppl 3): 2–16.

15. Parashar S, Collins AB, Montaner JS, Hogg RS, Milloy MJ. Reducing rates of preventable HIV/AIDS-associated mortality among people living with HIV who inject drugs. Curr Opin HIV AIDS 2016;11:507–13.

16. Pelton M, Ciarletta M, Wisnousky H, Lazzara N, Manglani M, Ba DM, et al. Rates and risk factors for suicidal ideation, suicide attempts and suicide deaths in persons with HIV: a systematic review and meta-analysis. Gen Psychiatr 2021;34:e100247.

17. Mollan KR, Pence BW, Xu S, Edwards JK, Mathews WC, O'Cleirigh C, et al. Transportability from randomized trials to clinical care: on initial HIV treatment with efavirenz and suicidal thoughts or behaviors. Am J Epidemiol 2021;190: 2075–84.

18. Catalan J, Harding R, Sibley E, Clucas C, Croome N, Sherr L. HIV infection and mental health: suicidal behaviour—systematic review. Psychol Health Med 2011; 16:588–611.

19. DeBastiani S, De Santis JP. Suicide lethality: a concept analysis. Issues Ment Health Nurs 2018;39:117–25.

20. Wang W, Xiao C, Yao X, Yang Y, Yan H, Li S. Psychosocial health and suicidal ideation among people living with HIV/AIDS: a cross-sectional study in Nanjing, China. PLoS One 2018;13:1–17.

21. Quinlivan EB, Gaynes BN, Lee JS, Heine AD, Shirey K, Edwards M, et al. Suicidal ideation is associated with limited engagement in HIV care. AIDS Behav 2017;21:1699–708.

22. Kinyanda E, Nakasujja N, Levin J, Birabwa H, Mpango R, Grosskurth H, et al. Major depressive disorder and suicidality in early HIV infection and its association with risk factors and negative outcomes as seen in semi-urban and rural Uganda. J Affect Disord 2017;212:117–27.

23. Lawrence ST, Willig JH, Crane HM, Ye J, Aban I, Lober W, et al. Routine, self-administered, touch-screen, computer-based suicidal ideation assessment linked to automated response team notification in an HIV primary care setting. Clin Infect Dis 2010;50:1165–73.

24. Rodriguez VJ, Mandell LN, Babayigit S, Manohar RR, Weiss SM, Jones DL. Correlates of suicidal ideation during pregnancy and postpartum among women living with HIV in rural South Africa. AIDS Behav 2018;22:3188–97.

25. Rodriguez VJ, Cook RR, Peltzer K, Jones DL. Prevalence and psychosocial correlates of suicidal ideation among pregnant women living with HIV in Mpumalanga Province, South Africa. AIDS Care 2017;29:593–7.

26. Wu YL, Yang HY, Wang J, Yao H, Zhao X, Chen J, et al. Prevalence of suicidal ideation and associated factors among HIV-positive MSM in Anhui, China. Int J STD AIDS 2015;26:496–503.

27. Cooperman NA, Simoni JM. Suicidal ideation and attempted suicide among women living with HIV/AIDS. J Behav Med 2005;28:149–56.

28. Borenstein M, Hedges LV, Higgins JPT, Rothstein H. Regression in Meta-Analysis. 2017. Available at: https://www.meta-analysis.com/downloads/MRManual.pdf.

29. Page MJ, Moher D. Evaluations of the uptake and impact of the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) Statement and extensions: a scoping review. Syst Rev 2017;6:263.

30. McInnes MDF, Moher D, Thombs BD, McGrath TA, Bossuyt PM, Clifford T, et al. Preferred Reporting Items for a Systematic Review and Meta-analysis of Diagnostic Test Accuracy Studies: The PRISMA-DTA Statement. JAMA 2018; 319:388–96.

31. Badiee J, Moore DJ, Atkinson JH, Vaida F, Gerard M, Duarte NA, et al. Lifetime suicidal ideation and attempt are common among HIV+ individuals. J Affect Disord 2012;136:993–9.

32. Bantjes J, Kagee A, Saal W. Suicidal ideation and behaviour among persons seeking HIV testing in peri-urban areas of Cape Town, South Africa: a lost opportunity for suicide prevention. AIDS Care 2017;29:919–27.

33. Carrieri MP, Marcellin F, Fressard L, Preau M, Sagaon-Teyssier L, Suzan-Monti M, et al. Suicide risk in a representative sample of people receiving HIV care: time to target most-at-risk populations (ANRS VESPA2 French national survey). PLoS One 2017;12.

34. Borges Migliavaca C, Stein C, Colpani V, Barker TH, Munn Z, Falavigna M, et al. How are systematic reviews of prevalence conducted? A methodological study. BMC Med Res Methodol 2020;20:96.

35. DerSimonian R, Kacker R. Random-effects model for meta-analysis of clinical trials: an update. Contemp Clin Trials 2007;28:105–14.

