Suicide Prevention among College Students before and during COVID-19 Pandemic: Systematic Review and Meta-Analysis Protocol

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Abstract

Background: Suicide is the second leading cause of death for college-aged individuals worldwide and in the US. Recent studies have identified preliminary evidence of widening disparities across sex, sexual orientation, race/ethnicity, age, and socioeconomic status among college students. Yet few systematic reviews and meta-analyses are available to offer a comprehensive understanding of on-campus and off-campus interventions with different types of screening, assessment, treatment, and postvention plans. Further challenges have been identified since the COVID-19 pandemic, calling for cost-effective and innovative interventions to address increased rates of suicidal behaviors among college students facing unprecedented stressors.

Objective: This research protocol describes the first systematic review and meta-analysis to identify the most effective and cost-effective intervention components for universal and targeted (indicated and selected) suicide prevention among college students. Special attention is placed on disparities in suicide prevention across sociodemographic subgroups, inclusive interventions beyond campus, global context, and intervention responses to the COVID-19 pandemic.

Methods: A sensitive search strategy will be executed across Medline (Ovid), EMBASE (Embase.com), PsycINFO (EBSCO), ERIC (EBSCO), Cochrane Library (Cochranelibrary.com), Dissertations and Theses Global (ProQuest), Scopus (Scopus.com), and Google Scholar. Data extraction and evaluation will be conducted by two independent researchers. Risk of bias will be assessed. A multilevel meta-regression model and subgroup analysis will be used to analyze the data and estimate effect size.

Results: The search was completed in December 2020. We expect the results to be submitted for publication in mid-2021.

Conclusions: Despite increasing rates of suicidal behaviors among college students, there are few preventative efforts targeting this population, and even less focus on health disparities and equity. The impact of COVID-19 on suicidal behaviors among college students further calls for an urgent need for rapid and effective interventions that might differ from traditional approaches. This equity-focused study will address these gaps and provide a valuable analysis of the effectiveness of suicide preventions and interventions. Findings will inform clinicians, researchers, policymakers, families, and organizations about evidence-based approaches to reducing the gaps in the suicide crisis among college students from different sociodemographic groups. Clinical Trial: PROSPERO Registration: CRD42020225429.

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Contributors' Statement Page

YX conceptualized, designed, and initiated the study, drafted the initial manuscript, and reviewed and revised the manuscript. RH contributed to the analytic plan. The other authors reviewed and revised the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Abstract

Introduction

Suicide is the second leading cause of death for college-aged individuals worldwide and in the US. Recent studies have identified preliminary evidence of widening disparities in suicidal behaviors across sex, sexual orientation, race/ethnicity, age, and socioeconomic status among college students. Few systematic reviews and meta-analyses offer a comprehensive understanding of on-campus and off-campus suicide interventions, nor is collated information available for different types of screening, assessment, treatment, and postvention plans. Further challenges have been identified since the COVID-19 pandemic, calling for cost-effective and innovative interventions to address increased rates of suicidal behaviors among college students facing unprecedented stressors.

Objective

This research protocol describes the first systematic review and meta-analysis to identify the most effective and cost-effective intervention components for universal and targeted (indicated and selected) suicide prevention among college students in a global context. Special attention will be placed on disparities in suicide prevention across sociodemographic subgroups, inclusive interventions beyond campus, global context, and intervention responses to the COVID-19 pandemic.

Methods

A sensitive search strategy will be executed across Medline (Ovid), EMBASE (Embase.com), PsycINFO (EBSCO), ERIC (EBSCO), Cochrane Library (Cochranelibrary.com), Dissertations and Theses Global (ProQuest), Scopus (Scopus.com), Global Index Medicus, SciELO, African Journals Online, Global Health (CABI), and Google Scholar. Data extraction and evaluation will be conducted by three independent researchers. Risk of bias will be assessed. A multilevel meta-regression model and subgroup analysis will be used to analyze the data and estimate effect sizes.

Results

The initial search was completed in December 2020 and updated with additional other-language studies in March 2020. We expect the results to be submitted for publication in mid-2021.

Conclusions

Despite increasing rates of suicidal behaviors among college students, few preventative efforts have targeted this population, and even less focus on factors that might place specific demographic groups at heightened risk. The impact of COVID-19 on suicidal behaviors among college students highlights and exacerbates the urgent need for rapid and effective interventions that might differ from traditional approaches. This equity-focused study will address these gaps and provide a valuable analysis of the effectiveness of suicide preventions and interventions. Findings will inform clinicians, researchers, policymakers, families, and organizations about evidence-based interventions to reducing the gaps in the suicide crisis among college students from different sociodemographic groups.

Ethics and Dissemination Ethical approval is not required for this review. Results will be published in peer-reviewed journals, presented in academic conferences, and translated into educational materials to disseminate to appropriate users.

PROSPERO Registration: CRD42020225429.

Introduction

Background

Suicide is the second leading cause of death for college-aged individuals worldwide and in the United States (US) [1-7]. Globally, results from the WHO World Mental Health International College Student (WMH-ICS) Surveys indicated that 32.7% of college students seriously thought about suicide, and 4.3% attempted suicide, between 2014 and 2017 [3]. In the US, one-fifth of college student participants in a recent national survey reported suicidal ideation, with 9% reporting suicide attempts [4]. Between 2007 and 2017, past-year suicidal ideation among college students nearly doubled (5.8% to 10.8%) [7]. Based on the Household Pulse Survey by the Centers for Disease Control and Prevention (CDC) conducted from Feb 17 to March 1, 2021, 42.2% of participants ages 18-29 reported indicators of depression in the past week [8]. Notably, colleges and universities (hereafter “colleges”) have been identified as potential sites for suicide clusters where a substantial number of suicides could occur rapidly within a short timeframe [9]. The trauma associated with exposure to a young person’s suicide significantly increases widespread anxiety, panic, and prolonged grief across victims, families, and communities [10]. There is an urgent need for research to develop effective, innovative, and accessible suicide prevention and interventions for college students.

