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The effect of synchronous remote-based interventions on suicidal behaviours: Protocol for a systematic review and meta-analysis

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ABSTRACT

Introduction Suicide is among the leading causes of preventable death worldwide. The impact of suicide affects personal, social, and economic level. Therefore, its prevention is a priority for public health systems. Previous studies seem to support the efficacy of providing active contact to people who have made a suicide attempt. The current systematic review and meta-analysis aims to investigate the efficacy of distance suicide prevention strategies implemented through synchronous technology-based interventions.

Methods and analysis This protocol is designed according to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P). The bibliographic searches will be conducted in the databases MEDLINE/PubMed, PsycInfo, Scopus, and Web of Science until April 2022, with no restrictions on the time of publication and limited to publications in English or Spanish. The search strategy will be performed using free-text terms and Medical Subject Headings (MeSH) terms: suicide, follow-up, synchronous, remote, telehealth, telephone, hotline, videoconference, and text message. Two reviewers will independently conduct study screening, selection process, data extraction, and risk of bias (RoB) assessment. The analyses and synthesis of the results will be both qualitative and quantitative. If meta-analysis is not appropriate due to substantial heterogeneity, a narrative synthesis will be provided.

Ethics and dissemination The present review and meta-analysis will not require ethical approval as it will use data collected from previously published primary studies. The findings of this review will be published in peer-reviewed journals and widely disseminated.

PROSPERO registration number CRD42021275044.

Keywords Suicide, Telemedicine, Preventive Medicine.

STRENGTHS AND LIMITATIONS OF THE STUDY

- To the best of our knowledge, this study will be the first systematic review and meta-analysis about efficacy and effectiveness of remote suicide prevention strategies implemented through technology-based synchronous interventions.
- Randomized controlled studies and observational studies will be included to obtain sufficient data and adequate statistical power for meta-analysis.
- Study screening, quality assessment and data extraction will be reported according to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P), to maximise transparency, accuracy, and significance.
- There is a potential limitation attributed to the expected small sample size of included studies and the heterogeneity of the study designs.

INTRODUCTION

Suicide is a universal, complex, and multifaceted public health problem which is among the leading causes of preventable death worldwide. More than 700,000 people die by suicide each year [1], becoming the seventeenth leading cause of death in 2019 [2]. Annual numbers of completed suicide account for 1.4% of all deaths worldwide [3]. For each completed suicide, there are twenty suicide attempts [4], constituting one of the leading causes of disease burden in the world [5, 6]. Moreover, suicide is one of the leading causes of death among young people [3], representing the fourth leading cause of death among people aged 15-29 years [1]. The number of adolescent deaths due to suicide has increased dramatically, with data reflecting that suicide represents a rate of 0.19/100,000 in people under 15 years of age and a rate of 2.23/100,000 in the 15-19 age group [7].

Suicide prevention is an emerging priority for the public health system due to its high social burden [8]. Evidence suggests that an increased risk of recidivism is directly related to a previous history of suicidal behaviour [9, 10]. It is estimated that 20% of people who had

engaged in suicidal behaviour showed a subsequent episode, and that 88% of these reattempts occurred within two years of the initial episode [11]. Furthermore, lack of follow-up care provided by healthcare professionals has been identified as a risk factor for repeat suicide attempts in patients discharged from the emergency department (ED) [12].

Over the last decades, the relevance of developing evidence-based prevention strategies focused on reducing the likelihood of suicide attempts in high-risk patients has become evident [13–16]. Suicide prevention programmes include a wide range of follow-up actions that promote connectivity between the patient and the mental health provider (sending letters, conducting telephone calls, texting via SMS, providing follow-up visits in specialised healthcare centres, or implementing 24/7 hotlines) [17, 18]. The development of Information and Communication Technologies (ICTs) has created opportunities and challenges in prevention, research, and clinical practice. eHealth interventions represent tools that allow reaching a larger number of at-risk populations, facilitating proactive follow-up compared to face-to-face treatments [19].

Considering that remotely delivered distance-based programmes can reach affected people regardless of their location, it is reasonable to expect that these interventions could be part of future suicide prevention efforts [17, 18]. Remotely brief contact-based interventions can be a cost-effective strategy for suicide prevention in healthcare settings [20–22]. In a recent meta-analysis, Inagaki et al. [12] found that secondary prevention programmes involving active contact and follow-up can be effective in reducing the risk of a repeat suicide attempt within six months of admission to an ED for suicidal behaviour. Moreover, promising results seem to be reported in studies that conduct telephone follow-up interventions for individuals at risk as a suicide prevention strategy [23–30]. Telephone management in a clinical-practice setting could be a useful and not expensive programme to implement in mental health centres [23, 31].

In 2015, Milner et al. [32] conducted a systematic review and meta-analyses of 14 randomized controlled trials (RCTs) using brief contact interventions and found that

considerable differences in outcomes are likely to exist depending on the intervention condition and time period over which the study was conducted (i.e., studies that reported on the effectiveness of the intervention condition in reducing suicide attempts were conducted a some decades ago and were rated as having a high risk of bias (RoB), whereas recent studies find more conservative results). Given the possible benefits, low cost and unlikely adverse effects, large-scale trials in clinical populations would be worthwhile; however, the authors do not recommend widespread clinical implementation of brief contact interventions. Also in 2015, Noh et al. [33] examined five RCTs comparing telephone-delivered interventions for preventing suicide reattempts with no telephone intervention. The results suggest that, in the case of providing telephone-delivered intervention only, more aggressive, structured, and theory-based telephone interventions led by mental health professionals should be designed and examined in the form of large-scale RCTs.

Although there is no clear consensus on the effect of these programmes in previous systematic reviews and meta-analyses [32, 33], there are data that appear to support the efficacy of providing active contact to individuals who have made a suicide attempt [12, 17, 34].

Overall, there are studies with positive results in the reduction of suicide-related outcomes [23, 26, 29, 30] and others that have found conflicting or inconclusive evidence [25, 35, 36], suggesting the suitability of conducting a systematic review with meta-analysis of the current scientific literature. Despite evidence describing a broad range of telecommunications-based suicide prevention approaches [21, 37], we are not aware of available publications that provide a synthesis of the literature on interventions that develop the use of synchronous strategies in suicide prevention. Based on the concept of connectivity [34], combined with a component of immediacy in the communication system; synchronous communication can increase accessibility, adherence, and treatment efficacy.

This study aims to collect and synthesize information on the efficacy and effectiveness of remote suicide prevention strategies implemented through technology-based synchronous

interventions (i.e., via digital tools that allow interactive and immediate real-time communication conducted remotely).

METHODS AND ANALYSIS

The primary source used to describe the methods of this protocol was the Cochrane Handbook for Systematic Reviews of Interventions (version 6.2) [39], specifically Part 2: Core methods "Chapter 2: Determining the scope of the review and the questions it will address" to "Chapter 10: Analysing data and undertaking meta-analyses". The protocol was constructed according to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) [40, 41] (see Supplementary File 1). A version of the protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO), under identification number CRD42021275044.

Systematic review question

The research question was built according to PICOS criteria (Population, Intervention, Comparison, Outcomes, and deSign) [38]. In adolescents and adults (≥ 12 years of age) with suicidal ideation or prior suicide attempts (P), what is the efficacy and effectiveness of synchronous remote-based interventions (I) in the prevention of non-fatal suicide attempts and completed suicide (O) compared to actives or inactives control groups (C), with any follow-up length?

Criteria for included and excluded studies

Types of studies

The review will consider published empirical research with the following study designs: randomized clinical trial, quasi-experimental trials, and observational case-controlled studies.

Primary data from cohort study designs or qualitative studies and secondary sources (e.g., systematic reviews, meta-analyses) will be excluded.

Types of participants

The population of interest will include adolescents and adults, defined as anyone over the age of 12 years, that reported suicidal ideation or prior suicide attempts. No restriction will be placed on gender, geographical provenance, or diagnosis. Participants with non-suicidal self-injury will be excluded.

Types of interventions

Synchronous remote-based interventions will be defined as programmes delivered through a technology device that is featured by (a) ensuring interactive and immediate communication, and (b) not requiring the patient to be at the same physical location as the mental health provider. Interventions should aim to reduce suicide risk by communicating with patients through telephone follow-up or active contact (i.e., contact to healthcare services made spontaneously by participants at elevated risk for suicidal behaviour, such as phone call or hotline, instant text messaging, or videoconference. The synchronous remote communication should include some, but not necessarily all, of the following elements: improving compliance with medication and follow-up appointments, addressing any problems, stressors, or risk factors, and reducing re-attempts. No restriction will be placed on the intensity or duration of the intervention.

We will include interventions delivered via remote-communication synchronous technologies only or multicomponent interventions, employing minimal face-to-face contact (one session) or multimedia-delivered materials. Studies using asynchronous telecommunication devices such online forums and communities, social networking sites/apps, video sharing sites, automated one-way text or voice messages, and self-directed web-based

programmes will be excluded. Studies that describe treatments focused on the prevention of non-suicidal self-harm will be excluded. In addition, the interventions for issues such as psychosis, eating disorders, and depression, which are not intending to specifically address suicidal behaviour, are out of the scope of this review.

All comparisons identified in the eligible studies will be included, such as treatment as usual (TAU), enhanced treatment as usual, no treatment, placebo, waiting list, and historical control. Therefore, the review will include active (i.e., participants engaged in some tasks unrelated to suicide prevention during the study period) or inactive control groups. The control group or time frame may involve a combination of strategies: visits to mental health services, non-psychological therapies (e.g., pharmacotherapy), and other expected interventions. Studies that do not include a control group will be excluded (e.g., cross-sectional trials).

Types of outcomes measures

The main outcomes will be the repetition of suicide attempt, suicide ideation and complete suicide. Suicide is defined as a self-inflicted and potentially injurious behaviour that is performed as a deliberate method to die [42]. Suicide attempts are defined as self-inflicted harm with a non-fatal outcome for which there is evidence, explicit or implicit, of the intention to die [3]. Furthermore, suicidal ideation is described by thoughts, ideas, or ruminations about the possibility of ending one's life [43].

The assessment can be conducted at any time (baseline, during, and after the intervention) with no limit on the length of follow-up, employing quantitative measurement of suicidal-related outcomes. The suicidal ideation outcome may be measured using different validated instruments, such as the Columbia Suicide Severity Rating Scale (C-SSRS) [44]. The non-fatal suicide attempts outcome will be measured by the number of suicides attempts a person has made within a certain timeframe. The suicide death outcome will be measured by the count of the number of people who have died by suicide.

Data collection and analysis

Information sources and search strategy

Literature searches will be conducted in the following electronic databases: PubMed (by NCBI-NLM-NIH website), PsycInfo (by ProQuest), Scopus (by ww.scopus.com), and Web of Science Core Collection (by www.clarivate.com). Grey literature and unpublished records will be searched on the following websites: ClinicalTrials.gov and Google Scholar.

Authors of published articles will be contacted to retrieve relevant information about their study that was either not reported or unclear. The references cited in the included articles will be considered for data collection. We will also examine the reference lists of existing systematic reviews on similar topics to identify other relevant articles. In addition, the personnel files of the workgroup members will be checked and experts in the field of suicide will be consulted regarding relevant publications.

