Review Paper

Effects of ambient temperature on physical and physiological demands and player's judgment ability assessed by a football-specific fatigue-inducing protocols: A systematic review

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ABSTRACT

We systematically reviewed the effect of ambient temperature on football players' performance during a football-specific fatigue protocol. Data sources: Cochrane Library, PubMed, Scopus, SPORTDiscus, Web of Science. Eligibility criteria followed the P.I.C.O.S. approach: (i) Healthy football players regardless of sex, age, or competitive level; (ii) football-specific fatigue-inducing protocol followed by assessment of anticipatory judgments, under controlled temperature conditions; (iii) Comparison groups using a different temperature during the foot-ball-specific fatigue-inducing protocols; (iv) Outcomes included measures of anticipation, and/or physical or physiological tests; (v) No limitations regarding study design, if (ii) and (iii) were present. The searches resulted in 1,289 titles. However, none of the articles met the P.I.C.O.S. adopted, resulting in a total of zero eligible articles for the systematic review. Therefore, from a critical review of the existing literature, it must be concluded that evidence bases of sufficient scientific quality for the understanding the effect of temperature on physical and physiological demands and anticipatory judgments of football players is simply lacking. This should strongly motivate the scientific community to engage in research on the topic, to test if theoretical assumptions are accurate.

Keywords: Soccer, Decision-Making, Environment, Heat, Evaluation.

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INTRODUCTION

Exposure to heat is a factor that can affect the performance of players who need to perform intermittent effort (Drust et al., 2000). Invasion field games, such as football, are characterized by intermittent activity profiles (Drust et al., 2000). Football match-play requires players to cover 10-12km (White et al., 2018) and perform a wide variety of activities ranging from walking to sprinting, with frequent and irregular intensity changes (Hamdan et al., 2022). Football simulation protocols aim to replicate the movement patterns and physiological demands of match-play (Drust et al., 2000; Nicholas et al., 2000; Russell et al., 2011; Thatcher et al., 2004), which is why researchers designed free running intermittent exercise protocols to simulate the activity pattern characteristics of football (Drust et al., 2000). However, several factors such as the omission of game specific skills (Russell et al., 2011), and the use of a non-grass surface might reduce the ecological validity of these protocols (Russell et al., 2011).

To cope with this limitation, modified protocols have been implemented to investigate football-specific skills (Ali et al., 2008; Foskett et al., 2009; Rostgaard et al., 2008), in which these protocols take into account that football requires mental concentration and situational-cognitive awareness to make the right tactical and technical decisions (Campo et al., 2011). Football is also cognitively demanding as it requires sustained attention to make quick, accurate decisions based on the retrieval and processing of information from a dynamic environment (Nédélec et al., 2012). These demands suggest that football may also be mentally fatiguing, with reductions in performance resulting from a combination of physical and mental fatigue. Successful football performance incorporates both physical and mental dimensions (Smith et al., 2016).

The ability to anticipate and make accurate decisions in a timely manner is fundamental to high-level performance in football (Williams et al., 2019). Decision-making is the ability to select and execute the appropriate action based on the current circumstances on the field of play, as well as the demands of the game strategically and tactically (Baker et al., 2003), which is considered essential in team sports, such as football (Gonzaga et al., 2014). For example, passing performance in football becomes important because an accurate pass may reach a teammate who is directly or indirectly unmarked and therefore create a chance to score a goal; it may also reach a teammate who is in the most advantageous position (Romeas et al., 2016). Considering the perceptual-cognitive processes underpinning decision-making (Casanova et al., 2013) and the amounts of information given to the athletes every moment, it is likely that football players may not make the best decisions if a perceptual-cognitive component is compromised (i.e. the athlete is mentally fatigued) (Gantois et al., 2020).

A key question for researchers, coaches, and practitioners is how to design practice activities and realistic environments so that athletes acquire and improve the ability to anticipate and make accurate decisions (Ford et al., 2019). For that to be possible, however, the relationships between certain environmental features, such as temperature, and performance require more investigation and investment, as well.

