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STUDY PROTOCOL

REVISED Using behavioural science to enhance use of core outcome sets in trials: protocol[version 2; peer review: 2 approved]

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Open Peer Review

Approval Status ✓ ✓

	1	2
version 2 (revision) 20 Nov 2023		✓ view
version 1 24 Mar 2022	✓ view	? view

1. **Nikita Nekliudov** [ID], Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russian Federation University of Oxford, Oxford, UK

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Abstract

Background

Core outcome sets (COS) represent agreed-upon sets of outcomes, which are the minimum that should be measured and reported in all trials in specific health areas. Use of COS can reduce outcome heterogeneity, selective outcome reporting, and research waste, and can facilitate evidence syntheses. Despite benefits of using COS, current use of COS in trials is low. COS use can be understood as a behaviour, in that it is something trialists do, or not do, adequately. The aim of this study is to identify strategies, informed by behaviour change theory, to increase COS use in trials.

Methods

The project will be conducted in two stages, informed by the

behaviour change wheel (BCW). The BCW is a theoretically based framework that can be used to classify, identify, and develop behaviour change strategies. In Stage 1, barriers and enablers to COS use will be extracted from published studies that examined trialist's use of COS. Barriers and facilitators will be mapped to the components of COM-B model (capability, opportunity, and motivation), which forms part of the BCW framework. Stage 2 will build on Stage 1 findings to identify and select intervention functions and behaviour change techniques to enhance COS use in trials.

Discussion

The findings of this study will provide an understanding of the behavioural factors that influence COS use in trials and what strategies might be used to target these factors to increase COS use in trials.

Keywords
Core outcome sets, trials, trial methodology

2. **Oscar Castro**, Singapore-ETH Centre, Singapore, Singapore

Any reports and responses or comments on the article can be found at the end of the article.

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REVISED   **Amendments from Version 1**

Stage 3 of the proposed project has been removed, and the protocol now outlines the two stages of the project.

As requested by the reviewers, the revised protocol also now includes more information on core outcome sets, why the reviewed papers were chosen and limitations regarding generalisability of these papers, why the behaviour change wheel was chosen, and on dissemination of the study findings.

Any further responses from the reviewers can be found at the end of the article

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Core outcome sets (COS) are agreed-upon sets of outcomes that should be measured and reported in all trials in specific health areas[1]. COS are not necessarily the only outcomes that should be included in trials, but they represent the minimum set of outcomes to be measured and reported. For instance, a recently published COS for post-COVID-19 condition, included 11 outcomes such as fatigue, pain, survival, and post-exertion symptoms[2]. COS are also applicable for use in other study designs, such as observational studies and clinical audit[1]. COS are usually developed using input from broad stakeholders, such as researchers (including trialists), healthcare professionals, patient/public representatives, and research funders[3]. COS are used and/or recommended for use by these stakeholders[1,3]. COS use involves trialists including the COS in the trial design, measuring the COS outcomes during the trial, and reporting the COS outcomes in the final trial report. Use of COS facilitates evidence syntheses[1,4,5] and can reduce outcome heterogeneity[6], selective outcome reporting[7], and research waste[8]. Despite the benefits of using COS in trials, low COS use has been demonstrated across multiple areas of health research[9–12]. Low use of COS is problematic because it means that methodological improvements associated with COS are not finding their way into trial conduct quickly enough.

Previous research has examined potential reasons for low COS use in trials, including identification of barriers and facilitators to COS use among researchers with trials registered on the International Standard Randomised Controlled Trial Number (ISRCTN) Registry[12], researchers who submitted funding applications to the National Institute for Health Research Health Technology Assessment (NIHR HTA) programme[13], researchers named as chief investigators of NIHR HTA funded trials[14], and researchers who published a trial report in a major medical journal (e.g., *The Lancet, BMJ*)[9]. Identified barriers to COS use include poor knowledge about existence of COS, and perceived outcome measurement issues, including patient burden[9,14]. Facilitators for COS use include good trialist knowledge about what COS are and how to use them, perceived importance of COS in trials, and having funder or professional recommendations or requirements to use COS in funded research[9,14].