The search strategy will be performed using relevant subject headings and search syntax appropriate to each database, including variations and combinations of free-text terms and Thersaurus of psychological index terms (American Psychological Association, APA) or Medical Subject Headings (MeSH) terms, combining with appropriate boolean operators. The general structure of search syntax was: (suicid* OR self-injur* OR self-harm OR "self-destructive behavio*" OR self-poisoning) AND (intervention OR therap* OR treatment OR psychotherap* OR prevention OR follow-up OR contact OR post-discharge) AND (synchron* OR remote OR non-presential OR non-face-to-face OR distance OR digital OR online OR telehealth OR telemedicine OR eHealth OR mHealth OR telephone OR phone OR call OR hotline OR helpline OR "suicide line" OR chat OR videoconferen* OR App OR text messag* OR SMS) AND ("randomized controlled trial" OR "controlled clinical trials" OR "clinical studies") NOT (review OR protocol). The drafted electronic search strategy for PubMed database is included in the Supplementary File 2.

The search is scheduled to be completed by Abril 2023. All searches will be re-run, before publication of the article, if more than 12 months have elapsed since the date of the initial search. The search will be limited to English or Spanish language, performed with no restrictions on the time of publication.

The search strategy was developed by the research team with the collaboration of an experienced health science librarian (GC) adhering to the Peer Review of Electronic Search Strategies (PRESS) [45]. Sensitivity and specificity criteria were considered; however, sensitivity was prioritised.

Data management

Results from the literature search will be imported into Rayyan Systems Inc. [46], an Internet-based software programme that facilitates collaboration and pursuit accelerated screening process. During the review process, this tool will be used to identify duplicate records and to extract and manage the data. Mendeley (version 1.19.8) will be employed as a reference management software.

Selection process

In the first phase, duplicate articles in the databases will be automatically removed by Rayyan Systems Inc. and manually by the first reviewer (LC). In the second phase, two authors (LC and MPJ) will blind-screen all articles based on titles, abstracts, and keywords. In the third phase, the two reviewers (LC and MPJ) will independently evaluate the full-texts articles according to eligibility criteria. The reasons for excluding articles will be recorded. If necessary, a third reviewer (AS) will be requested for discrepancies that may not be resolved by consensus of the two reviewers (LC and MPJ). Inter-rater agreement will be calculated by Cohen's Kappa in the second and third phases, prior to reaching consensus on the discrepancies between the two

reviewers or contrasting them with a third reviewer. The article selection process will be described in a PRISMA flow diagram [47].

Data collection process

Data extraction will be conducted independently by two authors (LC and MPJ), using a standard extraction form in line with the template from The Cochrane Collaboration [48]. Data will be managed using Microsoft Excel (16.56 version). Inter-rater agreement will be calculated by Cohen's Kappa. Disagreements will be resolved by consensus, and unresolved disagreements will be adjudicated by a third reviewer (AS). For missing information or data that needs to be clarified, first or corresponding authors of primary studies will be contacted by email; one follow-up email will be sent if no response is received to the first email. To ensure consistency across reviewers, training exercises will be conducted before starting the data extraction process.

Data items

Data will be extracted from the following categories: a) general characteristics of the study (authors, date of publication, setting and geographic location, research design, sample size, participant sociodemographic and baseline characteristics), b) intervention and control group details (type of intervention or control group, sample sizes, follow-up time, dropout rates), c) outcomes (descriptive and comparative statistical indexes of efficacy and effectiveness, assessment measures and procedures), and d) limitations reported by study authors.

Risk of bias assessment

The RoB assessment will be conducted independently by two reviewers (LC and MPJ), employing the Revised Cochrane risk-of-bias tool for randomised trials (RoB 2.0) [49], and Risk-of-bias In Non-randomized Studies – of Interventions (ROBINS-I) [50].

Inter-rater agreement will be calculated by Cohen's Kappa. Disagreements will be resolved by consensus with a third blind reviewer (AS). Ratings of bias for each study will be classified as low, high, or unclear RoB, according to standardised methodology. Intra-methodological quality evaluation will be synthesised in tables that will comprise the summary of each study individually, identifying their RoB. Studies will not be excluded based on their level of RoB.

Data synthesis

A descriptive summary and explanation of the characteristics and findings of all included studies will be displayed in a comprehensive table. A narrative synthesis will be conducted, and a random-effects meta-analysis will be computed when a suicidal-related outcome is reported in at least three studies.

Mean differences between control group and intervention group will be transformed to Hedges' *g* standardized effect sizes [51]. Effect sizes will be considered small ($g \geq 0.2$), medium ($g \geq 0.5$), or large ($g \geq 0.8$) [52]. The *Q* and Tau^2 statistics will be calculated to assess for statistical heterogeneity of effect sizes. Specific functions will be used to examine: (a) the profile likelihood plots of the variance components; (b) the potential outlying and influential studies and/or outcomes; and (c) the potential publication bias. All analyses will be performed using the Metafor package (version 4.0-0) for R.

Sensitivity analysis

The potential effect on the results due to the research design and the RoB of the studies will be analysed.

Analysis of subgroups or subsets

Subgroup and subsets analyses will be carried out if feasible and warranted, to examine potential effects modifiers based on sociodemographic characteristics of participants, length, and type of treatment. Meta-regression will be performed to analyse quantitative potential effect modifiers or covariates that might influence the size of intervention effect (e.g., age). We plan to summarise and categorise the below subgroups or subsets analyses if there is enough data:

a) Age: adolescents (12 to 17 years of age), adults (18 to 65 years of age), and older adults (over 65 years of age).

b) Type of intervention: type of synchronous remote-based interventions (telephone calls, instant text messaging, 24/7 hotlines, videoconferencing).

c) Number of follow-up contacts: hotline (24-hour consultation with a non-standardized number of follow-up contacts), 1 to 3 contacts, 3 to 6 contacts, and more than 6 contacts.

d) Length of contact period: hotlines (24-hour consultation with a non-standardized period of follow-up contacts), up to 1-month follow-up, 1 to 3-month follow-up, 3 to 6-month follow-up, and longer than 6-month follow-up.

Publication bias

Publication bias will be evaluated using Egger's test [53] and funnel plots [54] if ≥ 10 studies are available.

Confidence in cumulative evidence

The overall quality of evidence will be evaluated according to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) [55, 56] by two independent researchers (LC and MPJ). Discrepancies will be resolved in a discussion with a third researcher (AS).

DISCUSSION

The wide variety of remotely delivered distance-based programmes for suicide prevention [20, 23, 26–28] and the current lack of guidance on their implementation warrants further research to improve and standardise patient care.

To the best of the researchers' knowledge, no systematic review and meta-analysis has been reported that examined the efficacy of synchronous and remote telepsychiatry interventions, assessing suicide-specific outcomes. We aim to address a gap in research by examining the efficacy of synchronous remote-based interventions that are specifically designed for suicide prevention. The proposed approach is pertinent given the recent increase in the development and usage of technology communication devices for this purpose [19].

It has been anticipated that the systematic review has predicted limitations that should be considered. The inconsistency of terms used in suicidology is a limiting factor regarding the search for articles and the subsequent eligibility of studies. In addition, suicide is a rare event, making the design of studies with high statistical power particularly challenging. Furthermore, people who attempt suicide are typified by poor treatment-seeking and limited adherence to treatment [57], making it important to provide individuals at risk of suicide with appropriate and cost-effectiveness treatment options.

A limited number of available studies is expected; this explains why the search strategy has prioritised sensitivity over specificity. Moreover, RCTs may not provide sufficient evidence to exclude data from non-randomised studies. The inclusion of studies examining a wide range of remote-communication synchronous technologies rather than a specific intervention is intended to address this issue. Similarly, including no restriction on the mental health condition should allow for the collection of comprehensive and relevant data. Research studies that meet eligibility criteria may have a substantial degree of heterogeneity. In response, we initially planned subgroups and subsets analyses. However, the categorisation of interventions into

different typologies may be difficult since multiple research studies combine several interventions simultaneously.

Aside from several limitations, there are potential strengths. The objective is contributed to the body of evidence on suicide. The expected results will provide guidance for further research, contributing to globally suicide prevention efforts.

The current registration of the protocol for this review at PROSPERO may undergo changes, approved by all authors. Any changes to the protocol will be described and explained in the final manuscript.

ETHICS AND DISSEMINATION

Ethics approval is not needed as systematic review is based on published studies. The results will be disseminated through peer-reviewed publications.

Ethics statements

Patient consent for publication

Not applicable.

Contributors AS is the guarantor. LC, JML, DP, AC, and AS: Writing - Original Draft. LC, AS, MPJ, JPS, and CM: Software. LC, JML, DP and AS: Project administration, Supervision. All authors: Conceptualization, Methodology, Writing - Review & Editing. JML, AS, JPS, and CM provided statistical expertise. DP and AC provided expertise on suicidal behaviours. All authors approved the final manuscript.

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Competing interests D.P. has received grants and also served as consultant or advisor for Rovi, Angelini, Janssen, Lundbeck and Servier. The other authors declare no conflict of interest.

Patient and public involvement Patients and/or the public were not involved in the design, conduct, reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

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Supplemental material Supplementary File 1. PRISMA-P 2015 Checklist (DOCX 35 KB). Supplementary File 2. PubMed search strategy (DOCX 14 KB)

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PRISMA-P 2015 Checklist

This checklist has been adapted for use with protocol submissions to *Systematic Reviews* from Table 3 in Moher D et al: Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews* 2015 **4**:1

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
ADMINISTRATIVE INFORMATION					
Title					
Identification	1a	Identify the report as a protocol of a systematic review	☒	☐	1-2
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	☐	☒	N/A
Registration	2	If registered, provide the name of the registry (e.g., PROSPERO) and registration number in the Abstract	☒	☐	23
Authors					
Contact	3a	Provide name, institutional affiliation, and e-mail address of all protocol authors; provide physical mailing address of corresponding author	☒	☐	Title page
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	☒	☐	351-355
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	☐	☒	N/A
Support					
Sources	5a	Indicate sources of financial or other support for the review	☒	☐	369-378
Sponsor	5b	Provide name for the review funder and/or sponsor	☒	☐	369-378
Role of sponsor/funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	☒	☐	374-376
INTRODUCTION					
Rationale	6	Describe the rationale for the review in the context of what is already known	☒	☐	39-106
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	☒	☐	118-124
METHODS					
Eligibility criteria	8	Specify the study characteristics (e.g., PICO, study design, setting, time frame) and report characteristics (e.g., years considered, language, publication status) to be used as criteria for	☒	☐	126-181

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
		eligibility for the review			207-210
Information sources	9	Describe all intended information sources (e.g., electronic databases, contact with study authors, trial registers, or other grey literature sources) with planned dates of coverage	☒	☐	183-194 207
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	☒	☐	Supplementary File 2
STUDY RECORDS					
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	☒	☐	216-221
Selection process	11b	State the process that will be used for selecting studies (e.g., two independent reviewers) through each phase of the review (i.e., screening, eligibility, and inclusion in meta-analysis)	☒	☐	223-233
Data collection process	11c	Describe planned method of extracting data from reports (e.g., piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	☒	☐	235-244
Data items	12	List and define all variables for which data will be sought (e.g., PICO items, funding sources), any pre-planned data assumptions and simplifications	☒	☐	246-252
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	☒	☐	168-181
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	☒	☐	254-268
DATA					
Synthesis	15a	Describe criteria under which study data will be quantitatively synthesized	☒	☐	268-269
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data, and methods of combining data from studies, including any planned exploration of consistency (e.g., I^2, Kendall's tau)	☒	☐	270-276
	15c	Describe any proposed additional analyses (e.g., sensitivity or subgroup analyses, meta-regression)	☒	☐	278-298
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	☒	☐	266-269
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (e.g., publication bias across studies, selective reporting within studies)	☒	☐	300-302
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (e.g., GRADE)	☒	☐	304-307