During some football competitions, such as the World Cup in Brazil in 2014 and the recent tournament in Qatar in 2022, players are forced to compete in hot and humid environments (Chmura et al., 2017; Sofotasiou et al., 2015), which, if hot enough and combined with high-intensity exercise, can lead the player to experience heat stress and eventually hyperthermia (Meylan et al., 2021). Hyperthermia is characterized by an elevation in core (Tc) and skin temperature; an increase in sub-maximal exercise heart rate (HR); and, with subsequent dehydration, a reduction in peripheral blood flow and an eventual reduction in sweat rate, resulting in a decline in performance (Chalmers et al., 2014; Pryor et al., 2019; Racinais et al., 2015).

In this context, football is a sport with high physiological intensities that has the potential to result in greater heat-induced metabolic stress compared to other team sports (Chalmers et al., 2014; Datson et al., 2014). Previous research in high-level football players has shown how playing in temperature above 21ºC and associated hyperthermia (Buchheit et al., 2011; Carling et al., 2011; Mara et al., 2015; Mohr et al., 2012) are negatively correlated to match performance resulting in a decrease in the total running distance covered, reduction of the high-intensity running speed, and the number of fast directional movements (acceleration and deceleration). Therefore, enhancing environmental preparation is required to optimize football performance in heat environments (Meylan et al., 2021).

Albeit some efforts were made to investigate the relationship between temperature and anticipation in sport, the results obtained from several studies were heterogeneous (Fortes et at., 2018; Gonzaga et al., 2014; Slattery et al., 2019) and considering the pattern established for the searches in the present study, 49 articles focused on some mutual themes proposed and were treated as systematic reviews. Some of studies have investigated the effects of acute exercise on cognitive performance (Chang et al., 2012), the impact of fluid consumption on athletic and cognitive performance (McCartney et al., 2017), the development of fatigue during a real football game (Silva et al., 2018), the different physiological markers of training load monitoring in football (Djaoui et al., 2017) and the effects of temperature and altitude on physical performance indicators in players during the game (Draper et al., 2022). However, none of them focused on football players or did not have heat as a research variable or did not use a football specific fatigue-inducing protocol.

There is a lack of systematic summary related to the effects of high temperature on anticipation judgments in players after football-specific fatigue-inducing protocol, in which this research might contribute to the construction of summarized knowledge in this specific domain. Therefore, a systematic review is pertinent to establish and detail objectively the overall body of knowledge and aggregate existing results in a coherent and informative way. The aim of this systematic review was to assess the literature that addressed the effect of high temperature physical and physiological demands and anticipatory judgments of football players during a football-specific fatigue-inducing protocols.

MATERIALS AND METHODS

This systematic review followed the PRISMA 2020 guidelines (Page et al., 2021) (checklist presented in *Supplementary material Table1*) and Cochrane's guidelines (Higgins et al., 2019).

Eligibility criteria

We included original research published in peer-reviewed journals, with no language limit. Eligibility criteria followed the P.I.C.O.S. approach: (i) Healthy football players with no restrictions concerning sex, age, or competitive level; (ii) Studies using football-specific fatigue-inducing protocols followed by assessment of anticipatory judgments using temporal and/or spatial occlusion paradigm (e.g., response accuracy, reaction time, movement time), under controlled temperature conditions; (iii) Comparison groups were the same as the intervention, but using a different temperature during a football-specific fatigue-inducing protocols; (iv) Outcomes included measures of anticipation (i.e., response accuracy, reaction time, movement time), and/or physical or physiological tests (e.g., 1 repetition maximum strength test, salivary stress biomarkers); (v) No limitations regarding study design, as long as two groups exposed to different temperatures were present.

Information sources

Searches were performed on December 16th of 2022. In the following databases: Cochrane Library, PubMed, Scopus, SPORTDiscus and Web of Science. Subsequently, without applying filters. Two external experts

(Ph.D., published research on the topic through many publications on the Web of Science) were consulted to provide further suggestions of potentially relevant studies. Following the recommendations of Higgins et al. (2019), a final search was carried out for errata and retractions of the included studies. In case there were pre-registered protocols and/or complementary files of the included studies, these were also retrieved.

