PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Implementation, mechanisms of impact and key contextual factors involved in outcomes of the Modification of Diet, Exercise and Lifestyle (MODEL) randomized controlled trial in Australian adults: protocol for a mixed-method process evaluation
AUTHORS	ANOKYE, REINDOLF; Radavelli-Bagatini, Simone; Bondonno, Catherine P.; Sim, Marc; Blekkenhorst, Lauren; Connolly, Emma; Bondonno, Nicola P.; Schousboe, John; Woodman, Richard; Zhu, Kun; Szulc, Pawel; Jackson, Ben; Dimmock, James; Schlaich, Markus P.; Cox, Kay L.; Kiel, Douglas; Lim, Wai H.; Devine, Amanda; Thompson, Peter L.; Gianoudis, Jenny; De Ross, Belinda; Daly, Robin; Hodgson, Jonathan M.; Lewis, Joshua; Stanley, Mandy

VERSION 1 – REVIEW

REVIEWER	Patricia Masterson Algar Bangor University (Wales, UK)
REVIEW RETURNED	06-Feb-2020

GENERAL COMMENTS	I have enjoyed reading this paper and I am pleased to see that a process evaluation is going to carried out alongside the MODEL trial. This trial will look at a complex intervention and therefore the way the process evaluation assists in the identification of what worked (or didn't work) at the time of delivery and implementation should reflect this complexity. I consider that this paper should be published but I recommend a major revision. • The method section in the abstract should be edited to include more detail on qualitative methods being used, it is too general as it is written at present • In Page 6 (line 15) – that paragraph needs editing, there is a bit of repetition. • In Page 7 the MODEL trial is introduced but the trial is referred to as 'this trial' (Page 7 line 8). Then there is a section on 'The MODEL trial'. Page 7 and 8 need editing so that the information on the MODEL trial is summarized and synthesized in a clearer way and repetition is avoided as much as possible. • Please edit throughout to make sure abbreviations are explained when first used (only) (e.g. FV and DXA are not explained). • I would have liked to see a section in the paper clearly explaining the benefits of carrying out a process evaluation, maybe with some reference to published process evaluations that have proven to be useful at the time of explaining trial results of complex interventions. • The aims and objectives of the process evaluation are broadly explained but I don't see a clear link with the following section on Context, Implementation and Mechanisms. How the objectives will

	be addressed within those three constructs requires a more detailed explanation (maybe in the form of a table or figure?). The three objectives are very broad so a closer look at each of them will give the reader greater understanding of what are the questions that each objective will need to answer. • Page 6 (line 27-30): these lines are repeated a number of times throughout the paper. Please edit to avoid this repetition. • Design and methods: although the authors explain that they have used the MRC guidelines there is very little mention (or no mention at all) regarding any other theoretical underpinnings. For example, the authors mention several times behavioural changes. If the authors are thinking about this then maybe it would be necessary to do some preparatory work in trying to identify potential theories of change that can then be tested during data collection and analysis? Data collection methods will then need to reflect these theories of change. • Table 1: although I welcome the fact that this table has been included, I think the table needs editing to include more detail and less repetition. The 'objective' column and the 'data collection' column are very similar. I would like to see some reference to time points for data collection (e.g. when, within the running of the trial is each set of data going to be collected?) and also maybe more specific questions that would need to be asked to address each of the objectives. • According to Table 1, in order to address Objective 2, all 200 participants will be interviewed (maybe not realistic considering resources and cost?) and will complete a questionnaire. This information is not consistent with Page 14 line 41 were it seems like only a subsample will be interviewed. Please clarify. • As mentioned above it is not clear to me when the data collection is taking place (within the running of the trial). More clear detail of this needs to be provided. • I consider that it would be necessary for the authors to include the interview schedules and the 'close ended questionnaire' as additional files. These should be readily available as the authors explain that data collection started in January 2020. Without this information it is difficult to assess whether objectives will be met. • Data analysis: the authors explain both quantitative and qualitative data analysis. However, the authors don't mention how process evaluation results will be integrated with the trial results. The lack of information on this final effort to make sure the process evaluation results do help understand the complex trial is something that many authors have discussed in published process evaluation papers. A number of approaches have been suggested in the literature. The authors need to provide an explanation of how they intend to carry out this integration and what approaches they have decided to take. • Although this is a protocol it would have been informative to have a short discussion section maybe providing more detail as well on strengths and limitations. • The references section includes very relevant literature. As mentioned above I suggest that the authors review in detail a wider number of published process evaluations of complex interventions (and discuss/critique them in the introduction and discussion sections).