Supplementary File 2. PubMed search strategy

Search strategy

("suicide"[MeSH Terms] OR suicid*[Title] OR "suicidal ideation"[MeSH Terms] OR "suicide ideation"[Title] OR "suicide, attempted"[MeSH Terms] OR "attempted suicide"[Title] OR "suicidal behavio*"[Title] OR "non-fatal attempt"[Title] OR "unsuccessful attempt"[Title] OR "suicide, completed"[MeSH Terms] OR "completed suicide"[Title] OR "fatal attempt"[Title] OR "self-injurious behavior"[MeSH Terms] OR self-injur*[Title] OR self-harm*[Title] OR "self-destructive behavio*"[Title] OR self-poisoning[Title] OR "repeated suicide"[Title] OR suicide-risk[Title])

AND ("treatment outcome"[MeSH Terms] OR treatment[Title/Abstract] OR therap*[Title/Abstract] OR intervention*[Title/Abstract] OR "crisis intervention"[MeSH Terms] OR prevention[Title/Abstract] OR "follow-up studies"[MeSH Terms] OR follow-up[Title/Abstract] OR contact*[Title/Abstract] OR management[Title/Abstract] OR program*[Title/Abstract] OR "psychotherapy, brief"[MeSH Terms] OR "brief psychotherap*"[Title/Abstract] OR "brief contact intervention*"[Title/Abstract] OR "post-discharge intervention*"[Title/Abstract] OR effectiv*[Title/Abstract] OR efficacy[Title/Abstract])

AND (synchron*[Title/Abstract] OR "online systems"[MeSH Terms] OR real-time[Title/Abstract] OR "immediate communication*"[Title/Abstract] OR "remote consultation"[MeSH Terms] OR remote*[Title/Abstract] OR non-presential[Title/Abstract] OR non-face-to-face[Title/Abstract] OR non-attend*[Title/Abstract] OR "distance counseling"[MeSH Terms] OR distance[Title/Abstract] OR digital[Title/Abstract] OR "telemedicine"[MeSH Terms] OR telemedicine[Title/Abstract] OR "telecommunications"[MeSH Terms] OR "telecommunication*"[Title/Abstract] OR telehealth[Title/Abstract] OR teleassistance[Title/Abstract] OR telepsychology[Title/Abstract] OR telepsychiatry[Title/Abstract] OR telecare[Title/Abstract] OR telemonitoring[Title/Abstract] OR teleconsult*[Title/Abstract] OR telecounsel*[Title/Abstract] OR "telemental health"[Title/Abstract] OR online[Title/Abstract] OR on-line[Title/Abstract] OR "information and communication technolog*"[Title/Abstract] OR ICT[Title/Abstract] OR e-therap*[Title/Abstract] OR "electronic therap*"[Title/Abstract] OR e-health[Title/Abstract] OR "electronic health"[Title/Abstract] OR m-health[Title/Abstract] OR "mobile health"[Title/Abstract] OR "telephone"[MeSH Terms] OR telephon*[Title/Abstract] OR "cell phone"[MeSH Terms] OR phone*[Title/Abstract] OR "phone call*"[Title/Abstract] OR call*[Title/Abstract] OR "telephone contact*"[Title/Abstract] OR "hotlines"[MeSH Terms] OR hotline*[Title/Abstract] OR "hot line service*"[Title/Abstract] OR "call centers"[MeSH Terms] OR helpline*[Title/Abstract] OR lifeline*[Title/Abstract] OR "suicide prevention lifeline"[Title/Abstract] OR "crisis line*"[Title/Abstract] OR video*[Title/Abstract] OR "videoconferencing"[MeSH Terms] OR video-call*[Title/Abstract] OR "clinical videoconferencing"[Title/Abstract] OR CVT[Title/Abstract] OR chat*[Title/Abstract] OR chatbot[Title/Abstract] OR "text messaging"[MeSH Terms] OR "text messaging"[Title/Abstract] OR "instant messag*"[Title/Abstract] OR SMS[Title/Abstract] OR "mobile applications"[MeSH Terms] OR "mobile application*"[Title/Abstract] OR App[Title/Abstract] OR "phone application*"[Title/Abstract])

AND (“randomized controlled trials as Topic”[Mesh] OR “randomized controlled trial”[Title/Abstract] OR “controlled clinical trials as Topic”[Mesh] OR “controlled clinical trial”[Title/Abstract] OR trial*[Title/Abstract] OR "clinical studies as Topic"[MeSH Terms] OR

"clinical stud*"[Title/Abstract] OR "random allocation"[MeSH Terms] OR random*[Title/Abstract] OR "intervention group*"[Title/Abstract] OR "control group*"[Title/Abstract])

NOT (systematic review*[Title] OR review*[Title] OR meta*[Title] OR protocol[Title])

Filters

The following filters were applied: text availability (Full text), article type (Clinical Study, Clinical Trial, Controlled Clinical Trial, Randomized Controlled Trial, Journal Article), language (English, Spanish), age (Adolescent: 13-18 years, Adult: 19+ years).

BMJ Open

The effect of synchronous remote-based interventions on suicidal behaviours: Protocol for a systematic review and meta-analysis

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Primary Subject Heading:	Mental health
Secondary Subject Heading:	Public health
Keywords:	Suicide & self-harm < PSYCHIATRY, Telemedicine < BIOTECHNOLOGY & BIOINFORMATICS, PREVENTIVE MEDICINE

The effect of synchronous remote-based interventions on suicidal behaviours: Protocol for a systematic review and meta-analysis

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The effect of synchronous remote-based interventions on suicidal behaviours: Protocol for a systematic review and meta-analysis

ABSTRACT

Introduction Suicide is among the leading causes of preventable death worldwide. The impact of suicide affects the personal, social, and economic levels. Therefore, its prevention is a priority for public health systems. Previous studies seem to support the efficacy of providing active contact to people who have made a suicide attempt. The current systematic review and meta-analysis aim to investigate the efficacy of distance suicide prevention strategies implemented through synchronous technology-based interventions.

Methods and analysis This protocol is designed according to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P). The bibliographic searches were conducted in the databases PubMed, PsycInfo, Scopus, and Web of Science in April 2022, with no restrictions on the time of publication and limited to publications in English or Spanish. The search strategy was performed using free-text terms and Medical Subject Headings (MeSH) terms: suicide, follow-up, synchronous, remote, telehealth, telephone, hotline, videoconference, and text message. Two reviewers will independently conduct study screening, selection process, data extraction, and risk of bias (RoB) assessment. The analysis and synthesis of the results will be both qualitative and quantitative. A narrative synthesis, presented in a comprehensive table, will be performed and meta-analysis will be conducted, as appropriate, if sufficient data is provided.

Ethics and dissemination The present review and meta-analysis will not require ethical approval, as it will use data collected from previously published primary studies. The findings of this review will be published in peer-reviewed journals and widely disseminated.

PROSPERO registration number CRD42021275044.

Keywords Suicide, Telemedicine, Preventive Medicine.

STRENGTHS AND LIMITATIONS OF THE STUDY

- Study screening, quality assessment, and data extraction will be reported according to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) to maximise transparency, accuracy, and significance.
- The systematic review will focus on peer-reviewed articles, and findings will be limited to articles written in English or Spanish.
- Randomised clinical trials, quasi-experimental trials, and observational case-controlled studies will be included to obtain sufficient data and adequate statistical power for meta-analysis.
- There is a potential limitation attributed to the expected small sample size of the included studies and the heterogeneity of the study designs.

INTRODUCTION

Suicide is a universal, complex, and multifaceted public health problem that ranks annually among the leading causes of preventable death worldwide. More than 700,000 people die by suicide per year [1], becoming the seventeenth leading cause of death in 2019 in global epidemiology [2]. Annual suicide rates account for 1.4% of all deaths worldwide [3]. Suicide rates in European regions (10.5 per 100,000) were higher than the global average (9.0 per 100,000) in 2019, while the lowest suicide rate was in the Eastern Mediterranean region (6.4 per 100,000) [2, 3]. For each suicide death, there are twenty suicide attempts [4], constituting one of the leading causes of disease burden in the world [5, 6]. While most of the world's suicides occur in low- and-middle-income countries, high-income countries have the highest age-standardised suicide rate (10.9 per 100,000) [2, 3]. Moreover, suicide represents the fourth leading cause of death among people aged 15-29 years in global epidemiology [1, 3]. The number of adolescent deaths due to suicide has increased dramatically, with data reflecting that suicide represents a

rate per year of 0.19/100,000 in people under 15 years of age and a rate per year of 2.23/100,000 in the 15-19 age group, according to the Spanish National Institute of Statistics [7].

Suicide prevention is an emerging priority for the public health system due to its high social burden [8]. Evidence suggests that a prior suicide attempt is one of the most important risk factors for suicide, which supports the efforts to protect patients who attempt suicide during the acute period following an episode of self-harm [9, 10]. It is estimated that 20% of people who had engaged in suicidal behaviour showed a subsequent episode, and that 88% of these reattempts occurred within two years of the initial episode [11]. Furthermore, a lack of follow-up care provided by healthcare professionals has been identified as a risk factor for repeat suicide attempts in patients discharged from the emergency department (ED) [12].

Over the last decades, the relevance of developing evidence-based prevention strategies focused on reducing the likelihood of suicide attempts in high-risk patients has become evident [13–16]. Suicide prevention programmes include a wide range of follow-up actions that promote connectivity between the patient and the mental health provider (sending letters, conducting telephone calls, texting via SMS, providing follow-up visits in specialised healthcare centres, or implementing 24/7 hotlines) [17, 18]. The development of Information and Communication Technologies (ICTs) has created opportunities and challenges in prevention, research, and clinical practise. eHealth interventions represent tools that allow reaching a larger number of at-risk populations, facilitating proactive follow-up compared to face-to-face treatments [19].

Considering that remotely delivered distance-based programmes can reach affected people regardless of their location, it is reasonable to expect that these interventions could be part of future suicide prevention efforts [17, 18]. Remotely brief contact-based interventions can be a cost-effective strategy for suicide prevention in healthcare settings [20–22]. In a recent meta-analysis, Inagaki *et al.* [12] found that secondary prevention programmes involving active contact and follow-up can be effective in reducing the risk of a repeat suicide attempt within six

months of admission to an ED for suicidal behaviour. Moreover, promising results seem to be reported in studies that conduct telephone follow-up interventions for individuals at risk as a suicide prevention strategy [23–30]. Telephone management in a clinical-practise setting could be a useful and not expensive programme to implement in mental health centres [23, 31].

In 2015, Milner *et al*. [32] conducted a systematic review and meta-analyses of 14 randomised controlled trials (RCTs) using brief contact interventions and found that considerable differences in outcomes are likely to exist depending on the intervention condition and time period over which the study was conducted (i.e., studies that reported on the effectiveness of the intervention condition in reducing suicide attempts were conducted some decades ago and were rated as having a high risk of bias (RoB), whereas recent studies find more conservative results). Given the possible benefits, low cost and unlikely adverse effects, large-scale trials in clinical populations would be worthwhile; however, the authors do not recommend widespread clinical implementation of brief contact interventions. In 2016, Noh *et al*. [33] examined five RCTs comparing telephone-delivered interventions for preventing suicide reattempts with no telephone intervention. The results suggest that, in the case of providing telephone-delivered intervention only, more aggressive, structured, and theory-based telephone interventions led by mental health professionals should be designed and examined in the form of large-scale RCTs. It should be noted that there is an overlap in the studies included in the Milner *et al*. [32] and Noh *et al*. [33] meta-analyses.

