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Suicidal models in the elderly: protocol for a systematic review[1]

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Abstract

Introduction: Rates of suicide in older people are generally higher than other age groups. Suicidal models which are related to the elderly while explanting the phenomenon of suicide in life late can have research, clinical, and educational implications. The main purpose of this systematic review is to identify and review existing suicidal models with a particular focus on the elderly.

Methods and analysis: The authors will review the findings of observational studies including Cohort studies, cross-sectional studies, case-control studies, and quantitative studies including grounded theory designs published in the databases of Google Scholar, SCOPUS, PSYCINFO, PubMed, Web of Sciences, Cochrane Database of Systematic Reviews, and other research-related journals. The inclusion criteria for suicide models include a variety of models in which are specifically to describe, explain, and predict late life suicide. Therapeutic and interventional models or rehabilitation models as well as Suicidal models related to assisted suicide are excluded from research. Endnote software is used for data management. Two independent reviewers will extract data. For quantitative studies, The Newcastle-Ottawa Scale (NOS) and Newcastle-Ottawa Scale adapted for cross-sectional studies and for qualitative studies, the Critical Appraisal Skills Programme (CASP) and the

[1] Article Number 1, Ph.D. dissertation of Mohammad Rostami entitled "Explaining the Process of the Formation of Suicidal Thoughts and Sentiment in the Elderly.

evaluative criteria of credibility, transferability, dependability and confirmability will be used to evaluate the risk of bias and the methodology quality of preliminary studies. The final report will present a range of suicidal models in a form with a list of different subgroups.

Ethics and publication: There are no predictable moral issues in this research. In addition, the findings will be published in prestigious journals, and international and national conferences.

Registration number: This systematic review protocol is registered in the PROSPERO International Prospective Register of Systematic Reviews, registration number CRD42017070982

Keywords: suicide, elderly, model.

Strengths and limitations of this study:

1. The present systematic review is the first to study the suicide-specific models of the elderly through search of various databases.

2. To minimize potential bias, each process of initial screening, data extraction, and quality evaluation will be performed by two independent reviewers.

3. The limitation of this study is searching and reviewing studies in English only. This limitation may cause language bias.

Introduction

Population aging has been one of the most prominent phenomena in global health during recent years. The global over 60-year older population is projected to increase from 10% in 2000 to 21% in 2050(1). Although later life is defined as a period of life with better characteristics of well-being, a wider meaning of life and more capacity for management and regulation of emotions but getting older due to physical illness, cognitive defects and other changes associated with aging can be a threat to the individual and may increase the risk of depression and suicide (2). The suicide rate in many countries in the world in older people is higher than other age groups(3).

Suicide has now become an important public health issue attracting global attention. Suicide involves a deliberate and intentional action to terminate life(4). A large number of researchers have estimated suicide rates in elderly people as

compared to other people(5, 6). Given the increasing population of elderly people, the number of older people who die from suicide is likely to increase in the forthcoming decades(7).

Researchers agree that no single risk factor alone can predict suicidal ideation and suicidal behaviours among different population groups, especially the elderly. For example, psychiatric illnesses, especially depression, are the strongest risk factors for suicide in older people(8), while some studies have shown that older people with a history of suicide have not previously experienced specific symptoms of depression(9, 10). In addition, studies based on identification of risk factors for suicide do not clearly indicate how preventive interventions should be designed(3). It is, therefore, important to go beyond theoretical psychiatric factors to understand what factors contribute to suicide in the elderly(11). This can be performed by a model or theory in order to explain the suicide phenomenon, reveal the present knowledge gaps, provide guidance for future research, and propose practical considerations(11). Accordingly, the researchers (3) raised an open question whether or not a specific model for late life suicide could be useful for better understanding of the experience of aging. Such a model would depend on the assumption that late life suicide is different from other periods of life in terms of etiology and even epidemiology.

To date, suicide and suicidal behavior have been studied using different and often contradictory theoretical and experimental models, such as epidemiological (12), philosophical(13), socio-cultural(14), sociology(15), psychoanalysts(16), psychoanalytic(17), neurobiology(18), cognitive theories of suicide(19), family system theories(20), and other suicide models, such as interpersonal theory of suicide(21) and Motivational-Volitional Theory of Suicide(22). Although theories are not designed for a certain age range, they can be accommodated with the opportunities or challenges that older people face during their aging process, including biological, environmental, and psychological challenges(3, 23). As some of these theories and models provide implications for understanding and explaining suicide in the elderly(11), there are also some theories and models specifically developed to explain the suicide of the elderly. Therefore, some of these theories and models were identified in the preliminary search of the present research. Most of the models raised regarding life late suicide focused on psychological-with an emphasis on emotion and cognition-(24), developmental and longevity studies(25),

demographic and epidemiological(26), and neurobiology (27) areas. Older people at risk of Suicide experience Low (or Thwarted) Belonging with more Perceived Burdensomeness. Such older people have been exposed to provocative and painful experiences during their lifetimes, thus, they have gained the Acquired Capability to attempt suicide(28). Others presented a conceptual framework for the use of lifespan developmental theory to better understand suicidal behaviours at aging (25). The authors believe in the motivational theory of lifespan development, which focuses on the concept of control, is specifically relevant to late life suicide(25). The purpose present study is to systematically review such studies.

To date a number of systematic and non-systematic studies have been carried in the field of life late suicide such as comprehensively review of psychological and social theories of elderly suicide(11), physical diseases, functional weaknesses and suicidal behavior among the elderly(29), suicidal behaviours in old age based on gender perspective(30), suicide prevention in late life(31), self-harm in the elderly(32), attempted suicide in older people(33), prevention of suicidal behaviors older people (34) and neurobiology of elderly suicide(27). In regard to the conducted systematic studies, only one of study focused on the psychological and social theories of suicide, which is somewhat similar to the present study(11). The difference is that in the mentioned non-systematic review study, discussed theories of suicide are not elderly-specific, but are general and known theories of suicide(for example, Durkheim's sociological theory(15), The helplessness Theory(35) and The Psychological Pain Theory(36)) that discuss the implications and applications of suicide theories in understanding and preventing late life suicide. In other systematic review studies, the research objectives different from those pursued in the present study. Based on our knowledge from searching in databases, there is currently no systematic review of elderly-specific suicidal models. When older people decide to end their lives by suicide, to find out of how they experience their own existence will be necessary to understand suicide and its preventive programs. Better understanding of this issue depends on the model or theories that can explain the elderly suicide by providing a testable and parsimonious multifaceted framework or model(11). In other words, a systematic review of suicide models in the elderly clarifies the underlying causal mechanisms which can be used to determine the priorities in research and prevention of late life suicide.

Objectives:

1. Identify and review existing suicidal models with a particular focus on the elderly.

Review question(s)

1. Which suicidal models are associated with suicide in older people?
2. What are the preventive implications for suicide in older people?
3. What areas are in need of research?

Methods

The method used for this study will be in accordance with the guidelines detailed on the PRISMA checklist (see supplementary appendix 1). In addition, a PRISMA flow diagram will be used to describe the flow of information at different stages of the study (37). The protocol for this article has been registered in PRISMA as CRD42017070982. Also the preferred reporting items for systematic reviews and Meta-Analyses for Protocols 2015 (PRISMA-P 2015) have been used for protocol preparation and reporting. The Enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) will also be used in this study (see supplementary appendix 2). ENTREQ consists of 21 items grouped into five main domains: introduction, methods and methodology, literature search and selection, appraisal, and synthesis of findings(38).

Eligibility criteria (inclusion and exclusion criteria)

This systematic review will peruse published studies that focus on explaining the phenomenon of the elderly suicide in the form of models and theories. Criteria for including and excluding studies are presented below.

Types of studies

In this study, the researchers intend to investigate the findings of observational studies including Cohort studies, cross-sectional studies, case-control studies, and quantitative studies including grounded theory designs published in full text from all countries and in English, in which the term model is included in the title, abstract, or key words and is a part of the primary or secondary objectives of studies. In this study, the preliminary research was conducted to identify three types of studies; similar systematic studies, similar protocols, and identification of 3 to 5 related preliminary study. However, similar systematic studies and protocols have not been found. Exclusion of experimental studies (whether randomized or not randomized) is due to the fact that as noted in the criteria for inclusion and exclusion in study,

therapeutic and interventional models will not be investigated and only the models that describe the process of suicide formation will be emphasized. The Grounded theory method is also being studied since it increases the chance of access to models and theories associated with the suicide phenomenon in the elderly. Also Commentary, opinion papers, discussion papers and editorials will be excluded from the study.

Types of Participants

The research population is the studies in which the research samples are made by:

- Elderly man or woman
- Elderly aged 60 and older
- Elderly members of the community or nursing home(sanatorium)
- Elderly have no cognitive disorders or cognitive impairments (e.g. diagnosis of clinical dementia).
- Elderly should include one of the following cases: clinical diagnosis and reports of the intense desire to death or suicidal thoughts, planning to attempt suicide and thinking about how to do it, and having a history of intentional self-harm and suicidal behaviors. This case also covers suicidal behaviors without prior planning. Older people may have lost their lives as a result of the attempt or stay in the hospital and stay alive.

Types of Suicide models

- Studies in which suicidal models are proposed in each of a variety of models Theory-based models, explanatory models, or process models are included in the study. In addition, studies that use theory, explanatory frameworks or proposals terms instead of the term model are also included.
- Studies in which models focus solely on the causality and the emergence of suicide. Therefore, therapeutic and interventional models or rehabilitation models are excluded from research.
- The statistical quantities of the findings in each of the studies will not be analyzed. Only the discussion section of each study will be investigated.
- The proposed models can cover various fields including psychological, cognitive, biological, medical, sociological, demographic, economic, provided

that they are relate to the description, prediction, and explanation of suicide in the elderly.

- The suicide in this study can include desire to die, suicidal thoughts, intentional self-harm or death resulting from suicide.

  The desire to die can be defined as a wish to expedite death and act in a way that life ends earlier(39).

  Suicide thoughts can be defined as Individual thoughts and ideas about ending life that can appear in different ways such as: suicidal thoughts without a specific method, suicidal thoughts with several non-specific methods, suicidal thoughts with a specific method in mind but without a plan, suicidal thoughts with a specific method and well-conceived plan, often called a suicidal plan(40).

  Death resulting from suicide is the final stage in the suicidal process in which the individual loses his or her life after once or several suicide attempts(40).

  Suicidal behavior is any action that could cause a person to die, such as Hanging, suffocation, drowning and medicaments and biological substances. The current study also includes Deliberate Self Harm in the elderly that is different from Non-suicidal self-injury. **Deliberate Self Harm** includes any self-directed harmful behaviors (indirect or direct), regardless of their suicidal intent. In contrast, Non-suicidal self-injury defines only directly harmful behaviors without suicidal intent(41, 42).
- Suicidal models related to non-suicidal self-injury and assisted suicide, or with the help of a physician are excluded

Information sources

Electronic databases (including: Google scholar, SCOPUS, PSYCINFO, PubMed, Web of Sciences, EMBASE, Cochrane Database of Systematic Reviews), grey literature and targeted journals (e.g. Aging & Mental Health and Archives of Suicide Research), From database inception to 30 December 2017 will be searched.

Search strategies

To search the databases, a comprehensive search strategy will be developed and we will use vocabulary unique to each database. The search strategy is conducted by discussing with experts in the fields of psychology, psychiatry, and systematic review methodology, as well as by reviewing previous related areas and identifying relevant

keywords. We will also hand search reference lists of literature of review articles and sites such as the Journal of Mental Health and Aging and the Archives of Suicide Research to ensure that all relevant articles are covered. An outline of the master search strategy for SCOPUS and PUBMED has been developed (see supplementary appendix 3).

Study records:

Data management

Endnote software will be used to manage data. Once searching from all bases is completed, all searches will be exported to a single Endnote software library in order to identify and delete similar studies and help the search process. In addition, hand search will be used to identify similar studies along with this software.

Selection process

Two independent reviewers will extract data, which will screen titles and abstracts of identified studies as well as assess the quality of full papers to minimize bias in all stages of the review. It should be noted that studies which may initially be considered relevant but ultimately excluded, will be listed in the table entitled "Characteristics of excluded studies" and the reason for removing each one is also mentioned.

Disagreement at any stage will be resolved through discussion and referring to a third reviewer. In this study, the PRISMA diagram will also be completed to illustrate the screening process and the number of studies at each stage (see supplementary appendix 4).

Data collection process

At this stage, two reviewers independently extract and manage the data of included studies using a data extraction form. At first, data extraction form is executed as a pilot and then will be corrected according to feedback received from the expert colleagues. At this stage, any disagreement between the reviewers will be resolved by discussion. If the disagreements cannot be resolved through negotiation, a third review author will act as an arbiter.

