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Short-term functions and long-term consequences of checking behavior as a transdiagnostic phenomenon: Protocol for a systematic review

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Short-term functions and long-term consequences of checking behavior as a transdiagnostic phenomenon: Protocol for a systematic review

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ABSTRACT

Introduction: Checking behavior (CB) occurs in various mental health problems, such as obsessive-compulsive, generalized anxiety, eating, body dysmorphic and illness anxiety disorders. Etiological models of these disorders postulate a negative reinforcing effect of CB by reducing negative affect (i.e. anxiety) and a maintenance of the pathology due to a lack of reality-testing of concerns. This paper details methods for a systematic review that will be conducted to synthesize empirical evidence testing these theoretical assumptions across different disorders.

Methods and Analysis: We will search PsycINFO, PubMed, PSYNDEX, and Scopus for studies investigating the valence of situations in which CB occurs, as well as the immediate and longer-term effects of CB on cognitive and emotional measures in clinical and analogue samples. The selection process, data extraction and quality assessment of included studies will be performed by two independent reviewers. In the case of inconsistencies, a third reviewer will be involved. Study results will be reported in a narrative synthesis.

Ethics and dissemination: Ethics approval will not be required as this is a protocol for systematic review. The results are mainly disseminated through peer-reviewed publications.

Protocol registration number: PROSPERO, CRD42021238835.

KEYWORDS: Safety Behavior, Checking, Obsessive-Compulsive Disorder, Generalized Anxiety Disorder, Eating Disorders, Anorexia Nervosa, Bulimia Nervosa, Binge Eating Disorder, Body Dysmorphic Disorder, Illness Anxiety Disorder

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This systematic review addresses a gap in research as it will be the first to provide a detailed synthesis of the evidence regarding the valence of situations in which CB occurs, as well as the postulated immediate and longer-term effects of CB across different disorders and subthreshold forms.

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- The results of this systematic review are expected to foster our understanding of the mechanisms of action underlying CB, which is of high clinical relevance.
- As the review includes non-randomized studies that are likely to produce evidence of low certainty, risk of bias and the strength of evidence collected from each study will be assessed using the GRADE system.
- The protocol is written following the PRISMA-P guidelines.

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INTRODUCTION

Rationale

Safety behavior represents a core feature of various mental disorders[1, 2] and is defined as "actions taken to prevent, avoid, or escape a feared outcome"[3]. Besides avoidance, safety behavior includes checking behavior (CB), which manifests in different ways depending on the respective disorder. The earliest descriptions of CB can be found regarding obsessive-compulsive disorders (OCD)[4, 5].

CB is the most common compulsion in OCD[6] and manifests, for example, as controlling the absence of potential sources of danger in one's surroundings (e.g., stoves, windows or doors) or repetitive requests for reassurance from others[7, 8]. It belongs to the "repetitive behaviors […] that the individual feels driven to perform in response to an obsession or according to rules that must be applied rigidly" (part of Criterion A in the Diagnostic and Statistical Manual of Mental Disorders [DSM-5])[9]. Etiological models[7, 10] define CB as having a "preventive" character, because it is aimed to ward off misfortune and to lessen anxiety and discomfort. For example, this negative affect-reducing function of CB is a core aspect of Rachman's cognitive theory, which posits that people repeatedly check for safety in situations where they feel unsure about the absence of harm in order to gain relief from their indisposition, uncertainty, and anxiety[7]. Thus, the model assumes that people check for the safety of the environment in response to negative emotional states. Rachman postulates that as a consequence of negative reinforcement, the behavior becomes more likely to occur, producing negative emotions and therefore contributing to the maintenance of the psychopathology[7].

Besides OCD, CB can also be observed in people suffering from generalized anxiety disorder (GAD)[11-13]. While CB is not yet represented in the diagnostic criteria for GAD[14], it has been described predominantly in the form of interpersonal checking (i.e., seeking reassurance from others, for example before making decisions, when engaging in activities or asking a loved one if he or she is upset)[8, 15]. Similar to OCD, cognitive models of GAD[16-18] suggest that safety behaviors such as CB are performed in order to reduce the likelihood of feared negative events, to control worries and reduce or prevent discomfort. As a consequence, it is hypothesized that they turn into a self-perpetuating mechanism due to negative reinforcement.

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While in OCD and GAD, checking primarily refers to objects, environment, relationships, and achievement (see above), in other disorders, the main focus of CB is one's own body. Disorders with body-related CB include eating disorders (EDs)[19], body dysmorphic disorder (BDD)[20] and illness anxiety disorder (IAD)[21]. In EDs, i.e. anorexia nervosa (AN), bulimia nervosa (BN) and binge eating disorder (BED), CB expresses itself as controlling one's own body in terms of its weight or shape, and manifests in behaviors such as repeated weighing, measuring the circumference of body parts, inspecting one's body or individual body parts in the mirror, seeking reassurance about one's appearance and comparing it to others[19, 22]. Although the literature highlights the importance of CB in ED pathology[23], it is not explicitly listed in the diagnostic criteria of the DSM-5 for any of these three disorders. Nevertheless, it can be found indirectly in the criteria for AN (criteria B and C) and BN (criterion D), which describe aspects of body image disturbance (e.g. overvaluation of weight and shape), a component of which are behaviors such as avoidance or checking[24]. This does not apply to BED, although the literature suggests that body image disturbance can also be an important part of the symptomatology of the disorder[25]. Etiological models for EDs postulate that CB contributes to the maintenance of the disorder by increasing the perception of bodily imperfections[22, 26]. In line with the theories for OCD and GAD (described above), it is hypothesized that body checking reduces negative affect, which is triggered, for example, by dysfunctional body-related information processing[27]. This negative reinforcement may then lead patients to believe that it is helpful to perform CB. In contrast, theories postulate that CB increases anxiety and can foster distorted perception and evaluation of one's body[22, 27].

CB in BDD is described as controlling one's perceived defect by inspecting it in the mirror or other reflective surfaces (e.g. shop windows, car mirrors) in a ritualistic way, taking photos, comparing it with other people (in real life, media, photos of oneself in the past), checking its size or contour by touching it with one's fingers, and asking others for reassurance (e.g. whether the perceived flaw has become worse or is adequately camouflaged)[28-30]. It is explicitly mentioned as a part of the diagnostic criterion B in the DSM-5[31]. As already described for OCD, GAD and EDs, cognitive-behavioral models of BDD[28, 30, 32, 33] postulate that CB serves to reduce negative emotions (e.g. anxiety, disgust, anger, shame) or uncertainty and therefore provides immediate relief in the short term. In the

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long term, CB is hypothesized to increase selective attention and may intensify the dysfunctional beliefs about the supposed flaw(s), thus contributing to the maintenance of the disorder[28, 30].

In IAD, CB manifests as repeatedly checking one's body for signs of illness (e.g. breast self-examination) or seeking reassurance from others about health and signs of a severe illness (e.g. family, friends, health care physicians, or alternative sources such as medical textbooks)[21, 34]. Similar to BDD, CB is specified as a diagnostic criterion for IAD in the DSM-5[30]. In line with the theoretical assumptions described above, cognitive-behavioral models of IAD[35, 36] ascribe an immediate relief from anxiety and a quick reassurance to the utilization of CB. In the long run, it is hypothesized that receiving such reassurance leads to an increase in health anxiety and intensified checking[34].

Objectives

In sum, although CB looks phenomenologically different depending on the respective disorder, etiological models across disorders outline checking as an important behavior which provides immediate relief from negative states in the short term, therefore reinforcing itself and leading to a self-perpetuating mechanism, and hence contributing to the maintenance of the pathology in the long term. Although the mechanism of action of CB has been postulated in numerous models of different disorders, empirical support for these assumptions is lacking. To date, several empirical studies have investigated the proposed mechanisms in each disorder, but a systematic overview of studies is yet to be undertaken. Current cognitive-behavioral treatments for these disorders are based on the aforementioned models and include ritual prevention as one therapeutic technique aimed at reducing CB and consequently related disorder-specific symptoms. Depending on whether or not the empirical evidence supports the models and the proposed function of CB, the focus of these interventions would need to be intensified or altered, respectively. As such, our systematic review is intended to synthesize existing evidence for the reinforcing function of CB across OCD, GAD, EDs, BDD and IAD. The current study protocol outlines the methods of our investigation and is based on the PRISMA-P checklist (Additional file 1). It is registered on PROSPERO database and will address the following research questions: 1) Which (emotional) states are people in when engaging in CB? 2a) What effect does CB have on emotional,

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cognitive and disorder-specific outcomes in the short-term? 2b) What effect does CB have on emotional, cognitive and disorder-specific outcomes in the long-term?