Whether or not trialists use COS in their trials can be understood as a behaviour because COS use is something trialists do, or not do. As such, COS use in trials might be modified and increased through theoretically informed behaviour change strategies. The Behaviour Change Wheel (BCW) provides a useful theoretically based framework[15] to identify and develop behaviour change strategies for COS use. The BCW framework includes the COM-B model, in which behaviour is predicated on an individual's capability, opportunity, and motivation to engage in that behaviour[15,16]. Following the COM-B model, for a behaviour to occur, an individual must have the physical and psychological capability, social and physical opportunity, and reflective and automatic motivation to engage in the behaviour[15,16]. In addition to the COM-B model, the BCW also includes systematic guidance on identifying targeted intervention components and content in the form of intervention functions and behaviour change techniques (BCTs)[15–17]. Using the BCW is particularly useful as it facilitates mapping of barriers and facilitators to behavioural intervention functions and BCTs. As such, it can provide a systematic approach to selecting and implementing a wide range of intervention functions based on what is known about the behaviour. Adopting a behavioural science approach to understanding COS use behaviours and developing strategies to increase COS use using the BCW has the potential to maximise benefits of COS and improve the quality of trials and evidence-based practice.

The overall project aim is to identify strategies, informed by the BCW, to increase trialist use of COS in trials. The findings of this project will provide an understanding of the behavioural factors that influence COS use in trials, what strategies might be used to target these factors to increase COS use.

Methods

We will achieve the overall project aim by examining behavioural factors identified in the previous research[9,12–14] that influence whether or not trialists use COS. The focus is on the individual trialist behaviour, rather than broader system behaviours and factors, which are being examined in a separate project[18]. We will then map these factors to behaviour change strategies. This project will be conducted in two sequential stages to identify and prioritise behaviour change strategies that could enhance COS use in trials.

Stage 1. Identification of behavioural barriers and facilitators to COS use

Stage 1 is informed by the first phase of the BCW, which involves understanding the behaviour to be examined (i.e., use of COS in trials). This includes defining the components of the behaviour in terms of *who, what, where, when*, and *how often* the behaviour is done. Existing data from recently published examinations of COS use[9,12–14] and research team expertise will be used to understand and define use of COS in trials for these components.

Following on from behavioural specification of COS use in trials, barriers to and enablers of this behaviour will be extracted from four recent studies (all published since 2019) that examined trialist use of COS. These papers were identified in a recent review of COS uptake as addressing why trialists

use, or do not use, COS[19]. They represent up to date research that had been conducted on use and uptake of broad cohorts of COS, rather than use of COS in specific health areas. This information across a broad cohort of health areas is needed to develop intervention strategies that are potentially useful across health areas. It is important to note that the papers report on barriers and facilitators experienced predominantly by UK and European based researchers; for instance, one paper focuses solely on UK-based researchers[13]. This presents a limitation in terms of representativeness. However, global research on this topic was not available for inclusion. The four papers are listed below

1. A review and survey of COS use in a cohort of trials published in major medical journals[9].

2. A review and survey of COS use in funding applications submitted to the NIHR HTA programme[13].

3. A survey of trialists named as the contact person for trials registered on the ISRCTN Registry[12].

4. A qualitative study of trialist barriers and facilitators to COS use[14].

Barriers and facilitators will be extracted verbatim from the four papers and will be coded to the components of COM-B framework[15,16] to identify behavioural components influencing trialist use of COS. These components include capability (physical and psychological), opportunity (physical and social) and motivation (automatic and reflective). The previously conducted qualitative study of trialist barriers and facilitators to COS use[14], utilised the COM-B framework to guide analysis, and so will inform the approach taken in the current study. A realist approach to coding will be taken, whereby we are seeking to identify and understand underlying mechanisms of sources of behaviour, in the form of barriers and facilitators. One investigator will conduct initial coding using a standardised coding form (Extended Data). All coding will be verified by a second investigator, with any discrepancies discussed to reach consensus, involving a third investigator as needed; all investigators involved in coding will have prior experience in coding using the COM-B framework. The findings from this coding will be synthesised narratively and using matrices, guided by COM-B as a deductive framework to identify behavioural components influencing COS use in trials.