Data items

Release details: Title, journal, author, year, city, and country of study;

Design: Type of study design, the purpose of study, data collection methods, and inclusion and exclusion criteria;

Participants' profile: Number, gender, age, race, diagnosis, and other demographic information;

Study outcomes: Proposed models, key findings, discussion, limitations, practical/clinical implications and recommendations for future research.

Risk of bias in individual studies

When the primary studies are analyzed and interpreted in a systematic review, the quality assessment and susceptibility to biases are essential so that an important part in any systematic review is the quality assessment of the primary studies(43). Quality assessment of research involves appraisal of a study's internal validity, the degree to which its design, conduct and analysis have minimized biases or errors. For practical reasons, study quality assessment in reviews often covers both internal and external validity. Initially, quality assessment can be used to determine a minimum quality threshold for the selection of primary studies to be included in a review. Detailed quality assessment is then used to scrutinize the quality of included studies in order to explore quality differences as an explanation for heterogeneity in study results. This aids interpretation of the results and allows the generation of inferences to inform practice and research(44).

There are many sources of bias in methodology, which begin with the research question, such as selection bias, information bias, confounding and the overall quality of research.

Various studies have been conducted on non-interventional quality assessment tools. All the studies concluded that there is currently no agreed gold standard appraisal tool (44-47). Although strengthening the reporting of observational studies in epidemiology (STROBE) seems to be the only tool available for this type of studies, but this tool is used for the reporting of observational studies rather than assessing the quality of the primary studies(48). Since in this study both quantitative and qualitative studies are considered, appropriate tools will be used for each one:

For the observational studies Newcastle-Ottawa Scale (NOS) and Newcastle-Ottawa (see supplementary appendix 5) Scale adapted for cross-sectional studies are used (see supplementary appendix 6).

NOS has been created as a result of the continuous collaboration between the universities of Newcastle, Australia, and Ottawa. This tool was developed using a Delphi process and then, tested on systematic reviews. NOS is divided into two separate scales including Cohort studies and control case studies. Eight items and a

set of response options have been considered for both scales. A 'star system' has been developed in which a study is judged on three broad perspectives: the selection of the study groups; the comparability of the groups; and the ascertainment of either the exposure or outcome of interest for case-control or cohort studies respectively. The star system allows for a semi- quantitative assessment of the quality of the study so that a maximum of one star for each item is allocated to the highest quality of studies.There is only one exception to the comparability that can be assigned up to two stars. The range of stars in NOS is 0 to 9 stars(49). Newcastle-Ottawa Scale adapted for cross-sectional studies uses the same star system in main scale only with the difference that on this scale received 5 star for the dimension of selection, 2 stars for the dimension of comparability, and 3 stars for the dimension of Outcome indicate the high quality of the study(50, 51).

Since there is no agreement on how to assess qualitative evidence, a limited set of criteria may not able to apply to all types of qualitative studies(52). Therefore, in this study two different methods are used to evaluate the quality of qualitative studies: The Critical Appraisal Skills Programme (CASP) and the evaluative criteria of credibility, transferability, dependability and confirmability(see supplementary appendix 7). The CASP tool is generally appropriate for a variety of qualitative study designs. The tool consists of 10 questions and prompts. studies will be rated as "high quality" for studies that meet 8 of the 10 criteria, " medium quality" for studies that meet 5 to 7 of the criteria, and "low quality" if they meet 4 or less (52). Although CASP assesses reporting and the methodology quality, it does not address aspects of the research validity. Thus, the evaluative four criteria of credibility, transferability, dependability, and confirmability which provided by Cochran, will be applied (53).

Two independent reviewers complete the quality assessment tool for the included studies. Any conflict in evaluations will be discussed and agreement will be reached through consensus, or may be consulted by a third reviewer. It should be noted that appropriate and special tools will be used (or will be developed If not available) for the included studies that cannot assess the methodological quality with the mentioned tools.

Data synthesis

The final report will be divided into three parts: (1) a range of suicide models will be presented in a form with a list of subgroups. The list of subgroups may include the type of suicide model (e.g. Theory-based, explanatory, or process models), various

fields of models (e.g. demographic, psychological, social, biological, etc.), characteristics of samples (patient and non-patient, community resident, settled in hospice, gender, and age), suicide steps (death wishes, ideation, attempted suicide and death resulting from suicide). (2) The type of Implications (Implications for families, Implications for government and non-government organizations (NGOs), Implications for clinicians). (3) Future research. Then different models will be compared with each other and their differences and similarities will be discussed. One of the preliminary strategies in this regard would be to provide a narrative synthesis of the findings including a qualitative analysis of the models. Implications and Future research recommendations provided will be based on included models. In other words, the implications and areas in need of research can both be directly extracted from the discussion section of the studies, in which case practical/clinical and research recommendations may vary according to the type of model or theory, and be indirectly derived from the authors' conclusion and interpretation. The authors' conclusion and interpretation is based on comparison of the implications and areas in need of research derived from each of the models in terms of the most important and most frequent recommendations**.**

Discussion

This systematic review will provide a detailed account of the existing evidence in relation to life late suicide. The synthesis of review findings in present study will assess both the limitations of identified studies and any limitations in our own review methodology. Once a large volume of studies are identified as a result of a first search, we will use a multiple reviewer team to minimize the risk of bias. To make a multiplayer team is also useful for reduce time. The findings of this review will be of interest to mental health professionals and those who are in contact with suicidal older people. Suicidal models of the elderly can help in the evaluation, diagnosis, and design of interventions and more effective prevention of late life suicide. The findings of this review study can also be compared with findings from other studies on the elderly suicide. Finally, the discussion section will present key findings, study limitations, implications and recommendations for future research as well as practical/clinical considerations to the experts.

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Contributors: MR, SJY, FMS, SKM and MF contributed to the concept and study design. MR and MF contributed to the initial drafting and critical revision and approved the manuscript for submission. All the authors contributed to the revision of the manuscript and approved the final version. Any discrepancies will be resolved by consensus between the two authors.

Competing interests: none declared.

Provenance and peer review: not commissioned; externally peer reviewed.

Data sharing statement: All recorded data from the data extraction process will be available on request to the extent that they are not included in the Systematic review article

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PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: Recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Reported (Section)
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	Yes (Title)
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 (such as PROSPERO) and registration number	Yes (Abstract, Registration number)
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	Yes (Title page)
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	Yes (Contributions)
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	Yes (Amendments)
Support:			
Sources	5a	Indicate sources of financial or other support for the review	Yes (Funding statement)
Sponsor	5b	Provide name for the review funder and/or sponsor	Yes (Funding statement)
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	N/a
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	Yes (Introduction, Rationale)
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	Yes (Introduction, Objectives)

METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	Yes (Methods, Eligibility criteria)
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	Yes (Methods, Information sources)
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	Yes (Methods, Search)
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	Yes (Methods, Study records)
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	Yes (Methods, Study records)
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	Yes (Methods, Study records)
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	Yes (Methods, Data items)
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	Phenomenon of interest is defined. (Outcomes and prioritisation, Phenomenon of interest)
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	Appraisal of study quality is described. (Outcomes and prioritisation, Appraisal of study quality)
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	N/a
	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 (such as I^2, Kendall's τ)	N/a

	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	N/a
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	Thematic synthesis will be applied. (Outcomes and prioritisation, Data synthesis)
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	N/a
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	The ConQual approach will be adopted. (Outcomes and prioritisation, Confidence in the synthesised qualitative findings)

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.

Enhancing transparency in reporting the synthesis of qualitative research: the ENTREQ statement

No	Item	Guide and description
1	Aim	State the research question the synthesis addresses.
2	Synthesis methodology	Identify the synthesis methodology or theoretical framework which underpins the synthesis, and describe the rationale for choice of methodology
3	Approach to searching	Indicate whether the search was pre-planned
4	Inclusion criteria	Specify the inclusion/exclusion criteria
5	Data sources	Describe the information sources used and when the searches conducted; provide the rationale for using the data sources.
6	Electronic Search strategy	Describe the literature search
7	Study screening methods	Describe the process of study screening and
8	Study characteristics	Present the characteristics of the included studies
9	Study selection results	Identify the number of studies screened and provide reasons for study exclusion
10	Rationale for appraisal	Describe the rationale and approach used to appraise the included studies or selected findings
11	Appraisal items	State the tools, frameworks and criteria used to appraise the studies or selected findings
12	Appraisal process	Indicate whether the appraisal was conducted independently by more than one reviewer and if consensus was required.
13	Appraisal results	Present results of the quality assessment and indicate which articles, if any, were weighted/excluded based on the assessment and give the rationale.
14	Data extraction	Indicate which sections of the primary studies were analysed and how were the data extracted from the primary studies?
15	Software	State the computer software used, if any.
16	Number of	Identify who was involved in coding and analysis.

	reviewers	
17	Coding	Describe the process for coding of data
18	Study comparison	Describe how were comparisons made within and across studies
19	Derivation of themes	Explain whether the process of deriving the themes or constructs was inductive or deductive.
20	Quotations	Provide quotations from the primary studies to illustrate themes/constructs, and identify whether the quotations were participant quotations of the author's interpretation.
21	Synthesis output	Present rich, compelling and useful results that go beyond a summary of the primary studies

From: Tong A, Flemming K, McInnes E, Oliver S, Craig .(2012). Enhancing transparency in reporting the synthesis of qualitative research: ENTREQ. BMC Medical Research Methodology, 12(1):181.

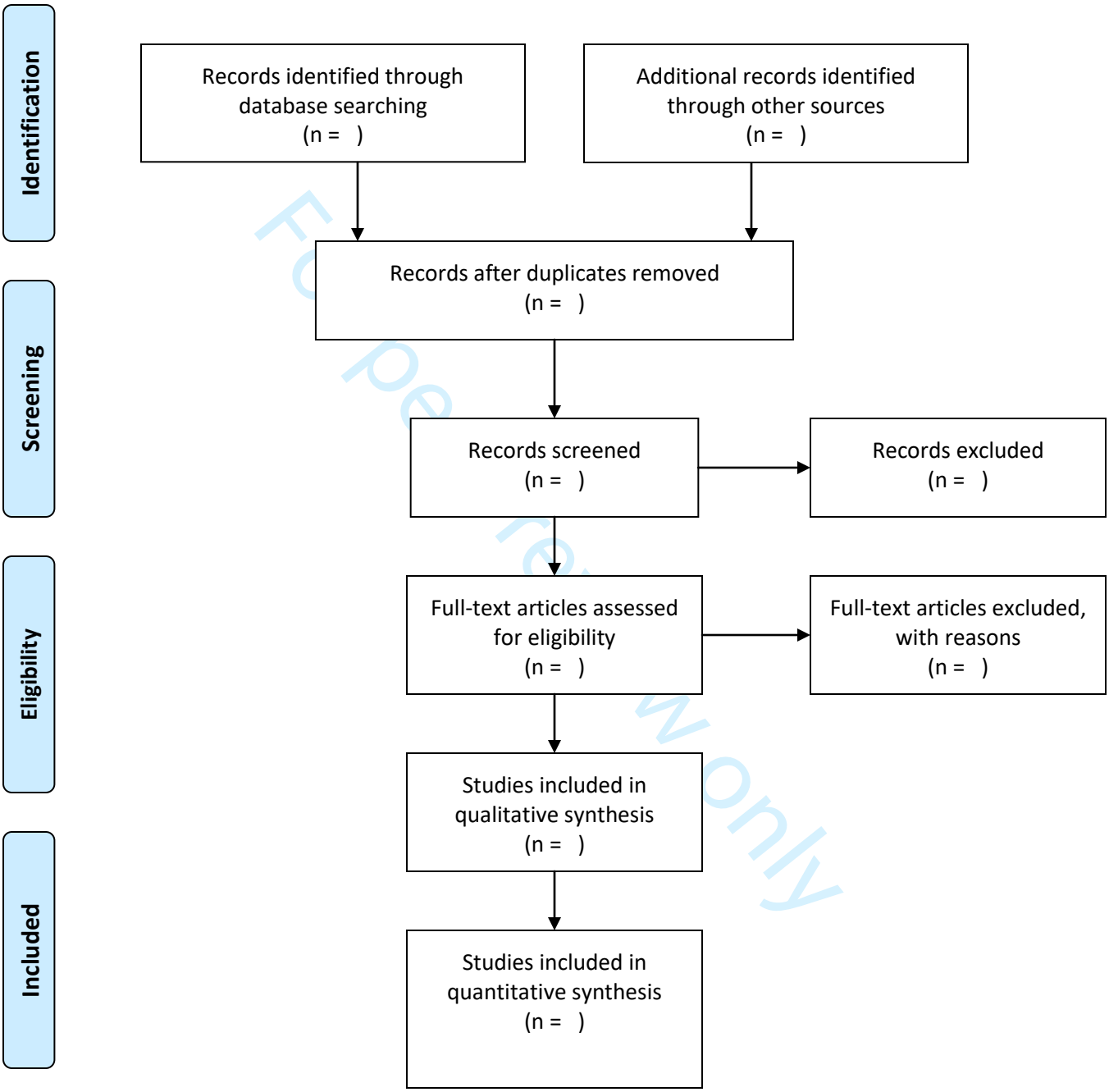
Final syntax in SCOPUS:
(TITLE-ABS(suicid*) OR TITLE-ABS(death wishes)) OR TITLE ABS(deliberate self-harm[1])) AND (TITLE-ABS(model*) OR TITLE-ABS(theory) OR TITLE ABS(Framework) OR TITLE ABS(proposal)) AND (TITLE-ABS(old*) OR ALL(old*) OR ALL(eld*) OR ALL(geriatric*) OR ALL(aging) OR ALL(ageing) OR ALL(age*) OR ALL("later life") OR ALL(senior) OR ALL(nonagenarian) OR ALL(octogenarian) OR ALL(centenarian)) AND (PUBYEAR < 2017)

Our initial search syntax for PubMed will be

(suicid[tiab] OR death wishes [tiab] OR deliberate self-harm[tiab]) AND (model[tiab] OR theory [tiab] OR Framework [tiab] OR proposal [tiab]) AND (old[tiab] OR old*[tiab]OR eld* OR geriatric* OR aging OR ageing OR age* OR "later life" OR senior OR nonagenarian OR octogenarian OR centenarian) AND 30-12-2017[dp]

[1] Non-suicidal self-injury is different from Deliberate self-harm and does not include study.