VERSION 1 – AUTHOR RESPONSE

REVIEWER
The method section in the abstract should be edited to include more detail on qualitative methods being used, it is too general as it is written at present.
Response: We have edited the abstract section to include more detail on qualitative methods being used.
Lines 58-61: The qualitative component will be determined based on analytical saturation. Interviews will be digitally recorded and transcribed verbatim. Qualitative data will be analysed thematically and reported according to the consolidated criteria for reporting qualitative research (COREQ) guidelines.
In Page 6 (line 15) – that paragraph needs editing, there is a bit of repetition.
Response: We have replaced the information in the paragraph with new details on the strengths and limitations of the study as suggested by the editors.
In Page 7 the MODEL trial is introduced but the trial is referred to as 'this trial' (Page 7 line 8). Then there is a section on 'The MODEL trial'. Page 7 and 8 need editing so that the information on the MODEL trial is summarized and synthesized in a clearer way and repetition is avoided as much as possible.
Response: We have moved the section describing the MODEL study in the introduction section to the section on The MODEL Study and all information has been summarised and synthesized in a clearer way to avoid any repetition.
Please edit throughout to make sure abbreviations are explained when first used (only) (e.g. FV and DXA are not explained).
Response: We have revised the manuscript to spell out all abbreviations on first use.
I would have liked to see a section in the paper clearly explaining the benefits of carrying out a process evaluation, maybe with some reference to published process evaluations that have proven to be useful at the time of explaining trial results of complex interventions.
Response: We thank the Reviewer for the comments. This has been included in the introduction section of the manuscript.
Lines 99-134:
Critics of RCTs contend that there's a set of 'positivist' assumptions that drive RCTs which are discordant with understanding the context of complex interventions.(8) Berwick,(9); Clark et al., (10); Pawson and Tilley (11) opined that there is an oversimplification of cause and effect in RCTs of complex interventions and investigators often ignore the agency of participants and implementers as well as the context in which the intervention is experienced and implemented. There is emerging evidence to support the line of reasoning that a more critical realist framework should guide the conduct of RCTs of complex interventions. This will enable methods to be applied and interpreted critically while social realities are viewed as valid objects of scientific study.(12) The Medical Research Council (MRC) framework(13, 14) does not support the arguments against RCTs but acknowledges that 'effect sizes' alone are not sufficient and that process evaluations should be conducted alongside of RCTs to limit biases when estimating effects. Process evaluations provide insight into implementation processes and mechanisms of impact in complex interventions, assisting with interpretation of overall study outcomes.(13, 15) (16) They can also provide detailed information that could support the interpretation of causality by a systematic reviewer, practitioner or policymaker. (13, 14) Process evaluations have demonstrated to be useful at the time of explaining trial results of complex interventions. (17) (18) (19) (20)
For example, Van Dongen et al.,(17) used a comprehensive process evaluation plan to examine the delivery and receipt of a diabetes prevention intervention by evaluating the intervention components that contributed to effective prevention of type 2 diabetes.(17) They concluded that it is feasible to implement a diabetes prevention intervention in Dutch primary health care after completion and reporting results of the process evaluation.(17)Another process evaluation assessed the quality of the execution of a programme for a self-management intervention for people with polyarthritis from the participants' perspective.(12) The process evaluation results highlighted the extent to which specific