Stage 2. Identification of behavioural intervention strategies to enhance COS use in trials

The BCW framework[15,16] will be applied to identify and select intervention functions to enhance COS use by trialists in trials. Intervention functions are 'broad categories of means by which an intervention can change behaviour' (e.g., incentivisation, training)[15]. Intervention functions map on to COM-B components[15] and can be used in isolation or together to develop behavioural strategies. Stage 2 will use the findings of Stage 1 to identify potential intervention functions by mapping identified behavioural components to corresponding intervention functions. For example, the behavioural component

'psychological capability' maps on to the intervention functions 'training', 'education', and 'enablement'[15]. Where multiple intervention functions are identified, we will ensure that the selected intervention functions are affordable, practical, effective/cost-effective, acceptable, safe, and equitable (the APEASE criteria)[15]. Two investigators will independently apply the APEASE criteria to each identified intervention function, with APEASE criteria rated as 'yes', 'no', or 'unsure'; any disagreements will be resolved by discussion, involving a third investigator as needed. Rationale for each decision made using the APEASE criteria will be also documented on the standardised APEASE template (Extended Data). Final decisions on inclusion and exclusion of intervention functions based on APEASE criteria will be made based on team review and discussion to reach consensus.

We will also identify potential intervention content in terms of BCTs. BCTs are irreducible, observable, and replicable active ingredients of an intervention designed to change behaviour that can be mapped from identified intervention functions[15]. BCTs will be identified using the BCT Taxonomy Version 1 (BCTTv1)[17] and with reference to the more recently published ontology of BCTs[20]. Each BCT will be operationalised by translating it from the BCTTv1 definition to a concrete application; for example, the BCT 'demonstration of the behaviour' may be operationalised as delivering a workshop for trialists demonstrating how COS can be included in trials. As with intervention functions, two investigators will independently screen BCTs using the APEASE criteria to evaluate identified BCTs based on the APEASE criteria[15]. Rationale for each decision made using the APEASE criteria will be documented on a standardised template (Extended data) and any disagreements will be resolved by discussion, involving a third investigator as needed. As for intervention functions, decisions on inclusion or exclusion of BCTs will be based on team review and discussion to reach consensus.

Ethical considerations
All research activities will be conducted following the University College Cork (UCC) Code of Research Conduct ethical approval and in accordance with General Data Protection Regulations (GDPR). Stages one and two do not involve any potential ethical issues because they relate to reviewing and synthesising evidence from the existing literature.

Dissemination
This study is registered on the Open Science Framework (DOI:10.17605/OSF.IO/GWYZS); accompanying data and materials will also be made openly available upon study completionon the Open Science Framework. The study findings will be submitted for publication in a peer-reviewed journal and disseminated through presentations to the working groups and the MRC-NIHR TMRP and the HRB-TMRN and presentations at general and domain specific conferences and events. Dissemination through platforms such as the Core Outcome Measures in Effectiveness Trials (COMET) Initiative, Harmonising Outcome Measures for Eczema (HOME) and

Outcome Measures in Rheumatology (OMERACT) will be explored. Dissemination via social media will also be conducted.

Discussion

Use of COS in trials can benefit evidence syntheses[1,4,5], in addition to reducing outcome heterogeneity[6], selective outcome reporting[7], and research waste[8]. This project will provide information on strategies, informed by behavioural science, to enhance COS use in trials. The results will therefore provide the foundation for future methodology research and development and implementation of strategies to maximise COS use in trials.

Study status

Stage one of the study commenced in March 2022.

Data availability

Extended data

Open Science Framework: Enhancing COS Use in Trials, https://doi.org/10.17605/OSF.IO/BN3YQ (Matvienko-Sikar *et al.*, 2022)

This project contains the following extended data:

- Supplementary File 1: Coding barriers and facilitators to COM-B components

- Supplementary File 2. Selection of Intervention Functions

- Supplementary File 3. Selection of Behaviour Change Techniques (BCTs)

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

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18. Williamson PR, Clarke M, Hughes K, *et al.*: **Improving core outcome set uptake in trials: Project advertisment**.
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19. Williamson PR, Barrington H, Blazeby JM: **Review finds core outcome set uptake in new studies and systematic reviews needs improvement.** *J Clin Epidemiol.* 2022; **150**: 154–164.
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20. Marques MM, Wright AJ, Corker E: **The Behaviour Change Technique Ontology: Transforming the Behaviour Change Technique Taxonomy v1 [version 1; peer review: 4 approved].** *Wellcome Open Res.* 2023; **8**: 308.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

Open Peer Review

Current Peer Review Status: ✓ ✓

Version 2

Reviewer Report 27 November 2023

https://doi.org/10.21956/hrbopenres.15152.r37096

✓ **Oscar Castro**

Future Health Technologies,Campus for Research Excellence and Technological Enterprise, Singapore-ETH Centre, Singapore, Singapore