In addition, recent studies have identified preliminary evidence of widening disparities in suicide across sex, sexual orientation, race/ethnicity, age, and socioeconomic status subgroups among college students [4, 11, 12]. Since 2000, female college students have reported a higher prevalence of suicidal ideation, planning, and attempts than their male counterparts in the US [13, 14]. Bisexual and transgender students were 2-3 times more likely to report suicidality than heterosexual and gay/lesbian students in 2015 [4]. In 2017, Black college students reported the highest rate of suicide attempts among college students (2.6%, vs. 1.4% in White) [11]. There are sociodemographic differences in barriers to using mental health services on college campuses [12, 15]. However, evidence-based suicide programs tailored to meet the unique needs of specific demographic groups are few. There is a need to develop culturally adaptive suicide interventions, given emerging evidence that experiences of structural discrimination, minority stress, adverse childhood experiences, social discord, and cultural sanctions might disproportionately affect the risk of suicidal behavior [16, 17].

Further challenges for student mental health have been identified during the COVID-19 pandemic. In a recent CDC survey, young adults ages 18-24 reported significantly greater rates of suicidal ideation than the general population during the pandemic (25.5% vs. 10.7%) [18]. Yet, existing studies have focused on primary and secondary school students [19, 20], and actions to tackle the impact of COVID-19 on mental health among college students has not been comprehensively understood. The new synergistic challenge that calls for proactive and effective responses to prevent youth suicide from policymakers, researchers, and the global community [21, 22]. Telepsychiatry interventions and digital tools (e.g., mobile apps, internet chatbots, videoconferencing) have proliferated rapidly in response to the COVID-19 emergency [23]. It is therefore important to review whether suicide prevention studies conducted since the onset of the COVID-19 pandemic to address pandemic-specific suicide risk [21]. If such studies have been published, preliminary results should also be synthesized, and service gaps identified [22].

Rationale

Suicidal behaviors among college students can have wide-ranging adverse effects on well-being and development, including low academic achievement [24, 25], chronic physical health conditions [26], and reduced labor market performance [27]. Early identification, effective treatment, and

appropriate interventions for students have the potential to save students' lives and improve societal well-being and social capital [3]. Despite recent attention to the alarming rates of suicidal behaviors among college students [3, 4, 7, 28], there has been less research comparatively addressing suicide prevention and early intervention for college students than for primary and secondary school students [29]. This is troubling because the college years represent a critical and unique developmental stage [30], characterized by dynamic social role transitions, new living situations, and changing relationships [31]. It is important to understand and design college-specific intervention programs targeting the developmental stress-diathesis factors [32] during the transition from adolescence to emerging adulthood.

Existing systematic reviews on suicide prevention among college students are generally strong but are limited by their narrow foci in terms of populations, interventions, comparisons, and outcomes, as well as a lack of guidance from a theoretical framework. First, most previous reviews focus on symptomatic students [33], but evidence suggests a need for additional focus on those at risk but undiagnosed or untreated. To address this gap, this study will not be restricted to studies of students with a current diagnosis. Second, many campus counseling centers are under-resourced, and college students have to use off-campus mental health services [12, 34]. Yet, previous reviews predominantly focus on on-campus settings [35]. Conceptually, this may be related to a gap recently identified by the U.S. Preventive Services Task Force (USPSTF): the lack of effective interventions linking clinical and community resources [36, 37]. This study will extend the previous review by deliberately attempting to build a comprehensive understanding of available on-campus and off-campus services (e.g., those in the community) interventions. Third, consideration of the disparities faced by specific sociodemographic student groups is needed to improve screening and referral systems targeting high-risk groups [38]. Previous reviews exclude studies on interventions targeting high-risk populations (e.g., sexual minorities), and no reviews have delineated differential intervention effects. This study will add to existing knowledge by exploring suicide interventions tailored to specific sociodemographic groups and assess their intervention outcomes.

Fourth, the interventions included in previous systematic reviews have been concentrated on gatekeeper programs with outcomes that do not directly measure suicidal behaviors (e.g., many such programs assess secondary outcomes, including knowledge, skills, attitudes, or awareness) [33, 35, 39]. Our proposed study will include both primary suicide assessment (e.g., suicidal ideation, plan, planning, and attempts) and secondary outcomes (e.g., attitudes). Additionally, we plan to evaluate the cost-effectiveness (i.e., costs of death prevented using the incremental cost-effectiveness ratio [ICER]) of the interventions where data are available, which has not been attempted in previous reviews.

Fifth, as one might expect, no reviews have examined the adaptability of suicide prevention programs in the context of the COVID-19 pandemic. This information will be important to inform the emerging transformation and proliferation of telepsychiatry in terms of the ways in which it might increase the accessibility of mental health services for college students [21-23, 40]. Digital interventions provide the opportunity to reach at-risk college students who experience barriers to accessing traditional mental health services [41]. This study will add a specific focus on suicide interventions implemented during the COVID-19 pandemic when available.

Sixth, most existing reviews only consider studies conducted on college campuses in the US [33, 35, 39], limiting the chance to learn from other developed and developing countries. This study will not limit the search criteria by geographic location, potentially adding informative global experiences to the existing body of knowledge. Finally, few reviews have adapted an evidence-based theoretical framework to guide the synthesis, with selected exceptions. Reviews that applied the two-paradigm framework (Clinical Intervention Zone, Prevention Zone) [35, 39] and social-ecological model [42, 43] suggest the need for more theoretically-sound reviews with public health perspectives to offer a rigorous evaluation of existing efforts as a whole and within each level or paradigm. None of the existing systematic reviews have adopted a health equity framework [44, 45] to guide the review

process. This study will use a logic framework (Figure 1) based on PRISMA-E, relevant guides, and previous empirical studies.

Objectives

This protocol articulates our plan to conduct a comprehensive systematic review and meta-analysis to identify the most effective and cost-effective intervention components for universal and targeted (indicated and selected) suicide prevention among college students. This project will accomplish the following objectives:1) analyze all student participants with a focus on disparities in suicide, 2) include on-campus and off-campus programs (in-person and virtual), 3) examine broader outcomes specific to suicidal behaviors, and other secondary outcomes that might reduce suicide (e.g., knowledge, attitudes), 4) incorporate US and non-US studies, and 5) adhere to a theoretically developed logic framework (Figure 1). To offer a breadth of program evolution across various eras, our review will not limit the study timeframe, though it will focus on the development of novel interventions prior to and during COVID-19. If a paucity of studies during COVID-19 is identified, we will summarize the existing findings and reinforce the importance of understanding the potential effects of COVID-19 on this body of literature [46].