Although there is no clear consensus on the effect of these programmes in previous systematic reviews and meta-analyses [32, 33], there are data that appear to support the efficacy of providing active contact to individuals who have made a suicide attempt [12, 17, 34]. Overall, there are studies with positive results in the reduction of suicide-related outcomes [23, 26, 29, 30] and others that have found conflicting or inconclusive evidence [25, 35, 36], suggesting the suitability of conducting a systematic review with meta-analysis of the current scientific literature. Despite evidence describing a broad range of telecommunications-based

suicide prevention approaches [21, 37], we are not aware of any publications that provide a synthesis of the literature on interventions that develop the use of synchronous strategies in suicide prevention. Based on the concept of connectivity [34], combined with a component of immediacy in the communication system; synchronous communication can increase accessibility, adherence, and treatment efficacy.

This study aims to collect and synthesise information on the efficacy and effectiveness of remote suicide prevention strategies implemented through technology-based synchronous interventions (i.e., via digital tools that allow interactive and immediate real-time communication conducted remotely).

METHODS AND ANALYSIS

The primary source used to describe the methods of this protocol was the Cochrane Handbook for Systematic Reviews of Interventions (version 6.2) [38], specifically Part 2: Core methods "Chapter 2: Determining the scope of the review and the questions it will address" to "Chapter 10: Analysing data and undertaking meta-analyses". The protocol was constructed according to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) [39, 40] (see Supplementary File 1). A version of the protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO), under identification number CRD42021275044.

Systematic review question

The research question was built according to PICOS criteria (Population, Intervention, Comparison, Outcomes, and deSign) [41]. In adolescents and adults (≥ 12 years of age) with suicidal ideation or prior suicide attempts (P), what is the efficacy and effectiveness of synchronous remote-based interventions (I) in the prevention of non-fatal suicide attempts and suicide deaths (O) compared to active or inactive control groups (C) with any follow-up length?

Criteria for included and excluded studies

Types of studies

The review will consider published empirical research with the following study designs: randomised clinical trials, quasi-experimental trials, and observational case-controlled studies. Primary data from cohort study designs or qualitative studies and secondary sources (e.g., systematic reviews, meta-analyses) will be excluded.

Types of participants

The population of interest will include adolescents and adults, defined as anyone over the age of 12 years, who have reported suicidal ideation or prior suicide attempts. No restriction will be placed on gender, geographical provenance, or diagnosis. Participants with non-suicidal self-injury will be excluded.

Types of interventions

Synchronous remote-based interventions will be defined as programmes delivered through a technology device that is characterised by (a) ensuring interactive and immediate communication, and (b) not requiring the patient to be at the same physical location as the mental health provider. Interventions should aim to reduce suicide risk by communicating with patients through telephone follow-up or active contact (i.e., contact with healthcare services made spontaneously by participants at elevated risk for suicidal behaviour, such as a phone call or hotline), instant text messaging, or videoconference. The synchronous remote communication should include some, but not necessarily all, of the following elements: improving compliance with medication and follow-up appointments, addressing any problems, stressors, or risk factors, and reducing re-attempts. No restriction will be placed on the intensity or duration of the intervention.

We will include interventions delivered via synchronous remote-communication technologies; however, synchronous remote-based programmes that include minimal face-to-face contact (i.e., in-person contact for a maximum of 1 session) or are complemented with multimedia-delivered materials will be also considered. Studies using asynchronous telecommunication devices such as online forums and communities, social networking sites, video sharing sites, automated one-way text or voice messages, and self-directed web-based programmes will be excluded. Studies that describe treatments focused on the prevention of non-suicidal self-harm will be excluded. In addition, the interventions for issues such as psychosis, eating disorders, and depression, which are not intended to specifically address suicidal behaviour, are out of the scope of this review.

All comparisons identified in the eligible studies will be included, such as treatment as usual (TAU), enhanced treatment as usual, no treatment, placebo, waiting list, and historical control. Therefore, the review will include active (i.e., participants engaged in some tasks unrelated to suicide prevention during the study period) or inactive control groups. The control group may involve a combination of strategies: visits to mental health services, non-psychological therapies (e.g., pharmacotherapy), and other expected interventions. Studies that do not include a control group will be excluded (e.g., cross-sectional trials).

Types of outcomes measures

The main outcomes will be the repetition of suicide attempt, suicide ideation and suicide death. Suicide is defined as a self-inflicted and potentially injurious behaviour that is performed as a deliberate method to die [42]. Suicide attempts are defined as self-inflicted harm with a non-fatal outcome for which there is evidence, explicit or implicit, of the intention to die [3]. Furthermore, suicidal ideation is described by thoughts, ideas, or ruminations about the possibility of ending one's life [43].

The assessment can be conducted post-intervention with no limit on the length of follow-up, employing quantitative measurement of suicidal-related outcomes. The suicidal ideation outcome may be measured using different validated instruments (Table 1). According to a recent systematic review [44], the most common instruments are the Beck Scale for Suicide Ideation (BSI) and the Columbia Suicide Severity Rating Scale (C-SSRS). The non-fatal suicide attempts outcome will be measured by the number of suicide attempts a person has made within a certain timeframe. The suicide death outcome will be measured by the number of people who have died by suicide.

Table 1. Instruments most cited in the literature for assessing suicide risk.

Instrument	Reference
Beck Scale for Suicide Ideation (BSI)	Beck *et al.* [45]
The Columbia – Suicide Severity Rating Scale (C-SSRS)	Posner *et al.* [46]
Beck Suicidal Intent Scale (SIS)	Beck *et al.* [47]
Paykel Suicide Scale (PSS)	Fonseca-Pedrero *et al.* [48]
Beck Suicide Scale – worst ever version (BSSw)	Beck & Steer [49]
Suicidal Ideation Questionnaire (SIQ; SIQ-Junior)	Reynolds [50]
Mini-International Neuropsychiatric Interview (MINI)	Sheehan *et al.* [51]
Risk of Suicide Questionnaire (RSQ; RSQ-Revised)	Horowitz *et al.* [52]
Suicide Score Scale (SSS)	Innamorati *et al.* [53]
Suicide Opinion Questionnaire (SOQ)	Domino *et al.* [54]
WMH Composite International Diagnostic Interview (WMH-CIDI)	Kessler & Ustün [55]
InterSePT Suicide Scale (ISST)	Lindenmayer *et al.* [56]
Plutchik Suicide Risk Scale	Koslowsky *et al.* [57]
Harkavy-Asnis Suicide Scale (HASS)	Friedman & Asnis [58]
Suicide Probability Scale (SPS)	Cull & Gill [59]

Data collection and analysis

Information sources and search strategy

Literature searches were conducted in the following electronic databases: PubMed (by NCBI-NLM-NIH website), PsycInfo (by ProQuest), Scopus (by ww.scopus.com), and Web of Science Core Collection (by www.clarivate.com). Grey literature and unpublished records were searched on the following websites: ClinicalTrials.gov and Google Scholar.

Authors of published articles will be contacted to retrieve relevant information about their study that was either not reported or unclear. The references cited in the included articles will be considered for data collection. We will also examine the reference lists of existing systematic reviews on similar topics to identify other relevant articles. In addition, the personnel files of the workgroup members will be checked and experts in the field of suicide will be consulted regarding relevant publications.

The search strategy was performed using relevant subject headings and search syntax appropriate to each database, including variations and combinations of free-text terms and Thersaurus of psychological index terms (American Psychological Association, APA) or Medical Subject Headings (MeSH) terms, combining with appropriate boolean operators. The general structure of search syntax was: (suicid* OR self-injur* OR self-harm OR "self-destructive behavio*" OR self-poisoning) AND (intervention OR therap* OR treatment OR psychotherap* OR prevention OR follow-up OR contact OR post-discharge) AND (synchron* OR remote OR non-presential OR non-face-to-face OR distance OR digital OR online OR telehealth OR telemedicine OR eHealth OR mHealth OR telephone OR phone OR call OR hotline OR helpline OR "suicide line" OR chat OR videoconferen* OR App OR text messag* OR SMS) AND ("randomised controlled trial" OR "controlled clinical trials" OR "clinical studies") NOT (review OR protocol). The drafted electronic search strategy for PubMed database is included in the Supplementary File 2.

The search was scheduled to be completed by April 2022. All searches have been re-run, before publication of the article, as more than 12 months have elapsed since the date of the initial search. The search was limited to English or Spanish and was performed with no restrictions on the time of publication.

The search strategy was developed by the research team with the collaboration of an experienced health science librarian (GC), adhering to the Peer Review of Electronic Search Strategies (PRESS) [60]. Sensitivity (i.e., retrieval rate) and specificity (i.e., precision rate) criteria were considered in the development of the literature search strategy [61, 62]; however, sensitivity was prioritised.

Data management

Results from the literature search will be imported into Rayyan Systems Inc. [63], an Internet-based software programme that facilitates collaboration and pursuit accelerated screening process. During the review process, this tool will be used to identify duplicate records and manage the data. Mendeley (version 1.19.8) will be employed as reference management software.

Selection process

In the first phase, duplicate articles in the databases will be automatically removed by Rayyan Systems Inc. and manually by the first reviewer (LC). In the second phase, two authors (LC and MPJ) will blind-screen all articles based on titles, abstracts, and keywords. In the third phase, the two reviewers (LC and MPJ) will independently evaluate the full-text articles according to eligibility criteria. The reasons for excluding articles will be recorded. If necessary, a third reviewer (AS) will be requested for discrepancies that may not be resolved by consensus among the two reviewers (LC and MPJ). Inter-rater agreement will be calculated by Cohen's Kappa in the second and third phases, prior to reaching consensus on the discrepancies between the two reviewers or contrasting them with a third reviewer. The article selection process will be described in a PRISMA flow diagram [64].

Data collection process

Data extraction will be conducted independently by two authors (LC and MPJ), using a standard extraction form in line with the template from The Cochrane Collaboration [65]. Data will be managed using Microsoft Excel (16.56 version). For missing information or data that needs to be clarified, first or corresponding authors of primary studies will be contacted by email; one follow-up email will be sent if no response is received to the first email.

Data items

Data will be extracted from the following categories: a) general characteristics of the study (authors, date of publication, setting and geographic location, research design, sample size, participant sociodemographic and baseline characteristics), b) intervention and control group details (type of intervention or control group, sample sizes, follow-up time, dropout rates), c) outcomes (descriptive and comparative statistical indexes of efficacy and effectiveness, assessment measures, and procedures), and d) limitations reported by study authors.

Risk of bias assessment

The RoB assessment will be conducted independently by two reviewers (LC and MPJ), employing the Revised Cochrane risk-of-bias tool for randomised trials (RoB 2.0) [66], and Risk-of-bias In Non-randomised Studies – of Interventions (ROBINS-I) [67].

Inter-rater agreement will be calculated by Cohen's Kappa. Disagreements will be resolved by consensus with a third blind reviewer (AS). Ratings of bias for each study will be classified as low, high, or unclear RoB, according to standardised methodology. Intra-methodological quality evaluation will be synthesised in tables that will comprise the summary of each study individually, identifying their RoB. Studies will not be excluded based on their level of RoB.

