

## PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (<http://bmjopen.bmj.com/site/about/resources/checklist.pdf>) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Implementation of Clean Cookstove Interventions and Its Effects on Blood Pressure in Low and Middle-Income Countries: A Systematic Review
<b>AUTHORS</b>	Onakomaiya, Deborah; Gyamfi, Joyce; Iwelunmor, Juliet; Opeyemi, Jumoke; Oluwasanmi, Mofetoluwa; Obiezu-Umeh, Chisom; Dalton, Milena; Nwaozuru, Ucheoma; Ojo, Temitope; Vieira, Dorice; Ogedegbe, Gbenga; Olopade, Christopher

### VERSION 1 – REVIEW

<b>REVIEWER</b>	Onno van Schayck/Esther Boudewijns Maastricht University, Netherlands
<b>REVIEW RETURNED</b>	03-Oct-2018

<b>GENERAL COMMENTS</b>	<p>Major problems:</p> <ul style="list-style-type: none"><li>- the study excluded studies that did not describe implementation science strategies (adoption, sustainability, feasibility) and therefore does not provide a complete overview of studies that have been performed to assess the effect of improved cook stoves on blood pressure</li><li>- the study excluded qualitative studies, while implementation is often described in qualitative studies</li><li>- the study included a cross-sectional study, while cross-sectional studies cannot demonstrate any effect</li><li>- the study should not be limited to blood pressures studies when describing implementation science strategies</li></ul> <p>Title:</p> <ul style="list-style-type: none"><li>- 'implementation of use' is not correct (throughout entire manuscript): either implementation or use, but not implementation of use</li></ul> <p>Abstract:</p> <ul style="list-style-type: none"><li>- Implementation science strategies is vague: what is this exactly?</li><li>- You do not assess reduction, you assess change, regardless whether this is a reduction or an increase (unless all studies use a one-sided test, this is probably not the case)</li></ul> <p>Background:</p> <ul style="list-style-type: none"><li>- We evaluated:<ul style="list-style-type: none"><li>o The evidence on the effect of clean cook stove use on BP reduction</li><li>o The evidence for the implementation of clean cook stove for BP reduction in LMICs</li></ul></li></ul>
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	<p>The difference between these two is unclear; although there is a difference between use and implementation, this distinction is not made in your results section. Moreover, you evaluate:</p> <ul style="list-style-type: none"> <li>o The effect of clean cook stoves use on blood pressure in LMICs</li> <li>o The effect of clean cook stove implementation on blood pressure in LMICs</li> </ul> <p>Methods:</p> <ul style="list-style-type: none"> <li>- Remove 'for example ... other variations'. This does not necessarily add something</li> <li>- We excluded qualitative studies: feasibility, sustainability etc. is often assessed in qualitative studies</li> <li>- It is unclear how the results precisely describe the implementation science outcomes</li> </ul> <p>Results:</p> <ul style="list-style-type: none"> <li>- 29 were excluded for the following reasons: no implementation science reported</li> </ul> <p>This is a major concern, authors that have not described any implementation science outcome (feasibility, sustainability or adoption) are excluded from this systematic review. Therefore, the current manuscript does not provide an overall overview</p> <ul style="list-style-type: none"> <li>- Primary outcomes not related to hypertension</li> </ul> <p>It is unclear whether the primary outcome is blood pressure (continuous) or hypertension (yes/no)</p> <ul style="list-style-type: none"> <li>- Mean difference in BP reduction <input type="checkbox"/> mean difference in BP (not in reduction)</li> <li>- Cross-sectional studies cannot demonstrate any effect and should therefore not be included if you want to describe the effects of clean cook stoves</li> <li>- (McCracken) In the Guatemalan study ... using open fires. Only the effect on DBP was significant, not the effect on SBP (as displayed in table 3)</li> <li>- (Alexander) Post-intervention was ... during cooking. Only for SBP, not for DBP (as displayed in table 3)</li> <li>- (Clark), there was a ... using Eco-stove. Only significant reduction for SBP, not for DBP (as displayed in table 3)</li> <li>- (Neupane) reported reduced risk of hypertension. Only for DBP, not for SBP (as displayed in table 3)</li> </ul> <p>Results evidence on the implementation of clean cook stove in LMICs for BP reduction:</p> <ul style="list-style-type: none"> <li>- Please explain how you can indirectly measure feasibility, adoption, sustainability</li> <li>- This part does not necessarily add something. If you want to describe the implementation of cook stoves, you should not limit yourself to studies on blood pressure. Also qualitative studies should then be included.</li> </ul> <p>Discussion:</p> <ul style="list-style-type: none"> <li>- .. all the studies (except the Ghanaian study) reported statistically significant reduction in BP: Yes, both not for both SBP and DBP, please make a distinction between those two</li> <li>- The Ghana study was a negative trial <input type="checkbox"/> The Ghana study did not demonstrate any significant effect of improved cook stoves on BP as compared to the traditional wood cooking</li> <li>- Limitations: sample sizes varied from 28 to 519</li> </ul>
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	<p>Tables:</p> <ul style="list-style-type: none"> <li>- Please provide all results in one table, this makes it much more organized</li> <li>- It does not make sense to describe statistical improvement in BP in table 2 and table 3 (same information in different tables).</li> <li>- Table 2B: Cross-sectional study is not able to measure a risk</li> <li>- Table 2 describes both BP and hypertension. Please distinguish these two.</li> <li>- Table 3A: Mean difference in BP reduction: do negative values (-3.7 mm Hg) mean that there is an increase, because there is a negative reduction? Better to describe the mean difference.</li> <li>- Please provide the p-values and 95%CI for every study (calculate)</li> </ul> <p>Grammar/textual mistakes:</p> <ul style="list-style-type: none"> <li>- Abstract: systemic reviews <input type="checkbox"/> systematic review</li> <li>- Abstract: HAP <input type="checkbox"/> Household air pollution (HAP)</li> <li>- Abstract: was a null study <input type="checkbox"/> did not show significant associations</li> <li>- Abstract: of the 461 ... one cross-sectional <input type="checkbox"/> cross-sectional studies were identified</li> <li>- Abstract: effects .. were positive <input type="checkbox"/> effects were significant</li> <li>- Strengths: .. article inclusion this increased the <input type="checkbox"/> inclusion. This increased</li> <li>- Limitations: sample sizes varied from 33 to 324 <input type="checkbox"/> from 28 to 519</li> <li>- Background: High Blood pressure <input type="checkbox"/> high blood pressure (no capital)</li> <li>- Results: was associated with a greater SBP and DBP reduction <input type="checkbox"/> better to say: was associated with significant lower levels of SBP and DBP</li> <li>- Please check your grammar, e.g. be consistent in using punctuation marks (p value or p-value, consistent use of abbreviations)</li> <li>- Results: the randomized studies in Table 3A (... BP).. <input type="checkbox"/> check parentheses</li> <li>- Results: the non-randomized studies in Table 3B <input type="checkbox"/> this sentence is not correct</li> </ul>
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<b>REVIEWER</b>	William D Evans George Washington University, USA
<b>REVIEW RETURNED</b>	04-Oct-2018