METHODS

Eligibility criteria

Studies will be selected according to the criteria outlined below.

Types of studies / Study Designs & Setting

All types of studies investigating the effect of CB will be included. There will be no restrictions regarding study design, setting or publication year. We will only consider original empirical papers. If our search yields studies investigating the effect of CB in an experimental design (and consequently using an instruction to check), there might be the need to delimit CB from exposure. Therefore, we will exclude studies investigating CB with an instruction to check for therapeutic purposes.

Participants

There will be no limits on study participants in terms of age, gender, or ethnicity. We will include both studies with clinical and nonclinical samples to take into account that CB might also play an important role in analogue samples, e.g. with high trait worry, weight concerns, or appearance-related concerns.

Outcomes of interest

We will accept any outcome measure indicating changes in emotional (e.g. anxiety) and cognitive (e.g. worry) measures both globally and specific to disorders. To be included, studies will need to have investigated at least one outcome.

Language

Only studies reported in or translated into English, German, French, or Italian will be included.

Information sources

The following electronic databases will be searched: PsycINFO, PubMed, PSYNDEX and Scopus. Furthermore, we will screen the bibliographies of relevant articles for additional studies. Additionally,

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research registries (ClinicalTrials.gov, PROSPERO and the International Clinical Trials Registry Platform of the World Health Organization) will be searched for eligible unpublished studies.

Search strategy

During the design of the search strategy, library staff were on hand to advise us. To generate search terms, we screened reviews and primary studies as well as the respective keywords (using the "Thesaurus of Psychological Index Terms" and "Medical Subject Headings"). The search terms available for selection were presented to and discussed by a group of experienced clinical researchers. Finally, relevant keywords and, if necessary due to lack of indexing, free text words were selected for each disorder. Since checking behaviors have not yet been keyworded, their search was limited to free text words. To reduce irrelevant hits, only studies that included checking terms in the title or abstract were searched. To be implemented in the scientific databases, the disorder-related search terms were combined using the Boolean operator "AND" with the free text words for Checking. Only a limit to human studies will be set. The full search strategy for one database is displayed as additional file (Additional file 2). This will be adapted for each database according to the respective guidelines.

Study records

Selection process

In a first step, two independent reviewers will screen the titles and abstracts yielded by the search after removal of duplicates. We will then obtain the full text for potentially eligible studies. If the full text is not available, e.g., through institutional membership, we will contact the authors to request access. By screening the full text in a second step, the two reviewers will assess for inclusion in the review based on the criteria outlined before. We will note the reason for exclusion of any study and present the selection process in a PRISMA flow diagram (Additional file 3). In the case of discrepancies between the two reviewers in either step, a third reviewer will be consulted. None of the reviewers will be blind to the journal titles or to the study authors or institutions.

Data Extraction

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For all included studies, data will be extracted by two independent raters using a data collection form developed for this review (Additional file 4). Both reviewers will pilot this in advance with five studies and make adjustments prior to the extraction of data if necessary. We plan to extract the following information and data from each study: 1) Basic characteristics of the study: authors, title, publication year, country; 2) Sample: sample size, average age, gender, type of sample (clinical vs. analogue), diagnosis and criteria for diagnosis (clinical samples) or type of symptoms in analogue samples, comorbidities; 3) Setting (e.g. online survey, laboratory experiment); 4) Type of CB investigated; 5) Assessment time points; 6) Instruments for the assessment of outcomes and type of outcomes investigated; 7) Study results with regard to the research questions.

Data Synthesis

Selected studies will first be assigned according to the disorder or psychopathology they investigated. Within these five groups, studies will additionally be categorized according to which research question they address. Due to the expected low number of eligible studies, we will carry out a narrative synthesis and compile a table outlining characteristics and findings of every study.

Risk of Bias

We will assess the risk of bias within randomized trials using the Cochrane Collaboration tool for assessing risk of bias[37] and within non-randomized studies with the Risk Of Bias In Non-randomized Studies of Interventions (ROBINS-I) tool[38]. The strength of evidence collected from each study in the review will be assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system[39]. The evaluation process will be conducted by two independent reviewers. If necessary, a third reviewer will resolve disagreements.

ETHICS AND DISSEMINATION

Patients and Public Involvement

This systematic review will be based on previously published data, so patients and the public will not be directly involved in the design, interpretation or dissemination of the results.

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STATEMENTS

Authors' contribution

SV and ASH developed the primary idea for the review, and this was refined with the help of MV and VO. All authors contributed to the development of the protocol document. All authors read and agreed the final version of the manuscript. MV is the guarantor of the review.

Ethics approval and consent to participate

Ethics approval will not be required as this is a protocol for systematic review.

Availability of data and materials

No additional data available.

Competing interests

The authors declare that they have no competing interests.

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Patient and public involvement

As this research will be based on already published data, patients and the public will not be involved in the design, interpretation or dissemination of the results.

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Additional files

PRISMA-P checklist (Additional file 1.docx)

Search strategy (Additional file 2.pdf)

PRISMA flow diagram (Additional file 3.doc)

data collection form (Additional file 4.docx)

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PRISMA-P 2015 Checklist

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

An Editorial from the Editors-in-Chief of *Systematic Reviews* details why this checklist was adapted – **Moher D, Stewart L & Shekelle P:** Implementing PRISMA-P: recommendations for prospective authors. *Systematic Reviews* 2016 **5**:15

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
ADMINISTRATIVE INFORMATION					
Title					
Identification	1a	Identify the report as a protocol of a systematic review	☒	☐	1-2
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	☐	☐	
Registration	2	If registered, provide the name of the registry (e.g., PROSPERO) and registration number in the Abstract	☒	☐	38
Authors					
Contact	3a	Provide name, institutional affiliation, and e-mail address of all protocol authors; provide physical mailing address of corresponding author	☒	☐	8-10
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	☒	☐	228-231
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	☐	☐	
Support					
Sources	5a	Indicate sources of financial or other support for the review	☒	☐	240-242
Sponsor	5b	Provide name for the review funder and/or sponsor	☐	☒	
Role of sponsor/funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	☐	☒	
INTRODUCTION					
Rationale	6	Describe the rationale for the review in the context of what is already known	☒	☐	72-134
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to	☒	☐	135-153

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Section/topic	#	Checklist item	Information reported Yes	Information reported No	Line number(s)
		participants, interventions, comparators, and outcomes (PICO)			
METHODS					
Eligibility criteria	8	Specify the study characteristics (e.g., PICO, study design, setting, time frame) and report characteristics (e.g., years considered, language, publication status) to be used as criteria for eligibility for the review	☒	☐	155-172
Information sources	9	Describe all intended information sources (e.g., electronic databases, contact with study authors, trial registers, or other grey literature sources) with planned dates of coverage	☒	☐	173-177
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	☒	☐	178-173
STUDY RECORDS					
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	☒	☐	200-214
Selection process	11b	State the process that will be used for selecting studies (e.g., two independent reviewers) through each phase of the review (i.e., screening, eligibility, and inclusion in meta-analysis)	☒	☐	191-199
Data collection process	11c	Describe planned method of extracting data from reports (e.g., piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	☒	☐	191-209
Data items	12	List and define all variables for which data will be sought (e.g., PICO items, funding sources), any pre-planned data assumptions and simplifications	☒	☐	204-209
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	☒	☐	167-170, 200-209
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	☒	☐	215-221
DATA					
Synthesis	15a	Describe criteria under which study data will be quantitatively synthesized	☐	☐	
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data, and methods of combining data from studies, including any planned exploration of consistency (e.g., I^2, Kendall's tau)	☐	☐	
	15c	Describe any proposed additional analyses (e.g., sensitivity or subgroup analyses, meta-regression)	☐	☐	
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	☒	☐	210-214
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (e.g., publication bias across studies, selective reporting within studies)	☐	☐	

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Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (e.g., GRADE)	☒	☐	218-220

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Datenbank: APA PsycInfo <1806 to January Week 4 2021>

Suchstrategie:

---

1 (Checking* or gazing* or "safety behavi*r" or "reassurance seek*").ti,ab. (7270)

2 obsessive compulsive disorder/ or compulsions/ or Generalized Anxiety Disorder/ or worry.ti,ab. or eating disorders/ or anorexia nervosa/ or binge eating disorder/ or bulimia/ or body image/ or body image disturbances/ or body dysmorphic disorder/ or dissatisfaction/ or hypochondriasis/ or health anxiety/ (70340)

3 1 and 2 (1197)

4 limit 3 to human (1152)

****

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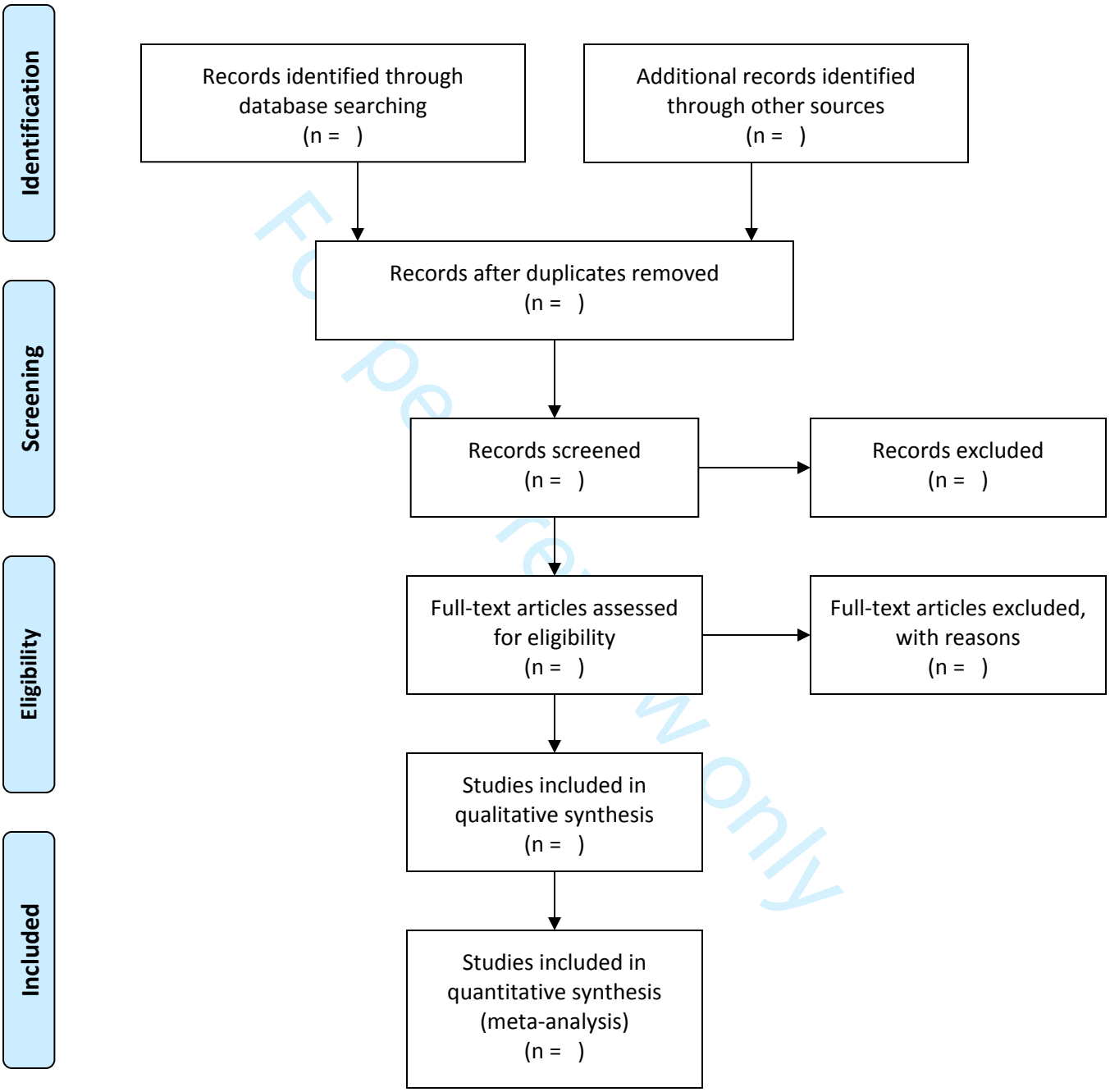
PRISMA 2009 Flow Diagram



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.

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Data Extraction Form

Disorder:
☐ OCD ☐ GAD ☐ ED ☐ BDD ☐ IAD

Research question:
☐ (1) situation ☐ (2a) short-term ☐ (2b) long-term

Reviewer:

Date:

BASIC CHARACTERISTICS

Ref ID:

Author(s):

Publication title:

Publication year: Country:

SAMPLE

Sample Size:

Average Age:

Gender:

Type of sample:

- Diagnosis and criteria for diagnosis (clinical samples):
- Type of symptoms (analogue samples):

Co-morbidities:

STUDY DESIGN

Setting:

Type of CB investigated:

Assessment time points:

Instruments for the assessment of outcomes and types of outcomes investigated:

STUDY RESULTS

Research question and outcome:

Brief summary (add research question and disorder in each case):

– Confirmed ☐ Rejected ☐

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BMJ Open

Short-term functions and long-term consequences of checking behavior as a transdiagnostic phenomenon: Protocol for a systematic review

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Primary Subject Heading:	Mental health
Secondary Subject Heading:	Research methods
Keywords:	Eating disorders < PSYCHIATRY, Anxiety disorders < PSYCHIATRY, Adult psychiatry < PSYCHIATRY, MENTAL HEALTH

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Manuscripts

Short-term functions and long-term consequences of checking behavior as a transdiagnostic phenomenon: Protocol for a systematic review

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Word Count: 2559

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ABSTRACT

Introduction: Checking behavior (CB) occurs in various mental health problems. Cognitive-behavioral models for these mental disorders share similar theoretical assumptions. Thus, they postulate a negative reinforcing effect of CB by reducing negative affect (i.e. anxiety) and a maintenance of the pathology due to a lack of reality-testing of concerns. This paper details methods for a systematic review that will be conducted to synthesize empirical evidence testing these theoretical assumptions across obsessive-compulsive, generalized anxiety, eating, body dysmorphic and illness anxiety disorder. The results are expected to foster our understanding of the mechanisms of action underlying CB, which is of high clinical relevance. Depending on whether or not the findings confirm the model assumptions regarding CB, the focus of treatments would need to be intensified or modified.

Methods and Analysis: We will search PsycINFO, PubMed, PSYNDEX, and Scopus for studies investigating the emotional state in which CB is being used as well as the immediate and longer-term effects of CB on cognitive and emotional measures in clinical and analogue samples. The selection process, data extraction and quality assessment of included studies will be performed by two independent reviewers. In the case of inconsistencies, a third reviewer will be involved. Study results will be reported in a narrative synthesis.

Ethics and dissemination: Ethics approval will not be required as this is a protocol for systematic review. The results are mainly disseminated through peer-reviewed publications.

Protocol registration number: PROSPERO, CRD42021238835.

KEYWORDS: Safety Behavior, Checking, Obsessive-Compulsive Disorder, Generalized Anxiety Disorder, Eating Disorders, Anorexia Nervosa, Bulimia Nervosa, Binge Eating Disorder, Body Dysmorphic Disorder, Illness Anxiety Disorder

STRENGTHS AND LIMITATIONS OF THIS STUDY

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- This systematic review addresses a gap in research as it will be the first to provide a detailed synthesis of the evidence regarding the valence of situations in which CB occurs, as well as the postulated immediate and longer-term effects of CB across different disorders and subthreshold forms.
- The results of this systematic review are expected to foster our understanding of the mechanisms of action underlying CB, which is of high clinical relevance.
- As the review includes non-randomized studies that are likely to produce evidence of low certainty, risk of bias and the strength of evidence collected from each study will be assessed using the GRADE system.
- The protocol is written following the PRISMA-P guidelines.
- The heterogeneity and the expected small number of studies represents a limitation of this systematic review.