Data synthesis

A descriptive summary and explanation of the characteristics and findings of all included studies will be displayed in a comprehensive table. A narrative synthesis will be conducted, and a random-effects meta-analysis will be computed when a suicidal-related outcome is reported in at least three studies. To ensure that the data we are combining from different studies is comparable and can be appropriately synthesised, several adjustments may be necessary. These adjustments could involve contacting study authors to request more detailed data or transforming the data (e.g., if we encounter a situation where some studies report suicide attempts as a binary outcome while others report them as a count); conducting sensitivity analyses to assess the impact of the articles; performing subgroup analyses for each type of data; or adopting a narrative synthesis approach when a quantitative combination of studies is not feasible. Any data transformations will be documented in the manuscript, and the limitations introduced by differences in data reporting between studies should be acknowledged.

Three types of meta-analyses will be conducted according to the type of outcome measure: count (number of suicide attempts), quantitative (standardised mean differences of suicidal ideation), and binary (death by suicide). The length of the follow-up period will be included as an exposure (offset) variable in meta-analyses of the number of suicide attempts. In the meta-analyses of the suicidal ideation and death by suicide outcomes, responses will be analysed at different follow-up time intervals, as indicated below in the description of subgroup analyses. Mean differences between the control group and intervention group will be transformed into Hedges' *g* standardised effect sizes [68], which means different tools for measuring suicidal ideation will be combined. Effect sizes will be considered small ($g \geq 0.2$), medium ($g \geq 0.5$), or large ($g \geq 0.8$) [69]. The *Q* and Tau^2 statistics will be calculated to assess the statistical heterogeneity of effect sizes. Specific functions will be used to examine: (a) the profile likelihood plots of the variance components; (b) the potential outlying and influential studies

and/or outcomes; and (c) the potential publication bias. All analyses will be performed using the Metafor package (version 4.0-0) for R.

Sensitivity analysis

The potential effect on the results due to the trial design (i.e., pragmatic vs. explanatory trials) and the RoB of the studies will be analysed, if feasible.

Analysis of subgroups or subsets

Subgroup and subset analyses will be carried out if feasible and warranted to examine potential effect modifiers based on sociodemographic characteristics of participants, length, type of treatment, research design, and RoB assessment. Meta-regression will be performed to analyse quantitative potential effect modifiers or covariates that might influence the size of the intervention effect (e.g., age). We plan to summarise and categorise the below subgroup or subset analyses if there is enough data:

a) Age: adolescents (12 to 17 years of age), adults (18 to 65 years of age), and older adults (over 65 years of age).
b) Type of intervention: type of synchronous remote-based interventions (telephone calls, instant text messaging, 24/7 hotlines, videoconferencing).
c) Number of follow-up contacts: hotline (24-hour consultation with a non-standardised number of follow-up contacts), 1 to 3 contacts, 3 to 6 contacts, and more than 6 contacts.
d) Length of contact period: hotlines (24-hour consultation with a non-standardised period of follow-up contacts), up to 1-month follow-up, 1 to 3-month follow-up, 3 to 6-month follow-up, and longer than 6-month follow-up.
e) Research design: RCTs, quasi-experimental trials, and observational case-controlled studies.

f) RoB assessment: low, high, and unclear RoB.

Publication bias

Publication bias will be evaluated using Egger's test [70], funnel plots [71], and trim-and-fill approaches [72].

Confidence in cumulative evidence

The overall quality of evidence will be evaluated according to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) [73, 74] by two independent researchers (LC and MPJ). Discrepancies will be resolved in a discussion with a third researcher (AS).

Patient and public involvement

Patients and/or the public were not involved in the design, conduct, reporting, or dissemination plans of this research.

DISCUSSION

The wide variety of remotely delivered distance-based programmes for suicide prevention [20, 23, 26–28] and the current lack of guidance on their implementation warrant further research to improve and standardise patient care.

To the best of the researchers' knowledge, no systematic review and meta-analysis has been reported that examined the efficacy of synchronous and remote telepsychiatry interventions, assessing suicide-specific outcomes. We aim to address a gap in research by examining the efficacy of synchronous remote-based interventions that are specifically designed for suicide prevention. The proposed approach is pertinent given the recent increase in the development and usage of technology communication devices for this purpose [19].

It is anticipated that the systematic review will have predicted limitations that should be considered. The inconsistency of terms used in suicidology is a limiting factor regarding the search for articles and the subsequent eligibility of studies. In addition, suicide is a rare event, making the design of studies with high statistical power particularly challenging. Furthermore, people who attempt suicide are typified by poor treatment-seeking and limited adherence to treatment [75], making it important to provide individuals at risk of suicide with appropriate and cost-effectiveness treatment options.

A limited number of available studies is expected, which explains why the search strategy prioritises sensitivity over specificity. Moreover, RCTs may not provide sufficient evidence to exclude data from non-randomised studies. The inclusion of studies examining a wide range of synchronous remote-communication technologies rather than a specific intervention is intended to address this issue. Similarly, including no restriction on the mental health condition should allow for the collection of comprehensive and relevant data. Research studies that meet eligibility criteria may have a substantial degree of heterogeneity. In response, we initially planned subgroup and subset analyses. However, the categorisation of interventions into different typologies may be difficult since multiple research studies combine several interventions simultaneously.

Aside from several limitations, there are potential strengths. The aim is to contribute to the body of evidence on suicide. The development of the research proposed in the present protocol will allow to analyse the quality and methodology used in the research of remote-based synchronous interventions for suicide prevention, synthesizing scientific evidence, generating hypotheses, and establishing lines of research. In addition, the study protocol per se will provide more transparency in the methods and processes involved, decrease the possibility of duplication, and reduce bias. The meta-analysis of the studies found can allow the quantification of their global efficacy and effectiveness. Likewise, the subgroups or subsets analyses can

provide useful information to guide the design of more efficient and effective efficacy or effectiveness of remote-based synchronous programs for suicide prevention in the future.

The current registration of the protocol for this review at PROSPERO may undergo changes, if approved by all authors. Any changes to the protocol will be described and explained in the final manuscript. The research has been previously presented at a conference and has been published as a conference abstract [76].

ETHICS AND DISSEMINATION

Ethics approval is not needed, as systematic reviews are based on published studies. The results will be disseminated through peer-reviewed publications.

Ethics statements

Patient consent for publication

Not applicable.

Contributors AS is the guarantor. LC, JML, DP, AC, and AS: Writing - Original Draft. LC, AS, MPJ, JPS, and CM: Software. LC, JML, DP and AS: Project administration, Supervision. All authors: Conceptualization, Methodology, Writing - Review & Editing. JML, AS, JPS, and CM provided statistical expertise. DP and AC provided expertise on suicidal behaviours. All authors approved the final manuscript.

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Supplemental material Supplementary File 1. PRISMA-P 2015 Checklist (DOCX 35 KB). Supplementary File 2. PubMed search strategy (DOCX 14 KB).

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PRISMA-P 2015 Checklist

This checklist has been adapted for use with protocol submissions to *Systematic Reviews* from Table 3 in Moher D et al: Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews* 2015 **4**:1

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
ADMINISTRATIVE INFORMATION					
Title					
Identification	1a	Identify the report as a protocol of a systematic review	☒	☐	1-2
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	☐	☒	N/A
Registration	2	If registered, provide the name of the registry (e.g., PROSPERO) and registration number in the Abstract	☒	☐	24
Authors					
Contact	3a	Provide name, institutional affiliation, and e-mail address of all protocol authors; provide physical mailing address of corresponding author	☒	☐	Title page
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	☒	☐	379-383
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	☐	☒	N/A
Support					
Sources	5a	Indicate sources of financial or other support for the review	☒	☐	397-407
Sponsor	5b	Provide name for the review funder and/or sponsor	☒	☐	397-407
Role of sponsor/funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	☒	☐	404-406
INTRODUCTION					
Rationale	6	Describe the rationale for the review in the context of what is already known	☒	☐	39-112
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	☒	☐	124-129
METHODS					

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
Eligibility criteria	8	Specify the study characteristics (e.g., PICO, study design, setting, time frame) and report characteristics (e.g., years considered, language, publication status) to be used as criteria for eligibility for the review	☒	☐	131-190 215-218
Information sources	9	Describe all intended information sources (e.g., electronic databases, contact with study authors, trial registers, or other grey literature sources) with planned dates of coverage	☒	☐	191-202 215
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	☒	☐	Supplementary File 2
STUDY RECORDS					
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	☒	☐	225-230
Selection process	11b	State the process that will be used for selecting studies (e.g., two independent reviewers) through each phase of the review (i.e., screening, eligibility, and inclusion in meta-analysis)	☒	☐	232-242
Data collection process	11c	Describe planned method of extracting data from reports (e.g., piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	☒	☐	244-249
Data items	12	List and define all variables for which data will be sought (e.g., PICO items, funding sources), any pre-planned data assumptions and simplifications	☒	☐	251-257
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	☒	☐	174-190
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	☒	☐	259-268
DATA					
Synthesis	15a	Describe criteria under which study data will be quantitatively synthesized	☒	☐	273-274 284 - 290
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data, and methods of combining data from studies, including any planned exploration of consistency (e.g., I^2, Kendall's tau)	☒	☐	290-297
	15c	Describe any proposed additional analyses (e.g., sensitivity or subgroup analyses, meta-regression)	☒	☐	299-322
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	☒	☐	271-274

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (e.g., publication bias across studies, selective reporting within studies)	☒	☐	324-326
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (e.g., GRADE)	☒	☐	328-331

Supplementary File 2. PubMed search strategy

Search strategy

("suicide"[MeSH Terms] OR suicid*[Title] OR "suicidal ideation"[MeSH Terms] OR "suicide ideation"[Title] OR "suicide, attempted"[MeSH Terms] OR "attempted suicide"[Title] OR "suicidal behavio*"[Title] OR "non-fatal attempt"[Title] OR "unsuccessful attempt"[Title] OR "suicide, completed"[MeSH Terms] OR "completed suicide"[Title] OR "fatal attempt"[Title] OR "self-injurious behavior"[MeSH Terms] OR self-injur*[Title] OR self-harm*[Title] OR "self-destructive behavio*"[Title] OR self-poisoning[Title] OR "repeated suicide"[Title] OR suicide-risk[Title])

AND ("treatment outcome"[MeSH Terms] OR treatment[Title/Abstract] OR therap*[Title/Abstract] OR intervention*[Title/Abstract] OR "crisis intervention"[MeSH Terms] OR prevention[Title/Abstract] OR "follow-up studies"[MeSH Terms] OR follow-up[Title/Abstract] OR contact*[Title/Abstract] OR management[Title/Abstract] OR program*[Title/Abstract] OR "psychotherapy, brief"[MeSH Terms] OR "brief psychotherap*"[Title/Abstract] OR "brief contact intervention*"[Title/Abstract] OR "post-discharge intervention*"[Title/Abstract] OR effectiv*[Title/Abstract] OR efficacy[Title/Abstract])