exercises and programme were highly valued and therefore the need to use various components such as writing exercises, use of role models and combined individual trajectory and group training to create an attractive intervention for a broad audience.(18) Also, the ProActive study (a physical activity intervention) process evaluation(19) (20) identified various reasons for trial outcomes using an explicit a priori hypothesised causal model while the Welsh National Exercise Referral Scheme intervention (21) process evaluation reported that there were limitations in communication, training and support which impacted the fidelity of some components.(21) Moreover, a process evaluation for an adolescent sexual health programme intervention in Tanzania reported the extent to which young people were engaged with the programme and quality of programme implementation.(22) All of these process evaluation examples have reported on the impact of contextual factors on the effectiveness of an intervention(22) as well as contextual factors and implementers' actions that shaped delivery(21) and the fidelity of implementation (19) using mixed-methods (21, 22) or quantitative approaches.(19)

The aims and objectives of the process evaluation are broadly explained but I don't see a clear link with the following section on Context, Implementation and Mechanisms. How the objectives will be addressed within those three constructs requires a more detailed explanation (maybe in the form of a table or figure?). The three objectives are very broad so a closer look at each of them will give the reader greater understanding of what are the questions that each objective will need to answer.

Response: We thank the Reviewer for the comments. A new table (Table 1: Domain/constructs, objectives and how the objectives will be addressed) has been included to cover these details.

Page 6 (line 27-30): these lines are repeated a number of times throughout the paper. Please edit to avoid this repetition.

Response: We have modified the section on strengths and limitations of the study as suggested by the editors and the repeated lines are no longer in the manuscript.

Design and methods: although the authors explain that they have used the MRC guidelines there is very little mention (or no mention at all) regarding any other theoretical underpinnings. For example, the authors mention several times behavioural changes. If the authors are thinking about this then maybe it would be necessary to do some preparatory work in trying to identify potential theories of change that can then be tested during data collection and analysis? Data collection methods will then need to reflect these theories of change.

Response: We have included a theory of behaviour change that will be tested during data collection and analysis. This can be found in the design considerations section of the manuscript.

Lines 213-215:

Health-related behaviour change will be explained and predicted in this study using the social-psychological health behaviour change model known as the Health Belief Model.

Table 1: although I welcome the fact that this table has been included, I think the table needs editing to include more detail and less repetition. The 'objective' column and the 'data collection' column are very similar. I would like to see some reference to time points for data collection (e.g. when, within the running of the trial is each set of data going to be collected?) and also maybe more specific questions that would need to be asked to address each of the objectives.

Response: We thank the Reviewer for the comments. Table 1 (now Table 2) has been edited to include more details and less repetition. There is also an added column providing details on time points for data collection (Stage of trial)

According to Table 1, in order to address Objective 2, all 200 participants will be interviewed (maybe not realistic considering resources and cost?) and will complete a questionnaire. This information is not consistent with Page 14 line 41 were it seems like only a subsample will be interviewed. Please clarify.

Response: Table 1 (now Table 2) has been edited to clarify the number of participants to be selected for the quantitative and qualitative components of the study.

As mentioned above it is not clear to me when the data collection is taking place (within the running of the trial). More clear detail of this needs to be provided.