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INTRODUCTION

Rationale

Safety behavior represents a core feature of various mental disorders[1, 2] and is defined as "actions taken to prevent, avoid, or escape a feared outcome"[3]. In the narrower sense, this includes behaviors such as taking sedatives, not going to certain places without another person, or always carrying a bottle of water. Furthermore, it comprises avoidance behaviors and checking behavior (CB), which manifests in different ways depending on the respective disorder. The earliest descriptions of the latter can be found regarding obsessive-compulsive disorders (OCD)[4, 5].

In OCD, CB is the most common compulsion[6] and manifests, for example, as controlling the absence of potential sources of danger in one's surroundings (e.g., stove turned off to prevent fire, windows or doors locked to prevent burglary) or repetitive requests for reassurance from others[7, 8]. Closely related to this, CB in generalized anxiety disorder (GAD) is also described[9-11], but mainly in terms of interpersonal checking (i.e., seeking reassurance from others, for example before making decisions, when engaging in activities or asking a loved one if he or she is upset)[8, 12]. While in OCD and GAD, checking primarily refers to objects, environment, relationships, and achievement, in other disorders, the main focus of CB is one's own body. Disorders with body-related CB include eating disorders (EDs)[13], body dysmorphic disorder (BDD)[14] and illness anxiety disorder (IAD)[15]. In EDs, i.e. anorexia nervosa (AN), bulimia nervosa (BN) and binge eating disorder (BED), CB expresses itself as inspecting one's own body in terms of its weight or shape, and manifests in behaviors such as repeated weighing, measuring the circumference of body parts, inspecting one's body or individual body parts in the mirror, seeking reassurance about one's appearance and comparing it to others[13, 16]. CB in BDD is described as inspecting one's perceived defect by looking at it in the mirror or other reflective surfaces (e.g. shop windows, car mirrors) in a ritualistic way, taking photos, comparing it with other people (in real life, media, photos of oneself in the past), checking its size or contour by touching it with one's fingers, and asking others for reassurance (e.g. whether the perceived flaw has become worse or is adequately camouflaged)[17-19]. Whereas checking in EDs and BDD refers to figure, weight, or appearance, checking in IAD focuses on health. It manifests as repeatedly inspecting one's body for

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signs of illness (e.g. breast self-examination, lymph node palpation) or seeking reassurance from others about health and signs of a severe illness (e.g. family, friends, health care physicians, or alternative sources such as medical textbooks)[15, 20].

Although CB refers to different domains (e.g. weight, illness, safety of the environment) in all five disorders, cognitive-behavioral theories regarding the mechanism of action of checking are very alike[e.g. 7, 21-24]. Three central theoretical postulates are formulated in each case. First, it is proposed that CB is used primarily when people are in order to respond to unpleasant emotional states[22, 25]. Relatedly, the second theoretical postulate states that CB is thought to have a negative affect-reducing function in the short-term[17]. For example in OCD, it is postulated by Rachman (2002), that people repeatedly check for safety in situations where they feel unsure about the absence of harm in order to gain relief from their indisposition, uncertainty, and anxiety[7]. In EDs it is hypothesized that body checking reduces negative affect which is triggered, for example, by dysfunctional body-related information processing[22]. For BDD, it is postulated that there is distress caused by physical appearance, which becomes very strong, for example, in social situations. CB, according to the theory, serves to reduce these unpleasant emotions (e.g., fear, disgust, anger, shame) caused by appearance[23]. By providing immediate short-term relief from unpleasant feelings, the third theoretical assumption is based on a learning theory mechanism[23]. It is postulated, that CB as a behavior is negatively reinforced (i.e., produces the absence of a negative consequence), therefore increasing the likelihood that it will be performed more frequently in the future[22] as patients experience CB to be helpful and necessary in the short run. In contrast, theories postulate that repeated use of CB reinforces anxiety and psychopathology in the long-term, turning into a self-perpetuating mechanism[24]. For example, it is discussed that CB can foster distorted perception and evaluation of one's body in EDs[16, 22]. For BDD, it is postulated that CB increases selective attention in the long-term and may intensify the dysfunctional beliefs about the supposed flaw(s), thus contributing to the maintenance of the disorder[17, 19].

In sum, although CB looks phenomenologically different depending on the respective disorder, etiological models across disorders outline checking as an important behavior which provides immediate relief from negative states in the short term, therefore reinforcing itself and leading to a self-perpetuating

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mechanism, and hence contributing to the maintenance of the pathology in the long term. Although the mechanism of action of CB has been postulated in numerous models of different disorders, empirical support for these assumptions is lacking. To date, several empirical studies have investigated the proposed mechanisms in each disorder, but a systematic overview of studies is yet to be undertaken. A systematic overview, however, is urgently needed, given that current cognitive-behavioral treatments for these disorders are based on the aforementioned theories and include ritual prevention (i.e., not using CB to learn that situations can be handled without this safety behavior) as one therapeutic technique aimed at reducing CB and consequently related disorder-specific symptoms. Depending on whether or not the empirical evidence supports the proposed emotion regulating mechanism of checking in the cognitive-behavioral models, the focus of these interventions would need to be intensified or altered, respectively. For example, as a function of CB, in addition to reducing negative affect, gaining certainty could also play a role in different disorders[26]. Therefore, it might be worthwhile to address the excessive need for certainty more directly through, e.g., cognitive interventions questioning the pursuit of certainty[27] or promoting the willingness to experience fear and uncertainty[28].

Objectives

As such, our systematic review intends to synthesize existing evidence for the three postulates regarding CB across the mental disorders OCD, GAD, EDs, BDD and IAD. The current study protocol outlines the methods of our investigation and is based on the PRISMA-P checklist (Additional file 1). The following research questions will be addressed: 1) Which (emotional) states are people in when engaging in CB? 2a) What effect does CB have on emotional, cognitive and disorder-specific outcomes in the short-term? 2b) What effect does CB have on emotional, cognitive and disorder-specific outcomes in the long-term?

METHODS

Our review has been registered with PROSPERO (CRD42021238835). The planned data selection process runs from January to May 2022.

Inclusion and exclusion criteria

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The inclusion and exclusion criteria are shown in Table 1.

Table 1

	Inclusion criteria	Exclusion criteria
Types of studies	all study designs and settings original empirical papers and dissertations	therapeutically guided checking[a]
Participants	clinical and nonclinical samples	
Type of checking	disorder specific checking	checking not typical for the diagnosis
Outcomes of interest	global and disorder specific emotional (e.g. anxiety) or cognitive (e.g. worry) measures	
Language	English, German, French or Italian	

[a] If our search yields studies investigating the effect of CB in an experimental design, it may be necessary to distinguish CB from exposure as a treatment modality. Therefore, we will exclude studies investigating CB with an instruction to check for therapeutic purposes (e.g., in therapeutically guided mirror exposures).

Information sources

The following electronic databases will be searched: PsycINFO, PubMed, PSYNDEX and Scopus. Furthermore, we will screen the bibliographies of relevant articles for additional studies. Additionally, research registries (ClinicalTrials.gov, PROSPERO and the International Clinical Trials Registry Platform of the World Health Organization) will be searched for eligible unpublished studies. The search process will be presented in a PRISMA flow diagram (Additional file 2). It shows whether an article stems from the electronic databases or from further literature research.

Search strategy

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During the design of the search strategy, library staff were on hand to advise us. To generate search terms, we screened reviews and primary studies as well as the respective keywords (using the "Thesaurus of Psychological Index Terms" and "Medical Subject Headings"). The search terms available for selection were presented to and discussed by a group of experienced clinical researchers. Finally, relevant keywords and, if necessary due to lack of indexing, free text words were selected for each disorder. Since checking behaviors have not yet been keyworded, their search was limited to free text words. To reduce irrelevant hits, only studies that included checking terms in the title or abstract were searched. To be implemented in the scientific databases, the disorder-related search terms were combined using the Boolean operator "AND" with the free text words for Checking. The only filter set is that the search should be limited to studies with human participants. The full search strategy for one database is displayed as additional file (Additional file 3). This will be adapted for each database according to the respective guidelines.

Study records

Selection process

In a first step, two independent reviewers will screen the titles and abstracts yielded by the search after removal of duplicates. We will then obtain the full text for potentially eligible studies. If the full text is not available, e.g., through institutional membership, we will contact the authors to request access. By screening the full text in a second step, the two reviewers will assess for inclusion in the review based on the criteria outlined before. We will note the reason for exclusion of any study and present the selection process in the PRISMA flow diagram (Additional file 2). In the case of discrepancies between the two reviewers in either step, a third reviewer will be consulted. None of the reviewers will be blind to the journal titles or to the study authors or institutions.