We will attempt to clearly answer the following research questions: (1) What are the existing college-based and community-based suicide interventions for college students? (2) what are the common elements/types of suicide prevention interventions for college students? (3) what are the health and social outcomes of the interest of the selected interventions? (4) are there sufficient variability in interventions concerning the population, interventions, controls, and outcomes, based on the reported results and discussions? (5) which components or combinations of components of suicide interventions are effective, and for which outcomes (primary vs. secondary), demographic subgroups, settings (on vs. off-campus), and delivery method (in-person vs. digital)? (6) are there existing suicide intervention programs tailored to students from specific sociodemographic subpopulations? If so, what elements of the intervention are tailored? (7) which suicide intervention has been the most efficacious and effective during COVID-19? And (8) which suicide intervention is the most cost-effective based on standard economic evaluation? Cost-effectiveness will be measured by the values of incremental cost-effectiveness ratios (ICER) that are available in the identified studies, or calculated given the availability of costs (e.g., healthcare sector costs, non-medical costs, and costs of productivity losses) reported in the studies [47].

Knowledge generated from our study will identify gaps in the evidence base and inform college leaders, policy actors, healthcare practitioners, clinicians, parents, and society about feasible approaches to screen and support at-risk college students across sociodemographic characteristics.

Methods

This protocol was developed using the 2015 PRISMA-P (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols) recommended checklist for systematic review protocols [48]. The systematic review and meta-analysis will be conducted and reported in accordance with the PRISMA statement [49] and the methods outlined in the Cochrane Handbook for Systematic Reviews of Interventions [50]. Given our specific focus on at-risk subpopulations (e.g., racial/ethnic minorities, sexual minority students) and interventions aimed at reducing barriers to seeking help among college students across sex, race/ethnicity, sexual orientation and socioeconomic status, we further adapted the PRISMA statement on equity-focused systematic reviews (PRISMA-E 2012) [51-55] to improve transparency and completeness in reporting health equity-focused systematic reviews, in addition to the previous PRISMA-E checklist developed by Moher and colleagues [56, 57]. The review team is composed of researchers across disciplines with diverse backgrounds.

Eligibility Criteria

Types of Participants

This review will consider studies involving college students (ages 18 and older). We will also examine subpopulations across age, race/ethnicity, sex, sexual orientation, and socioeconomic status [58-61].

Types of Interventions

All programs that have at least one component intended to address suicide are eligible for inclusion. This includes programs that address general suicidal thoughts and behaviors (STB), specific suicidal thoughts and behaviors, awareness of suicidal behaviors, help-seeking behaviors, or a combination of conditions. Included interventions will be broadly defined and include universal, indicated, or selected interventions at the individual, family, and school levels. Possible intervention mechanisms will include psychological (e.g., cognitive behavioral therapy, psychodynamic psychotherapy), pharmacological (e.g., antidepressants) [62], psychosocial (e.g., restricting access to lethal means; screening for high-risk persons), educational (e.g., education and awareness programs for the general public and professionals; media reporting of suicide), and physical (e.g., exercise, occupational therapy) interventions to prevent/reduce suicidal ideation and behaviors. Interventions targeting secondary outcomes such as awareness of suicide and help-seeking behaviors will also be included. Interventions designed to primarily target behaviors that are risk factors for suicidal behaviors (e.g., substance abuse) but that do not specifically address any of the components above will be excluded. Interventions focusing on gatekeepers (e.g., families, teachers, healthcare providers) will be included. We will include randomized controlled trials (RCTs), pseudo-RCTs, observational pretest/posttest designs, and ecological or population-based studies that evaluate the effectiveness of suicide interventions.

Types of Prevention Settings

We will include all relevant settings, including campuses, community centers, digital tools, and hybrid (in-person and virtual) models. We will conceptualize digital tools, broadly, as internet-based interventions, chatbots, mobile device interventions, and social media interventions. We will not restrict inclusion criteria based on geographic location.

Types of Outcomes

The primary outcomes will include suicide-specific outcomes, suicidal ideation, suicidal thoughts, and suicidal behaviors (completed suicide or suicide attempts). If multiple measures of suicide are used, we will prioritize data extraction as follows: (1) validated questionnaires (e.g., the Columbia-Suicide Severity Rating Scale [63] or Beck Scale for Suicide Ideation[64]), (2) clinician ratings, and (3) single item analysis of other self-reported rating scales (e.g., question 9 from the Patient Health Questionnaire-9 [65]). The secondary outcomes will include changes in suicide-related knowledge, attitudes, and behaviors. To examine equity-focused interventions, outcomes associated with inequality (e.g., barriers to accessing care) will be included.

Information Sources

We conducted a systematic search of the following databases from their inception until December 8, 2020: Medline (Ovid), EMBASE (Embase.com), PsycINFO (EBSCO), ERIC (EBSCO), Cochrane Library (Cochranelibrary.com), Dissertations and Theses Global (ProQuest), Scopus (Scopus.com), and Google Scholar. For Google Scholar, all references on the first 10 pages, excluding books, will be retrieved. Including 10-20 pages (100-200) of references is suggested to achieve an optimal collection of the most relevant references [66]. On March 25th, 2021, we expanded our search to

include Global Index Medicus, SciELO, African Journals Online, and Global Health (CABI) in order to capture literature from low- and middle-income countries. Including such information sources may improve our ability to identify studies specifically relevant to suicide risks among sociodemographic subpopulations. Editorials, news items, conference proceedings and abstracts, patents, legal findings, and commentaries will be excluded. We will not restrict the search by language or publication date. We plan to use Google Translate (Google, Mountain View, CA, USA) for the purpose of data extraction of non-English language articles and to consult translators and colleagues proficient in the language, consistent with previous systematic reviews which included worldwide study context [67, 68]. Researchers from our study team are native speakers of Chinese (YX) and proficient in Spanish (AM). We will screen relevant review articles and the reference lists of all included studies (backward search) for additional eligible studies. We will further screen studies that cited the included studies and relevant reviews (forward search). We will perform hand searches. We will include grey literature in ProQuest Dissertations and Theses dissemination from inception until December 8, 2020, in the systematic review, but not in the meta-analysis. We will also contact three experts in suicide prevention that we have identified to potentially obtain additional sources.