All my points have been addressed satisfactorily and have no further comments. Wishing the authors a successful project completion.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Health behaviour change; evidence synthesis; development and evaluation of theory-based interventions

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 31 August 2023

https://doi.org/10.21956/hrbopenres.14741.r35734

? **Oscar Castro**

Future Health Technologies,Campus for Research Excellence and Technological Enterprise, Singapore-ETH Centre, Singapore, Singapore

Thank you for the opportunity to participate in this review. The protocol paper describes a programme of research with three stages aimed at identifying theory-indicated behaviour change strategies to promote the use of core outcome sets (COS) when reporting medical research. The research described is novel and important. Authors have provided a comprehensive overview of the different research activities planned and their methodology. However, I lack specific details on the research protocol and I have also some suggestions to expand the discussion section. I hope my comments below will help authors to improve this submission.

Introduction
- While the rationale is sound and well-presented, more information could be added to help readers understand what authors mean by 'core outcome sets'. Introducing one or two examples would be helpful in this regard. Moreover, it would be good to clarify whether COS only apply to interventional research or also include all medical research (e.g., observational).

- Authors state that "*The Behaviour Change Wheel (BCW) provides a useful theoretically based framework to identify and develop behaviour change strategies for COS use*", but it is not clearly specified why is that the case. The selection of a given theoretical framework is critical as it will determine subsequent work according to the protocol, so it should be better justified. For example, a unique advantage of the BCW is that it helps intervention designers to not just better understand behaviour but also how to act upon it (i.e., provides a systematic approach on how to select and implement a wide range of intervention functions based on what is known about the behaviour).

Methods –Stage 1
- I lack further details on the four studies that will be used as part of this stage. Why have these been selected? Do they represent a sizeable portion of *all* literature on COS influences? Have these studies been conducted by the research team, or other researchers? What is the rationale to select studies published since 2019? These details are relevant as this constitutes the source data from which the entire project will be based on.

- I understand the COM-B will be used deductively to code the source data. Are authors using any specific qualitative analysis deductive approach (e.g., directed content analysis)? What are the authors' epistemology stance when it comes to these qualitative analyses? Do authors plan to use the TDF to expand on the COM-B components and provide a more nuanced framework for coding (and later mapping of intervention functions / BCTs)?

Methods –Stage 2
- It is not clear to me why a prioritisation effort is taking place here to select between different intervention functions when you have a specific phase (stage 3) to precisely do that. Why not simply present all intervention functions to the experts as part of the consensus meeting? Please clarify.

- Regarding the rating for the APASE criteria, I understand you will use different categories ('yes', 'no', or 'unsure'), but it is not clear how this will lead to an overall inclusion/exclusion decision (e.g., will you use the number of 'yes' per intervention function / BCT as a criterion?)

- When it comes to BCT definitions and labels, apart from the original taxonomy perhaps the research team wants to also cross-check the recently published ontology of behaviour change interventions (see below), as I understand some BCTs have been updated in this

new resource.

Marques, M. M., Wright, A. J., Corker, E., Johnston, M., West, R., Hastings, J., ... & Michie, S. (2023). The Behaviour Change Technique Ontology: Transforming the Behaviour Change Technique Taxonomy v1. Wellcome Open Research, 8.

Methods –Stage 3
- ○ Although not explicitly mentioned, I understand the consensus meeting will be conducted in English, with most (all?) participants from English-speaking countries. Will this hamper the broad applicability of findings?

- ○ Could you also please specify the expected duration of the meeting? It seems there are many aspects to be covered.

- ○ Will the APEASE criteria will be somehow introduced here? For consistency with stage 2.

Discussion
- ○ While I agree that the use of COS will potentially improve evidence synthesis, I also see some limitations which could be interesting to elaborate further to provide a broader picture. To my understanding, COS basically refers to a checklist of outcomes that need to be reported for a given health condition. That is, COS do not provide a controlled vocabulary for such outcomes to ensure the same labels are used consistently to describe the same outcomes. This is unlike other evidence synthesis approaches (e.g., ontologies such as the BCIO) that use pre-defined entities and have the added benefit of being computer-friendly, which could be very useful to support evidence synthesis automation and leverage on AI / machine learning. In addition, COS are focused on outcomes so do not seem to address other important aspects of clinical trials that would also benefit from standardisation and a more comprehensive reporting (e.g., population targeted, methods, etc). I understand this research is not about COS but rather the use of COS (i.e., it's a behaviour change question rather than an evidence synthesis question), but I still think authors could use the introduction and/or the discussion to provide a broader overview of COS and highlight similarities (and differences) with other evidence synthesis improvement approaches (e.g., ontologies), as well as comment on how COS relates, or could be interoperable with, common reporting guidelines (e.g., CONSORT statement).