Search strategy

The general search strategy made use of free text terms and the Boolean operators AND/OR, with four lines of code being implemented in all fields/all text/full text:
(Soccer OR Football) AND (Anticipat* OR Judg* OR Decision* OR Percept* OR cogniti*) AND (Temperature OR cold OR heat*)*

The full search strategies for each database are presented in Table 1.

Table 1. Full search strategies for each database.

Database	Search strategy
Cochrane Library	Soccer OR Football* in Title Abstract Keyword AND Anticipat* OR Judg* OR Decision* OR Percept* OR cogniti* in Title Abstract Keyword AND Temperature OR cold OR heat* in All Text - (Word variations have been searched)
PubMed	((Soccer [Title/Abstract] OR Football*[Title/Abstract]) AND (Anticipat*[Title/Abstract] OR Judg*[Title/Abstract] OR Decision*[Title/Abstract] OR Percept*[Title/Abstract] OR cogniti*[Title/Abstract])) AND (Temperature OR cold OR heat*))
Scopus	(TITLE-ABS-KEY (soccer OR football*) AND TITLE-ABS-KEY (*anticipat** OR *judg** OR *decision** OR *percept** OR *cogniti**) AND ALL (*temperature* OR *cold* OR *heat**))
SPORTDiscus	Title/Title/Text "TI (Soccer* OR "Anticipat*" OR "Judg*" OR "Decision*" OR "Percept*" OR "cogniti*" OR "cold*" OR "Temperature*" OR "heat*") AND TI (Football* OR "Anticipat*" OR "Judg*" OR "Decision*" OR "Percept*" OR "cogniti*" OR "cold*" OR "Temperature*" OR "heat*") AND TX (Soccer* OR Football* "Anticipat*" OR "Judg*" OR "Decision*" OR "Percept*" OR "cogniti*" OR "cold*" OR "Temperature*" OR "heat*")" Abstract/Title/Text "AB (Soccer* OR Football* "Anticipat*" OR "Judg*" OR "Decision*" OR "Percept*" OR "cogniti*" OR "cold*" OR "Temperature*" OR "heat*") TI (Soccer* OR "Anticipat*" OR "Judg*" OR "Decision*" OR "Percept*" OR "cogniti*" OR "cold*" OR "Temperature*" OR "heat*") AND TI (Football* OR "Anticipat*" OR "Judg*" OR "Decision*" OR "Percept*" OR "cogniti*" OR "cold*" OR "Temperature*" OR "heat*") AND TX (Soccer* OR Football* "Anticipat*" OR "Judg*" OR "Decision*" OR "Percept*" OR "cogniti*" OR "cold*" OR "Temperature*" OR "heat*")"
Web of Science	ALL FIELDS: (Soccer OR Football*) TOPIC: Anticipat* OR Judg* OR Decision* OR Percept* OR cogniti*) AND ALL FIELDS: (Temperature OR cold OR heat*)

Selection process

AP and EC independently screened each record and each report retrieved. In case of disagreements between the two authors, JA provided arbitrage until consensus was achieved. Automated removal of duplicates was performed using EndNoteX9, but further manual removal of duplicates was required.

Data collection process

AP and EC independently collected data from reports. In case of disagreements between the two authors, JA provided arbitrage until consensus was achieved. In case of relevant data being missing and/or additional details being required, the authors of the studies were contacted at least two times, and the required information were solicited. No automation tools were used.

Data items

Outcomes: Anticipation assessment using at least one of the following outcomes- temporal and/or spatial occlusion paradigm (e.g., response accuracy, reaction time, movement time); Physical tests (e.g., countermovement-jump, football-specific fatigue-inducing protocols); Physiological tests (e.g., salivary stress biomarkers).

Additional variables: participant-related characteristics (e.g., sample size, sex, competitive level, exposure to different temperatures, exposure to regular sports training), assessment-related features (e.g., specific assessments that were performed, number and blinding of testers, familiarization with testing procedures, time of season during the assessments, reliability of the assessments), adverse events, and other study-related information (e.g., country, funding, competing interests).