PRISMA 2009 Flow Diagram



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

CODING MANUAL FOR CASE-CONTROL STUDIES

SELECTION

1) Is the Case Definition Adequate?

a) Requires some independent validation (e.g. >1 person/record/time/process to extract information, or reference to primary record source such as x-rays or medical/hospital records) ☆
b) Record linkage (e.g. ICD codes in database) or self-report with no reference to primary record
c) No description

2) Representativeness of the Cases

a) All eligible cases with outcome of interest over a defined period of time, all cases in a defined catchment area, all cases in a defined hospital or clinic, group of hospitals, health maintenance organisation, or an appropriate sample of those cases (e.g. random sample) ☆
b) Not satisfying requirements in part (a), or not stated.

3) Selection of Controls

This item assesses whether the control series used in the study is derived from the same population as the cases and essentially would have been cases had the outcome been present.

a) Community controls (i.e. same community as cases and would be cases if had outcome) ☆
b) Hospital controls, within same community as cases (i.e. not another city) but derived from a hospitalised population
c) No description

4) Definition of Controls

a) If cases are first occurrence of outcome, then it must explicitly state that controls have no history of this outcome. If cases have new (not necessarily first) occurrence of outcome, then controls with previous occurrences of outcome of interest should not be excluded. ☆
b) No mention of history of outcome

COMPARABILITY

1) Comparability of Cases and Controls on the Basis of the Design or Analysis

A maximum of 2 stars can be allotted in this category

Either cases and controls must be matched in the design and/or confounders must be adjusted for in the analysis. Statements of no differences between groups or that differences were not statistically significant are not sufficient for establishing comparability. Note: If the odds ratio for the exposure of interest is adjusted for the confounders listed, then the groups will be considered to be comparable on each variable used in the adjustment.

There may be multiple ratings for this item for different categories of exposure (e.g. ever vs. never, current vs. previous or never)

Age =☆ , Other controlled factors = ☆

EXPOSURE

1) Ascertainment of Exposure

Allocation of stars as per rating sheet

2) Non-Response Rate

Allocation of stars as per rating sheet

CODING MANUAL FOR COHORT STUDIES

SELECTION

1) Representativeness of the Exposed Cohort

Item is assessing the representativeness of exposed individuals in the community, not the representativeness of the sample of women from some general population. For example, subjects derived from groups likely to contain middle class, better educated, health oriented women are likely to be representative of postmenopausal estrogen users while they are not representative of all women (e.g. members of a health maintenance organisation (HMO) will be a representative sample of estrogen users. While the HMO may have an under-representation of ethnic groups, the poor, and poorly educated, these excluded groups are not the predominant users users of estrogen).

Allocation of stars as per rating sheet

2) Selection of the Non-Exposed Cohort

Allocation of stars as per rating sheet

3) Ascertainment of Exposure

Allocation of stars as per rating sheet

4) Demonstration That Outcome of Interest Was Not Present at Start of Study

In the case of mortality studies, outcome of interest is still the presence of a disease/ incident, rather than death. That is to say that a statement of no history of disease or incident earns a star.

COMPARABILITY

1) Comparability of Cohorts on the Basis of the Design or Analysis

A maximum of 2 stars can be allotted in this category
Either exposed and non-exposed individuals must be matched in the design and/or confounders must be adjusted for in the analysis. Statements of no differences between groups or that differences were not statistically significant are not sufficient for establishing comparability. Note: If the relative risk for the exposure of interest is adjusted for the confounders listed, then the groups will be considered to be comparable on each variable used in the adjustment.
There may be multiple ratings for this item for different categories of exposure (e.g. ever vs. never, current vs. previous or never)
Age = ☆ , Other controlled factors = ☆

OUTCOME

1) Assessment of Outcome

For some outcomes (e.g. fractured hip), reference to the medical record is sufficient to satisfy the requirement for confirmation of the fracture. This would not be adequate for vertebral fracture outcomes where reference to x-rays would be required.

a) Independent or blind assessment stated in the paper, or confirmation of the outcome by reference to secure records (x-rays, medical records, etc.) ☆
b) Record linkage (e.g. identified through ICD codes on database records) ☆
c) Self-report (i.e. no reference to original medical records or x-rays to confirm the outcome)
d) No description.

2) Was Follow-Up Long Enough for Outcomes to Occur

An acceptable length of time should be decided before quality assessment begins (e.g. 5 yrs. for exposure to breast implants)

3) Adequacy of Follow Up of Cohorts

This item assesses the follow-up of the exposed and non-exposed cohorts to ensure that losses are not related to either the exposure or the outcome.

Allocation of stars as per rating sheet

Newcastle-Ottawa Scale adapted for cross-sectional studies

Selection: (Maximum 5 stars)

1) Representativeness of the sample:
- a) Truly representative of the average in the target population. * (all subjects or random sampling)
- b) Somewhat representative of the average in the target population. * (non-random sampling)
- c) Selected group of users.
- d) No description of the sampling strategy.

2) Sample size:
- a) Justified and satisfactory. *
- b) Not justified.

3) Non-respondents:
- a) Comparability between respondents and non-respondents characteristics is established, and the response rate is satisfactory. *
- b) The response rate is unsatisfactory, or the comparability between respondents and non-respondents is unsatisfactory.
- c) No description of the response rate or the characteristics of the responders and the non-responders.

4) Ascertainment of the exposure (risk factor):
- a) Validated measurement tool. **
- b) Non-validated measurement tool, but the tool is available or described.*
- c) No description of the measurement tool.

Comparability: (Maximum 2 stars)

1) The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled.
- a) The study controls for the most important factor (select one). *
- b) The study control for any additional factor. *

Outcome: (Maximum 3 stars)

1) Assessment of the outcome:
- a) Independent blind assessment. **
- b) Record linkage. **
- c) Self report. *
- d) No description.

2) Statistical test:
- a) The statistical test used to analyze the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p value). *
- b) The statistical test is not appropriate, not described or incomplete.

Appendix 6. Quality appraisal: CASP Qualitative Checklist and Evaluative criteria for Trustworthiness.

Title: …… Author(s) and date: …… Study No: …… **Critical Appraisal Skills Programme Qualitative Checklist.**	**Yes**	**No**	**Can't answer**
1. Was there a clear statement of the aims of the research? *What was the goal of the research? Why it was thought important?*			
2. Is a qualitative methodology appropriate? *If the research seeks to interpret or illuminate the actions and/or subjective experiences of research participants. Is qualitative research the right methodology for addressing the research goal?*			
3. Was the research design appropriate to address the aims of the research? *If the researcher has justified the research design (e.g. have they discussed how they decided which method to use)?*			
4. Was the recruitment strategy appropriate to the aims of the research? *If the researcher has explained how the participants were selected. If they explained why the participants they selected were the most appropriate to provide access to the type of knowledge sought by the study. If there are any discussions around recruitment (e.g. why some people chose not to take part).*			
5. Was the data collected in a way that addressed the research issue? *If the setting for data collection was justified. If the researcher has justified the methods chosen. If the researcher has made the methods explicit (e.g. for interview method, is there an indication of how interviews were conducted, or did they use a topic guide)? If the methods were modified during the study. If so, has the researcher explained how and why? If the form of data is clear (e.g. tape recordings, video material, notes etc). If the form of data is clear (e.g. tape recordings, video material, notes etc). if the researcher has discussed saturation of data.*			
6. Has the relationship between researcher and participants been adequately considered? *If the researcher critically examined their own role, potential bias and influence during (a) Formulation of the research questions (b) Data collection, including sample recruitment and choice of location How the researcher responded to events during the study and whether they considered the implications of any changes in the research design.*			
7. Have ethical issues been taken into consideration? *If there are sufficient details of how the research was explained to participants for the reader to assess whether ethical standards were maintained If the researcher has discussed issues raised by the study (e.g. issues around informed consent or confidentiality or how they have handled the effects of the study on the participants during and after the study). If approval has been soughtfrom the ethics committee.*			
8. Was the data analysis sufficiently rigorous? *If there is an in-depth description of the analysis process If thematic analysis is used. If so, is it clear how the categories/themes were derived from the data? Whether the researcher explains how the data presented were selected from the original sample to demonstrate the analysis process. If sufficient data are presented to support the findings. To what extent contradictory data are taken into account. Whether the researcher critically examined their own role, potential bias and influence during analysis and selection of data for presentation.*			
9. Is there a clear statement of findings? *If the findings are explicit If there is adequate discussion of the evidence both for and against the researchers' arguments. If the researcher has discussed the credibility of their findings (e.g. triangulation, respondent validation, more than one analyst). If the findings are discussed in relation to the original research question.*			
10. How valuable is the research? *If the researcher discusses the contribution the study makes to existing knowledge or understanding e.g. do they consider the findings in relation to current practice or policy or relevant research-based literature? If they identify new areas where research is necessary If the researchers have discussed*			

whether or how the findings can be transferred to other populations or considered other ways the research may be used.			
Criteria for trustworthiness based on Creswell (2007) and Cohen & Crabtree (2006)	Reviewer's assessment (Technique applied? How?)		
Credibility			
Prolonged engagement and persistent observation. Do the researchers spend sufficient time in the field, observe, talk to different people, build relationships, check for misinformation stemming from the researcher or the informants?			
Triangulation. Do the researchers make use of multiple data sources, investigators, theories to enhance understanding and ensure a rich and robust account of the study inquiry?			
Peer review or debriefing. "External check of the research process" (Creswell, 2007; p.208) or exposition of the research process to an unaffected peer. Do sessions between the researcher and a peer take place? Are written accounts of these sessions being kept?			
Negative case analysis. Do the researchers take account of the data that do not fit with emerging patterns or explanations? Do they revise the initial hypotheses and analysis until it accounts for the majority of cases?			
Referential adequacy. "Identifying a portion of data to be archived, but not analysed. The researcher then conducts the data analysis on the remaining data and develops preliminary findings. The researcher then returns to this archived data and analyses it as a way to test the validity of his or her findings" (Cohen & Crabtree, 2006).			
Member checking. Do the researchers take data, analyses, interpretations, conclusions back to the participants to evaluate the truthfulness of the account?			
Transferability			
Thick description refers to "describing and interpreting observed social action (or behaviour) within its particular context" (Ponterotto, 2006) Does the author achieve to give a sense of verisimilitude? Does the author describe in detail each part of the study (fully describing the study participants; settings and procedures, such as location and length of the interviews, recording procedures, interviewer's and interviewee's reactions; results, e.g. long quotes from the participants or the interview dialogue; successfully bringing together the participants' experiences with the researchers' interpretation of those in discussion)?			
Dependability			
External audit. ("Inquiry audit") Is there an "external consultant", who is not part of the study, examining the process and product of the study?			
Confirmability			
External audit ("confirmability audit")			
Reflexivity. (Clarification of researcher bias) Are the authors reflexive, i.e. do they "identify the perspectives they bring to their studies as insiders and/ or outsiders" and ways through which those affect "how they analyse, interpret and report the findings" (Sparkes & Smith, 2014: p 181-3). Is there a "critical friend" to help in this process?			
Triangulation (as above)			
Audit trail. Is the process of the study transparent and trackable? Do the researchers provide descriptions of the decision making process in detail?			