Search Strategy

The database search strategies were developed by a health sciences librarian (RH) with expertise in literature searches. Known, relevant articles collected by the authors were analyzed to select keywords and subject headings. An initial search strategy in Medline Ovid was then iteratively developed by adding or removing additional keywords and subject headings until all known, relevant articles were retrieved by the search, and no new, relevant articles were found. The final search terms incorporated numerous headings, keywords, and publication types associated with three main concepts: college students, suicide, and intervention/prevention. In keeping with the health equity focus of the review, terms related to potentially under-resourced college populations, such as nontraditional, commuter, foreign, international, or first-generation, were specifically included. Terms for prevention were purposely kept broad to encompass a wide range of possible interventions. The full search strategies for all information sources are provided in Multimedia Appendix 1.

Study Records

Data Management

Identified articles are imported into EndNote 20 software (Clarivate Analytics), where duplicate references are removed. The remaining references are imported and managed in Covidence software (Veritas Health Innovation) for screening.

Selection Process

A total of two reviewers (NJ and AM) will independently screen the studies for eligibility (making a yes or no selection). Potential discrepancies during any step of the screening for inclusion/exclusion will be resolved by a third reviewer (YX). First, the reviewers will screen titles and abstracts identified in the databases. Then, the team will obtain and screen full-text articles. Studies that do not meet the eligibility criteria will be moved to an exclusion folder. All reviewers will strictly adhere to the inclusion and exclusion criteria. Final selected articles will be approved by the consensus of all reviewers and sent to an expert consultant for potential suggestions. The selection process will be displayed in a PRISMA flowchart [69].

Logic Framework

Figure 1 illustrates the logic framework that we will employ during the review process. The logic framework recognizes that the causal chain of events linking preventative efforts to reduced suicidal behaviors can lead to differences in effects between socioeconomically disadvantaged and advantaged students in at least four ways: disparities in access/exposure, attention/retention, screening/response, and interventions.

Data Collection Process

Data abstraction will occur independently and in duplication using a piloted standard data collection form. Data extraction will include three categories: (1) study population and design; (2) intervention; and (3) outcome. Specific items in the extraction form will include study design, participant characteristics, geographic location, sample size, intervention methods, comparison intervention methods, primary and secondary outcomes, theoretical basis, mode of delivery, suicide prevention strategies, control condition, intensity and frequency of intervention, and treatment engagement (retention and attrition). Following PRISMA-E [44, 45, 55], we will include participant characteristics mapped to PROGRESS (place of residence, race/ethnicity/culture/language, occupation, gender/sex, religion, education, socioeconomic status, and social capital).

Risk of Bias Assessment

For RCTs and pseudo-RCTs, reviewers will use the Cochrane Collaboration's Risk of Bias tool [70]. Randomization procedures, bias, allocation, outcome assessor, reporting of findings, and losses to follow-up will be assessed. Studies will be classified as having a low, high, or unclear risk of bias. For non-RCTs (e.g., controlled before/after designed studies), reviewers will use the ROBINS-I ("Risk of Bias in Non-randomized Studies - of Interventions") tool for evaluating the risk of bias in estimates [71]. The ROBINS-I assesses confounding participant selection, classification of the intervention, departures from the intended intervention, missing data, measurement of outcomes, selection of the reported results, and overall bias. Studies will be classified as being of low, moderate, serious, or critical risk of bias.

Data Synthesis

Qualitative Synthesis

If the selected studies contain large amounts of heterogeneity or lack sufficient numbers to conduct the meta-analysis, we will follow the "Narrative Synthesis in Systematic Reviews" tool [72] and the PRISMA guidelines [69] to undertake a full narrative review. Following the PRISMA-E checklist [51], we will report both relative and absolute differences in intervention outcomes between sociodemographic groups. We will discuss the extent and limits of applicability to students across sex, race/ethnicity, age, and socioeconomic status. We will further provide implications for research, practice, or policy related to health equity in suicide prevention among college students where relevant (e.g., types of interventions needed to address increasing suicide attempts among young Black males).

Meta-Analysis

Should we identify a sufficient number of articles with low heterogeneity, we will conduct a meta-analysis among the final selected studies.

RevMan 5.3 will be used for all analyses. For continuous data, we will report the mean differences between groups and the 95 % confidence interval (95 % CI). We will calculate the standardized mean difference and 95% CI if different measurement tools were used for the same outcome, and the standard deviation if not reported [50]. We will use a random effects meta-analysis model given the

possibility that there will be different types of interventions, heterogeneous characteristics of participants and comparators, and different intervention effects.

We will use χ^2, I^2, and T^2 to assess heterogeneity [73]. χ^2 assesses the compatibility of observed differences in results (χ^2 with p <.01 will be considered substantial heterogeneity). The I^2 statistic represents the proportion of the total variation across studies due to heterogeneity (I^2 <40% indicates insignificant heterogeneity) [50]. T^2 estimates the between-study variance in a random effects meta-analysis (T^2 >1 indicates substantial heterogeneity).

Sensitivity analysis will be conducted by examining whether excluding studies identified as having a greater risk of bias affects the effect sizes and comparisons between intervention and control groups.

Publication bias will be assessed by funnel plots and Egger's test [74].

Sensitivity Analysis

With our comprehensive inclusion criteria, it is expected that the selected studies will include multiple study designs (e.g., RCTs, non-RCTs, and observational studies). Recent studies report improved diagnostic accuracy after including different study designs in meta-analyses [74, 75]. We plan to first conduct an analysis among combined RCTs and pseudo-RCTs, followed by separate subgroup analyses by study design to investigate the impact on the magnitude of the effect size observed for the included interventions.

Subgroup Analysis

Given the focus of this study on investigating health disparities, we plan to conduct subgroup analyses by sociodemographic characteristics and by pre-and during- COVID-19 periods when there are sufficient studies to do so. To increase the statistical rigor of our meta-analysis, we will include an independent meta-analysis statistician to review all our work as a blinded reviewer.