Data Extraction

For all included studies, data will be extracted by two independent raters using a data collection form developed for this review (Additional file 4). Both reviewers will pilot this in advance with five studies and make adjustments prior to the extraction of data if necessary. We plan to extract the following

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information and data from each study: 1) Basic characteristics of the study: authors, title, publication year, country; 2) Sample: sample size, average age, gender, type of sample (clinical vs. analogue), diagnosis and criteria for diagnosis (clinical samples) or type of symptoms in analogue samples, comorbidities; 3) Setting (e.g. online survey, laboratory experiment); 4) Type of CB investigated; 5) Assessment time points; 6) Instruments for the assessment of outcomes and type of outcomes investigated; 7) Study results with regard to the research questions.

Data Synthesis

Selected studies will first be assigned according to the disorder or psychopathology they investigated. Within these five groups, studies will additionally be categorized according to which research question they address. Due to the expected low number of eligible studies, we will carry out a narrative synthesis and compile a table outlining characteristics and findings of every study.

Risk of Bias

We will assess the risk of bias within randomized trials using the Cochrane Collaboration tool for assessing risk of bias[29] and within non-randomized studies with the Risk Of Bias In Non-randomized Studies of Interventions (ROBINS-I) tool[30]. The strength of evidence collected from each study in the review will be assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system[31]. The evaluation process will be conducted by two independent reviewers. If necessary, a third reviewer will resolve disagreements.

Patients and Public Involvement

This systematic review will be based on previously published data, so patients and the public will not be directly involved in the design, interpretation or dissemination of the results.

Dissemination

The results of the review will be submitted for publication in a peer-reviewed psychological journal. In addition, the results will be disseminated in various media such as symposia, congresses, seminars.

STATEMENTS

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Authors' contribution

SV and ASH developed the primary idea for the review, and this was refined with the help of MV and VO. All authors contributed to the development of the protocol document. All authors read and agreed the final version of the manuscript. MV is the guarantor of the review.

Ethics approval and consent to participate

Ethics approval will not be required as this is a protocol for systematic review.

Availability of data and materials

No additional data available.

Competing interests

The authors declare that they have no competing interests.

Funding

This work was supported by the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG) to ASH (HA 8589/5-1) and SV (VO1750/5-1).

Acknowledgements

We want to thank Dr. Jost Hindersmann (subject librarian), Wibke Meyer zu Westerhausen and Carin Tholen-Wandel (information specialists) for their advice during the design of the search strategy. We are also thankful to Sarah Mannion de Hernandez for language editing services as well as Antonia Lucht and Lotta Flechsig for the support in the management of literature.

Patient and public involvement

As this research will be based on already published data, patients and the public will not be involved in the design, interpretation or dissemination of the results.

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Additional files

PRISMA-P checklist (Additional file 1.pdf)

PRISMA flow diagram (Additional file 2.pdf)

Search strategy (Additional file 3.pdf)

data collection form (Additional file 4.pdf)

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PRISMA-P 2015 Checklist

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

An Editorial from the Editors-in-Chief of *Systematic Reviews* details why this checklist was adapted - Moher D, Stewart L & Shekelle P: Implementing PRISMA-P: recommendations for prospective authors. *Systematic Reviews* 2016 **5**:15

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
ADMINISTRATIVE INFORMATION					
Title					
Identification	1a	Identify the report as a protocol of a systematic review	☒	☐	1-2
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	☐	☐	
Registration	2	If registered, provide the name of the registry (e.g., PROSPERO) and registration number in the Abstract	☒	☐	42
Authors					
Contact	3a	Provide name, institutional affiliation, and e-mail address of all protocol authors; provide physical mailing address of corresponding author	☒	☐	9-11
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	☒	☐	214-216
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	☐	☐	
Support					
Sources	5a	Indicate sources of financial or other support for the review	☒	☐	224-225
Sponsor	5b	Provide name for the review funder and/or sponsor	☐	☒	
Role of sponsor/funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	☐	☒	
INTRODUCTION					
Rationale	6	Describe the rationale for the review in the context of what is already known	☒	☐	74-139

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Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	☒	☐	141-147
METHODS					
Eligibility criteria	8	Specify the study characteristics (e.g., PICO, study design, setting, time frame) and report characteristics (e.g., years considered, language, publication status) to be used as criteria for eligibility for the review	☒	☐	152-153
Information sources	9	Describe all intended information sources (e.g., electronic databases, contact with study authors, trial registers, or other grey literature sources) with planned dates of coverage	☒	☐	155-160
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	☒	☐	162-173
STUDY RECORDS					
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	☒	☐	185-193
Selection process	11b	State the process that will be used for selecting studies (e.g., two independent reviewers) through each phase of the review (i.e., screening, eligibility, and inclusion in meta-analysis)	☒	☐	176-183
Data collection process	11c	Describe planned method of extracting data from reports (e.g., piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	☒	☐	175-193
Data items	12	List and define all variables for which data will be sought (e.g., PICO items, funding sources), any pre-planned data assumptions and simplifications	☒	☐	188-193
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	☒	☐	153, 188-193
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	☒	☐	200-205
DATA					
Synthesis	15a	Describe criteria under which study data will be quantitatively synthesized	☐	☐	
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data, and methods of combining data from studies, including any planned exploration of consistency (e.g., I^2, Kendall's tau)	☐	☐	

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Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
	15c	Describe any proposed additional analyses (e.g., sensitivity or subgroup analyses, meta-regression)	☐	☐	
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	☒	☐	195-198
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (e.g., publication bias across studies, selective reporting within studies)	☐	☐	
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (e.g., GRADE)	☒	☐	202-204

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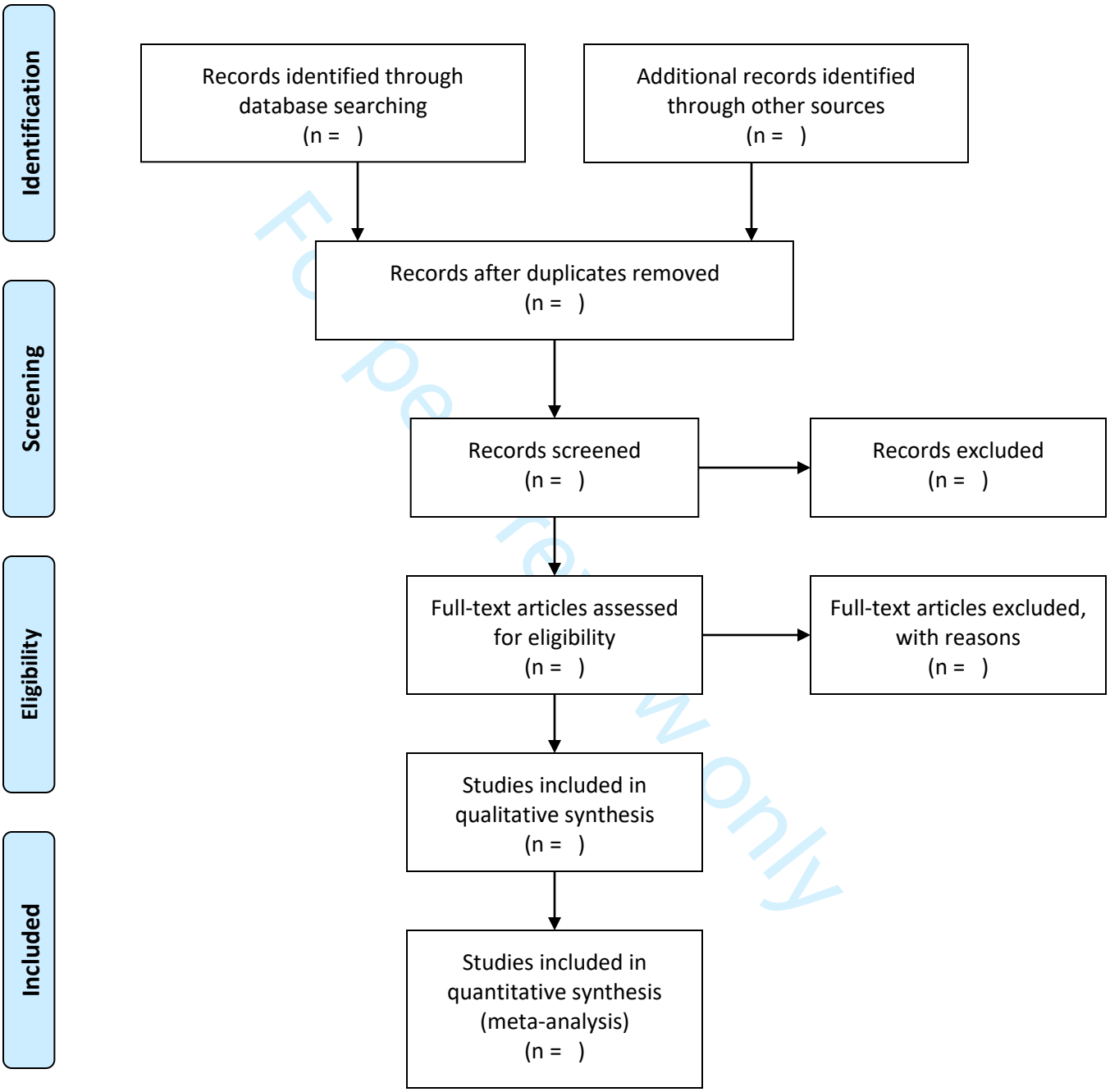
PRISMA 2009 Flow Diagram