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Models of suicide in elderly: a protocol for systematic review

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-022087.R1
Article Type:	Protocol
Date Submitted by the Author:	17-May-2018
Complete List of Authors:	rostami, mohammad; Department of Counseling, University of Social Welfare and Rehabilitation Sciences Younesi, Seyed Jalal ; Department of Counseling, University of Social Welfare and Rehabilitation Sciences Mohammadi shahboulaghi, Farahnaz; Department of gerontology & nursing university of social welfare and rehabilitation sciences Malakouti, Seyedkazem; Tehran Psychiatric Institute, Foroughan, Mahshid; Department of Aging, University of Social Welfare and Rehabilitation Sciences
Primary Subject Heading:	Global health
Secondary Subject Heading:	Mental health
Keywords:	suicide, elderly, model

Models of suicide in elderly: a protocol for systematic review[1]

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Abstract

Introduction: Rates of suicide in older populations are generally higher than other age groups. Models of suicide explaining the phenomenon of suicide in later life may have research, clinical, and educational implications for the field of aging. The main purpose of this systematic review is to identify and review existing models of suicide with a particular focus on elderly.

Methods and analysis: The authors will review the findings of observational studies including cohort studies, cross-sectional studies, case-control studies, and qualitative studies including grounded theory designs published in the databases of Google Scholar, SCOPUS, PSYCINFO, PubMed, Web of Sciences, Cochrane Database of Systematic Reviews, and research-related journals. The models of suicide which are specifically describe, explain, and predict late life suicides are included. The therapeutic, interventional, and rehabilitation models as well as the models related to assisted suicide are excluded. Endnote software is used for data management. Two independent reviewers will extract data. For quantitative studies, The Newcastle-Ottawa Scale (NOS) and Newcastle-Ottawa Scale adapted for cross-sectional studies and for qualitative studies, the Critical Appraisal Skills Program (CASP) and the

[1] Article Number 1, Ph.D. dissertation of Mohammad Rostami entitled "Explaining the Process of the Formation of Suicidal Thoughts and Sentiment in the Elderly.

evaluative criteria of credibility, transferability, dependability and confirmability will be used to evaluate the risk of bias and quality of methodology of the preliminary studies. The final report will present a range of models of suicide in a form with a list of different subgroups.

Ethics and publication: There are no predictable ethical issues related to this research. The findings will be published in prestigious journals, and will be presented in international and national conferences.

Registration number: This systematic review protocol is registered in the PROSPERO International Prospective Register of Systematic Reviews, with registration number of CRD42017070982

Keywords: suicide, elderly, model.

Strengths and limitations of this study:

1. The present systematic review is the first one to study the suicide-specific models of elderly through search of various databases.

2. To minimize potential bias, each process of initial screening, data extraction, and quality evaluation will be performed by two independent reviewers.

3. The limitation of this study is searching and reviewing studies in English only. This limitation may cause language bias.

Introduction

Population aging has been one of the most major challenges is occurring in health areas during recent decades. The global over 60-year old population is projected to increase from 10% in 2000 to 21% in 2050(1). Although later life is defined as a period of life accompanying by higher levels of well-being, a wider meaning of life and a better emotion regulation, getting older is also associated with physical illnesses, cognitive deficits and socio-economical changes which can be felt as a threat to individual and increase risk of depression and suicide (2). The suicide rate reported as higher among older people compared to other age groups in many countries of the world (3).

Suicide has known as an important public health issue which is attracting global attention, recently. Suicide defines as a deliberate and intentional act to terminate

own life(4). Suicide rates among older population have been estimated in a number of studies (5, 6). Given the increasing population of older people, it can be predicted that the number of elderly who die from suicide is likely to increase in the forthcoming decades(7).

Most authors are agreed upon that no single risk factor alone can predict suicide ideation and behavior among older population. For example, psychiatric illnesses, especially depression, are mentioned as the strongest risk factors for suicide in older people(8), while some studies have shown that many older people with a history of suicide have not previously experienced symptoms of depression(9, 10). In addition, clinical trials based on the identified risk factors of suicide have not clearly indicated that how preventive interventions work (3). It is, therefore, important to go beyond the surface of current knowledge and dig in more deeper to see which risk factors really contribute to suicide and how they interact with each other(11). Here, as claimed, only models and theories can describe the suicide phenomenon comprehensively, reveal the present knowledge gaps, provide guidance for future research, and propose practical considerations(11). Accordingly, an open question has been raised by some researchers in the field of aging that whether a specific model for late life suicide is useful or not and, if so, how it can help us in a better understanding of the experience of aging (3). Such a model stands on the assumption that late life suicide is a different phenomenon compared to the suicide happens in other periods of life in terms of etiology and even epidemiology.

Looking at the current knowledge, we see that suicide and suicidal behavior have been studied using different and often contradictory theoretical and experimental models, including epidemiological (12), philosophical(13), social and socio-cultural(14, 15), Psychiatric (16), psychoanalytical (17), and neurobiological(18); To this long list, cognitive theories of suicide(19), family system theory(20), interpersonal theory (21) and Motivational-Volitional Theory of Suicide(22) can be added. Although, these theories are not designed for a certain age range, they can be accommodated according to the positive and negative events that older people face during their aging process(3, 23), and may have implications for explaining and understanding the etiology of old age suicide (11). Meanwhile, some other theories have been specifically designed to explain suicide in elderly which are mostly focused on either psychological, especially emotion and cognition(24), developmental and longevity (25), demographic and epidemiological(26), or

neurobiological (27) aspects of suicide. For example, the neurobiological models of suicide in later life, generally, believe in a biological pathway, including some responsible genes, vascular diseases, or degenerative processes which are leading to vulnerabilities and in combination with late life events, may increase the risk of suicide attempts(27).

To date a number of systematic and narrative reviews have been carried out in the area of late life suicide such as comprehensive review of psychological and social theories of elderly suicide(11), physical diseases, functional weaknesses and suicidal behavior among elderly(28), suicidal behaviors in old age based on gender perspective(29), suicide prevention in late life(30), self-harm in elderly(31), attempted suicide in older people(32), prevention of suicidal behaviors of older people (33) and neurobiology of elderly suicide(27), etc. Most of the narrative reviews, focused on the theories that are not later life-specific; They mostly describe general and known theories of suicide(for example, Durkheim's sociological theory(15), The helplessness Theory(34) and The Psychological Pain Theory(35)) with their implications and applications in the understanding and preventing late life suicide. Systematic reviews on suicide models have been mostly age- non-specific and based on our knowledge coming from searching the known databases, currently there is no systematic review focusing on old age-specific models of suicide. Considering that in many countries, the older people have the highest suicide rates among all age groups(27, 28), and suicidal behaviors of older people have a more deadly profile compared to younger ones with a ratio of attempted/die by suicide of 4:1 vs. 200:1(36), the importance of exploring the nature and process of suicidal ideation and suicidality in the aged becomes more evident. By adding to this scenario, the fact that population aging will lead to increased number of death by suicide in later life very soon, the necessity of doing more study in this field multiplied(27). Better understanding of this issue depends on the theories that can explain the old age suicide by providing a testable and parsimonious multifaceted framework or model(11). Therefore, a systematic review of models of suicide in old age clarifies the underlying causal mechanisms which can be used to determine the priorities in both the research field and prevention of late life suicide.

Objectives:

1. To identify and review existing models of suicide with a particular focus on late life suicide.

Review question(s)

1. Which models of suicide are considering suicide in older people?
2. What are the preventive implications of these models for suicide in older people?
3. What are the areas in need of more research?

Methods

The method used for this study will be in accordance with the guidelines detailed on the PRISMA checklist (see supplementary appendix 1). In addition, a PRISMA flow diagram will be used to describe the flow of information at different stages of the study (37). The protocol for this article has been registered in PRISMA as CRD42017070982. Also the preferred reporting items for systematic reviews and Meta-Analyses for Protocols 2015 (PRISMA-P 2015) have been used for protocol preparation and reporting. The Enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) will also be used in this study (see supplementary appendix 2). ENTREQ consists of 21 items grouped into five main domains: introduction, methods and methodology, literature search and selection, appraisal, and synthesis of findings(38).

Eligibility criteria (inclusion and exclusion criteria)

This systematic review will peruse published studies that focus on explaining the phenomenon of later life suicide in the form of models and theories. Criteria for including and excluding studies are presented below.

Types of studies

This study intended to investigate the findings of observational studies including cohort studies, cross-sectional studies, case-control studies, and qualitative studies including grounded theory designs published in full text from all countries, in English, in which the term model is included in the title, abstract, or key words and is a part of the primary or secondary objectives of the study. In the present study, first, a preliminary search was conducted with the object to identify three types of studies: similar systematic studies, similar protocols, and identification of 3 to 5 related preliminary studies. However, similar systematic studies and protocols have not been found. Based on the study inclusion/exclusion criteria, experimental studies (whether randomized or not) based on therapeutic and interventional models will be excluded and only the models that describe how suicide ideation and behavior are formed will

be emphasized. The Grounded theory studies is also being considered since they increase the chances of access to models and theories associated with the suicide phenomenon in elderly. Also Commentary, opinion papers, discussion papers and editorials will be excluded from the study.

Types of Participants

Those studies consist of research samples with the following characteristics will be selected:

- Elderly man or woman
- Elderly aged 60 and older
- Elderly who are residing in community or nursing home(sanatorium)
- Elderly who are not affected by cognitive disorders or cognitive impairments (e.g. diagnosis of clinical dementia).
- Elderly categorized as one of the following cases: clinical reports showing the intense desire to die or having suicidal thoughts, planning to attempt suicide and thinking about how to do it, and having a history of intentional self-harm and suicidal behaviors. This last case also covers suicidal behaviors without prior planning. Cases may have lost their lives as a result of the attempt or be stayed at the hospital and stay alive. In addition to clinical reports and hospital samples, studies using national mortality databases will also be included.

Types of models of suicide

- Those studies in which the models proposed for suicide are Theory-based models, explanatory models, or process models will be included in our study.
- Solely, the studies considering the models which focus on the causality and the emergence of suicide will be included; Therapeutic and interventional models or rehabilitation models are excluded.
- Only the discussion section of the studies, not the statistical part, will be investigated.
- The proposed models can cover various fields including psychological, biological, medical, sociological, demographic, and economic, provided that they relate to the description, prediction, and explanation of suicide in elderly.
- The suicide in this study can include desire to die, suicidal thoughts, intentional self-harm or death resulting from suicide.

The desire to die can be defined as a wish to expedite death and act in a way that life ends earlier(39).

Suicide thoughts can be defined as Individuals' thoughts and ideas about ending his/her own life that can appear in different ways such as: suicidal thoughts without a specific method, suicidal thoughts with several non-specific methods, suicidal thoughts with a specific method in mind but without a plan, suicidal thoughts with a specific method and well-conceived plan, often called a suicide plan(40).

Death resulting from suicide is the final stage in the suicide process in which the individual loses his or her life after once or several suicide attempts(40).

Suicidal behavior is any action that could cause a person to die, such as hanging, suffocation, drowning and medicaments and biological substances. The current study also includes Deliberate Self Harm in elderly that is different from Non-suicidal self-injury. **Deliberate Self Harm** includes any self-directed harmful behaviors (indirect or direct), regardless of their suicidal intent. In contrast, Non-suicidal self-injury defines only directly harmful behaviors without suicidal intent(41, 42).

- Models of suicide related to non-suicidal self-injury and assisted suicide with the help of a physician are excluded

Information sources

Electronic databases (including: Google scholar, SCOPUS, PSYCINFO, PubMed, Web of Sciences, EMBASE, Cochrane Database of Systematic Reviews), grey literature and targeted journals (e.g. Aging & Mental Health, Suicide and Life Threatening Behavior, Archives of Suicide Research and Suicidology Online), From database inception to 30 December 2017 will be searched.

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Search strategies

To search the databases, a comprehensive search strategy will be developed and the vocabulary unique to each database will be used. The search strategy is conducted by discussing with experts in the fields of psychology, psychiatry, and systematic review methodology, as well as by reviewing the related areas and identifying relevant keywords. We will also hand search reference lists of the literature of review articles and sites such as Aging & Mental Health, Suicide and Life Threatening Behavior,

Archives of Suicide Research and Suicidology Online to ensure that all relevant articles are covered. An outline of the master search strategy for SCOPUS and PUBMED has been developed (see supplementary appendix 3).

Study records:

Data management

Endnote software will be used to manage data. Once searching from all bases is completed, all searches will be exported to a single Endnote software library in order to identify and delete similar studies and help the search process. In addition, hand search will be used to identify similar studies along with this software.

Selection process

Two independent reviewers will extract data, screening titles and abstracts of the identified studies as well as assessing the quality of full papers to minimize bias in all stages of the review. Studies which may initially be considered as relevant but ultimately are excluded, will be listed in the table entitled "Characteristics of excluded studies" and the reason for removing each one is also mentioned.

Disagreement at any stage will be resolved through discussion and referring to a third reviewer. In this study, the PRISMA diagram will also be completed to illustrate the screening process and the number of studies at each stage (see supplementary appendix 4).