Evaluation of Cost-Effectiveness

We plan to evaluate the cost-effectiveness of the studies based on the reported ICER and the strength of evidence. We will classify interventions into cost-saving (better health outcomes and costs less than controlled group) or cost-neutral (ICER=0); very cost-effective (0 < ICER ≤ $25,000 per quality-adjusted life-years [QALYs] or life-years gained [LYGs]); cost-effective ($25,000 < ICER ≤ $50,000 per QALY or LYG); marginally cost-effective ($50,000 < ICER ≤ $100,000 per QALY or LYG); or not cost-effective (>$100,000 per QALY or LYG) [47]. The strength of evidence (strong, supportive, or uncertain) will be assessed using criteria from a previous systematic review [76]. If there are no reported direct healthcare costs or evaluation of the cost-effectiveness in the identified studies, we will summarize the data as reported in a previous review on depression intervention [77].

Results

The systematic review and meta-analysis are currently in progress and expected to be finished by Summer 2021. We welcome comments from reviewers and will be flexible in adjusting based on concerns related screening and data analysis to improve scientific rigor. Our final manuscript is expected to be submitted to peer-reviewed journals by August 2021.

Discussion

Suicide is a significant public health crisis among college students worldwide [1-7]. However, there is a lack of research pertaining to effective suicide prevention programs among college students, particularly programs that could be tailored to target the unique needs among student subgroups across sex, sexual orientation, racial/ethnicity, age, and socioeconomic status. While the impact of COVID-19 on suicidal behaviors among college students has been recognized [18], little is known

about possible suicide preventions for college students during the pandemic and their differences in crisis management that differ from pre-COVID intervention programs.
Our systematic review and meta-analysis will address a significant lack of outcomes research examining the efficacy and effectiveness of available suicide preventions among college students. The strengths of our study are the inclusion of intervention and prevention programs with various study designs, different settings, modes of delivery across countries, and a specific focus on health equity. Our findings will inform clinicians, researchers, policymakers, families, and higher education organizations in reducing the gaps in suicide crisis among college students from different sociodemographic subgroups.

Limitations

Given the broad inclusion criteria, there may be high heterogeneity among the included studies. There may also be a small number of studies focused on newly developed interventions (e.g., mobile technologies), which may have limited representativeness. We plan to follow established guidelines for handling heterogeneity [50, 69, 78, 79]. We are minimizing the potential risk of studies being excluded during selection by following a rigorous protocol, conducting a pre-screening training, including multiple coders, and employing cross-validation through a third reviewer. We will conduct sensitivity analysis by considering duplicate data extraction to minimize extraction errors [80] [81]. We will include an external meta-analysis statistician to detect any scientific and statistical errors during the meta-analysis [82]. We are also aware that some community-based interventions may not have identified participants as college students, and thus, it may be difficult to identify data to examine any potential differences between on- and off-campus services. In such a case, we will summarize findings from the existing studies that report college students as the study sample. By submitting our protocol for review, we will also adjust for any critical threats not identified by the team prior to conducting the study.

Implication

To the best of our knowledge, this will be the first systematic review and meta-analysis to examine the effectiveness of suicide prevention interventions among college students in such a wide-ranging and comprehensive manner. In addition, if possible, comparing pre- and during- COVID-19 interventions could offer guidance for future initiatives and emerging needs.

Ethics and dissemination

No ethical approval is required for this protocol and proposed systematic review as we will only use data from previously published papers that have themselves received ethics clearance and used proper informed consent procedures. The results of our systematic review and meta-analysis will be published in a peer-reviewed journal.

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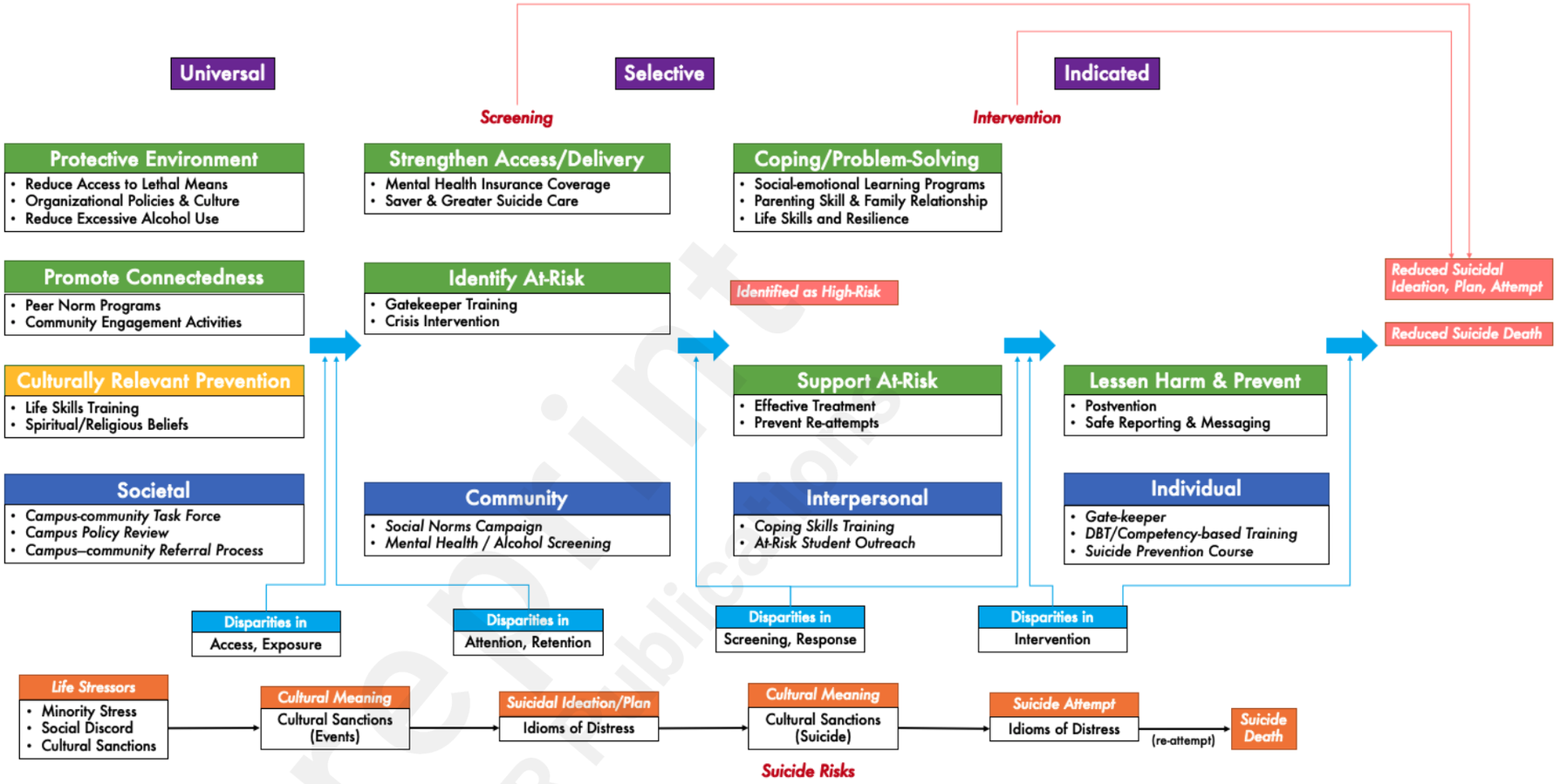
Figure 1. Logic model depicting potential sources of disparity in response to suicide prevention among college students.