Michie, S., West, R., Finnerty, A. N., Norris, E., Wright, A. J., Marques, M. M., ... & Hastings, J. (2020). Representation of behaviour change interventions and their evaluation: Development of the Upper Level of the Behaviour Change Intervention Ontology. Wellcome open research, 5.

References

1. Marques MM, Wright AJ, Corker E, Johnston M, et al.: The Behaviour Change Technique Ontology: Transforming the Behaviour Change Technique Taxonomy v1.*Wellcome Open Res*. 2023; **8**: 308 PubMed Abstract | Publisher Full Text

2. Michie S, West R, Finnerty A, Norris E, et al.: Representation of behaviour change interventions and their evaluation: Development of the Upper Level of the Behaviour Change Intervention Ontology. *Wellcome Open Research*. 2020; **5**. Publisher Full Text

Is the rationale for, and objectives of, the study clearly described?

Yes

Is the study design appropriate for the research question?

Yes

Are sufficient details of the methods provided to allow replication by others?

Partly

Are the datasets clearly presented in a useable and accessible format?

Not applicable

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Health behaviour change; evidence synthesis; development and evaluation of theory-based interventions

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 08 Nov 2023

Karen Matvienko-Sikar

Reviewer comment 1. Thank you for the opportunity to participate in this review. The protocol paper describes a programme of research with three stages aimed at identifying theory-indicated behaviour change strategies to promote the use of core outcome sets (COS) when reporting medical research. The research described is novel and important. Authors have provided a comprehensive overview of the different research activities planned and their methodology. However, I lack specific details on the research protocol and I have also some suggestions to expand the discussion section. I hope my comments below will help authors to improve this submission.
Author response 1. Thank you for your feedback on the protocol manuscript and for your useful suggestions for improvement, which have now been incorporated.

Reviewer comment 2. Introduction
While the rationale is sound and well-presented, more information could be added to help readers understand what authors mean by 'core outcome sets'. Introducing one or two examples would be helpful in this regard. Moreover, it would be good to clarify whether COS only apply to interventional research or also include all medical research (e.g., observational).
 Author Response 2. We have now added the following to the introduction to provide more information and clarification on COS:
"COS are not necessarily the only outcomes that should be included in trials, but they represent the minimum set of outcomes to be measured and reported. For instance, a recently published COS for post-COVID-19 condition, included 11 outcomes such as fatigue,

pain, survival, and post-exertion symptoms. COS are also applicable for use in other study designs, such as observational studies and clinical audit[1]."

Reviewer comment 3. Authors state that "The Behaviour Change Wheel (BCW) provides a useful theoretically based framework to identify and develop behaviour change strategies for COS use", but it is not clearly specified why is that the case. The selection of a given theoretical framework is critical as it will determine subsequent work according to the protocol, so it should be better justified. For example, a unique advantage of the BCW is that it helps intervention designers to not just better understand behaviour but also how to act upon it (i.e., provides a systematic approach on how to select and implement a wide range of intervention functions based on what is known about the behaviour).

Author Response 3. We agree that clearly explaining the choice of theoretical framework is important and have added the following to the introduction to better clarify this choice: "Using the BCW is particularly useful as it facilitates mapping of barriers and facilitators to behavioural intervention functions and BCTs. As such, it can provide a systematic approach to selecting and implementing a wide range of intervention functions based on what is known about the behaviour."

Reviewer comment 4. Methods –Stage 1
I lack further details on the four studies that will be used as part of this stage. Why have these been selected? Do they represent a sizeable portion of all literature on COS influences? Have these studies been conducted by the research team, or other researchers? What is the rationale to select studies published since 2019? These details are relevant as this constitutes the source data from which the entire project will be based on.

Author 4. The four studies included represent the research that had been conducted to the date of the protocol on use and uptake of broad cohorts of COS, rather than use of COS in specific health areas. This information across a broad cohort of health areas is needed to develop intervention strategies that are potentially useful across health areas. Some, but not all, members of the research team were involved in these papers, though the first authors of three papers (Dr Hughes, Ms Bellucci) are not involved in this project. This was not a deciding factor in inclusion of these papers, rather a reflection of the work of members of the research team in this area. Similarly, studies were not required to be published since 2019 but the studies identified were, thus providing up to date information. We have included the following for further clarification:
"These papers were identified in a recent review of COS uptake as addressing why trialists use, or do not use, COS. They represent up to date research that had been conducted on use and uptake of broad cohorts of COS, rather than use of COS in specific health areas. This information across a broad cohort of health areas is needed to develop intervention strategies that are potentially useful across health areas."