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.

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Datenbank: APA PsycInfo <1806 to January Week 4 2021>

Suchstrategie:

---

1 (Checking* or gazing* or "safety behavi*r" or "reassurance seek*").ti,ab. (7270)

2 obsessive compulsive disorder/ or compulsions/ or Generalized Anxiety Disorder/ or worry.ti,ab. or eating disorders/ or anorexia nervosa/ or binge eating disorder/ or bulimia/ or body image/ or body image disturbances/ or body dysmorphic disorder/ or dissatisfaction/ or hypochondriasis/ or health anxiety/ (70340)

3 1 and 2 (1197)

4 limit 3 to human (1152)

****

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Data Extraction Form

Reviewer:

Date:

Disorder:
☐ OCD ☐ GAD ☐ ED ☐ BDD ☐ IAD
☐ clinical ☐ analogue

Research question:
☐ (1) situation ☐ (2a) short-term ☐ (2b) long-term

BASIC CHARACTERISTICS

Ref ID:

Author(s):

Publication title:

Publication year: Country:

SAMPLE

Sample Size:

Average Age:

Gender:

Type of sample:

- Diagnosis and criteria for diagnosis (clinical samples):
- Type of symptoms (analogue samples):

Co-morbidities:

STUDY DESIGN

Setting:

Type of CB investigated:

Assessment time points:

Instruments for the assessment of outcomes and types of outcomes investigated:

STUDY RESULTS

Research question and outcome:

Brief summary (add research question and disorder in each case):

– Confirmed ☐ Rejected ☐

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BMJ Open

Short-term functions and long-term consequences of checking behavior as a transdiagnostic phenomenon: Protocol for a systematic review

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Primary Subject Heading:	Mental health
Secondary Subject Heading:	Research methods
Keywords:	Eating disorders < PSYCHIATRY, Anxiety disorders < PSYCHIATRY, Adult psychiatry < PSYCHIATRY, MENTAL HEALTH

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Manuscripts

Short-term functions and long-term consequences of checking behavior as a transdiagnostic phenomenon: Protocol for a systematic review

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Word Count: 2397

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ABSTRACT

Introduction: Checking behavior (CB) occurs in various mental health problems. Cognitive-behavioral models for these mental disorders share similar theoretical assumptions. Thus, they postulate a negative reinforcing effect of CB by reducing negative affect (i.e. anxiety) and a maintenance of the pathology due to a lack of reality-testing of concerns. This paper details methods for a systematic review that will be conducted to synthesize empirical evidence testing these theoretical assumptions across obsessive-compulsive, generalized anxiety, eating, body dysmorphic and illness anxiety disorder. The results are expected to foster our understanding of the mechanisms of action underlying CB, which is of high clinical relevance. Depending on whether or not the findings confirm the model assumptions regarding CB, the focus of treatments would need to be intensified or modified.

Methods and Analysis: We will search PsycINFO, PubMed, PSYNDEX, and Scopus for studies investigating the emotional state in which CB is being used as well as the immediate and longer-term effects of CB on cognitive and emotional measures in clinical and analogue samples. The selection process, data extraction and quality assessment of included studies will be performed by two independent reviewers. In the case of inconsistencies, a third reviewer will be involved. Study results will be reported in a narrative synthesis.

Ethics and dissemination: Ethics approval will not be required as this is a protocol for systematic review. The results are mainly disseminated through peer-reviewed publications.

Protocol registration number: PROSPERO, CRD42021238835.

KEYWORDS: Safety Behavior, Checking, Obsessive-Compulsive Disorder, Generalized Anxiety Disorder, Eating Disorders, Anorexia Nervosa, Bulimia Nervosa, Binge Eating Disorder, Body Dysmorphic Disorder, Illness Anxiety Disorder

STRENGTHS AND LIMITATIONS OF THIS STUDY

- The protocol is written following the PRISMA-P guidelines.

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- As the review includes non-randomized studies that are likely to produce evidence of low certainty, risk of bias and the strength of evidence collected from each study will be assessed using the GRADE system.
- The heterogeneity and the expected small number of studies represents a limitation of this systematic review.

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INTRODUCTION

Rationale

Safety behavior represents a core feature of various mental disorders[1, 2] and is defined as "actions taken to prevent, avoid, or escape a feared outcome"[3]. In the narrower sense, this includes behaviors such as taking sedatives, not going to certain places without another person, or always carrying a bottle of water. Furthermore, it comprises avoidance behaviors and checking behavior (CB), which manifests in different ways depending on the respective disorder. The earliest descriptions of the latter can be found regarding obsessive-compulsive disorders (OCD)[4, 5].

In OCD, CB is the most common compulsion[6] and manifests, for example, as controlling the absence of potential sources of danger in one's surroundings (e.g., stove turned off to prevent fire, windows or doors locked to prevent burglary) or repetitive requests for reassurance from others[7, 8]. Closely related to this, CB in generalized anxiety disorder (GAD) is also described[9-11], but mainly in terms of interpersonal checking (i.e., seeking reassurance from others, for example before making decisions, when engaging in activities or asking a loved one if he or she is upset)[8, 12]. While in OCD and GAD, checking primarily refers to objects, environment, relationships, and achievement, in other disorders, the main focus of CB is one's own body. Disorders with body-related CB include eating disorders (EDs)[13], body dysmorphic disorder (BDD)[14] and illness anxiety disorder (IAD)[15]. In EDs, i.e. anorexia nervosa (AN), bulimia nervosa (BN) and binge eating disorder (BED), CB expresses itself as inspecting one's own body in terms of its weight or shape, and manifests in behaviors such as repeated weighing, measuring the circumference of body parts, inspecting one's body or individual body parts in the mirror, seeking reassurance about one's appearance and comparing it to others[13, 16]. CB in BDD is described as inspecting one's perceived defect by looking at it in the mirror or other reflective surfaces (e.g. shop windows, car mirrors) in a ritualistic way, taking photos, comparing it with other people (in real life, media, photos of oneself in the past), checking its size or contour by touching it with one's fingers, and asking others for reassurance (e.g. whether the perceived flaw has become worse or is adequately camouflaged)[17-19]. Whereas checking in EDs and BDD refers to figure, weight, or appearance, checking in IAD focuses on health. It manifests as repeatedly inspecting one's body for

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signs of illness (e.g. breast self-examination, lymph node palpation) or seeking reassurance from others about health and signs of a severe illness (e.g. family, friends, health care physicians, or alternative sources such as medical textbooks)[15, 20].