Response: More clear details on when the data collection is taking place (within the running of the trial) is provided in Table 2 and Data Collection sub-section.
Lines 246-253:
Interviews will be conducted approximately one month after participants complete the baseline component of the intervention. Participants must complete a 30-minute counselling session at baseline (including watching three educational videos, receiving a booklet with diet and lifestyle information), and receive their AAC results and baseline biochemistry results. A questionnaire (Post counselling health status questionnaire -- Supplementary Appendix 2) to obtain information on the perceived risk of CVD, perceptions of CVD severity and susceptibility and perceived self-efficacy will be administered immediately after participants complete their baseline counselling session.
I consider that it would be necessary for the authors to include the interview schedules and the 'close ended questionnaire' as additional files. These should be readily available as the authors explain that data collection started in January 2020. Without this information it is difficult to assess whether objectives will be met.
Response: The interview schedules and close ended questionnaire are now included as additional files (Supplementary Files 1 and 2, respectively)
Data analysis: the authors explain both quantitative and qualitative data analysis. However, the authors don't mention how process evaluation results will be integrated with the trial results. The lack of information on this final effort to make sure the process evaluation results do help understand the complex trial is something that many authors have discussed in published process evaluation papers. A number of approaches have been suggested in the literature. The authors need to provide an explanation of how they intend to carry out this integration and what approaches they have decided to take.
Response: A new sub-section (Integration of process and outcomes data) has been included to clarify how the process evaluation results will be integrated with the trial results.
Lines 303-312:
Integration of process and outcomes dataSurvey data on contextual factors (participant characteristics) and mediators (perceived risk of CVD, perceptions of CVD severity and susceptibility and perceived self-efficacy) will be analysed prior to analysis of outcome data. After the interviews (on the impact of contextual factors such as family, GP etc.) are conducted and analysed, the process evaluation investigators will be able to conclude that the MODEL study intervention has been successful by communicating clear information on CVD risk and prompting lifestyle/behaviour change. The process data will also highlight the role of contextual factors and mediators enabling participants to change lifestyle/behaviour or not. This data will be used for post-hoc explanation after trial outcomes are known.
Although this is a protocol it would have been informative to have a short discussion section maybe providing more detail as well on strengths and limitations.
Response: We thank the Reviewer for the comments. A discussion section and strengths and limitations section has been included in the main section of the manuscript.
Lines 313-369:
DISCUSSION This is a detailed protocol for a process evaluation embedded within a randomised control trial, the MODEL study. The process evaluation will provide useful information on the MODEL study intervention and how and why the key components/elements (provision of information on CVD risk) impacted on lifestyle/behaviour change or not. This process evaluation will complement and add value to the MODEL Study by providing a better insight into study results. The investigators of the MODEL study will, therefore, be confident after the report of the process evaluation data that it is feasible or otherwise to use similar approaches to conduct this type of study or influence lifestyle/behaviour change. The researchers will also derive insight into possible methods for improvement to inform wider implementation strategies as demonstrated in previous process evaluations. (17, 18, 39)
This process evaluation will employ a comprehensive approach to evaluate the resources, structures, and the procedures used to deliver the MODEL study intervention. Interviews will be conducted to

gather information on participants experiences throughout the intervention. This would be useful in identifying reasons for lack of intervention effect (if any) or any significant changes in lifestyle/behaviour. This is in contrast with some other process evaluations such as the ProActive study (a physical activity intervention)(19) (20) which did not include any qualitative component to identify reasons for lack of intervention effect and a significant increase in physical activity among participants.(19) (20)

Although a mixed-method approach was employed for the process evaluation for the Welsh National Exercise Referral Scheme intervention,(21) the logic model focused more on links between intervention activities and mechanisms of impact and only limited focus on delivery mechanisms. The MODEL study process evaluation aims to focus equally on delivery mechanisms (i.e. application of resources such as videos and counselling to ensure implementation), intervention components, mechanisms of impact and intended outcomes (behaviour change).

The MODEL study process evaluation also aims to gather extensive data on the impact of the intervention on theoretical determinants of behaviour change (i.e. Health Belief Model). However, a process evaluation for an adolescent sexual health programme intervention in Tanzania (22) gathered inadequate data on the impact of the intervention on the theoretical determinants of behaviour change.

Evaluating and reporting what works for which group and what constitutes an effective intervention is an essential consideration for practitioners, researchers and policymakers.(40, 41) The MODEL study process evaluation will contribute to existing knowledge and understanding of the processes that took place during participation in the MODEL study trial. It will also serve as a guide for future studies that will be conducted for such complex trials.

STRENGTHS AND LIMITATIONS

This study will employ a comprehensive mixed-method approach to evaluate the resources, structures, and the procedures used to deliver the MODEL study intervention. The process evaluation will assess participants responses to the MODEL study intervention and mediating processes which may influence subsequent changes in outcomes and identify key contextual (external) factors which may influence the process of changing behaviour. Core intervention components that were effective in influencing lifestyle/behaviour change will be identified, forming the basis for guidance for replication in future studies and implementation in other programmes.