Note. This figure was adapted from PRISMA-E 2012 [44, 45]; recommendations of including health equity and social determinant of health in systematic review [53]; guide and applications of using logic models to capture complexity in systematic reviews from the Cochrane Public Health Group, the Kellogg Foundation and others [83-88]; US Preventive Services Task Force's Guide for Screening for Depression, Anxiety, and Suicide Risk in Adults, Including Pregnant and Postpartum Persons [89]; CDC'S technical package of suicide prevention [90]; Institute of Medicine's Universal, Selective, and Indicated (USI) prevention model [38]; Suicide Prevention Resource Center's Comprehensive Approach to Suicide Prevention [91]; suicide prevention models in previous systematic review [40, 92, 93]; Cramer and colleagues' public health framework of suicide prevention among college students [42]; Chu and colleagues' cultural theory of suicide outcomes [17]; Wong and colleagues' Racial-Cultural Framework for addressing suicide-related outcomes in communities of color [94].

Multimedia Appendix 1: Search strategies and updated number of results on March 24, 2021
Search ran on 12/14/2020

Medline Ovid

(((College* OR universit*) adj10 ((young adj (people OR adult*)) OR gatekeep* OR employee* OR enrolled OR student* OR hotspot*)) OR ((post-secondary OR tertiary) adj3 (school OR institution* OR education)) OR campus* OR graduate* OR undergraduate* OR (resident adj3 (advisor* OR assistant*)) OR (commuter adj3 school*) OR ((first generation OR international OR foreign OR nontraditional) adj3 student*) OR (young adult/ and universities/) OR ((nursing OR medical OR social work) adj (student* OR interns OR intern OR school)))
AND
(exp Suicide/ OR suicid* OR parasuicide)
AND
(intervention.tw or interventions.tw or prevent*.tw or program*.tw or policy.tw or policies.tw or ((mental.tw OR suicide.tw) adj3 (curriculum.tw OR awareness.tw OR screening.tw OR education.tw or training.tw or treatment.tw)) or counseling.tw or mass screening/ or help-seeking behavior/ or counseling/ OR hotline*.tw or phone*.tw. or telephone*.tw. OR Student Health Services/ OR exp Mental Health Services/)
not (letter OR editorial or news or comment).pt.
Results: 967

EMBASE

((((college* OR universit*) NEAR/10 ('young people' OR 'young adults' OR 'young adult' OR gatekeep* OR employee* OR enrolled OR student* OR hotspot*)):ab,ti,kw) OR ((('post secondary' OR tertiary) NEAR/3 (school OR institution* OR education)):ab,ti,kw) OR campus*:ab,ti,kw OR graduate*:ab,ti,kw OR undergraduate*:ab,ti,kw OR ((resident NEAR/3 (advisor* OR assistant*)):ab,ti,kw) OR ((commuter NEAR/3 school*):ab,ti,kw) OR ((("first generation" OR international OR foreign OR nontraditional) NEAR/3 student*):ab,ti,kw) OR (((nursing OR medical OR 'social work') NEAR/1 (student* OR interns OR intern OR school)):ab,ti,kw) OR 'health student'/exp OR 'college student'/de OR 'graduate student'/de OR 'nontraditional student'/de OR 'phd student'/de OR 'postgraduate student'/de OR 'undergraduate student'/de OR 'university student'/de OR ((college/de OR 'university'/de) AND ('young adult'/de OR 'student'/de))) AND
('suicide'/exp OR 'suicidal behavior'/exp OR suicid*:ab,ti,kw OR parasuicide:ab,ti,kw)
AND
(intervention:ab,ti,kw OR interventions:ab,ti,kw OR prevent*:ab,ti,kw OR program*:ab,ti,kw OR policy:ab,ti,kw OR policies:ab,ti,kw OR (((mental OR suicide) NEAR/3 (curriculum OR awareness OR screening OR education OR training OR treatment)):ab,ti,kw) OR counseling:ab,ti,kw OR hotline*:ab,ti,kw OR phone*:ab,ti,kw OR telephone*:ab,ti,kw OR telemedicine:ab,ti,kw OR telehealth:ab,ti,kw OR telepsychiatry:ab,ti,kw OR 'mental health service'/exp OR 'telehealth'/exp OR 'mass screening'/de OR 'anonymous testing'/de OR 'help seeking behavior'/de OR 'counseling'/exp OR 'mass medium'/de OR 'social media'/de OR 'social media':ab,ti,kw OR 'mass media':ab,ti,kw OR (mobile NEAR/2 (technology OR app*)):ab,ti,kw)
NOT
([conference abstract]/lim OR [conference paper]/lim OR [conference review]/lim OR [data papers]/lim OR [editorial]/lim OR [erratum]/lim OR

[letter]/lim OR [note]/lim)
Results: 1188

PsycINFO

S1: (((College* OR universit*) N10 (“young people OR “young adult” OR “young adults” OR gatekeep* OR employee* OR enrolled OR student* OR hotspot*)) OR ((post-secondary OR tertiary) N3 (school OR institution* OR education)) OR campus* OR graduate* OR undergraduate* OR (resident N3 (advisor* OR assistant*)) OR (commuter N3 school*) OR ((first generation OR international OR foreign OR nontraditional) N3 student*) OR ((nursing OR medical OR social work) N1 (student* OR interns OR intern OR school)))