Reviewer comment 5. I understand the COM-B will be used deductively to code the source data. Are authors using any specific qualitative analysis deductive approach (e.g., directed content analysis)? What are the authors' epistemology stance when it comes to these qualitative analyses? Do authors plan to use the TDF to expand on the COM-B components and provide a more nuanced framework for coding (and later mapping of intervention functions / BCTs)?

Response 5. We are not conducting specific qualitative deductive analyses beyond coding

the included qualitative data to the COM-B framework. The epistemological stance taken in analysis of the qualitative data is a realist approach whereby we are seeking to identify and understand underlying mechanisms of sources of behaviour, in the form of barriers and facilitators. The COM-B was chosen as the single framework for use in this study to enable development of broad strategies, tied to specific behaviour change techniques that could be used. Future studies may build upon this work, utilising other frameworks such as the TDF, but this is not part of the current study.

The following has been added to Stage 1 in the Methods to clarify the epistemological stance:

"A realist approach to coding will be taken, whereby we are seeking to identify and understand underlying mechanisms of sources of behaviour, in the form of barriers and facilitators."

Reviewer comment 6.
Methods –Stage 2
It is not clear to me why a prioritisation effort is taking place here to select between different intervention functions when you have a specific phase (stage 3) to precisely do that. Why not simply present all intervention functions to the experts as part of the consensus meeting? Please clarify.

Response 6. The consensus meeting (stage 3) has now been removed from the project. This has resulted from the decision to not conduct prioritisation of behavioural intervention components due to the heterogeneity in the behavioural intervention components identified. The research team felt that this heterogeneity would have limited meaningful ability to prioritise these techniques for trialists who are unfamiliar with them. Further, by providing a range of potential strategies, researchers can choose those which are best suited for their areas and COS.

Reviewer comment 7. Regarding the rating for the APASE criteria, I understand you will use different categories ('yes', 'no', or 'unsure'), but it is not clear how this will lead to an overall inclusion/exclusion decision (e.g., will you use the number of 'yes' per intervention function / BCT as a criterion?)

Response 7.
Decisions around inclusion or exclusion of intervention functions/BCTs are based on discussion as informed by the yes/no/unsure ratings. A numeric approach is not used to reach decisions, as individual criterion can result in intervention approaches being unfeasible. For instance, if an intervention is likely effective but is not affordable, it may be untenable. The following has been added to clarify this in the methods:

"Final decisions on inclusion and exclusion of intervention functions based on APEASE criteria will be made based on team review and discussion to reach consensus."

"As for intervention functions, decisions on inclusion or exclusion of BCTs will be based on team review and discussion to reach consensus."

Reviewer comment 8. When it comes to BCT definitions and labels, apart from the original taxonomy perhaps the research team wants to also cross-check the recently published ontology of behaviour change interventions (see below), as I understand some BCTs have been updated in this new resource.

Marques, M. M., Wright, A. J., Corker, E., Johnston, M., West, R., Hastings, J., ... & Michie, S. (2023). The Behaviour Change Technique Ontology: Transforming the Behaviour Change Technique Taxonomy v1. Wellcome Open Research, 8.

Response 8. Thank you, the team are aware of the recently published ontology by Dr Marta Marques and colleagues, and this is consulted in the project. Reference to the ontology is now included in the methods section in relation to identifying BCTs.

Reviewer comment 9. Methods –Stage 3

Although not explicitly mentioned, I understand the consensus meeting will be conducted in English, with most (all?) participants from English-speaking countries. Will this hamper the broad applicability of findings?

Could you also please specify the expected duration of the meeting? It seems there are many aspects to be covered.

Will the APEASE criteria will be somehow introduced here? For consistency with stage 2.

Response 9. As noted above, the consensus meeting has now been removed from the project.