This process evaluation will not evaluate the fidelity of the MODEL study and the associated challenges in delivery from the perspective of the study investigators. Another limitation is the risk of recall bias specifically referring to responder bias (unintentional or intentional) or possible difficulties on the part of participants recalling all information gathered from the intervention. Unintentional responder bias may be attributed to incomplete or poor memory recall and intentional responder bias may be attributed to embarrassment with admitting truth about previous event or nature of disease under investigation. The MODEL study intervention will utilise several resources and procedures in its delivery and it is anticipated that recalling all information gathered from the intervention may be a challenge. Also, some participants may intentionally give inaccurate details about their lifestyle/behaviour change due to the life-threating/life-changing nature of cardiovascular disease or embarrassment associated with not changing behaviour.

The references section includes very relevant literature. As mentioned above I suggest that the authors review in detail a wider number of published process evaluations of complex interventions (and discuss/critique them in the introduction and discussion sections).

Response: A number of published process evaluations of complex interventions have been discussed/critiqued in the introduction and discussion sections.

Introduction section, lines 115-134:

For example, Van Dongen et al.,(17) used a comprehensive process evaluation plan to examine the delivery and receipt of a diabetes prevention intervention by evaluating the intervention components that contributed to effective prevention of type 2 diabetes.(17) They concluded that it is feasible to implement a diabetes prevention intervention in Dutch primary health care after completion and reporting results of the process evaluation.(17)Another process evaluation assessed the quality of the

execution of a programme for a self-management intervention for people with polyarthritis from the participants' perspective.(12) The process evaluation results highlighted the extent to which specific exercises and programme were highly valued and therefore the need to use various components such as writing exercises, use of role models and combined individual trajectory and group training to create an attractive intervention for a broad audience.(18) Also, the ProActive study (a physical activity intervention) process evaluation(19) (20) identified various reasons for trial outcomes using an explicit a priori hypothesised causal model while the Welsh National Exercise Referral Scheme intervention (21) process evaluation reported that there were limitations in communication, training and support which impacted the fidelity of some components.(21) Moreover, a process evaluation for an adolescent sexual health programme intervention in Tanzania reported the extent to which young people were engaged with the programme and quality of programme implementation.(22) All of these process evaluation examples have reported on the impact of contextual factors on the effectiveness of an intervention(22) as well as contextual factors and implementers' actions that shaped delivery(21) and the fidelity of implementation (19) using mixed-methods (21, 22) or quantitative approaches.(19)

Discussion section, lines 324-343:

This process evaluation will employ a comprehensive approach to evaluate the resources, structures, and the procedures used to deliver the MODEL study intervention. Interviews will be conducted to gather information on participants experiences throughout the intervention. This would be useful in identifying reasons for lack of intervention effect (if any) or any significant changes in lifestyle/behaviour. This is in contrast with some other process evaluations such as the ProActive study (a physical activity intervention)(19) (20) which did not include any qualitative component to identify reasons for lack of intervention effect and a significant increase in physical activity among participants.(19) (20)

Although a mixed-method approach was employed for the process evaluation for the Welsh National Exercise Referral Scheme intervention,(21) the logic model focused more on links between intervention activities and mechanisms of impact and only limited focus on delivery mechanisms. The MODEL study process evaluation aims to focus equally on delivery mechanisms (i.e. application of resources such as videos and counselling to ensure implementation), intervention components, mechanisms of impact and intended outcomes (behaviour change).

The MODEL study process evaluation also aims to gather extensive data on the impact of the intervention on theoretical determinants of behaviour change (i.e. Health Belief Model). However, a process evaluation for an adolescent sexual health programme intervention in Tanzania (22) gathered inadequate data on the impact of the intervention on the theoretical determinants of behaviour change.