Risk of bias in studies, effect measures, data synthesis and certainty of evidence

The risk of bias of individual studies, planned effect measures, data synthesis and certainty of evidence can be consulted in the pre-registered protocol (https://osf.io/qkeas/). Due to a lack of studies fulfilling the eligibility criteria, these steps were not implemented.

RESULTS

Study selection

An initial search returned 1,289 results (Cochrane Library: 1; EBSCO: 530; PubMed: 69; Scopus: 513; and Web of Science: 176). After removing duplicates, 652 records remained. Screening titles and abstracts for eligibility criteria resulted in the exclusion of 637 records, 71 were excluded because they were not empirical studies published in peer-reviewed journals. However, no studies were identified that met the P.I.C.O.S. adopted in this systematic review (Figure 1). As such, we were not able to perform the meta-analysis initially proposed in our project (https://osf.io/qkeas/) nor any narrative synthesis. Two external experts (Ph.D., published research on the topic through many publications on the Web of Science) were asked to indicate probable studies that respect the P.I.C.O.S. established, but their responses resulted in no additional study fulfilling the eligibility criteria.

Study characteristics

No studies met the inclusion criteria for this review; this was largely attributed to the fact that no study has evaluated at least two groups of football players exposed to different temperatures (i.e., heat and on ambient temperature) when simultaneously performed a football-specific protocol to induce physical and physiological fatigue and assessing the judgment ability. Particularly, in the present systematic review, few studies were found that proposed to evaluate the effect of heat on players (Duffield et al., 2013; Duffield et al., 2012), but some of them did not use a football-specific fatigue-inducing protocol (Guttierres et al., 2011; Meylan et al., 2021). Other studies found assessed the effect of heat on physical and physiological capacities (Bandelow et al., 2010; Yeargin et al., 2010). There were studies that proposed to evaluate the effect of heat on physical and physiological indicators, including the players' judgments, but the players were not evaluated at a control room temperature (Ernwein et al., 1998; Greig et al., 2007).