Reviewer comment 10. Discussion

While I agree that the use of COS will potentially improve evidence synthesis, I also see some limitations which could be interesting to elaborate further to provide a broader picture. To my understanding, COS basically refers to a checklist of outcomes that need to be reported for a given health condition. That is, COS do not provide a controlled vocabulary for such outcomes to ensure the same labels are used consistently to describe the same outcomes. This is unlike other evidence synthesis approaches (e.g., ontologies such as the BCIO) that use pre-defined entities and have the added benefit of being computer-friendly, which could be very useful to support evidence synthesis automation and leverage on AI / machine learning. In addition, COS are focused on outcomes so do not seem to address other important aspects of clinical trials that would also benefit from standardisation and a more comprehensive reporting (e.g., population targeted, methods, etc). I understand this research is not about COS but rather the use of COS (i.e., it's a behaviour change question rather than an evidence synthesis question), but I still think authors could use the introduction and/or the discussion to provide a broader overview of COS and highlight similarities (and differences) with other evidence synthesis improvement approaches (e.g., ontologies), as well as comment on how COS relates, or could be interoperable with, common reporting guidelines (e.g., CONSORT statement).

Michie, S., West, R., Finnerty, A. N., Norris, E., Wright, A. J., Marques, M. M., ... & Hastings, J. (2020). Representation of behaviour change interventions and their evaluation: Development of the Upper Level of the Behaviour Change Intervention Ontology. Wellcome open research, 5.

Author response 10. Thank you very much for this important comment. We fully agree that this is an important topic but feel it is beyond the scope of the work described in this protocol.

Competing Interests: No competing interests were disclosed.

Reviewer Report 29 April 2022

✔️ **Nikita Nekliudov** 🆔

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Thank you for the opportunity to review the manuscript entitled "Using behavioural science to enhance the use of core outcome sets in trials: protocol". The protocol provides a comprehensive overview of the study methodology aiming to synthesise the strategies to increase the uptake of Core Outcome Sets (COS). The study addresses a well-recognised knowledge gap that impedes the dissemination and use of COS despite their potential to harmonise research activities, increasing the comparability across studies and shift the focus of research to patients. This protocol requires minor changes; all the possible limitations are rooted in the methodology of the studies collecting the data to be used in this study.

Major comments

1. A comprehensive approach and high quality of previously gathered data that is proposed to inform Stage 1 (Identification of behavioural barriers and facilitators to COS use) is a strength of this protocol; however, the process might benefit from considering a more global approach. While Stage 1 process is based on data from four studies (ref. 8,11-13) that are collected from majorly the UK and European researchers, endorsing more international participation at Stage 3 seems feasible. Given that different settings, funding policies, and various levels of access to medical/research facilities can influence COS use in different countries. It would be very informative if the authors could add some details on how this diversity will be achieved, or, if it is not possible, acknowledge that as a limitation.

2. The fourth component of the synthesis is a qualitative study of trialist barriers and facilitators, *"In-depth qualitative interviews identified barriers and facilitators that influence chief investigators' use of core outcome sets in randomised controlled trials"* by Hughes *et al.* that was conducted on a UK sample. Despite the study methodology of the study, its limited generalisability due to possible missed barriers and facilitators relevant to trialists outside of the UK might need to be acknowledged in the relevant section of the protocol.

3. Given the primary objective of the project to release the strategies for increasing COS uptake, dissemination is an integral step to implement these strategies. Please consider

expanding the dissemination strategies by including additional platforms (e.g. the COMET initiative, possibly HOME and OMERACT).

Minor comments

1. Authors are mentioning 10-15 participants of the consensus meeting (*'with recruitment focused on diversity of expertise and representativeness across stakeholder groups'*) and it could be useful for readers to know the distribution across the stakeholder groups at the consensus meeting. It seems that this data can be added at this stage as the participants are going to be identified by the study group ('*Healthcare professionals and patient/ public representatives will be identified from existing networks, trials and/or outcomes research by the study team and invited to participate via direct email contact').*

2. It is stated that during the consensus meeting ('*...a final round of ranking will follow with the aim of reaching consensus on a prioritised list of strategies to target in future research')* the consensus will be reached using the NGT approach and the process will follow COMET guidance ('*The prioritisation meeting will be conducted using the Nominal Group Technique (NGT) approach and following recent guidance from the Core Outcome Measures for Effectiveness Trials (COMET) Initiative'*). It could be useful to state consensus criteria/prioritisation process details.

Is the rationale for, and objectives of, the study clearly described?

Yes

Is the study design appropriate for the research question?

Yes

Are sufficient details of the methods provided to allow replication by others?

Yes

Are the datasets clearly presented in a useable and accessible format?