Data collection process

At this stage, two reviewers independently extract and manage the data of included studies using a data extraction form. At first, data extraction form is executed as a pilot and then will be corrected according to the feedback received from the expert colleagues. At this stage, any disagreement between the reviewers will be resolved by discussion. If the disagreements cannot be resolved through negotiation, a third review author will act as an arbiter. Also data will be collected electronically using Census and Survey Processing System (CSPro) software.

Data items

Release details: Title, journal, author, year, city, and country of study;

Design: Type of study design, the purpose of study, data collection methods, and inclusion and exclusion criteria;

Participants' profile: Number, gender, age, race, diagnosis, and other demographic information;

Study outcomes: Proposed models, key findings, discussion, limitations, practical/clinical implications and recommendations for future research.

Risk of bias in individual studies

When the primary studies are analyzed and interpreted in a systematic review, the quality assessment and evaluation of susceptibility to biases are essential so that an important part in any systematic review is the quality assessment of the primary studies(43). Quality assessment of research involves appraisal of a study's internal validity, the degree to which its design, conduct and analysis have minimized biases or errors. For practical reasons, study quality assessment in reviews often covers both internal and external validity. Initially, quality assessment can be used to determine a minimum quality threshold for the selection of primary studies to be included in a review. Detailed quality assessment is then used to scrutinize the quality of included studies in order to explore quality differences as an explanation for heterogeneity in study results. This aids interpretation of the results and allows the generation of inferences to inform practice and research(44).

There are many sources of bias in methodology, which begin with the research question, such as selection bias, information bias, confounding and the overall quality of research.

Various studies have been conducted on non-interventional quality assessment tools. All the studies concluded that there is currently no agreed gold standard appraisal tool (44-47). Although strengthening the reporting of observational studies in epidemiology (STROBE) seems to be the only tool available for this type of studies, but this tool is used for the reporting of observational studies rather than assessing the quality of the primary studies(48). Since in this study both quantitative and qualitative studies are considered, appropriate tools will be used for each one:

For the observational studies Newcastle-Ottawa Scale (NOS) and Newcastle-Ottawa (see supplementary appendix 5) Scale adapted for cross-sectional studies are used (see supplementary appendix 6).

NOS was created as a result of the continuous collaboration between the universities of Newcastle, Australia, and Ottawa. This tool was developed using a Delphi process and then, tested on systematic reviews. NOS is divided into two separate scales including Cohort studies and case control studies. Eight items and a set of response

options have been considered for both scales. A 'star system' has been developed in which a study is judged on three broad perspectives: the selection of the study groups; the comparability of the groups; and the ascertainment of either the exposure or outcome of interest for case-control or cohort studies respectively. The star system allows for a semi- quantitative assessment of the quality of the study so that a maximum of one star for each item is allocated to the highest quality of studies.There is only one exception to the comparability that can be assigned up to two stars. The range of stars in NOS is 0 to 9 stars(49). Newcastle-Ottawa Scale adapted for cross-sectional studies uses the same star system in main scale only with the difference that on this scale received 5 star for the dimension of selection, 2 stars for the dimension of comparability, and 3 stars for the dimension of Outcome indicate the high quality of the study(50, 51).

Since there is no agreement on how to assess qualitative evidence, a limited set of criteria may not able to apply to all types of qualitative studies(52). Therefore, in this study two different methods are used to evaluate the quality of qualitative studies: The Critical Appraisal Skills Program (CASP) and the evaluative criteria of credibility, transferability, dependability and confirmability(see supplementary appendix 7). The CASP tool is generally appropriate for a variety of qualitative study designs. The tool consists of 10 questions and prompts. Studies will be rated as "high quality", if they meet 8 of the 10 criteria, " medium quality" if they meet 5 to 7 of the criteria, and "low quality" if they meet 4 or less (52). Although CASP assesses the quality of reporting and methodology, it does not address the aspects of research validity. Thus, the four evaluative criteria of credibility, transferability, dependability, and confirmability which provided by Cochran, will be applied (53).

Two independent reviewers complete the quality assessment tools for the included studies. Any conflict in evaluations will be discussed between reviewers and agreement will be reached through consensus, or may be consulted by a third reviewer. It should be noted that appropriate and special tools will be used (or will be developed If not available) for the included studies that their methodological quality cannot be assessed by the mentioned tools.

Data synthesis

The final report will be divided into three parts: (1) a range of models of suicide will be presented in a form with a list of subgroups. The list of subgroups may include the type of suicide model (e.g. Theory-based, explanatory, or process models), various

fields of models (e.g. demographic, psychological, social, biological, etc.), characteristics of samples (patient and non-patient, community resident, settled in hospice, gender, and age), suicide steps (death wishes, ideation, attempted suicide and death resulting from suicide). (2) The type of implications (implications for families, governments and non-government organizations (NGOs), and implications for clinicians). (3) Future research. Then different models will be compared with each other and their differences and similarities will be discussed. One of the preliminary strategies in this regard would be to provide a narrative synthesis of the findings including a qualitative analysis of the models. Implications and Future research recommendations will be provided based on the included models. In other words, the implications and areas in need of research can both be directly extracted from the discussion section of the studies, which in each case practical/clinical and research recommendations may vary according to the type of model or theory, and be indirectly derived from the authors' conclusion and interpretation. The authors' conclusion and interpretation is based on comparison of the implications and areas in need of research derived from each of the models in terms of the most important and most frequent recommendations**.**

Patient and public involvement

Patients and the public were not involved with the development of this protocol. The results will be published in open-access peer-review publications.

Discussion

This systematic review will provide a detailed account of the existing evidence in relation to late life suicide. The synthesis of review findings in present study will assess both the limitations of identified studies and any limitations in our own review methodology. Once a large volume of studies are identified as a result of a first search, we will use a multiple reviewer team to minimize the risk of bias. To make a multiplayer team is also useful for reducing the time needed for completing the study. The findings of this review will be of interest to physicians, psychiatrist, and mental health professionals and those who are in contact with suicidal older people. Models of suicide in late life can help in the evaluation, diagnosis, and design of interventions and more effective prevention of late life suicide. The findings of this review study can also be compared with findings from other studies on this issue. Finally, the

discussion section will present key findings, study limitations, implications and recommendations for future research as well as practical/clinical considerations to the experts.

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Competing interests: none declared.

Provenance and peer review: not commissioned; externally peer reviewed.

Data sharing statement: All recorded data from the data extraction process will be available on request to the extent that they are not included in the Systematic review article

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PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: Recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Reported (Section)
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	Yes (Title)
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 (such as PROSPERO) and registration number	Yes (Abstract, Registration number)
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	Yes (Title page)
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	Yes (Contributions)
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	Yes (Amendments)
Support:			
Sources	5a	Indicate sources of financial or other support for the review	Yes (Funding statement)
Sponsor	5b	Provide name for the review funder and/or sponsor	Yes (Funding statement)
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	N/a
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	Yes (Introduction, Rationale)
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	Yes (Introduction, Objectives)

METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	Yes (Methods, Eligibility criteria)
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	Yes (Methods, Information sources)
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	Yes (Methods, Search)
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	Yes (Methods, Study records)
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	Yes (Methods, Study records)
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	Yes (Methods, Study records)
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	Yes (Methods, Data items)
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	Phenomenon of interest is defined. (Outcomes and prioritisation, Phenomenon of interest)
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	Appraisal of study quality is described. (Outcomes and prioritisation, Appraisal of study quality)
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	N/a
	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 (such as I^2, Kendall's τ)	N/a

	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	N/a
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	Thematic synthesis will be applied. (Outcomes and prioritisation, Data synthesis)
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	N/a
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	The ConQual approach will be adopted. (Outcomes and prioritisation, Confidence in the synthesised qualitative findings)

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.

Enhancing transparency in reporting the synthesis of qualitative research: the ENTREQ statement

No	Item	Guide and description
1	Aim	State the research question the synthesis addresses.
2	Synthesis methodology	Identify the synthesis methodology or theoretical framework which underpins the synthesis, and describe the rationale for choice of methodology
3	Approach to searching	Indicate whether the search was pre-planned
4	Inclusion criteria	Specify the inclusion/exclusion criteria
5	Data sources	Describe the information sources used and when the searches conducted; provide the rationale for using the data sources.
6	Electronic Search strategy	Describe the literature search
7	Study screening methods	Describe the process of study screening and
8	Study characteristics	Present the characteristics of the included studies
9	Study selection results	Identify the number of studies screened and provide reasons for study exclusion
10	Rationale for appraisal	Describe the rationale and approach used to appraise the included studies or selected findings
11	Appraisal items	State the tools, frameworks and criteria used to appraise the studies or selected findings
12	Appraisal process	Indicate whether the appraisal was conducted independently by more than one reviewer and if consensus was required.
13	Appraisal results	Present results of the quality assessment and indicate which articles, if any, were weighted/excluded based on the assessment and give the rationale.
14	Data extraction	Indicate which sections of the primary studies were analysed and how were the data extracted from the primary studies?
15	Software	State the computer software used, if any.
16	Number of	Identify who was involved in coding and analysis.

	reviewers	
17	Coding	Describe the process for coding of data
18	Study comparison	Describe how were comparisons made within and across studies
19	Derivation of themes	Explain whether the process of deriving the themes or constructs was inductive or deductive.
20	Quotations	Provide quotations from the primary studies to illustrate themes/constructs, and identify whether the quotations were participant quotations of the author's interpretation.
21	Synthesis output	Present rich, compelling and useful results that go beyond a summary of the primary studies

From: Tong A, Flemming K, McInnes E, Oliver S, Craig .(2012). Enhancing transparency in reporting the synthesis of qualitative research: ENTREQ. BMC Medical Research Methodology, 12(1):181.

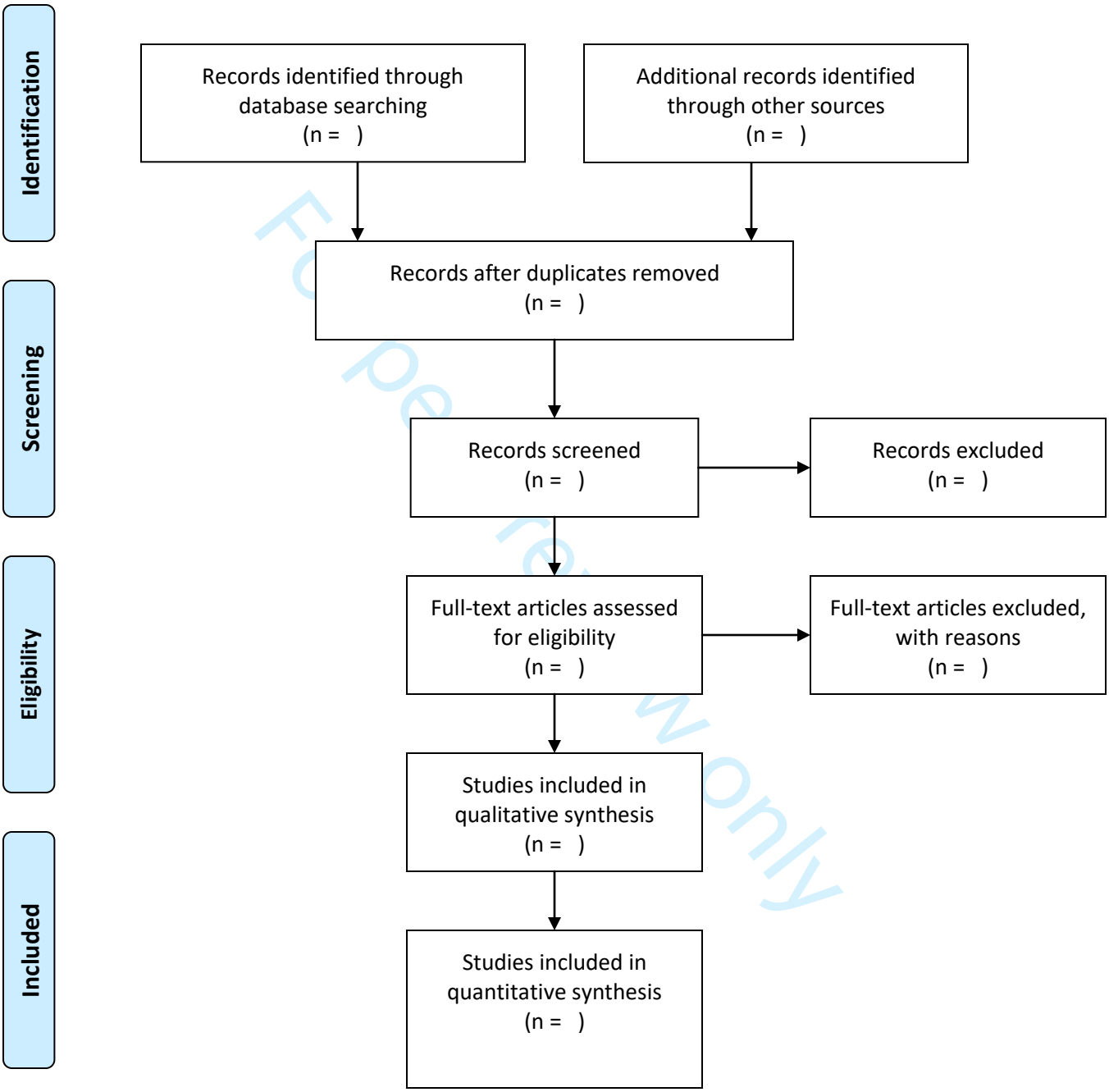
Final syntax in SCOPUS:
(TITLE-ABS(suicid*) OR TITLE-ABS(death wishes)) OR TITLE ABS(deliberate self-harm[1])) AND (TITLE-ABS(model*) OR TITLE-ABS(theory) OR TITLE ABS(Framework) OR TITLE ABS(proposal)) AND (TITLE-ABS(old*) OR ALL(old*) OR ALL(eld*) OR ALL(geriatric*) OR ALL(aging) OR ALL(ageing) OR ALL(age*) OR ALL("later life") OR ALL(senior) OR ALL(nonagenarian) OR ALL(octogenarian) OR ALL(centenarian)) AND (PUBYEAR < 2017)

Our initial search syntax for PubMed will be

(suicid[tiab] OR death wishes [tiab] OR deliberate self-harm[tiab]) AND (model[tiab] OR theory [tiab] OR Framework [tiab] OR proposal [tiab]) AND (old[tiab] OR old*[tiab]OR eld* OR geriatric* OR aging OR ageing OR age* OR "later life" OR senior OR nonagenarian OR octogenarian OR centenarian) AND 30-12-2017[dp]

[1] Non-suicidal self-injury is different from Deliberate self-harm and does not include study.