AND (synchron*[Title/Abstract] OR "online systems"[MeSH Terms] OR real-time[Title/Abstract] OR "immediate communication*"[Title/Abstract] OR "remote consultation"[MeSH Terms] OR remote*[Title/Abstract] OR non-presential[Title/Abstract] OR non-face-to-face[Title/Abstract] OR non-attend*[Title/Abstract] OR "distance counseling"[MeSH Terms] OR distance[Title/Abstract] OR digital[Title/Abstract] OR "telemedicine"[MeSH Terms] OR telemedicine[Title/Abstract] OR "telecommunications"[MeSH Terms] OR "telecommunication*"[Title/Abstract] OR telehealth[Title/Abstract] OR teleassistance[Title/Abstract] OR telepsychology[Title/Abstract] OR telepsychiatry[Title/Abstract] OR telecare[Title/Abstract] OR telemonitoring[Title/Abstract] OR teleconsult*[Title/Abstract] OR telecounsel*[Title/Abstract] OR "telemental health"[Title/Abstract] OR online[Title/Abstract] OR on-line[Title/Abstract] OR "information and communication technolog*"[Title/Abstract] OR ICT[Title/Abstract] OR e-therap*[Title/Abstract] OR "electronic therap*"[Title/Abstract] OR e-health[Title/Abstract] OR "electronic health"[Title/Abstract] OR m-health[Title/Abstract] OR "mobile health"[Title/Abstract] OR "telephone"[MeSH Terms] OR telephon*[Title/Abstract] OR "cell phone"[MeSH Terms] OR phone*[Title/Abstract] OR "phone call*"[Title/Abstract] OR call*[Title/Abstract] OR "telephone contact*"[Title/Abstract] OR "hotlines"[MeSH Terms] OR hotline*[Title/Abstract] OR "hot line service*"[Title/Abstract] OR "call centers"[MeSH Terms] OR helpline*[Title/Abstract] OR lifeline*[Title/Abstract] OR "suicide prevention lifeline"[Title/Abstract] OR "crisis line*"[Title/Abstract] OR video*[Title/Abstract] OR "videoconferencing"[MeSH Terms] OR video-call*[Title/Abstract] OR "clinical videoconferencing"[Title/Abstract] OR CVT[Title/Abstract] OR chat*[Title/Abstract] OR chatbot[Title/Abstract] OR "text messaging"[MeSH Terms] OR "text messaging"[Title/Abstract] OR "instant messag*"[Title/Abstract] OR SMS[Title/Abstract] OR "mobile applications"[MeSH Terms] OR "mobile application*"[Title/Abstract] OR App[Title/Abstract] OR "phone application*"[Title/Abstract])

AND (“randomized controlled trials as Topic”[Mesh] OR “randomized controlled trial”[Title/Abstract] OR “controlled clinical trials as Topic”[Mesh] OR “controlled clinical trial”[Title/Abstract] OR trial*[Title/Abstract] OR "clinical studies as Topic"[MeSH Terms] OR

"clinical stud*"[Title/Abstract] OR "random allocation"[MeSH Terms] OR random*[Title/Abstract] OR "intervention group*"[Title/Abstract] OR "control group*"[Title/Abstract])

NOT (systematic review*[Title] OR review*[Title] OR meta*[Title] OR protocol[Title])

Filters

The following filters were applied: text availability (Full text), language (English, Spanish), age (Adolescent: 13-18 years, Adult: 19+ years).

BMJ Open

The effect of synchronous remote-based interventions on suicidal behaviours: Protocol for a systematic review and meta-analysis

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The effect of synchronous remote-based interventions on suicidal behaviours: Protocol for a systematic review and meta-analysis

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The effect of synchronous remote-based interventions on suicidal behaviours: Protocol for a systematic review and meta-analysis

ABSTRACT

Introduction Suicide is among the leading causes of preventable death worldwide. The impact of suicide affects the personal, social, and economic levels. Therefore, its prevention is a priority for public health systems. Previous studies seem to support the efficacy of providing active contact to people who have made a suicide attempt. The current systematic review and meta-analysis aim to investigate the efficacy of distance suicide prevention strategies implemented through synchronous technology-based interventions.

Methods and analysis This protocol is designed according to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P). The bibliographic searches were conducted in the databases PubMed, PsycInfo, Scopus, and Web of Science in April 2022, with no restrictions on the time of publication and limited to publications in English or Spanish. The search strategy was performed using free-text terms and Medical Subject Headings (MeSH) terms: suicide, follow-up, synchronous, remote, telehealth, telephone, hotline, videoconference, and text message. Two reviewers will independently conduct study screening, selection process, data extraction, and risk of bias (RoB) assessment. The analysis and synthesis of the results will be both qualitative and quantitative. A narrative synthesis, presented in a comprehensive table, will be performed and meta-analysis will be conducted, as appropriate, if sufficient data is provided.

Ethics and dissemination The present review and meta-analysis will not require ethical approval, as it will use data collected from previously published primary studies. The findings of this review will be published in peer-reviewed journals and widely disseminated.

PROSPERO registration number CRD42021275044.

Keywords Suicide, Telemedicine, Preventive Medicine.

STRENGTHS AND LIMITATIONS OF THE STUDY

- Study screening, quality assessment and data extraction will be determined by transparency, precision, and significance according to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA).
- The systematic review will focus on peer-reviewed articles, and findings will be limited to articles written in English or Spanish.
- Randomised clinical trials, quasi-experimental trials, and observational case-controlled studies will be included to obtain sufficient data and adequate statistical power for meta-analysis.
- There is a potential limitation attributed to the expected small sample size of the included studies and the heterogeneity of the study designs.

INTRODUCTION

Suicide is a universal, complex, and multifaceted public health problem that ranks annually among the leading causes of preventable death worldwide. More than 700,000 people die by suicide per year [1], becoming the seventeenth leading cause of death in 2019 in global epidemiology [2]. Annual suicide rates account for 1.4% of all deaths worldwide [3]. Suicide rates in European regions (10.5 per 100,000) were higher than the global average (9.0 per 100,000) in 2019, while the lowest suicide rate was in the Eastern Mediterranean region (6.4 per 100,000) [2, 3]. For each suicide death, there are twenty suicide attempts [4], constituting one of the leading causes of disease burden in the world [5, 6]. While most of the world's suicides occur in low- and-middle-income countries, high-income countries have the highest age-standardised suicide rate (10.9 per 100,000) [2, 3]. Moreover, suicide represents the fourth leading cause of death among people aged 15-29 years in global epidemiology [1, 3]. The number of adolescent deaths due to suicide has increased dramatically, with data reflecting that suicide represents a

rate per year of 0.19/100,000 in people under 15 years of age and a rate per year of 2.23/100,000 in the 15-19 age group, according to the Spanish National Institute of Statistics [7].

Suicide prevention is an emerging priority for the public health system due to its high social burden [8]. Evidence suggests that a prior suicide attempt is one of the most important risk factors for suicide, which supports the efforts to protect patients who attempt suicide during the acute period following an episode of self-harm [9, 10]. It is estimated that 20% of people who had engaged in suicidal behaviour showed a subsequent episode, and that 88% of these reattempts occurred within two years of the initial episode [11]. Furthermore, a lack of follow-up care provided by healthcare professionals has been identified as a risk factor for repeat suicide attempts in patients discharged from the emergency department (ED) [12].

Over the last decades, the relevance of developing evidence-based prevention strategies focused on reducing the likelihood of suicide attempts in high-risk patients has become evident [13–16]. Suicide prevention programmes include a wide range of follow-up actions that promote connectivity between the patient and the mental health provider (sending letters, conducting telephone calls, texting via SMS, providing follow-up visits in specialised healthcare centres, or implementing 24/7 hotlines) [17, 18]. The development of Information and Communication Technologies (ICTs) has created opportunities and challenges in prevention, research, and clinical practise. eHealth interventions represent tools that allow reaching a larger number of at-risk populations, facilitating proactive follow-up compared to face-to-face treatments [19].

Considering that remotely delivered distance-based programmes can reach affected people regardless of their location, it is reasonable to expect that these interventions could be part of future suicide prevention efforts [17, 18]. Remotely brief contact-based interventions can be a cost-effective strategy for suicide prevention in healthcare settings [20–22]. In a recent meta-analysis, Inagaki *et al.* [12] found that secondary prevention programmes involving active contact and follow-up can be effective in reducing the risk of a repeat suicide attempt within six

months of admission to an ED for suicidal behaviour. Moreover, promising results seem to be reported in studies that conduct telephone follow-up interventions for individuals at risk as a suicide prevention strategy [23–30]. Telephone management in a clinical-practise setting could be a useful and not expensive programme to implement in mental health centres [23, 31].

In 2015, Milner *et al*. [32] conducted a systematic review and meta-analyses of 14 randomised controlled trials (RCTs) using brief contact interventions and found that considerable differences in outcomes are likely to exist depending on the intervention condition and time period over which the study was conducted (i.e., studies that reported on the effectiveness of the intervention condition in reducing suicide attempts were conducted some decades ago and were rated as having a high risk of bias (RoB), whereas recent studies find more conservative results). Given the possible benefits, low cost and unlikely adverse effects, large-scale trials in clinical populations would be worthwhile; however, the authors do not recommend widespread clinical implementation of brief contact interventions. In 2016, Noh *et al*. [33] examined five RCTs comparing telephone-delivered interventions for preventing suicide reattempts with no telephone intervention. The results suggest that, in the case of providing telephone-delivered intervention only, more aggressive, structured, and theory-based telephone interventions led by mental health professionals should be designed and examined in the form of large-scale RCTs. It should be noted that there is an overlap in the studies included in the Milner *et al*. [32] and Noh *et al*. [33] meta-analyses.

Although there is no clear consensus on the effect of these programmes in previous systematic reviews and meta-analyses [32, 33], there are data that appear to support the efficacy of providing active contact to individuals who have made a suicide attempt [12, 17, 34]. Overall, there are studies with positive results in the reduction of suicide-related outcomes [23, 26, 29, 30] and others that have found conflicting or inconclusive evidence [25, 35, 36], suggesting the suitability of conducting a systematic review with meta-analysis of the current scientific literature. Despite evidence describing a broad range of telecommunications-based

suicide prevention approaches [21, 37], we are not aware of any publications that provide a synthesis of the literature on interventions that develop the use of synchronous strategies in suicide prevention. Based on the concept of connectivity [34], combined with a component of immediacy in the communication system; synchronous communication can increase accessibility, adherence, and treatment efficacy.

This study aims to collect and synthesise information on the efficacy and effectiveness of remote suicide prevention strategies implemented through technology-based synchronous interventions (i.e., via digital tools that allow interactive and immediate real-time communication conducted remotely).

METHODS AND ANALYSIS

The primary source used to describe the methods of this protocol was the Cochrane Handbook for Systematic Reviews of Interventions (version 6.2) [38], specifically Part 2: Core methods "Chapter 2: Determining the scope of the review and the questions it will address" to "Chapter 10: Analysing data and undertaking meta-analyses". The protocol was constructed according to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) [39, 40] (see Supplementary File 1). A version of the protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO), under identification number CRD42021275044.

Systematic review question

The research question was built according to PICOS criteria (Population, Intervention, Comparison, Outcomes, and deSign) [41]. In adolescents and adults (≥ 12 years of age) with suicidal ideation or prior suicide attempts (P), what is the efficacy and effectiveness of synchronous remote-based interventions (I) in the prevention of non-fatal suicide attempts and suicide deaths (O) compared to active or inactive control groups (C) with any follow-up length?

Criteria for included and excluded studies

Types of studies

The review will consider published empirical research with the following study designs: randomised clinical trials, quasi-experimental trials, and observational case-controlled studies. Primary data from cohort study designs or qualitative studies and secondary sources (e.g., systematic reviews, meta-analyses) will be excluded.

Types of participants

The population of interest will include adolescents and adults, defined as anyone over the age of 12 years, who have reported suicidal ideation or prior suicide attempts. No restriction will be placed on gender, geographical provenance, or diagnosis. Participants with non-suicidal self-injury will be excluded.