Not applicable

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Epidemiology, Global Health Science, Clinical Informatics

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 08 Nov 2023

Karen Matvienko-Sikar

Reviewer comment 1. Thank you for the opportunity to review the manuscript entitled "Using behavioural science to enhance the use of core outcome sets in trials: protocol". The protocol provides a comprehensive overview of the study methodology aiming to synthesise the strategies to increase the uptake of Core Outcome Sets (COS). The study addresses a well-recognised knowledge gap that impedes the dissemination and use of COS despite their potential to harmonise research activities, increasing the comparability across

studies and shift the focus of research to patients. This protocol requires minor changes; all the possible limitations are rooted in the methodology of the studies collecting the data to be used in this study.

Author response 1. Thank you for your review of our protocol manuscript. We have incorporated your feedback and are grateful for your suggestions.

Major comments

Reviewer comment 2. A comprehensive approach and high quality of previously gathered data that is proposed to inform Stage 1 (Identification of behavioural barriers and facilitators to COS use) is a strength of this protocol; however, the process might benefit from considering a more global approach. While Stage 1 process is based on data from four studies (ref. 8,11-13) that are collected from majorly the UK and European researchers, endorsing more international participation at Stage 3 seems feasible. Given that different settings, funding policies, and various levels of access to medical/research facilities can influence COS use in different countries. It would be very informative if the authors could add some details on how this diversity will be achieved, or, if it is not possible, acknowledge that as a limitation.

Author response 2. This is a valid and important point regarding the representativeness of the data underpinning this study. We acknowledge that it is limited in terms of a more global approach and have included this as a limitation in the methods as follows: "It is important to note that the papers report on barriers and facilitators experienced predominantly by UK and European based researchers; for instance one paper focuses solely on UK-based researchers[12]. This presents a limitation in terms of representativeness. However, global research on this topic was not available for inclusion."

Reviewer comment 3. The fourth component of the synthesis is a qualitative study of trialist barriers and facilitators, "In-depth qualitative interviews identified barriers and facilitators that influence chief investigators' use of core outcome sets in randomised controlled trials" by Hughes et al. that was conducted on a UK sample. Despite the study methodology of the study, its limited generalisability due to possible missed barriers and facilitators relevant to trialists outside of the UK might need to be acknowledged in the relevant section of the protocol.

Author response 3. This point has been made clearer in the methods section in the note regarding representativeness of the data: "...for instance one paper focuses solely on UK-based researchers[12]"

Reviewer comment 4. Given the primary objective of the project to release the strategies for increasing COS uptake, dissemination is an integral step to implement these strategies. Please consider expanding the dissemination strategies by including additional platforms (e.g. the COMET initiative, possibly HOME and OMERACT).

Author response 4. We agree that broadening the dissemination is important to support use of the strategies. We have included the following text to the dissemination section: "...and presentations at general and domain specific conferences and events. Dissemination through platforms such as the Core Outcome Measures in Effectiveness Trials (COMET) Initiative, Harmonising Outcome Measures for Eczema (HOME) and Outcome Measures in Rheumatology (OMERACT) will be explored. Dissemination via social media will also be conducted."

Minor comments

Reviewer comment 5. Authors are mentioning 10-15 participants of the consensus meeting ('with recruitment focused on diversity of expertise and representativeness across stakeholder groups') and it could be useful for readers to know the distribution across the stakeholder groups at the consensus meeting. It seems that this data can be added at this stage as the participants are going to be identified by the study group ('Healthcare professionals and patient/ public representatives will be identified from existing networks, trials and/or outcomes research by the study team and invited to participate via direct email contact').

It is stated that during the consensus meeting ('...a final round of ranking will follow with the aim of reaching consensus on a prioritised list of strategies to target in future research') the consensus will be reached using the NGT approach and the process will follow COMET guidance ('The prioritisation meeting will be conducted using the Nominal Group Technique (NGT) approach and following recent guidance from the Core Outcome Measures for Effectiveness Trials (COMET) Initiative'). It could be useful to state consensus criteria/prioritisation process details.

Author response 5. The consensus meeting has now been removed from the project. This has resulted from the decision to not conduct prioritisation of behavioural intervention components due to the heterogeneity in the behavioural intervention components identified. The research team felt that this heterogeneity would have limited meaningful ability to prioritise these techniques for trialists who are unfamiliar with them.

Competing Interests: No competing interests were disclosed.