PRISMA 2009 Flow Diagram



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

CODING MANUAL FOR CASE-CONTROL STUDIES

SELECTION

1) Is the Case Definition Adequate?

a) Requires some independent validation (e.g. >1 person/record/time/process to extract information, or reference to primary record source such as x-rays or medical/hospital records) ☆
b) Record linkage (e.g. ICD codes in database) or self-report with no reference to primary record
c) No description

2) Representativeness of the Cases

a) All eligible cases with outcome of interest over a defined period of time, all cases in a defined catchment area, all cases in a defined hospital or clinic, group of hospitals, health maintenance organisation, or an appropriate sample of those cases (e.g. random sample) ☆
b) Not satisfying requirements in part (a), or not stated.

3) Selection of Controls

This item assesses whether the control series used in the study is derived from the same population as the cases and essentially would have been cases had the outcome been present.

a) Community controls (i.e. same community as cases and would be cases if had outcome) ☆
b) Hospital controls, within same community as cases (i.e. not another city) but derived from a hospitalised population
c) No description

4) Definition of Controls

a) If cases are first occurrence of outcome, then it must explicitly state that controls have no history of this outcome. If cases have new (not necessarily first) occurrence of outcome, then controls with previous occurrences of outcome of interest should not be excluded. ☆
b) No mention of history of outcome

COMPARABILITY

1) Comparability of Cases and Controls on the Basis of the Design or Analysis

A maximum of 2 stars can be allotted in this category

Either cases and controls must be matched in the design and/or confounders must be adjusted for in the analysis. Statements of no differences between groups or that differences were not statistically significant are not sufficient for establishing comparability. Note: If the odds ratio for the exposure of interest is adjusted for the confounders listed, then the groups will be considered to be comparable on each variable used in the adjustment.

There may be multiple ratings for this item for different categories of exposure (e.g. ever vs. never, current vs. previous or never)

Age =☆ , Other controlled factors = ☆

EXPOSURE

1) Ascertainment of Exposure

Allocation of stars as per rating sheet

2) Non-Response Rate

Allocation of stars as per rating sheet

CODING MANUAL FOR COHORT STUDIES

SELECTION

1) Representativeness of the Exposed Cohort

Item is assessing the representativeness of exposed individuals in the community, not the representativeness of the sample of women from some general population. For example, subjects derived from groups likely to contain middle class, better educated, health oriented women are likely to be representative of postmenopausal estrogen users while they are not representative of all women (e.g. members of a health maintenance organisation (HMO) will be a representative sample of estrogen users. While the HMO may have an under-representation of ethnic groups, the poor, and poorly educated, these excluded groups are not the predominant users users of estrogen).

Allocation of stars as per rating sheet

2) Selection of the Non-Exposed Cohort

Allocation of stars as per rating sheet

3) Ascertainment of Exposure

Allocation of stars as per rating sheet

4) Demonstration That Outcome of Interest Was Not Present at Start of Study

In the case of mortality studies, outcome of interest is still the presence of a disease/ incident, rather than death. That is to say that a statement of no history of disease or incident earns a star.

COMPARABILITY

1) Comparability of Cohorts on the Basis of the Design or Analysis

A maximum of 2 stars can be allotted in this category
Either exposed and non-exposed individuals must be matched in the design and/or confounders must be adjusted for in the analysis. Statements of no differences between groups or that differences were not statistically significant are not sufficient for establishing comparability. Note: If the relative risk for the exposure of interest is adjusted for the confounders listed, then the groups will be considered to be comparable on each variable used in the adjustment.
There may be multiple ratings for this item for different categories of exposure (e.g. ever vs. never, current vs. previous or never)
Age = ☆ , Other controlled factors = ☆

OUTCOME

1) Assessment of Outcome

For some outcomes (e.g. fractured hip), reference to the medical record is sufficient to satisfy the requirement for confirmation of the fracture. This would not be adequate for vertebral fracture outcomes where reference to x-rays would be required.

a) Independent or blind assessment stated in the paper, or confirmation of the outcome by reference to secure records (x-rays, medical records, etc.) ☆
b) Record linkage (e.g. identified through ICD codes on database records) ☆
c) Self-report (i.e. no reference to original medical records or x-rays to confirm the outcome)
d) No description.

2) Was Follow-Up Long Enough for Outcomes to Occur

An acceptable length of time should be decided before quality assessment begins (e.g. 5 yrs. for exposure to breast implants)

3) Adequacy of Follow Up of Cohorts

This item assesses the follow-up of the exposed and non-exposed cohorts to ensure that losses are not related to either the exposure or the outcome.

Allocation of stars as per rating sheet

Newcastle-Ottawa Scale adapted for cross-sectional studies

Selection: (Maximum 5 stars)

1) Representativeness of the sample:
- a) Truly representative of the average in the target population. * (all subjects or random sampling)
- b) Somewhat representative of the average in the target population. * (non-random sampling)
- c) Selected group of users.
- d) No description of the sampling strategy.

2) Sample size:
- a) Justified and satisfactory. *
- b) Not justified.

3) Non-respondents:
- a) Comparability between respondents and non-respondents characteristics is established, and the response rate is satisfactory. *
- b) The response rate is unsatisfactory, or the comparability between respondents and non-respondents is unsatisfactory.
- c) No description of the response rate or the characteristics of the responders and the non-responders.

4) Ascertainment of the exposure (risk factor):
- a) Validated measurement tool. **
- b) Non-validated measurement tool, but the tool is available or described.*
- c) No description of the measurement tool.

Comparability: (Maximum 2 stars)

1) The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled.
- a) The study controls for the most important factor (select one). *
- b) The study control for any additional factor. *

Outcome: (Maximum 3 stars)

1) Assessment of the outcome:
- a) Independent blind assessment. **
- b) Record linkage. **
- c) Self report. *
- d) No description.

2) Statistical test:
- a) The statistical test used to analyze the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p value). *
- b) The statistical test is not appropriate, not described or incomplete.

Appendix 6. Quality appraisal: CASP Qualitative Checklist and Evaluative criteria for Trustworthiness.

Title: …… Author(s) and date: …… Study No: …… **Critical Appraisal Skills Programme Qualitative Checklist.**	**Yes**	**No**	**Can't answer**
1. Was there a clear statement of the aims of the research? *What was the goal of the research? Why it was thought important?*			
2. Is a qualitative methodology appropriate? *If the research seeks to interpret or illuminate the actions and/or subjective experiences of research participants. Is qualitative research the right methodology for addressing the research goal?*			
3. Was the research design appropriate to address the aims of the research? *If the researcher has justified the research design (e.g. have they discussed how they decided which method to use)?*			
4. Was the recruitment strategy appropriate to the aims of the research? *If the researcher has explained how the participants were selected. If they explained why the participants they selected were the most appropriate to provide access to the type of knowledge sought by the study. If there are any discussions around recruitment (e.g. why some people chose not to take part).*			
5. Was the data collected in a way that addressed the research issue? *If the setting for data collection was justified. If the researcher has justified the methods chosen. If the researcher has made the methods explicit (e.g. for interview method, is there an indication of how interviews were conducted, or did they use a topic guide)? If the methods were modified during the study. If so, has the researcher explained how and why? If the form of data is clear (e.g. tape recordings, video material, notes etc). If the form of data is clear (e.g. tape recordings, video material, notes etc). if the researcher has discussed saturation of data.*			
6. Has the relationship between researcher and participants been adequately considered? *If the researcher critically examined their own role, potential bias and influence during (a) Formulation of the research questions (b) Data collection, including sample recruitment and choice of location How the researcher responded to events during the study and whether they considered the implications of any changes in the research design.*			
7. Have ethical issues been taken into consideration? *If there are sufficient details of how the research was explained to participants for the reader to assess whether ethical standards were maintained If the researcher has discussed issues raised by the study (e.g. issues around informed consent or confidentiality or how they have handled the effects of the study on the participants during and after the study). If approval has been soughtfrom the ethics committee.*			
8. Was the data analysis sufficiently rigorous? *If there is an in-depth description of the analysis process If thematic analysis is used. If so, is it clear how the categories/themes were derived from the data? Whether the researcher explains how the data presented were selected from the original sample to demonstrate the analysis process. If sufficient data are presented to support the findings. To what extent contradictory data are taken into account. Whether the researcher critically examined their own role, potential bias and influence during analysis and selection of data for presentation.*			
9. Is there a clear statement of findings? *If the findings are explicit If there is adequate discussion of the evidence both for and against the researchers' arguments. If the researcher has discussed the credibility of their findings (e.g. triangulation, respondent validation, more than one analyst). If the findings are discussed in relation to the original research question.*			
10. How valuable is the research? *If the researcher discusses the contribution the study makes to existing knowledge or understanding e.g. do they consider the findings in relation to current practice or policy or relevant research-based literature? If they identify new areas where research is necessary If the researchers have discussed*			

whether or how the findings can be transferred to other populations or considered other ways the research may be used.			
Criteria for trustworthiness based on Creswell (2007) and Cohen & Crabtree (2006)	Reviewer's assessment (Technique applied? How?)		
Credibility			
Prolonged engagement and persistent observation. Do the researchers spend sufficient time in the field, observe, talk to different people, build relationships, check for misinformation stemming from the researcher or the informants?			
Triangulation. Do the researchers make use of multiple data sources, investigators, theories to enhance understanding and ensure a rich and robust account of the study inquiry?			
Peer review or debriefing. "External check of the research process" (Creswell, 2007; p.208) or exposition of the research process to an unaffected peer. Do sessions between the researcher and a peer take place? Are written accounts of these sessions being kept?			
Negative case analysis. Do the researchers take account of the data that do not fit with emerging patterns or explanations? Do they revise the initial hypotheses and analysis until it accounts for the majority of cases?			
Referential adequacy. "Identifying a portion of data to be archived, but not analysed. The researcher then conducts the data analysis on the remaining data and develops preliminary findings. The researcher then returns to this archived data and analyses it as a way to test the validity of his or her findings" (Cohen & Crabtree, 2006).			
Member checking. Do the researchers take data, analyses, interpretations, conclusions back to the participants to evaluate the truthfulness of the account?			
Transferability			
Thick description refers to "describing and interpreting observed social action (or behaviour) within its particular context" (Ponterotto, 2006) Does the author achieve to give a sense of verisimilitude? Does the author describe in detail each part of the study (fully describing the study participants; settings and procedures, such as location and length of the interviews, recording procedures, interviewer's and interviewee's reactions; results, e.g. long quotes from the participants or the interview dialogue; successfully bringing together the participants' experiences with the researchers' interpretation of those in discussion)?			
Dependability			
External audit. ("Inquiry audit") Is there an "external consultant", who is not part of the study, examining the process and product of the study?			
Confirmability			
External audit ("confirmability audit")			
Reflexivity. (Clarification of researcher bias) Are the authors reflexive, i.e. do they "identify the perspectives they bring to their studies as insiders and/ or outsiders" and ways through which those affect "how they analyse, interpret and report the findings" (Sparkes & Smith, 2014: p 181-3). Is there a "critical friend" to help in this process?			
Triangulation (as above)			
Audit trail. Is the process of the study transparent and trackable? Do the researchers provide descriptions of the decision making process in detail?			