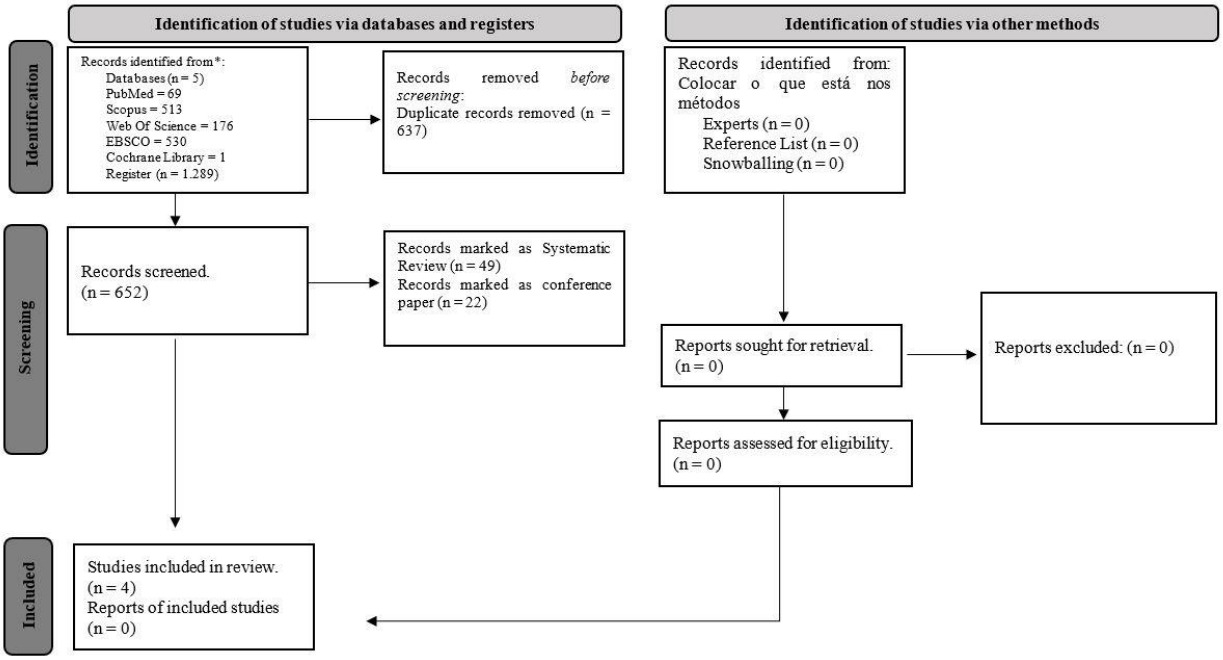

Figure 1. PRISMA flow diagram highlighting the selection process for the studies included in the systematic review.

DISCUSSION

The aim of the present systematic review was to establish and detail current literature focusing on the effects of high temperature in physical and physiological demands and anticipatory judgments of football players during a football-specific fatigue-inducing protocols. From the literature search, no studies met the P.I.C.O.S. criteria that was adopted in this systematic review, with all studies failed to provide evidence on the effects of different temperatures (i.e., heat and on ambient temperature) in physical, physiological and judgment abilities on football during a football-specific protocol.

In recent years, two FIFA World Cups were held in countries where a predominance of hot weather during the competition was observed (Brazil 2014 and Qatar 2022). These environmental conditions caught the attention of the scientific community (Assembly, 2015), which was concerned with investigating in a deeper way the risks that players might be expose to this adverse condition. A football-specific fatigue-inducing protocol allows the researcher to simulate the effects that the player suffers in a football match in a laboratory environment (Drust et al., 2000), since heat becomes a variable of great importance to be currently analysed.

At the present, few researchers have studied the influence of temperature in physical and decisional performance on football players (Benjamin et al., 2021; Clarke et al., 2011; Coull et al., 2015; Edwards et al., 2007). Moreover, it is important to suggest that future studies must have the assumption of helping the sports community to improve and to evolute the football.

Four studies were closest to the P.I.C.O.S. criteria, but as previously mentioned, none of them addressed all the criteria adopted in this systematic review (Benjamin et al., 2021; Clarke et al., 2011; Coull et al., 2015; Edwards et al., 2007). Particularly, in these four studies we methodological detected that the effect of heat on performance was analysed without using a control group exposing and comparing their performance to

different temperatures, which lead to heterogeneous and dissimilar results. For example, the study conducted by Clarke et al. (2011) aimed to examine the effect of carbohydrate ingestion and pre-cooling on the physiological responses of 12 players using a football-specific intermittent exercise and the impact on subsequent high-intensity exercise performance in the heat. The results obtained must be questioned since the changes in physical and mental performance were only provoked by the exposure of hot conditions or by the protocol itself.

Another critical point detected in some of the studies excluded from the present systematic review was about the sample size, particularly the subjects used in the experimental studies consisted in a range of 8 (Coull et al., 2015) and 12 football players (Benjamin et al., 2021; Clarke et al., 2011; Edwards et al., 2007). We considered that small sample could be insufficient to present any robust conclusion that may guide the scientific and sports community. Additionally, we observed that only one study (Coull et al., 2015) implemented a protocol familiarization procedure to the subjects tested, which concerned us about the reliability of the results obtained by the other studies mentioned (Coull et al., 2015; Edwards et al., 2007). Moreover, in all these four studies (Benjamin et al., 2021; Clarke et al., 2011; Coull et al., 2015; Edwards et al., 2007), the physiological variables collected (e.g., HR, level of dehydration and body temperature) in football players were conducted using different procedures, which lead us to observe heterogeneous results in all of them.

Due to these issues, the literature to date has considerable inconsistencies in the experimental conditions and in evaluating all the variables separately or combined, which has likely contributed to the poor understanding of this phenomenon. In addition, the literature is lacking in terms of the effects that the heat would have on the physical, physiological and on male or female football players' judgments during a football-specific fatigue-inducing protocol.