<b>GENERAL COMMENTS</b>	<p>This is an interesting and much needed systematic review of improved cookstove intervention studies in LMIC. The paper is well organized and follows accepted systematic review methodology. However, there are some relatively minor issues that should be addressed before it may be considered for publication.</p> <p>1) There are a number of grammatical mistakes, lack of verbs, conjunctions, etc. throughout. A careful copy edit should be done.</p> <p>2) The introduction is too brief and really doesn't set the stage for the study. For example, it does not define what an improved cookstove is. The literature review misses a number of recent</p>
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	<p>publications on improved cookstove promotion campaigns and evaluations.</p> <p>3) The methods section does not describe how data were analyzed, although there is a section that mentions analysis in the title. Once data were extracted and coded, what was done in terms of analysis? Also, the coding is not described in any depth. This section needs substantial elaboration.</p> <p>4) The discussion of implications and future research is quite limited. What kind of future research should be done? Perhaps studies on interventions that examine the effects of improved cookstove use on reduced BP among certain at-risk populations? This part of the discussion is not well developed.</p> <p>5) Early in the methods section, authors refer to Table 4. But there is no table with that number in the list of tables. Please check all table call outs and labels.</p>
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### VERSION 1 – AUTHOR RESPONSE

#### RESPONSES TO REVIEWERS' COMMENTS REVIEWER: 1

##### Major problems

COMMENT 1: The study excluded studies that did not describe implementation science strategies (adoption, sustainability, feasibility) and therefore does not provide a complete overview of studies that have been performed to assess the effect of improved cook stoves on blood pressure

RESPONSE: We agree with the reviewer, however the objective of the paper was to show the effect of clean cookstove interventions on blood pressure as demonstrated in studies that reported implementation science outcomes. (See page 6)

COMMENT 2: The study excluded qualitative studies, while implementation is often described in qualitative studies

RESPONSE: Because the objective of the paper was to show the effect of clean cookstove interventions on blood pressure, articles must have a quantifiable measure of blood pressure reduction and report on implementation science outcomes, hence we eliminated studies without quantitative blood pressure findings.