36. DerSimonian R, Laird N. Meta-analysis in clinical trials. Control Clin Trials 1986;7:177–88.

37. Munn Z, Moola S, Lisy K, Riitano D, Tufanaru C. Methodological guidance for systematic reviews of observational epidemiological studies reporting prevalence and cumulative incidence data. Int J Evid Based Healthc 2015;13:147–53.

38. Peters JL, Sutton AJ, Jones DR, Abrams KR, Rushton L. Comparison of two methods to detect publication bias in meta-analysis. JAMA 2006;295:676–80.

39. Borenstein MRH, Sutton A. Publication Bias in Meta-Analysis: Prevention, Assessment and Adjustments. Chichester, United Kingdom: Wiley; 2005. Available at: https://www.wiley.com/en-us/Publication+Bias+in+Meta+Analysis: +Prevention,+Assessment+and+Adjustments-p-9780470870143.

40. Moola SMZ, Tufanaru C, Aromataris E, Sears K, Sfetcu R, Currie M, et al. Chapter 7: systematic reviews of etiology and risk. In: Aromataris E, Munn Z, editors. Joanna Briggs Institute Reviewer's Manual vol. 5. Adelaide, Australia: The Joanna Briggs Institute; 2017.

41. Zhang H, Feng Y, Li Z, Xiu X, Wang L. Spatial analysis and risk factors of suicide among people living with HIV/AIDS who committed suicide. Int J STD AIDS 2021;32:490–500.

42. Zewdu LB, Reta MM, Yigzaw N, Tamirat KS. Prevalence of suicidal ideation and associated factors among HIV positive perinatal women on follow-up at Gondar town health institutions, Northwest Ethiopia: a cross-sectional study. BMC Pregnancy Childbirth 2021;21:42.

43. Wang W, Chen X, Yan H, Yu B, Li S. Association between social capital and suicide ideation, plan and attempt among men living with HIV in China. J Affect Disord 2021;280:173–9.

44. Tamirat KS, Tesema GA, Tessema ZT. Psychosocial factors associated with suicidal ideation among HIV/AIDS patients on follow-up at dessie Referral Hospital, Northeast Ethiopia: a cross-sectional study. HIV AIDS (Auckl) 2021;13: 415–23.

45. Mandell LN, Parrish MS, Rodriguez VJ, Alcaide ML, Weiss SM, Peltzer K, et al. Blood pressure, depression, and suicidal ideation among pregnant women with HIV. AIDS Behav 2022;26:1289–98.

46. Mahlomaholo PM, Wang H, Xia Y, Wang Y, Yang X, Wang Y. Depression and suicidal behaviors among HIV-infected inmates in Lesotho: prevalence, associated factors and a moderated mediation model. AIDS Behav 2021;25:3255–66.

47. Gizachew KD, Chekol YA, Basha EA, Mamuye SA, Wubetu AD. Suicidal ideation and attempt among people living with HIV/AIDS in selected public hospitals: Central Ethiopia. Ann Gen Psychiatry 2021;20:1–18.

48. Ophinni Y, Adrian, Siste K, Wiwie M, Anindyajati G, Hanafi E, Damayanti R, et al. Suicidal ideation, psychopathology and associated factors among HIV-infected adults in Indonesia. BMC Psychiatry 2020;20:255.

49. Knettel BA, Mwamba RN, Minja L, Goldston DB, Boshe J, Watt MH. Exploring patterns and predictors of suicidal ideation among pregnant and postpartum women living with HIV in Kilimanjaro, Tanzania. AIDS 2020;34:1657–64.

50. Gebreegziabhier Kindaya G, Kassaw Demoze C. Lifetime prevalence and determinants of suicidal ideation and attempt among all patients living with HIV/AIDS in Hiwot Fana Specialized Hospital, Harar, Ethiopia, 2020. HIV AIDS (Auckl) 2020;12:331–9.

51. Durham MD, Armon C, Mahnken JD, Novak RM, Palella FJ Jr., Tedaldi E, et al. Rates of suicidal ideation among HIV-infected patients in care in the HIV Outpatient Study 2000–2017, USA. Prev Med 2020;134:106011.

52. Zeng C, Li L, Hong YA, Zhang H, Babbitt AW, Liu C, et al. A structural equation model of perceived and internalized stigma, depression, and suicidal status among people living with HIV/AIDS. BMC Public Health 2018;18:138.

53. Zarei N, Joulaei H. The impact of perceived stigma, quality of life, and spiritual beliefs on suicidal ideations among HIV-positive patients. AIDS Res Treat 2018;2018:6120127.

54. Tang X, Wang HY, Wang M, Ren XH, Jiang FR, Li JL. Structural equation modeling analysis of social support, coping strategies, depression and suicidal ideation among people living with HIV/AIDS in Changsha, China. Neuropsychiatr Dis Treat 2018;14:2923–30.

55. Rodriguez VJ, Sued O, Cecchini D, Mandell LN, Bofill LM, Weiss SM, et al. Suicidality among nonadherent patients living with HIV in Buenos Aires, Argentina: prevalence and correlates. AIDS Care 2018;30:1380–7.