Types of interventions

Synchronous remote-based interventions will be defined as programmes delivered through a technology device that is characterised by (a) ensuring interactive and immediate communication, and (b) not requiring the patient to be at the same physical location as the mental health provider. Interventions should aim to reduce suicide risk by communicating with patients through telephone follow-up or active contact (i.e., contact with healthcare services made spontaneously by participants at elevated risk for suicidal behaviour, such as a phone call or hotline), instant text messaging, or videoconference. The synchronous remote communication should include some, but not necessarily all, of the following elements: improving compliance with medication and follow-up appointments, addressing any problems, stressors, or risk factors, and reducing re-attempts. No restriction will be placed on the intensity or duration of the intervention.

We will include interventions delivered via synchronous remote-communication technologies; however, synchronous remote-based programmes that include minimal face-to-face contact (i.e., in-person contact for a maximum of 1 session) or are complemented with multimedia-delivered materials will be also considered. Studies using asynchronous telecommunication devices such as online forums and communities, social networking sites, video sharing sites, automated one-way text or voice messages, and self-directed web-based programmes will be excluded. Studies that describe treatments focused on the prevention of non-suicidal self-harm will be excluded. In addition, the interventions for issues such as psychosis, eating disorders, and depression, which are not intended to specifically address suicidal behaviour, are out of the scope of this review.

All comparisons identified in the eligible studies will be included, such as treatment as usual (TAU), enhanced treatment as usual, no treatment, placebo, waiting list, and historical control. Therefore, the review will include active (i.e., participants engaged in some tasks unrelated to suicide prevention during the study period) or inactive control groups. The control group may involve a combination of strategies: visits to mental health services, non-psychological therapies (e.g., pharmacotherapy), and other expected interventions. Studies that do not include a control group will be excluded (e.g., cross-sectional trials).

Types of outcomes measures

The main outcomes will be the repetition of suicide attempt, suicide ideation and suicide death. Suicide is defined as a self-inflicted and potentially injurious behaviour that is performed as a deliberate method to die [42]. Suicide attempts are defined as self-inflicted harm with a non-fatal outcome for which there is evidence, explicit or implicit, of the intention to die [3]. Furthermore, suicidal ideation is described by thoughts, ideas, or ruminations about the possibility of ending one's life [43].

The assessment can be conducted post-intervention with no limit on the length of follow-up, employing quantitative measurement of suicidal-related outcomes. The suicidal ideation outcome may be measured using different validated instruments (Table 1). According to a recent systematic review [44], the most common instruments are the Beck Scale for Suicide Ideation (BSI) and the Columbia Suicide Severity Rating Scale (C-SSRS). The non-fatal suicide attempts outcome will be measured by the number of suicide attempts a person has made within a certain timeframe. The suicide death outcome will be measured by the number of people who have died by suicide.

Table 1. Instruments most cited in the literature for assessing suicide risk.

Instrument	Reference
Beck Scale for Suicide Ideation (BSI)	Beck *et al.* [45]
The Columbia – Suicide Severity Rating Scale (C-SSRS)	Posner *et al.* [46]
Beck Suicidal Intent Scale (SIS)	Beck *et al.* [47]
Paykel Suicide Scale (PSS)	Fonseca-Pedrero *et al.* [48]
Beck Suicide Scale – worst ever version (BSSw)	Beck & Steer [49]
Suicidal Ideation Questionnaire (SIQ; SIQ-Junior)	Reynolds [50]
Mini-International Neuropsychiatric Interview (MINI)	Sheehan *et al.* [51]
Risk of Suicide Questionnaire (RSQ; RSQ-Revised)	Horowitz *et al.* [52]
Suicide Score Scale (SSS)	Innamorati *et al.* [53]
Suicide Opinion Questionnaire (SOQ)	Domino *et al.* [54]
WMH Composite International Diagnostic Interview (WMH-CIDI)	Kessler & Ustün [55]
InterSePT Suicide Scale (ISST)	Lindenmayer *et al.* [56]
Plutchik Suicide Risk Scale	Koslowsky *et al.* [57]
Harkavy-Asnis Suicide Scale (HASS)	Friedman & Asnis [58]
Suicide Probability Scale (SPS)	Cull & Gill [59]

Data collection and analysis

Information sources and search strategy

Literature searches were conducted in the following electronic databases: PubMed (by NCBI-NLM-NIH website), PsycInfo (by ProQuest), Scopus (by ww.scopus.com), and Web of Science Core Collection (by www.clarivate.com). Grey literature and unpublished records were searched on the following websites: ClinicalTrials.gov and Google Scholar.

Authors of published articles will be contacted to retrieve relevant information about their study that was either not reported or unclear. The references cited in the included articles will be considered for data collection. We will also examine the reference lists of existing systematic reviews on similar topics to identify other relevant articles. In addition, the personnel files of the workgroup members will be checked and experts in the field of suicide will be consulted regarding relevant publications.

The search strategy was performed using relevant subject headings and search syntax appropriate to each database, including variations and combinations of free-text terms and Thersaurus of psychological index terms (American Psychological Association, APA) or Medical Subject Headings (MeSH) terms, combining with appropriate boolean operators. The general structure of search syntax was: (suicid* OR self-injur* OR self-harm OR "self-destructive behavio*" OR self-poisoning) AND (intervention OR therap* OR treatment OR psychotherap* OR prevention OR follow-up OR contact OR post-discharge) AND (synchron* OR remote OR non-presential OR non-face-to-face OR distance OR digital OR online OR telehealth OR telemedicine OR eHealth OR mHealth OR telephone OR phone OR call OR hotline OR helpline OR "suicide line" OR chat OR videoconferen* OR App OR text messag* OR SMS) AND ("randomised controlled trial" OR "controlled clinical trials" OR "clinical studies") NOT (review OR protocol). The drafted electronic search strategy for PubMed database is included in the Supplementary File 2.

The search was scheduled to be completed by April 2022. All searches have been re-run, before publication of the article, as more than 12 months have elapsed since the date of the initial search. The search was limited to English or Spanish and was performed with no restrictions on the time of publication.

The search strategy was developed by the research team with the collaboration of an experienced health science librarian (GC), adhering to the Peer Review of Electronic Search Strategies (PRESS) [60]. Sensitivity (i.e., retrieval rate) and specificity (i.e., precision rate) criteria were considered in the development of the literature search strategy [61, 62]; however, sensitivity was prioritised.

Data management

Results from the literature search will be imported into Rayyan Systems Inc. [63], an Internet-based software programme that facilitates collaboration and pursuit accelerated screening process. During the review process, this tool will be used to identify duplicate records and manage the data. Mendeley (version 1.19.8) will be employed as reference management software.

Selection process

In the first phase, duplicate articles in the databases will be automatically removed by Rayyan Systems Inc. and manually by the first reviewer (LC). In the second phase, two authors (LC and MPJ) will blind-screen all articles based on titles, abstracts, and keywords. In the third phase, the two reviewers (LC and MPJ) will independently evaluate the full-text articles according to eligibility criteria. The reasons for excluding articles will be recorded. If necessary, a third reviewer (AS) will be requested for discrepancies that may not be resolved by consensus among the two reviewers (LC and MPJ). Inter-rater agreement will be calculated by Cohen's Kappa in the second and third phases, prior to reaching consensus on the discrepancies between the two reviewers or contrasting them with a third reviewer. The article selection process will be described in a PRISMA flow diagram [64].

Data collection process

Data extraction will be conducted independently by two authors (LC and MPJ), using a standard extraction form in line with the template from The Cochrane Collaboration [65]. Data will be managed using Microsoft Excel (16.56 version). For missing information or data that needs to be clarified, first or corresponding authors of primary studies will be contacted by email; one follow-up email will be sent if no response is received to the first email.

Data items

Data will be extracted from the following categories: a) general characteristics of the study (authors, date of publication, setting and geographic location, research design, sample size, participant sociodemographic and baseline characteristics), b) intervention and control group details (type of intervention or control group, sample sizes, follow-up time, dropout rates), c) outcomes (descriptive and comparative statistical indexes of efficacy and effectiveness, assessment measures, and procedures), and d) limitations reported by study authors.

Risk of bias assessment

The RoB assessment will be conducted independently by two reviewers (LC and MPJ), employing the Revised Cochrane risk-of-bias tool for randomised trials (RoB 2.0) [66], and Risk-of-bias In Non-randomised Studies – of Interventions (ROBINS-I) [67].

Inter-rater agreement will be calculated by Cohen's Kappa. Disagreements will be resolved by consensus with a third blind reviewer (AS). Ratings of bias for each study will be classified as low, high, or unclear RoB, according to standardised methodology. Intra-methodological quality evaluation will be synthesised in tables that will comprise the summary of each study individually, identifying their RoB. Studies will not be excluded based on their level of RoB.

Data synthesis

A descriptive summary and explanation of the characteristics and findings of all included studies will be displayed in a comprehensive table. A narrative synthesis will be conducted, and a random-effects meta-analysis will be computed when a suicidal-related outcome is reported in at least three studies. To ensure that the data we are combining from different studies is comparable and can be appropriately synthesised, several adjustments may be necessary. These adjustments could involve contacting study authors to request more detailed data or transforming the data (e.g., if we encounter a situation where some studies report suicide attempts as a binary outcome while others report them as a count); conducting sensitivity analyses to assess the impact of the articles; performing subgroup analyses for each type of data; or adopting a narrative synthesis approach when a quantitative combination of studies is not feasible. Any data transformations will be documented in the manuscript, and the limitations introduced by differences in data reporting between studies should be acknowledged.

Three types of meta-analyses will be conducted according to the type of outcome measure: count (incidence rate ratio between groups of the number of suicide attempts), quantitative (standardised mean differences of suicidal ideation), and binary (odds-ratio between groups in the proportion of deaths by suicide). All outcomes will be analysed at different follow-up time intervals, as indicated below in the description of subgroup analyses. Comparisons adjusted for confounders between groups will be included in meta-analyses when reported in studies, and the effect of these adjustments on the meta-analytic summary will be studied using sensitivity and subgroup analyses. Mean differences between the control group and intervention group will be transformed into Hedges' g standardised effect sizes [68], which means different tools for measuring suicidal ideation will be combined. Effect sizes will be considered small ($g \geq 0.2$), medium ($g \geq 0.5$), or large ($g \geq 0.8$) [69]. The Q and Tau^2 statistics will be calculated to assess the statistical heterogeneity of effect sizes. Specific functions will be used to examine: (a) the profile likelihood plots of the variance components; (b) the potential outlying

and influential studies and/or outcomes; and (c) the potential publication bias. All analyses will be performed using the Metafor package (version 4.0-0) for R.

Sensitivity analysis

The potential effect on the results due to the trial design (i.e., pragmatic vs. explanatory trials), the adjustment for confounding, and the RoB of the studies will be analysed, if feasible.

Analysis of subgroups or subsets

Subgroup and subset analyses will be carried out if feasible and warranted to examine potential effect modifiers based on sociodemographic characteristics of participants, length, type of treatment, research design, adjustment for confounding, and RoB assessment. Meta-regression will be performed to analyse quantitative potential effect modifiers or covariates that might influence the size of the intervention effect (e.g., age). We plan to summarise and categorise the below subgroup or subset analyses if there is enough data:

a) Age: adolescents (12 to 17 years of age), adults (18 to 65 years of age), and older adults (over 65 years of age).
b) Type of intervention: type of synchronous remote-based interventions (telephone calls, instant text messaging, 24/7 hotlines, videoconferencing).
c) Number of follow-up contacts: hotline (24-hour consultation with a non-standardised number of follow-up contacts), 1 to 3 contacts, 3 to 6 contacts, and more than 6 contacts.
d) Length of contact period: hotlines (24-hour consultation with a non-standardised period of follow-up contacts), up to 1-month follow-up, 1 to 3-month follow-up, 3 to 6-month follow-up, and longer than 6-month follow-up.
e) Research design: RCTs, quasi-experimental trials, and observational case-controlled studies.

f) Adjustment for confounding: adjusted for confounding variables, or no adjustment.

g) RoB assessment: low, high, and unclear RoB.