Although CB refers to different domains (e.g. weight, illness, safety of the environment) in all five disorders, cognitive-behavioral theories regarding the mechanism of action of checking are very alike[e.g. 7, 21-24]. Three central theoretical postulates are formulated in each case. First, it is proposed that CB is used primarily in order to gain relief from unpleasant emotional states[22, 25]. Relatedly, the second theoretical postulate states that CB is thought to have a negative affect-reducing function in the short-term[17]. For example in OCD, it is postulated by Rachman (2002), that people repeatedly check for safety in situations where they feel unsure about the absence of harm in order to gain relief from their indisposition, uncertainty, and anxiety[7]. In EDs it is hypothesized that body checking reduces negative affect which is triggered, for example, by dysfunctional body-related information processing[22]. For BDD, it is postulated that there is distress caused by physical appearance, which becomes very strong, for example, in social situations. CB, according to the theory, serves to reduce these unpleasant emotions (e.g., fear, disgust, anger, shame) caused by appearance[23]. By providing immediate short-term relief from unpleasant feelings, the third theoretical assumption is based on a learning theory mechanism[23]. It is postulated, that CB as a behavior is negatively reinforced (i.e., produces the absence of a negative consequence), therefore increasing the likelihood that it will be performed more frequently in the future[22] as patients experience CB to be helpful and necessary in the short run. In contrast, theories postulate that repeated use of CB reinforces anxiety and psychopathology in the long-term, turning into a self-perpetuating mechanism[24]. For example, it is discussed that CB can foster distorted perception and evaluation of one's body in EDs[16, 22]. For BDD, it is postulated that CB increases selective attention in the long-term and may intensify the dysfunctional beliefs about the supposed flaw(s), thus contributing to the maintenance of the disorder[17, 19].

In sum, although CB looks phenomenologically different depending on the respective disorder, etiological models across disorders outline checking as an important behavior which provides immediate relief from negative states in the short term, therefore reinforcing itself and leading to a self-perpetuating

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mechanism, and hence contributing to the maintenance of the pathology in the long term. Although the mechanism of action of CB has been postulated in numerous models of different disorders, empirical support for these assumptions is lacking. To date, several empirical studies have investigated the proposed mechanisms in each disorder, but a systematic overview of studies is yet to be undertaken. A systematic overview, however, is urgently needed, given that current cognitive-behavioral treatments for these disorders are based on the aforementioned theories and include ritual prevention (i.e., not using CB to learn that situations can be handled without this safety behavior) as one therapeutic technique aimed at reducing CB and consequently related disorder-specific symptoms. Usually, this is addressed in the context of exposure therapy (i.e., confronting patients with fearful or even avoided situations without the use of safety behaviors, e.g., in OCD, leaving the house without checking the stove and windows). Depending on whether or not the empirical evidence supports the proposed emotion regulating mechanism of checking in the cognitive-behavioral models, the focus of these interventions would need to be intensified or altered, respectively. For example, one might assume that CB does not or not only serve to reduce negative affect, but also to gain certainty[26]. Therefore, it might be worthwhile to address the excessive need for certainty more directly, for example, through cognitive interventions questioning the pursuit of certainty[27] or promoting the willingness to experience fear and uncertainty[28]. Furthermore, a better understanding of the mechanisms of action underlying CB may also have implications for the prevention of mental disorders (for example, if the proposed long-term negative effect of CB on psychopathology can be supported by empirical evidence, prevention programs addressing the reduction of checking in healthy individuals or at-risk groups could be developed).

Objectives

As such, our systematic review intends to synthesize existing evidence for the three postulates regarding CB across the mental disorders OCD, GAD, EDs, BDD and IAD. The current study protocol outlines the methods of our investigation and is based on the PRISMA-P checklist (Additional file 1). The following research questions will be addressed: 1) Which (emotional) states are people in when engaging in CB? 2a) What effect does CB have on emotional, cognitive and disorder-specific outcomes in the

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short-term (i.e. directly following CB)? 2b) What effect does CB have on emotional, cognitive and disorder-specific outcomes in the long-term (i.e. after a repeated number of checking episodes)?

METHODS

Our review has been registered with PROSPERO (CRD42021238835). The planned data selection process runs from January to May 2022.

Inclusion and exclusion criteria

The inclusion and exclusion criteria are shown in Table 1.

Table 1

	Inclusion criteria	Exclusion criteria
Types of studies	all study designs and settings original empirical papers and dissertations	therapeutically guided checking[a]
Participants	clinical and nonclinical samples	
Type of checking	disorder specific checking	checking not typical for the diagnosis
Outcomes of interest	global and disorder specific emotional (e.g. anxiety) or cognitive (e.g. worry) measures	
Language	English, German, French or Italian	

[a] If our search yields studies investigating the effect of CB in an experimental design, it may be necessary to distinguish CB from exposure as a treatment modality. Therefore, we will exclude studies investigating CB with an instruction to check for therapeutic purposes (e.g., in therapeutically guided mirror exposures).

Information sources

The following electronic databases will be searched: PsycINFO, PubMed, PSYNDEX and Scopus. Furthermore, we will screen the bibliographies of relevant articles for additional studies. Additionally,

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research registries (ClinicalTrials.gov, PROSPERO and the International Clinical Trials Registry Platform of the World Health Organization) will be searched for eligible unpublished studies. The search process will be presented in a PRISMA flow diagram (Additional file 2). It shows whether an article stems from the electronic databases or from further literature research.

Search strategy

During the design of the search strategy, library staff were on hand to advise us. To generate search terms, we screened reviews and primary studies as well as the respective keywords (using the "Thesaurus of Psychological Index Terms" and "Medical Subject Headings"). The search terms available for selection were presented to and discussed by a group of experienced clinical researchers. Finally, relevant keywords and, if necessary due to lack of indexing, free text words were selected for each disorder. Since checking behaviors have not yet been keyworded, their search was limited to free text words. To reduce irrelevant hits, only studies that included checking terms in the title or abstract were searched. To be implemented in the scientific databases, the disorder-related search terms were combined using the Boolean operator "AND" with the free text words for Checking. The only filter set is that the search should be limited to studies with human participants. The full search strategy for one database is displayed as additional file (Additional file 3). This will be adapted for each database according to the respective guidelines.

Study records

Selection process

In a first step, two independent reviewers will screen the titles and abstracts yielded by the search after removal of duplicates. We will then obtain the full text for potentially eligible studies. If the full text is not available, e.g., through institutional membership, we will contact the authors to request access. By screening the full text in a second step, the two reviewers will assess for inclusion in the review based on the criteria outlined before. We will note the reason for exclusion of any study and present the selection process in the PRISMA flow diagram (Additional file 2). In the case of discrepancies between

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the two reviewers in either step, a third reviewer will be consulted. None of the reviewers will be blind to the journal titles or to the study authors or institutions.

Data Extraction

For all included studies, data will be extracted by two independent raters using a data collection form developed for this review (Additional file 4). Both reviewers will pilot this in advance with five studies and make adjustments prior to the extraction of data if necessary. We plan to extract the following information and data from each study: 1) Basic characteristics of the study: authors, title, publication year, country; 2) Sample: sample size, average age, gender, type of sample (clinical vs. analogue), diagnosis and criteria for diagnosis (clinical samples) or type of symptoms in analogue samples, comorbidities; 3) Setting (e.g. online survey, laboratory experiment); 4) Type of CB investigated; 5) Assessment time points; 6) Instruments for the assessment of outcomes and type of outcomes investigated; 7) Study results with regard to the research questions.

Data Synthesis

Selected studies will first be assigned according to the disorder or psychopathology they investigated. Within these five groups, studies will additionally be categorized according to which research question they address. Due to the expected low number of eligible studies, we will carry out a narrative synthesis and compile a table outlining characteristics and findings of every study.

Risk of Bias

We will assess the risk of bias within randomized trials using the Cochrane Collaboration tool for assessing risk of bias[29] and within non-randomized studies with the Risk Of Bias In Non-randomized Studies of Interventions (ROBINS-I) tool[30]. The strength of evidence collected from each study in the review will be assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system[31]. The evaluation process will be conducted by two independent reviewers. If necessary, a third reviewer will resolve disagreements.

Patients and Public Involvement

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Patients and the public will not be directly involved in the design, interpretation or dissemination of the results.

Ethics and Dissemination

This systematic review will be based on previously published data, so there will be no requirement for ethical approval. The results of the review will be submitted for publication in a peer-reviewed psychological journal. In addition, the results will be disseminated in various media such as symposia, congresses, seminars.

STATEMENTS

Authors' contribution

SV and ASH developed the primary idea for the review, and this was refined with the help of MV and VO. All authors contributed to the development of the protocol document. All authors read and agreed the final version of the manuscript. MV is the guarantor of the review.

Ethics approval and consent to participate

Ethics approval will not be required as this is a protocol for systematic review.

Availability of data and materials

No additional data available.

Competing interests

The authors declare that they have no competing interests.