56. Lu HF, Chang NT, Sheng WH, Liao SC, Wu PY, Hsiao FH. Exploring suicide ideation and suicide attempts among HIV-positive patients during the first six months to one year after their diagnosis. Hu Li Za Zhi 2018;65:60–72.

57. Hentzien M, Cabie A, Pugliese P, Billaud É, Poizot-martin I, Duvivier C, et al. Factors associated with deaths from suicide in a French nationwide HIV-infected cohort [published online June 1, 2018]. HIV Med 2018. doi:10. 1111/hiv.12633.

58. Oladeji BD, Taiwo B, Mosuro O, Fayemiwo SA, Abiona T, Fought AJ, et al. Suicidal behavior and associations with quality of life among HIV-infected patients in Ibadan, Nigeria. J Int Assoc Provid AIDS Care 2017;16:376–82.

59. Egbe CO, Dakum PS, Ekong E, Kohrt BA, Minto JG, Ticao CJ. Depression, suicidality, and alcohol use disorder among people living with HIV/AIDS in Nigeria. BMC Public Health 2017;17:542.

60. Walter KN, Petry NM. Lifetime suicide attempt history, quality of life, and objective functioning among HIV/AIDS patients with alcohol and illicit substance use disorders. Int J STD AIDS 2016;27:476–85.

61. Rukundo GZ, Mishara BL, Kinyanda E. Burden of suicidal ideation and attempt among persons living with HIV and AIDS in semiurban Uganda. AIDS Res Treat 2016, 2016:3015468.

62. Kang CR, Bang JH, Cho SI, Kim KN, Lee HJ, Ryu BY, et al. Suicidal ideation and suicide attempts among human immunodeficiency virus–infected adults: differences in risk factors and their implications. AIDS Care 2016;28:306–13.

63. Peltzer K. Prevalence of suicidal ideation and associated factors among postpartum HIV-positive women in health facilities, South Africa. J Psychol Afr 2015; 25:547–50.

64. Ceccon RF, Meneghel SN, Hirakata VN. Women with HIV: gender violence and suicidal ideation. Rev Saude Publica 2014;48:758–65.

65. Jiwatram-Negrón T, Meinhart M, Primbetova S, Terlikbayeva A, El-Bassel N. Examining the association between intimate partner violence and suicidal ideation among women living with HIV in a low- and middle-income country. J Aggress Maltreat Trauma 2021;30:1148–66.

66. Necho M, Tsehay M, Zenebe Y. Suicidal ideation, attempt, and its associated factors among HIV/AIDS patients in Africa: a systematic review and meta-analysis study. Int J Ment Health Syst 2021;15:13.

67. Tsegay L, Ayano G. The prevalence of suicidal ideation and attempt among young people with HIV/AIDS: a systematic review and meta-analysis. Psychiatr Q 2020;91:1291–304.

68. Escobar M. Suicide Rates In 2019. 2019. Available at: https://storymaps.arcgis.com/stories/5fea08b4095348cc82f8184735cea228.

69. Jackson-Best F, Edwards N. Stigma and intersectionality: a systematic review of systematic reviews across HIV/AIDS, mental illness, and physical disability. BMC Public Health 2018;18:919.

70. Hernansaiz-Garrido H, Alonso-Tapia J. Internalized HIV stigma and disclosure concerns: development and validation of two scales in Spanish-speaking populations. AIDS Behav 2017;21:93–105.

71. Milner A, Page K, Spencer-Thomas S, Lamotagne AD. Workplace suicide prevention: a systematic review of published and unpublished activities. Health Promot Int 2015;30:29–37.

72. Nock MK, Borges G, Bromet EJ, Alonso J, Angermeyer M, Beautrais A, et al. Cross-national prevalence and risk factors for suicidal ideation, plans and attempts. Br J Psychiatry 2008;192:98–105.

73. Durvasula R, Miller TR. Substance abuse treatment in persons with HIV/AIDS: challenges in managing triple diagnosis. Behav Med 2014;40:43–52.

74. Bing EG, Burnam MA, Longshore D, Fleishman JA, Sherbourne CD, London AS, et al. Psychiatric disorders and drug use among human immunodeficiency virus-infected adults in the United States. Arch Gen Psychiatry 2001;58:721–8.

75. Fang H, Tu S, Sheng J, Shao A. Depression in sleep disturbance: a review on a bidirectional relationship, mechanisms and treatment. J Cell Mol Med 2019;23:2324–32.

76. McCall WV. The correlation between sleep disturbance and suicide. Psychiatric Times 2015;32.

77. World Health Organization. World Health Statistics data visualizations dashboard-Suicide. 2018. Available at: https://apps.who.int/gho/data/node.sdg.3-4-viz-2?lang=en.

78. Hessamfar-Bonarek M, Morlat P, Salmon D, Cacoub P, May T, Bonnet F, et al. Causes of death in HIV-infected women: persistent role of AIDS. The 'Mortalité 2000 & 2005' Surveys (ANRS EN19). Int J Epidemiol 2010;39:135–46.

79. Forbes K, Barnes A. Behaviour trends and life experiences of young people living with or affected by HIV (YPLWAH) in the UK. Arch Dis Childhood 2014;99:A22.