Publication bias

Publication bias will be evaluated using Egger's test [70], funnel plots [71], and trim-and-fill approaches [72].

Confidence in cumulative evidence

The overall quality of evidence will be evaluated according to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) [73, 74] by two independent researchers (LC and MPJ). Discrepancies will be resolved in a discussion with a third researcher (AS).

Patient and public involvement

Patients and/or the public were not involved in the design, conduct, reporting, or dissemination plans of this research.

DISCUSSION

The wide variety of remotely delivered distance-based programmes for suicide prevention [20, 23, 26–28] and the current lack of guidance on their implementation warrant further research to improve and standardise patient care.

To the best of the researchers' knowledge, no systematic review and meta-analysis has been reported that examined the efficacy of synchronous and remote telepsychiatry interventions, assessing suicide-specific outcomes. We aim to address a gap in research by examining the efficacy of synchronous remote-based interventions that are specifically designed for suicide prevention. The proposed approach is pertinent given the recent increase in the development and usage of technology communication devices for this purpose [19].

It is anticipated that the systematic review will have predicted limitations that should be considered. The inconsistency of terms used in suicidology is a limiting factor regarding the search for articles and the subsequent eligibility of studies. In addition, suicide is a rare event, making the design of studies with high statistical power particularly challenging. Furthermore, people who attempt suicide are typified by poor treatment-seeking and limited adherence to treatment [75], making it important to provide individuals at risk of suicide with appropriate and cost-effectiveness treatment options.

A limited number of available studies is expected, which explains why the search strategy prioritises sensitivity over specificity. Moreover, RCTs may not provide sufficient evidence to exclude data from non-randomised studies. The inclusion of studies examining a wide range of synchronous remote-communication technologies rather than a specific intervention is intended to address this issue. Similarly, including no restriction on the mental health condition should allow for the collection of comprehensive and relevant data. Research studies that meet eligibility criteria may have a substantial degree of heterogeneity. In response, we initially planned subgroup and subset analyses. However, the categorisation of interventions into different typologies may be difficult since multiple research studies combine several interventions simultaneously.

Aside from several limitations, there are potential strengths. The aim is to contribute to the body of evidence on suicide. The development of the research proposed in the present protocol will allow to analyse the quality and methodology used in the research of remote-based synchronous interventions for suicide prevention, synthesizing scientific evidence, generating hypotheses, and establishing lines of research. In addition, the study protocol per se will provide more transparency in the methods and processes involved, decrease the possibility of duplication, and reduce bias. The meta-analysis of the studies found can allow the quantification of their global efficacy and effectiveness. Likewise, the subgroups or subsets analyses can

provide useful information to guide the design of more efficient and effective efficacy or effectiveness of remote-based synchronous programs for suicide prevention in the future.

The current registration of the protocol for this review at PROSPERO may undergo changes, if approved by all authors. Any changes to the protocol will be described and explained in the final manuscript. The research has been previously presented at a conference and has been published as a conference abstract [76].

ETHICS AND DISSEMINATION

Ethics approval is not needed, as systematic reviews are based on published studies. The results will be disseminated through peer-reviewed publications.

Ethics statements

Patient consent for publication

Not applicable.

Contributors AS is the guarantor. LC, JML, DP, AC, and AS: Writing - Original Draft. LC, AS, MPJ, JPS, and CM: Software. LC, JML, DP and AS: Project administration, Supervision. All authors: Conceptualization, Methodology, Writing - Review & Editing. JML, AS, JPS, and CM provided statistical expertise. DP and AC provided expertise on suicidal behaviours. All authors approved the final manuscript.

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Supplemental material Supplementary File 1. PRISMA-P 2015 Checklist (DOCX 35 KB). Supplementary File 2. PubMed search strategy (DOCX 14 KB).

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PRISMA-P 2015 Checklist

This checklist has been adapted for use with protocol submissions to *Systematic Reviews* from Table 3 in Moher D et al: Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews* 2015 **4**:1

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
ADMINISTRATIVE INFORMATION					
Title					
Identification	1a	Identify the report as a protocol of a systematic review	☒	☐	1-2
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	☐	☒	N/A
Registration	2	If registered, provide the name of the registry (e.g., PROSPERO) and registration number in the Abstract	☒	☐	24
Authors					
Contact	3a	Provide name, institutional affiliation, and e-mail address of all protocol authors; provide physical mailing address of corresponding author	☒	☐	Title page
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	☒	☐	390-394
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	☐	☒	N/A
Support					
Sources	5a	Indicate sources of financial or other support for the review	☒	☐	408-419
Sponsor	5b	Provide name for the review funder and/or sponsor	☒	☐	408-419
Role of sponsor/funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	☒	☐	416-419
INTRODUCTION					
Rationale	6	Describe the rationale for the review in the context of what is already known	☒	☐	39-112
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	☒	☐	124-129
METHODS					

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
Eligibility criteria	8	Specify the study characteristics (e.g., PICO, study design, setting, time frame) and report characteristics (e.g., years considered, language, publication status) to be used as criteria for eligibility for the review	☒	☐	131-191 216-219
Information sources	9	Describe all intended information sources (e.g., electronic databases, contact with study authors, trial registers, or other grey literature sources) with planned dates of coverage	☒	☐	192-203 216
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	☒	☐	Supplementary File 2
STUDY RECORDS					
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	☒	☐	226-231
Selection process	11b	State the process that will be used for selecting studies (e.g., two independent reviewers) through each phase of the review (i.e., screening, eligibility, and inclusion in meta-analysis)	☒	☐	233-243
Data collection process	11c	Describe planned method of extracting data from reports (e.g., piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	☒	☐	245-250
Data items	12	List and define all variables for which data will be sought (e.g., PICO items, funding sources), any pre-planned data assumptions and simplifications	☒	☐	252-258
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	☒	☐	174-191
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	☒	☐	260-269
DATA					
Synthesis	15a	Describe criteria under which study data will be quantitatively synthesized	☒	☐	273-275 285 - 299
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data, and methods of combining data from studies, including any planned exploration of consistency (e.g., I^2, Kendall's tau)	☒	☐	292-299
	15c	Describe any proposed additional analyses (e.g., sensitivity or subgroup analyses, meta-regression)	☒	☐	301-303
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	☒	☐	272-275

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (e.g., publication bias across studies, selective reporting within studies)	☒	☐	327-329
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (e.g., GRADE)	☒	☐	331-334

Supplementary File 2. PubMed search strategy

Search strategy

("suicide"[MeSH Terms] OR suicid*[Title] OR "suicidal ideation"[MeSH Terms] OR "suicide ideation"[Title] OR "suicide, attempted"[MeSH Terms] OR "attempted suicide"[Title] OR "suicidal behavio*"[Title] OR "non-fatal attempt"[Title] OR "unsuccessful attempt"[Title] OR "suicide, completed"[MeSH Terms] OR "completed suicide"[Title] OR "fatal attempt"[Title] OR "self-injurious behavior"[MeSH Terms] OR self-injur*[Title] OR self-harm*[Title] OR "self-destructive behavio*"[Title] OR self-poisoning[Title] OR "repeated suicide"[Title] OR suicide-risk[Title])

AND ("treatment outcome"[MeSH Terms] OR treatment[Title/Abstract] OR therap*[Title/Abstract] OR intervention*[Title/Abstract] OR "crisis intervention"[MeSH Terms] OR prevention[Title/Abstract] OR "follow-up studies"[MeSH Terms] OR follow-up[Title/Abstract] OR contact*[Title/Abstract] OR management[Title/Abstract] OR program*[Title/Abstract] OR "psychotherapy, brief"[MeSH Terms] OR "brief psychotherap*"[Title/Abstract] OR "brief contact intervention*"[Title/Abstract] OR "post-discharge intervention*"[Title/Abstract] OR effectiv*[Title/Abstract] OR efficacy[Title/Abstract])

AND (synchron*[Title/Abstract] OR "online systems"[MeSH Terms] OR real-time[Title/Abstract] OR "immediate communication*"[Title/Abstract] OR "remote consultation"[MeSH Terms] OR remote*[Title/Abstract] OR non-presential[Title/Abstract] OR non-face-to-face[Title/Abstract] OR non-attend*[Title/Abstract] OR "distance counseling"[MeSH Terms] OR distance[Title/Abstract] OR digital[Title/Abstract] OR "telemedicine"[MeSH Terms] OR telemedicine[Title/Abstract] OR "telecommunications"[MeSH Terms] OR "telecommunication*"[Title/Abstract] OR telehealth[Title/Abstract] OR teleassistance[Title/Abstract] OR telepsychology[Title/Abstract] OR telepsychiatry[Title/Abstract] OR telecare[Title/Abstract] OR telemonitoring[Title/Abstract] OR teleconsult*[Title/Abstract] OR telecounsel*[Title/Abstract] OR "telemental health"[Title/Abstract] OR online[Title/Abstract] OR on-line[Title/Abstract] OR "information and communication technolog*"[Title/Abstract] OR ICT[Title/Abstract] OR e-therap*[Title/Abstract] OR "electronic therap*"[Title/Abstract] OR e-health[Title/Abstract] OR "electronic health"[Title/Abstract] OR m-health[Title/Abstract] OR "mobile health"[Title/Abstract] OR "telephone"[MeSH Terms] OR telephon*[Title/Abstract] OR "cell phone"[MeSH Terms] OR phone*[Title/Abstract] OR "phone call*"[Title/Abstract] OR call*[Title/Abstract] OR "telephone contact*"[Title/Abstract] OR "hotlines"[MeSH Terms] OR hotline*[Title/Abstract] OR "hot line service*"[Title/Abstract] OR "call centers"[MeSH Terms] OR helpline*[Title/Abstract] OR lifeline*[Title/Abstract] OR "suicide prevention lifeline"[Title/Abstract] OR "crisis line*"[Title/Abstract] OR video*[Title/Abstract] OR "videoconferencing"[MeSH Terms] OR video-call*[Title/Abstract] OR "clinical videoconferencing"[Title/Abstract] OR CVT[Title/Abstract] OR chat*[Title/Abstract] OR chatbot[Title/Abstract] OR "text messaging"[MeSH Terms] OR "text messaging"[Title/Abstract] OR "instant messag*"[Title/Abstract] OR SMS[Title/Abstract] OR "mobile applications"[MeSH Terms] OR "mobile application*"[Title/Abstract] OR App[Title/Abstract] OR "phone application*"[Title/Abstract])

AND (“randomized controlled trials as Topic”[Mesh] OR “randomized controlled trial”[Title/Abstract] OR “controlled clinical trials as Topic”[Mesh] OR “controlled clinical trial”[Title/Abstract] OR trial*[Title/Abstract] OR "clinical studies as Topic"[MeSH Terms] OR

"clinical stud*"[Title/Abstract] OR "random allocation"[MeSH Terms] OR random*[Title/Abstract] OR "intervention group*"[Title/Abstract] OR "control group*"[Title/Abstract])

NOT (systematic review*[Title] OR review*[Title] OR meta*[Title] OR protocol[Title])

Filters

The following filters were applied: text availability (Full text), language (English, Spanish), age (Adolescent: 13-18 years, Adult: 19+ years).