- Do in title field and abstract field under advanced search

S2: DE "College Students" OR DE "College Athletes" OR DE "Community College Students" OR DE "Education Students" OR DE "Junior College Students" OR DE "Nursing Students" OR DE "ROTC Students" OR DE "Graduate Students" OR DE "International Students" OR DE "Medical Students" OR DE "Postgraduate Students" OR DE "Transfer Students"
S3: suicid* OR parasuicid* OR DE "Suicide" OR DE "Attempted Suicide" OR DE "Suicidality"
S4:
DE "Suicide Prevention" OR DE "Screening" AND DE "Counseling" OR DE "Group Counseling" OR DE "Peer Counseling" OR DE "School Counseling" OR DE "Mental Health Services" OR DE "Community Mental Health Services" OR DE "Student Personnel Services" AND DE "Family Intervention" OR DE "Group Intervention" OR DE "School Based Intervention" OR DE "Preventive Mental Health Services" or DE "Help Seeking Behavior" OR DE "Telemedicine" OR DE "Online Therapy" OR DE "Teleconsultation" OR DE "Telepsychiatry" OR DE "Telepsychology" OR DE "Mass Media" OR DE "Social Media"
S5: intervention or interventions or prevent* or program* or policy or policies or ((mental OR suicide) N3 (curriculum OR awareness OR screening OR education or training or treatment)) or counseling OR hotline* or phone* or telephone* or “mass media” OR “social media” OR telemedicine OR telehealth OR telepsychiatry OR “mobile application” OR “mobile applications” OR “mobile app” OR “mobile technology”

- Do in title and abstract fields in advanced search

(S1 or S2) AND S3 AND (S4 or S5)
Limit to academic journals
Results: 1,188

Scopus

TITLE-ABS((((College* OR universit*) W/10 ("young people" OR "young adults" OR "young adult" OR gatekeep* OR employee* OR enrolled OR student* OR hotspot*)) OR ((post-secondary OR tertiary) W/3 (school OR institution* OR education)) OR campus* OR graduate* OR undergraduate* OR (resident W/3 (advisor* OR assistant*)) OR (commuter W/3 school*) OR ((first generation OR international OR foreign OR nontraditional) W/3 student*) OR ((nursing OR medical OR "social work") W/1 (student* OR interns OR intern OR school))) AND (suicid* OR parasuicide) AND (intervention OR interventions OR prevent* OR program* OR policy OR policies OR ((mental OR suicide) W/3 (curriculum OR

awareness OR screening OR education OR training OR treatment)) OR counseling OR "help-seeking behavior" OR hotline* OR phone* OR telephone* OR "student health services"))
*limit to articles and reviews only
Results: 1309 results

ERIC

EBSCO
S1: (((College* OR universit*) N10 (“young people OR “young adult” OR “young adults” OR gatekeep* OR employee* OR enrolled OR student* OR hotspot*)) OR ((post-secondary OR tertiary) N3 (school OR institution* OR education)) OR campus* OR graduate* OR undergraduate* OR (resident N3 (advisor* OR assistant*)) OR (commuter N3 school*) OR ((first generation OR international OR foreign OR nontraditional) N3 student*) OR ((nursing OR medical OR social work) N1 (student* OR interns OR intern OR school)))

- Do in title field and abstract field under advanced search

S2: DE "College Students" OR DE "College Freshmen" OR DE "College Seniors" OR DE "College Transfer Students" OR DE "First Generation College Students" OR DE "Graduate Students" OR DE "In State Students" OR DE "On Campus Students" OR DE "Out of State Students" OR DE "Preservice Teachers" OR DE "Two Year College Students" OR DE "Undergraduate Students" OR DE "Law Students" OR DE "Medical Students"
S3: suicid* OR parasuicid* OR DE "Suicide"
S4: DE "Health Education" OR DE "Screening Tests" AND DE "Counseling" OR DE "Family Counseling" OR DE "Group Counseling" OR DE "Individual Counseling" OR DE "Peer Counseling" OR DE "Help Seeking" OR DE "Student Personnel Services" OR DE "Crisis Intervention"
S5: intervention or interventions or prevent* or program* or policy or policies or ((mental OR suicide) N3 (curriculum OR awareness OR screening OR education or training or treatment)) or counseling OR hotline* or phone* or telephone* OR telemedicine OR telehealth OR telepsychiatry OR “mass media” OR “social media” OR “mobile application” OR “mobile applications” OR “mobile app” OR “Mobile technology”
Do in title and abstract fields in advanced search
(S1 or S2) AND S3 AND (S4 or S5)
Excluded books
Results: 448 (should probably exclude books)

Cochrane Library

All searched in title, abstract, keyword fields:
(((university OR college) NEAR/3 (employee* OR student OR students OR enrolled)) OR ((post-secondary OR tertiary) NEAR/3 (school OR institution* OR education)) OR campus* OR graduate* OR undergraduate* OR (resident NEAR/3 (advisor* OR assistant*)) OR (commuter NEAR/3 school*) OR ((first generation OR international OR foreign OR nontraditional) NEAR/3 student*) OR ((nursing OR medical OR social work) NEXT (student* OR interns OR intern OR school)))
AND

(Suicid* OR parasuicid*)
AND
(intervention or interventions or prevent* or program* or policy or policies or ((mental OR suicide) NEAR/3 (curriculum OR awareness OR screening OR education or training or treatment)) or counseling OR hotline* or phone* or telephone* OR “help-seeking” OR “student personnel services” OR “student health services” OR telemedicine OR telehealth OR telepsychiatry OR “mass media” OR “social media” OR “mobile application” OR “mobile applications” OR “mobile app” OR “Mobile technology”)
Results: 146 trials

Google Scholar

college|university student|employee|staff "suicide" intervention|program|prevention|policy|telemedicine|counseling|screening|education|awareness|mobile
Download 10 pages of results, excluding books and citation-only
Downloaded 97 records

ProQuest Dissertations and Theses

ab,ti(((intervention OR interventions OR prevent* OR program* OR policy OR policies OR ((mental OR suicide) NEAR/3 (curriculum OR awareness OR screening OR education OR training OR treatment)) OR counseling OR hotline* OR phone* OR telephone* OR "help-seeking" OR "student personnel services" OR "student health services" OR telemedicine OR telehealth OR telepsychiatry OR “mass media” OR “social media” OR “mobile application” OR “mobile applications” OR “mobile app” OR “mobile technology”))) AND ab,ti(((Suicid* OR parasuicid*))) AND ab,ti(((post-secondary OR tertiary) NEAR/3 (school OR institution* OR education)) OR campus* OR graduate* OR undergraduate* OR (resident NEAR/3 (advisor* OR assistant*)) OR (commuter NEAR/3 school*) OR ((first-generation OR international OR foreign OR nontraditional) NEAR/3 student*) OR ((nursing OR medical OR "social work") NEAR/1 (student* OR interns OR intern OR school)))
No limits
Results: 276