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Additional files

PRISMA-P checklist (Additional file 1.pdf)

PRISMA flow diagram (Additional file 2.pdf)

Search strategy (Additional file 3.pdf)

data collection form (Additional file 4.pdf)

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PRISMA-P 2015 Checklist

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

An Editorial from the Editors-in-Chief of *Systematic Reviews* details why this checklist was adapted - Moher D, Stewart L & Shekelle P: Implementing PRISMA-P: recommendations for prospective authors. *Systematic Reviews* 2016 **5**:15

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
ADMINISTRATIVE INFORMATION					
Title					
Identification	1a	Identify the report as a protocol of a systematic review	☒	☐	1-2
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	☐	☐	
Registration	2	If registered, provide the name of the registry (e.g., PROSPERO) and registration number in the Abstract	☒	☐	42
Authors					
Contact	3a	Provide name, institutional affiliation, and e-mail address of all protocol authors; provide physical mailing address of corresponding author	☒	☐	9-11
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	☒	☐	214-216
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	☐	☐	
Support					
Sources	5a	Indicate sources of financial or other support for the review	☒	☐	224-225
Sponsor	5b	Provide name for the review funder and/or sponsor	☐	☒	
Role of sponsor/funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	☐	☒	
INTRODUCTION					
Rationale	6	Describe the rationale for the review in the context of what is already known	☒	☐	74-139

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Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	☒	☐	141-147
METHODS					
Eligibility criteria	8	Specify the study characteristics (e.g., PICO, study design, setting, time frame) and report characteristics (e.g., years considered, language, publication status) to be used as criteria for eligibility for the review	☒	☐	152-153
Information sources	9	Describe all intended information sources (e.g., electronic databases, contact with study authors, trial registers, or other grey literature sources) with planned dates of coverage	☒	☐	155-160
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	☒	☐	162-173
STUDY RECORDS					
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	☒	☐	185-193
Selection process	11b	State the process that will be used for selecting studies (e.g., two independent reviewers) through each phase of the review (i.e., screening, eligibility, and inclusion in meta-analysis)	☒	☐	176-183
Data collection process	11c	Describe planned method of extracting data from reports (e.g., piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	☒	☐	175-193
Data items	12	List and define all variables for which data will be sought (e.g., PICO items, funding sources), any pre-planned data assumptions and simplifications	☒	☐	188-193
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	☒	☐	153, 188-193
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	☒	☐	200-205
DATA					
Synthesis	15a	Describe criteria under which study data will be quantitatively synthesized	☐	☐	
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data, and methods of combining data from studies, including any planned exploration of consistency (e.g., I^2, Kendall's tau)	☐	☐	

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Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
	15c	Describe any proposed additional analyses (e.g., sensitivity or subgroup analyses, meta-regression)	☐	☐	
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	☒	☐	195-198
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (e.g., publication bias across studies, selective reporting within studies)	☐	☐	
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (e.g., GRADE)	☒	☐	202-204

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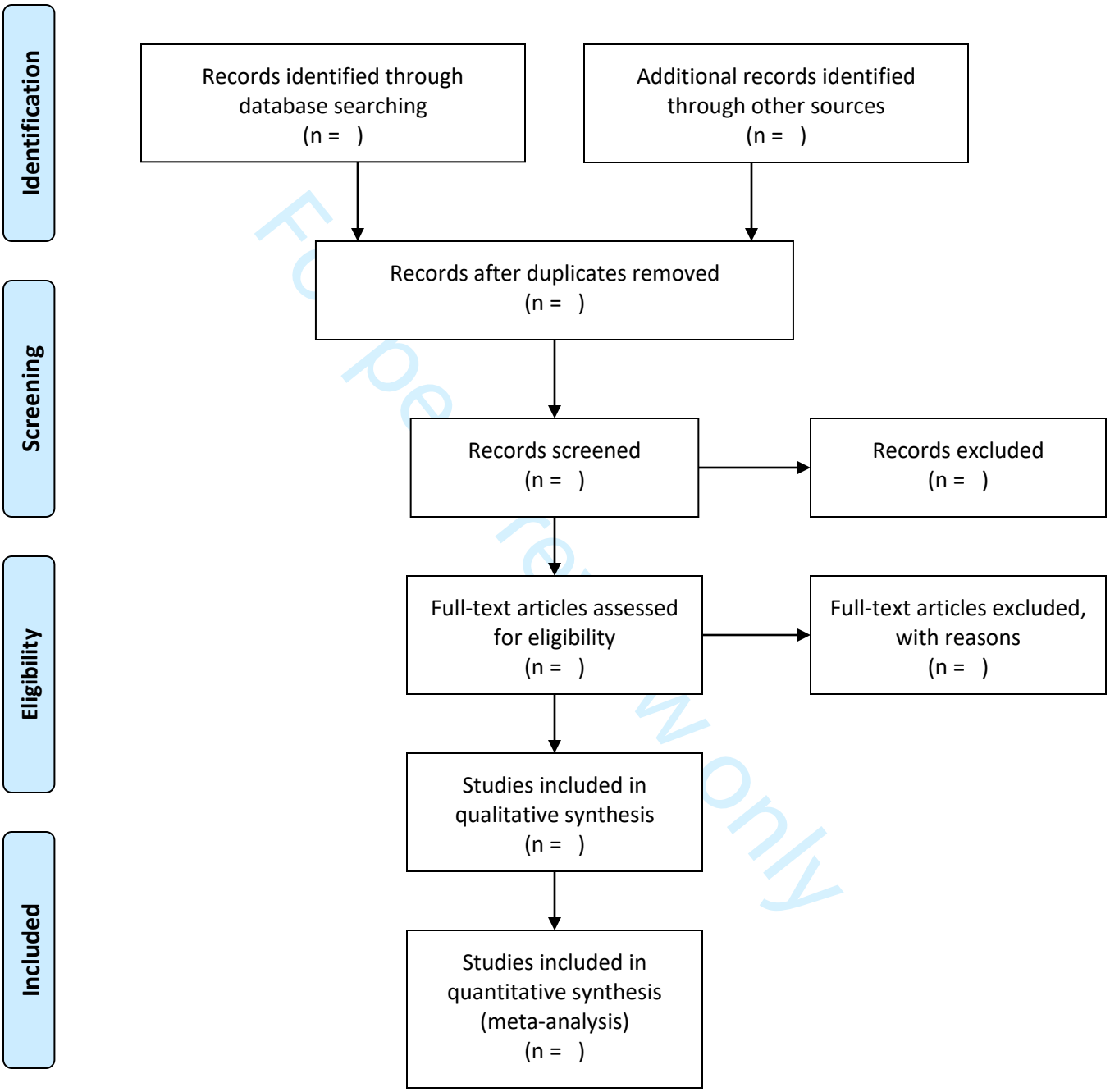
PRISMA 2009 Flow Diagram



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.

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Datenbank: APA PsycInfo <1806 to January Week 4 2021>

Suchstrategie:

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1 (Checking* or gazing* or "safety behavi*r" or "reassurance seek*").ti,ab. (7270)

2 obsessive compulsive disorder/ or compulsions/ or Generalized Anxiety Disorder/ or worry.ti,ab. or eating disorders/ or anorexia nervosa/ or binge eating disorder/ or bulimia/ or body image/ or body image disturbances/ or body dysmorphic disorder/ or dissatisfaction/ or hypochondriasis/ or health anxiety/ (70340)

3 1 and 2 (1197)

4 limit 3 to human (1152)

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Data Extraction Form

Reviewer:

Date:

Disorder:
☐ OCD ☐ GAD ☐ ED ☐ BDD ☐ IAD
☐ clinical ☐ analogue

Research question:
☐ (1) situation ☐ (2a) short-term ☐ (2b) long-term

BASIC CHARACTERISTICS

Ref ID:

Author(s):

Publication title:

Publication year: Country:

SAMPLE

Sample Size:

Average Age:

Gender:

Type of sample:

- Diagnosis and criteria for diagnosis (clinical samples):
- Type of symptoms (analogue samples):

Co-morbidities:

STUDY DESIGN

Setting:

Type of CB investigated:

Assessment time points:

Instruments for the assessment of outcomes and types of outcomes investigated:

STUDY RESULTS

Research question and outcome:

Brief summary (add research question and disorder in each case):

– Confirmed ☐ Rejected ☐

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