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Models of suicide in elderly: a protocol for systematic review

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Primary Subject Heading:	Global health
Secondary Subject Heading:	Mental health
Keywords:	suicide, elderly, model

Models of suicide in elderly: a protocol for systematic review[1]

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Abstract

Introduction: Rates of suicide in the elderly population are generally higher than other age groups. Models of suicide that explain the phenomenon of suicide in later life may have research, clinical, and educational implications for the field of aging. The primary purpose of this systematic review is to identify and review existing models of suicide that have a particular focus on the elderly.

Methods and analysis: The authors intend reviewing the findings of observational studies including cohort studies, cross-sectional studies, case-control studies, and qualitative studies such as grounded theory designs, which are published in the databases of Google Scholar, SCOPUS, PsycINFO, PubMed, Web of Sciences, Cochrane Database of Systematic Reviews, and research-related journals. The models of suicide, which specifically describe, explain, and predict late life suicides will be included. Therapeutic, interventional, and rehabilitation models as well as models related to assisted suicide will be excluded. Endnote software will be employed for data management. Two independent reviewers will extract data. Methodological quality and the risk of bias of quantitative studies will be assessed

[1] Article Number 1, Ph.D. dissertation of Mohammad Rostami entitled "Explaining the Process of the Formation of Suicidal Thoughts and Sentiment in the Elderly.

using the Newcastle-Ottawa Scale (NOS) and the Newcastle-Ottawa Scale adapted for cross-sectional studies, while that of qualitative studies will be assessed using the Critical Appraisal Skills Program (CASP) and the evaluative criteria of credibility, transferability, dependability and confirmability. The final report will present a range of models of suicide with a list of different subgroups.

Ethics and publication: There are no predictable ethical issues related to this study. The findings will be published in prestigious journals and presented at international and national conferences.

Registration number: This systematic review protocol is registered in the PROSPERO International Prospective Register of Systematic Reviews; the registration number is CRD42017070982

Keywords: suicide, elderly, model

Strengths and limitations of this study:

1. The present systematic review is the first one to examine suicide-specific models of elderly by searching various databases.

2. To minimize potential bias, each process of initial screening, data extraction, and quality evaluation will be performed by two independent reviewers.

3. The study is limited in that only studies in English are to be reviewed. This limitation may cause language bias.

Introduction

Population aging has been one of the major challenges the health arena has dealt with during recent decades. Globally, the population over 60 years of age is projected to increase from 10% in 2000 to 21% in 2050(1). Although later life is defined as a period of life accompanied by higher levels of well-being, a more encompassing meaning of life and better emotion regulation, getting older is also associated with physical illnesses, cognitive deficits, and socio-economic changes, which individuals may perceive to be a threat and accordingly, the risk of depression and suicide may increase (2). The suicide rate has been reported to be higher among older people in comparison to other age groups in many countries (3).

Suicide has become an important public health issue, which recently has attracted global attention. Suicide is a deliberate and intentional act to terminate one's own life (4). Suicide rates among the older population have been estimated in a number of studies (5, 6). Given the increasing population of older people, it is likely that the number of elderly who commit suicide will increase in forthcoming decades (7).

Most authors have agreed that no single risk factor alone can predict suicide ideation and behavior among the older population. Although psychiatric illnesses, especially depression, have been noted as the strongest risk factors for suicide in older people (8), various studies have found that many older people with a history of suicide have not previously experienced symptoms of depression (9, 10). Furthermore, clinical trials based on the identified risk factors of suicide have not clearly shown how preventive interventions work (3). Therefore, it is important to conduct an in-depth examination of current knowledge to determine the risk factors that contribute to suicide as well as how they interact with each other (11). Only models and theories can explain the suicide phenomenon comprehensively, reveal present knowledge gaps, provide guidance for future research, and propose practical considerations (11). Accordingly, various researchers in the field of aging have questioned whether a specific model for late life suicide is beneficial and if so, how it can help us arrive at an enhanced understanding of the aging experience (3). Such models assume that in relation to etiology and possibly epidemiology, suicide during later life is a different phenomenon to suicide in other periods of life.

An examination of current knowledge reveals that suicide and suicidal behavior have been studied using different and often contradictory theoretical and experimental models. These include epidemiological (12), philosophical (13), social and socio-cultural (14, 15), psychiatric (16), psychoanalytical (17), and neurobiological (18) models. In addition, cognitive theories of suicide (19), family system theory (20), interpersonal theory (21) and the Motivational-Volitional Model of Suicidal Behavior (22) have been employed to examine the phenomenon. Although these theories were not designed for a particular age group, they can be adapted to the positive and negative events that older people face during their aging process (3, 23). Furthermore, they may have implications for explaining and understanding the etiology of suicide in old age (11). In addition, various theories have been specifically designed to explain suicide in the elderly; these focus primarily on the following aspects of suicide: psychological, especially emotion and cognition (24),

developmental and longevity (25), demographic and epidemiological (26), and neurobiological (27). The neurobiological models of suicide in later life, for example, propose a biological pathway that includes responsible genes, vascular diseases, and/or degenerative processes, which lead to vulnerabilities, and in conjunction with late life events, may increase the risk of suicide attempts (27).

To date, a number of systematic and narrative reviews have been conducted in the area of late life suicide. These include a comprehensive review of psychological and social theories of elderly suicide (11); physical diseases, functional weaknesses and suicidal behavior among the elderly(28); suicidal behaviors in old age from a gender perspective (29); suicide prevention in late life (30); self-harm in the elderly(31); attempted suicide in older people (32); prevention of suicidal behaviors in older people (33); and the neurobiology of elderly suicide (27). Most of the narrative reviews have focused on theories that do not deal specifically with later life. Rather, they have mainly described, and discussed the implications and applications of general and known theories of suicide such as Durkheim's sociological theory (15), the helplessness theory (34) and the psychological pain theory (35) in an attempt to understand and prevent suicide in late life. Most systematic reviews on suicide models have been age-non-specific and based on knowledge from known databases. Currently, no systematic review on age-specific models of suicide that have focused specifically on the elderly has been conducted. In many countries, older people have the highest suicide rates among all age groups (27, 28), and suicidal behaviors of older people have a more deadly profile in comparison to younger people with a ratio of attempted/die by suicide of 4:1 vs. 200:1(36). Consequently, the importance of exploring the nature and process of suicidal ideation and suicidality in the aged is evident. In addition, the necessity of conducting studies in this field has become more imperative because of an increasing elderly population (27). An enhanced understanding of this issue is dependent on theories that can explain old age suicide by providing a testable and parsimonious multifaceted framework or model (11). Therefore, a systematic review of models of suicide in old age may clarify the underlying causal mechanisms, which can be utilized to determine priorities in the fields of research and prevention of late life suicide.

Objectives:

1. To identify and review existing models of suicide with a particular focus on late life suicide.

Review question(s):

1. Which models of suicide consider suicide in older people?
2. What are the implications of these models for the prevention of suicide in older people?
3. What areas need more research?

Methods

The method employed for this study is in accordance with the guidelines detailed on the PRISMA checklist (see supplementary appendix 1). In addition, a PRISMA flow diagram will be employed to describe the flow of information at different stages of the study(37). The protocol for this article has been registered in PRISMA as CRD42017070982. Furthermore, the preferred reporting items for systematic reviews and Meta-Analyses for Protocols 2015 (PRISMA-P 2015) have been used for protocol preparation and reporting. Enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) will also be utilized in the study. ENTREQ consists of 21 items grouped in five main domains: introduction, methods and methodology, literature search and selection, appraisal, and synthesis of findings (38).

Eligibility criteria (inclusion and exclusion criteria)

This systematic review will peruse published studies that focus on explaining the phenomenon of late life suicide in the form of models and theories. The criteria to be employed to include and exclude studies are thus presented.

Types of studies

It is the intention of this study to investigate findings of observational studies including cohort studies, cross-sectional studies, case-control studies, and qualitative studies such as grounded theory designs. Studies published in English and in full text from all countries will be included. The term, model should be included in the title, abstract, or keywords and form part of the primary or secondary objectives of the study. In the present study, a preliminary search was first conducted; the objective thereof was to identify three types of studies: similar systematic studies, similar protocols, and the identification of three to five related preliminary studies. However, similar systematic studies and protocols were not found. Based on the inclusion and exclusion criteria, experimental studies (whether randomized or not) that were based on therapeutic and interventional models are to be excluded. Only the models that

describe how suicide ideation and behavior are formed will be emphasized. Grounded theory studies will also be considered because they increase the chances of access to models and theories associated with the phenomenon of suicide in the elderly. Commentaries, opinion papers, discussion papers and editorials will also be excluded from the study.

Types of Participants

Those studies that comprise research samples with the following characteristics will be selected:

- Elderly men or women.
- Elderly classified as aged 60 and older.
- Elderly who are residing in a community or nursing home such as a sanatorium.
- Elderly who are not affected by cognitive disorders or cognitive impairments, for example, a diagnosis of clinical dementia.
- Elderly classified from clinical reports that show one of the following: 1) the intense desire to die or reveal suicidal thoughts; 2) plans to attempt suicide and thoughts about how to do it, and 3) a history of intentional self-harm and suicidal behaviors. The latter also includes suicidal behaviors without prior planning. These individuals may have lost their lives as a result of the attempt or remained in hospital and be alive. In addition to clinical reports and hospital samples, studies using national mortality databases will also be included.

Types of models of suicide

- Those studies in which the models that explained suicide are to be included in the study; the models comprise theory-based models, explanatory models, and process models.
- Studies that considered the models whose focus was on the causality and the emergence of suicide are to be included whereas therapeutic and interventional models or rehabilitation models will be excluded.
- In the studies, only the discussion will be investigated; not the statistical analysis.
- The proposed models that are to be included cover various fields, for example, psychological, biological, medical, sociological, demographic, and economic.

However, the description, prediction, and explanation of suicide in the elderly should be related to these fields.

- Suicide includes the desire to die, suicidal thoughts, intentional self-harm and death resulting from suicide.

  The desire to die may be defined as a wish to expedite death and act in a way that ends one's life earlier than it would have (39).

  Suicide thoughts may be defined as individuals' thoughts and ideas about ending their own life that may appear in various ways, which include suicidal thoughts without a specific method; suicidal thoughts with several non-specific methods; suicidal thoughts with a specific method in mind but without a plan; suicidal thoughts with a specific method; and a well-conceived plan, often referred to as a suicide plan (40).

  Death resulting from suicide is the final stage in the suicide process in which individuals lose their life after one or several suicide attempts (40).

  Suicidal behavior is any action that could cause a person to die such as hanging, suffocation, drowning, and medicaments and biological substances. Deliberate self-harm in the elderly, which is different from non-suicidal self-injury, will be included in the study.

  Deliberate Self Harm involves any self-directed direct or indirect harmful behaviors, regardless of their suicidal intent. In contrast, non-suicidal self-injury only comprises direct harmful behaviors without any suicidal intent (41, 42).

- Models of suicide related to non-suicidal self-injury and assisted suicide with the help of a physician will be excluded

Information sources

Electronic databases including Google Scholar, SCOPUS, PsycINFO, PubMed, Web of Sciences, EMBASE, and Cochrane Database of Systematic Reviews as well as grey literature and targeted journals, for example, *Aging & Mental Health, Suicide and Life Threatening Behavior, Archives of Suicide Research* and *Suicidology Online* from the inception of the database until 30 December 2017 will be searched.

Search strategies

A comprehensive search strategy will be developed to search the databases; the vocabulary unique to each database is to be used. The search strategy will be

conducted by having discussions with experts in the fields of psychology, psychiatry, and systematic review methodology. Furthermore, related areas will be reviewed and relevant keywords identified. The authors will also hand-search reference lists of review articles and sites such as *Aging & Mental Health, Suicide and Life Threatening Behavior, Archives of Suicide Research,* and *Suicidology Online* to ensure that all relevant articles are considered. An outline of the master search strategy for SCOPUS and PUBMED has been developed (see supplementary appendix 2).

Study records:

Data management

Endnote software will be employed to manage the data. Once all bases have been searched, the searches will be exported to a single Endnote software library in order to identify and delete similar studies and thus, aid the search process. In addition, hand-searches will be used to identify similar studies with this software.

Selection process

Two independent reviewers will extract data, screen titles and abstracts of the identified studies, and assess the quality of full papers to minimize bias in all stages of the review. Studies, which initially may have been considered to be relevant, but ultimately are excluded will be listed in the table: *Characteristics of excluded studies.* The reason for removing each one is to be noted.

Disagreement at any stage will be resolved through discussion and referred to a third reviewer. Furthermore, the PRISMA diagram(43) will be completed to illustrate the screening process and the number of studies at each stage (see supplementary appendix 3).