Global Index Medicus

Use advanced search. Title/Abstract/Subject
(((college* OR universit*) AND (employee* OR staff OR student* OR first-generation OR international OR foreign OR nontraditional)) OR "resident advisors" OR "resident assistants" OR "resident advisor" OR "resident assistant" OR "medical students" OR "nursing students" OR "Social work students")
AND
(Suicid* OR parasuicid*)
Results: 248

Search ran and added on 3/24/2021

Scielo

((((((college* OR universit*) AND (employee* OR staff OR student* OR first-generation OR international OR foreign OR nontraditional)) OR "resident advisors" OR "resident assistants" OR "resident advisor" OR "resident assistant" OR "medical students" OR "nursing students" OR "Social work students")) AND (Suicid* OR parasuicid*))) AND ((intervention or interventions or prevent* or program* or policy or policies or ((mental OR suicide) AND (curriculum OR awareness OR screening OR education or training or treatment)) or counseling OR hotline* or phone* or telephone* OR "help-seeking" OR "student personnel services" OR "student health services" OR telemedicine OR telehealth OR telepsychiatry OR "mass media" OR "social media" OR "mobile application" OR "mobile applications" OR "mobile app" OR "Mobile technology"))
Results: 82

African Journals Online

Uses a “Google-powered” search
college|university student|employee|staff "suicide" intervention|program|prevention|policy|telemedicine|counseling|screening|education|awareness|mobile
Download 5 pages of results
42 articles downloaded

Global Health (CABI)

(((university OR college) NEAR/3 (employee* OR student OR students OR enrolled)) OR ((post-secondary OR tertiary) NEAR/3 (school OR institution* OR education)) OR campus* OR graduate* OR undergraduate* OR (resident NEAR/3 (advisor* OR assistant*)) OR (commuter NEAR/3 school*) OR ((first generation OR international OR foreign OR nontraditional) NEAR/3 student*) OR ((nursing OR medical OR social work) NEAR/1 (student* OR interns OR intern OR school)))
AND
(Suicid* OR parasuicid*)
AND
(intervention or interventions or prevent* or program* or policy or policies or ((mental OR suicide) NEAR/3 (curriculum OR awareness OR screening OR education or training or treatment)) or counseling OR hotline* or phone* or telephone* OR “help-seeking” OR “student personnel services” OR “student health services” OR telemedicine OR telehealth OR telepsychiatry OR “mass media” OR “social media” OR “mobile application” OR “mobile applications” OR “mobile app” OR “Mobile technology”)
Results: 384

Multimedia Appendix 2: Checklist of items for reporting equity-focused systematic reviews (PRISMA-E 2012).

Checklist of Items for Reporting Equity-Focused Systematic Reviews				
Section	**Item**	**Standard PRISMA Item**	**Extension for Equity-Focused Reviews**	**Pg #**
Title				
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Identify equity as a focus of the review, if relevant, using the term equity	
Abstract				
Structured summary	2	2. Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	State research question(s) related to health equity.	
	2A		Present results of health equity analyses (e.g. subgroup analyses or meta-regression).	
	2B		Describe extent and limits of applicability to disadvantaged populations of interest.	
Introduction				
Rationale	3	Describe the rationale for the review in the context of what is already known.	Describe assumptions about mechanism(s) by which the intervention is assumed to have an impact on health equity.	
	3A		Provide the logic model/analytical framework, if done, to show the pathways through which the intervention is assumed to affect health equity and how it was developed.	
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Describe how disadvantage was defined if used as criterion in the review (e.g. for selecting studies, conducting analyses or judging applicability).	
	4A		State the research questions being addressed with reference to health equity	
Methods				
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.		
Eligibility criteria	6	6. Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Describe the rationale for including particular study designs related to equity research questions.	
	6A		Describe the rationale for including the outcomes - e.g. how these are relevant to reducing inequity.	
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Describe information sources (e.g. health, non-health, and grey literature sources) that were searched that are of specific relevance to address the equity questions of the review.	
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Describe the broad search strategy and terms used to address equity questions of the review.	
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in		

		systematic review, and, if applicable, included in the meta-analysis).		
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.		
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	List and define data items related to equity,where such data were sought (e.g. using PROGRESS-Plus or other criteria, context).	
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.		
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).		
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Describe methods of synthesizing findings on health inequities (e.g. presenting both relative and absolute differences between groups).	
Risk of bias across studies	15	15. Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).		
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Describe methods of additional synthesis approaches related to equity questions, if done, indicating which were pre-specified	
Results				
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.		
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Present the population characteristics that relate to the equity questions across the relevant PROGRESS-Plus or other factors of interest.	
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).		
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.		
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Present the results of synthesizing findings on inequities (see 14).	
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).		
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Give the results of additional synthesis approaches related to equity objectives, if done, (see 16).	
Discussion				
Summary of	24	Summarize the main findings including the strength of evidence for each main		

evidence		outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).		
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).		
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Present extent and limits of applicability to disadvantaged populations of interest and describe the evidence and logic underlying those judgments.	
	26A		Provide implications for research, practice or policy related to equity where relevant (e.g. types of research needed to address unanswered questions).	
Funding				
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.		

Note. Source: Welch V, Petticrew M, Tugwell P, Moher D, O'Neill J, Waters E, et al. PRISMA-Equity 2012 Extension: Reporting Guidelines for Systematic Reviews with a Focus on Health Equity. PLoS Med. 2012 Jul;9(10):e1001333. PMID: WOS:000324696900009.

Supplementary Files

Multimedia Appendixes

Search strategies and updated number of results on March 24, 2021.
URL: http://asset.jmir.pub/assets/8e12e910e38e06d08523e2ea5ab1db4a.docx

Checklist of items for reporting equity-focused systematic reviews (PRISMA-E 2012).
URL: http://asset.jmir.pub/assets/2daa575fd691a619996e128457dd7b33.docx