Therefore, we end up with an empty review (Lang et al., 2007; Yaffe et al., 2012). Globally, it is relevant to science that all data be published to provide a more balanced explanation of the topics being studied (Weintraub, 2016). Specifically, empty reviews are relevant and useful for the advancement of evidence-based practices, highlighting major research gaps (Lang et al., 2007; Weintraub, 2016; Yaffe et al., 2012).

CONCLUSIONS

The lack of publications related to this topic is in direct contrast with the importance given by the scientific community to the effects of heat on football players. The physical and physiological demands and player's judgment ability are fundamental factors in their performance throughout the game, especially when they are exposed to high temperatures. Unlike studies that evaluate these three variables separately, it is mandatory to evaluate all of them combined. Therefore, the diagnosis we can reach at the end of this systematic review is that there is still a gap in the literature on this topic, where other studies can contribute to increasing knowledge about athletes, not only with male, but also with female participants.

Future recommendations

Having confirmed that there are no studies to date that assess the effect that a football specific fatigue-inducing protocol has on the physical and physiological demands and players' judgments about the influence of heat, the present study contributes by pointing to this gap in the literature on the subject and reaffirming the importance of future studies should be carried out exposing male and/or female players to this type of condition and also more representative evaluative tasks in relation to the context of football is needed. Moreover, the findings of the present study as an empty review must be careful attended by researchers

given them clear instructions for the incorporation of potentially important information not always considered in systematic reviews of interventions, as well as specific direction on whether to discuss and how to present the findings of non-included studies.

Limitations

The limitations found in this systematic review were that no studies have been reported that focus on the impact of heat using football-specific fatigue-inducing protocols. The studies found related to heat carried out their collection in an external environment and always in the summer period, that is, there was no control of the ambient temperature or the humidity that the players were exposed to. In this systematic review, no studies were found that compared a control group with another group exposed to heat. The fact that the result was a total of zero articles found in the P.I.C.O.S. adopted prevented the performance of a meta-analysis.

AUTHOR CONTRIBUTIONS

Alberto Pompeo, research concept and study design, literature review, data collection, data analysis and interpretation. Everton Luis Rodrigues Cirillo: data collection and data analysis and interpretation. Júlio Alejandro Henriques da Costa: writing the manuscript or reviewing/editing a draft of the manuscript. José Vilaça-Alves: writing the manuscript or reviewing/editing a draft of the manuscript. Andrew Mark Williams: research concept, writing the manuscript, or reviewing/editing a draft of the manuscript. Rodrigo Ramirez-Campillo: data analysis and interpretation and statistical analyses. José Afonso: data collection, data analysis and interpretation, statistical analyses and reviewing/editing a draft of the manuscript. Filipe Casanova: research concept and study design, literature review, writing the manuscript, or reviewing/editing a draft of the manuscript.

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DISCLOSURE STATEMENT

No potential conflict of interest were reported by the author.

OTHER INFORMATION

This systematic review was registered on the OSF platform under the OSF registration number of January 20th of 2022. Link to the project: OSF registration https://osf.io/qkeas/. Link for registration: https://osf.io/p4fz8. It was also followed the PRISMA 2020 recommendations (Page et al., 2021) and Cochrane's guidelines (Higgins et al., 2019).

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Supplementary Table 1. PRISMA Checklist.

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Pages 1-2
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Pages 3
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 3-4
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 4
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Pages 4-5
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 5
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 5
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 5
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 6
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 6
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 6
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 6
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 6
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 6
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Page 6
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Page 6
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 6
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 6

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 6
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 6
Study characteristics	17	Cite each included study and present its characteristics.	Page 7
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Not applicable
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Not applicable
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Not applicable
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Not applicable
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Not applicable
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Not applicable
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Not applicable
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Not applicable:
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 7
	23b	Discuss any limitations of the evidence included in the review.	Page 8
	23c	Discuss any limitations of the review processes used.	Page 8
	23d	Discuss implications of the results for practice, policy, and future research.	Page 9
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 10
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 10
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Pages 10
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 10
Competing interests	26	Declare any competing interests of review authors.	Page 11
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Pages 4, 5 and 10