Data collection process

At this stage, two reviewers will extract and manage the data of included studies independently by using a data extraction form. At first, the data extraction form will be executed as a pilot and subsequently, corrected in accordance with the feedback received from colleagues who are specialists. At this stage, any disagreement between the reviewers will be resolved by discussion. If the disagreements cannot be resolved through negotiation, a third review author will act as an arbiter. Furthermore, data will be collected electronically by employing Census and Survey Processing System (CSPro) software.

Data items

- Release details: Title, journal, author, year, city, and country of study.
- Design: Type of study design, the purpose of study, data collection methods, and inclusion and exclusion criteria.
- Profile of participants: Number, gender, age, race, diagnosis, and other demographic information.
- Study outcomes: Proposed models, key findings, discussion, limitations, practical/clinical implications, and recommendations for future research.

Risk of bias in individual studies

When primary studies are analyzed and interpreted in a systematic review, quality assessment and evaluation of susceptibility to biases are essential (44). Quality assessment of research involves the appraisal of a study's internal validity; in other words, the degree to which its design, conduct and analysis have minimized biases or errors. For practical reasons, study quality assessment in reviews often covers both internal and external validity. Initially, quality assessment can be used to determine a minimum quality threshold for the selection of primary studies that are to be included in a review. Subsequently, detailed quality assessment is employed to scrutinize the quality of studies included so as to explore quality differences as an explanation for heterogeneity in study results. This aids the interpretation of the results and allows the generation of inferences to inform practice and research (45).

There are many sources of bias in methodology. Bias begins with the research question and includes selection bias, information bias, confounding variables and the overall quality of the study.

Various studies have been conducted on non-interventional quality assessment tools. All the studies have concluded that currently, there is no agreed gold standard appraisal tool (45-48). Although strengthening the reporting of observational studies in epidemiology (STROBE) seems to be the only tool available for this type of study, this tool is used for the reporting of observational studies rather than for assessing the quality of primary studies (49). Because both quantitative and qualitative studies are considered in this study, appropriate tools will be used for each one.

The Newcastle-Ottawa Scale (NOS) and the adapted Newcastle-Ottawa, which have been adapted for cross-sectional studies, will be used for the observational studies.

NOS was the product of the continuous collaboration between the universities of Newcastle, Australia, and Ottawa. This tool was developed by employing a Delphi process and subsequently, tested on systematic reviews. NOS is divided into two separate scales that include cohort and case-control studies. Eight items and a set of response options have been considered for both scales. A 'star system' has been developed in which a study is judged on three broad perspectives: the selection of the study groups; the comparability of the groups; and the ascertainment of either the exposure or outcome of interest for case-control or cohort studies, respectively. The star system allows for a semi-quantitative assessment of the quality of the study so that a maximum of one star for each item is allocated to the highest quality of studies.There is only one exception to the comparability that can be assigned up to two stars. The range of stars in NOS comprises zero to nine stars(50). The Newcastle-Ottawa Scale, which was adapted for cross-sectional studies, uses the same star system in the main scale only. The difference is that on this scale, there are five stars for the selection dimension, two stars for the comparability dimension, and three stars for the outcomes dimension, which indicates the quality of the study (51, 52).

Since there is no agreement on how to assess qualitative evidence, a limited set of criteria may not able to be applied to all types of qualitative studies (53). Consequently, in this study two different methods are to be used to evaluate the quality of qualitative studies: The Critical Appraisal Skills Program (CASP)(54), and the evaluative criteria of credibility, transferability, dependability and confirmability(55). The CASP tool is generally appropriate for a variety of qualitative study designs. The tool consists of 10 questions and prompts. Studies will be rated as high quality if they meet eight of the 10 criteria, medium quality if they meet five to seven criteria, and low quality if they meet 4 or less (53). Although CASP assesses the quality of reporting and methodology, it does not address any aspects of research validity. Thus, the four evaluative criteria of credibility, transferability, dependability, and confirmability provided by Cochran will be applied (56).

Two independent reviewers will complete the quality assessment tools for the included studies. Any conflict in evaluations will be discussed between the reviewers and agreement will be reached through consensus, or a third reviewer may be consulted. It should be noted that appropriate and special tools will be used for the included studies. If their methodological quality cannot be assessed by the tools noted previously, tools will be developed.

Data synthesis

The final report will be divided into three sections. First, a range of models of suicide will be presented with a list of subgroups. The list of subgroups may include the type of suicide model such as theory-based explanatory, and process models; various fields of models that include demographic, psychological, social, and biological; characteristics of samples that include patient and non-patient, community resident, settled in hospice, gender, and age; and suicide steps that comprise death wishes, ideation, attempted suicide and death resulting from suicide. Second, the type of implications, for example, implications for families, governments and non-government organizations (NGOs), and for clinicians will be discussed. The third section will focus on future research. Subsequently, different models will be compared with each other, and their differences and similarities will be discussed. One of the preliminary strategies in this regard is to provide a narrative synthesis of the findings including a qualitative analysis of the models. The implications and recommendations for future research will be based on the included models. In other words, the implications and recommendations for future research can be directly extracted from the discussions of the studies. However, in each case, practical/clinical and research recommendations may vary according to the type of model or theory, and may be indirectly derived from the authors' conclusion and interpretation. The latter is based on the comparison of the implications and recommendations for research, which are derived from each of the models in terms of the most important and most frequent recommendations**.**

Patient and public involvement

Patients and the public were not involved with the development of this protocol. The results will be published in open-access peer-review publications.

Discussion

This systematic review will provide a detailed account of the existing evidence in relation to late life suicide. The synthesis of review findings in the present study will assess the limitations of identified studies as well as any limitations in our own review methodology. Once a large volume of studies has been identified as a result of the first search, we will use a multiple reviewer team to minimize the risk of bias. A team that consists of multi-players is beneficial for reducing the time needed to complete the study. It is expected that the findings of this review will be of interest to

physicians, psychiatrists, mental health professionals and those who are in contact with older people who are suicidal. Models of suicide in late life can assist in the evaluation, diagnosis, and design of interventions that will lead to the effective prevention of late life suicide. The findings of this review study may also be compared to findings from other studies on this issue. Finally, in the discussion, key findings, study limitations, implications and recommendations for future research and practical/clinical considerations for specialists will be presented.

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Competing interests: None declared.

Provenance and peer review: not commissioned; externally peer reviewed.

Data sharing statement: All recorded data from the data extraction process will be available on request if the data are not included in the systematic review article.

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Appendix 1
The PRISMA Checklist

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: Recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Reported (Section)
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	Yes (Title)
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 (such as PROSPERO) and registration number	Yes (Abstract, Registration number)
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	Yes (Title page)
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	Yes (Contributions)
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	Yes (Amendments)
Support:			
Sources	5a	Indicate sources of financial or other support for the review	Yes (Funding statement)
Sponsor	5b	Provide name for the review funder and/or sponsor	Yes (Funding statement)
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	N/a
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	Yes (Introduction, Rationale)
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	Yes (Introduction, Objectives)
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	Yes (Methods, Eligibility criteria)

Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	Yes (Methods, Information sources)
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	Yes (Methods, Search)
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	Yes (Methods, Study records)
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	Yes (Methods, Study records)
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	Yes (Methods, Study records)
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	Yes (Methods, Data items)
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	Phenomenon of interest is defined. (Outcomes and prioritisation, Phenomenon of interest)
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	Appraisal of study quality is described. (Outcomes and prioritisation, Appraisal of study quality)
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	N/a
	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 (such as I2, Kendall's τ)	N/a

	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	N/a
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	Thematic synthesis will be applied. (Outcomes and prioritisation, Data synthesis)
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	N/a
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	The ConQual approach will be adopted. (Outcomes and prioritisation, Confidence in the synthesised qualitative findings)

* It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated.

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.

Appendix 2

Strategy for SCOPUS and PUBMED.

Final syntax in SCOPUS:

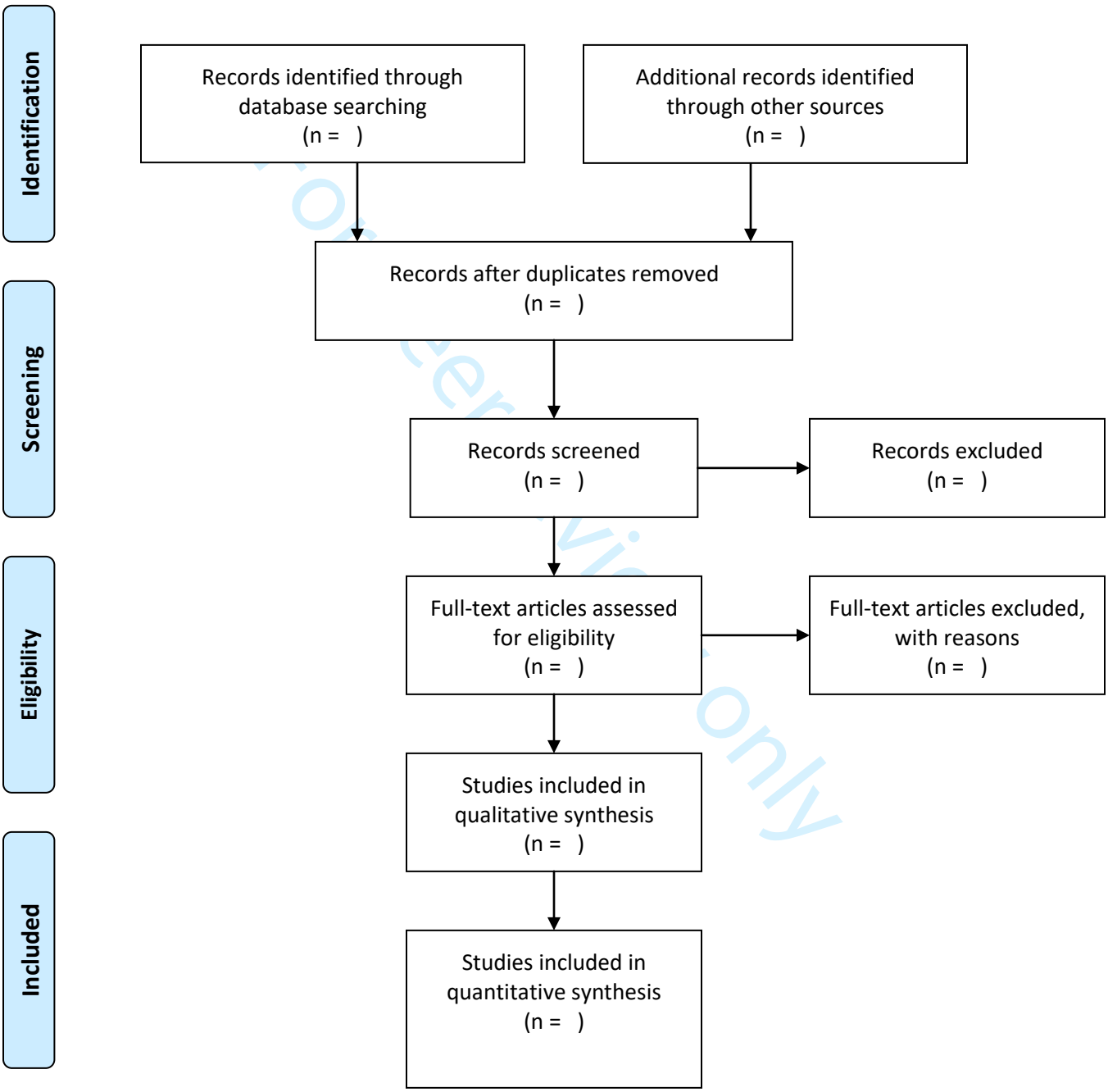
(TITLE-ABS(suicid*) OR TITLE-ABS(death wishes)) OR TITLE ABS(deliberate self-harm1)) AND (TITLE-ABS(model*) OR TITLEABS(theory) OR TITLE ABS(Framework) OR TITLE ABS(proposal)) AND (TITLE-ABS(old*) OR ALL(old*) OR ALL(eld*) OR ALL(geriatric*) OR ALL(aging) OR ALL(ageing) OR ALL(age*) OR ALL("later life") OR ALL(senior) OR ALL(nonagenarian) OR ALL(octogenarian) OR ALL(centenarian)) AND (PUBYEAR < 2017)

Our initial search syntax for PubMed will be:

(suicid[tiab] OR death wishes [tiab] OR deliberate self-harm[tiab]) AND (model[tiab] OR theory [tiab] OR Framework [tiab] OR proposal [tiab]) AND (old[tiab] OR old*[tiab]OR eld* OR geriatric* OR aging OR ageing OR age* OR "later life" OR senior OR nonagenarian OR octogenarian OR centenarian) AND 30-12-2017[dp]

Appendix 3

PRISMA 2009 Flow Diagram



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.