COMMENT 3: The study included a cross-sectional study, while cross-sectional studies cannot demonstrate any effect

RESPONSE: We agree with the reviewer, however considering the limited RCTs, utilizing implementation strategies we expanded our inclusion criteria to include non-RCTs. The cross-sectional study we selected explored sustained use of clean fuel stoves, which is our implementation outcome of interest. We, therefore included this study in order to help ascertain association rather than causality. We have added this as a limitation. (See page 18)

COMMENT 4: The study should not be limited to blood pressures studies when describing implementation science strategies

RESPONSE: As previously stated the objective of the paper was to show the effect of clean cookstove interventions on blood pressure as demonstrated in studies that reported implementation science outcomes. (See page 6)

#### Title

COMMENT 5: 'Implementation of use' is not correct (throughout entire manuscript): either implementation or use, but not implementation of use

RESPONSE: We have changed this terminology throughout the paper.

#### Abstract:

COMMENT 6: Implementation science strategies is vague: what is this exactly?

RESPONSE: We are no longer using the term, 'implementation science strategies'.

COMMENT 7: You do not assess reduction, you assess change, regardless whether this is a reduction or an increase (unless all studies use a one-sided test, this is probably not the case)

RESPONSE: We agree with the reviewer. Blood pressure reduction has been revised to change in blood pressure.

#### Background

COMMENT 8:

We evaluated:

- The evidence on the effect of clean cook stove use on BP reduction
- The evidence for the implementation of clean cook stove for BP reduction in LMICs

The difference between these two is unclear; although there is a difference between use and implementation, this distinction is not made in your results section. Moreover, you evaluate:

- The effect of clean cook stoves use on blood pressure in LMICs
  - The effect of clean cook stove implementation on blood pressure in LMICs
- RESPONSE: As previously stated, we have clarified our objectives in the background section of the paper as follows: to show the effect of clean cookstove interventions on blood pressure as demonstrated in studies that reported implementation science outcomes. (See page 6)

#### Methods

COMMENT 9: Remove 'for example ... other variations'. This does not necessarily add something

RESPONSE: We have made this change.

COMMENT 10: We excluded qualitative studies: feasibility, sustainability etc. is often assessed in qualitative studies

RESPONSE: Please refer to response for comment 2.

COMMENT 11: It is unclear how the results precisely describe the implementation science outcomes

RESPONSE: We have now clarified on page 5 of the manuscript, what implementation science outcomes are. A paragraph in the background section describing what implementation science outcomes has been included. A subsection of the Results section also outlines the evidence of implementation science outcomes reported in the articles. (See pages 5, 12-14)

#### Results:

COMMENT 12: 29 were excluded for the following reasons: no implementation science reported.

This is a major concern, authors that have not described any implementation science outcome (feasibility, sustainability or adoption) are excluded from this systematic review. Therefore, the current manuscript does not provide an overall overview

RESPONSE: Please refer to response for comment 1.

COMMENT 13: Primary outcomes not related to hypertension.

It is unclear whether the primary outcome is blood pressure (continuous) or hypertension (yes/no)

RESPONSE: We have made a clear distinction that the primary outcome is change in blood pressure as a continuous variable.

COMMENT 15: Mean difference in BP reduction □□ mean difference in BP (not in reduction)

RESPONSE: We agree with the reviewer this change has been made. (See page 9)

COMMENT 16: Cross-sectional studies cannot demonstrate any effect and should therefore not be included if you want to describe the effects of clean cook stoves

RESPONSE: Please refer to response for comment 3.

COMMENT 17: (McCracken) In the Guatemalan study ... using open fires. Only the effect on DBP was significant, not the effect on SBP (as displayed in table 3)

RESPONSE: We agree with the reviewer on this observation. However, in the McCracken study, the authors hypothesized that clean cookstove use will be associated with long-term reduction in both systolic and diastolic blood pressure. As such, we thought it was necessary to report findings for both DBP and SBP. (See page 10)

COMMENT 18: (Alexander) Post-intervention was ... during cooking. Only for SBP, not for DBP (as displayed in table 3)

RESPONSE: We agree with the reviewer on this observation. However, in the Alexander study, the authors hypothesized that reductions in PM levels during cooking would be associated with reductions in BP. As such we reported both findings. (See table 3)

COMMENT 19: (Clark), there was a ... using Eco-stove. Only significant reduction for SBP, not for DBP (as displayed in table 3)

RESPONSE: We agree with the reviewer on this observation. However, in the Clark study, the authors hypothesized that systolic and diastolic blood pressure would be reduced among participants following the introduction of the Eco-stove and that certain subgroups of the population would experience greater reductions in blood pressure following the intervention. As such we reported both findings. (See table 3)

COMMENT 20: (Neupane) reported reduced risk of hypertension. Only for DBP, not for SBP (as displayed in table 3)

RESPONSE: We agree with the reviewer on this observation. However, in the Neupane study, the authors hypothesized that the sustained use of biogas for at least ten years would be associated with lower systolic and diastolic blood pressure and a reduced risk of hypertension among adult female cooks. As such we reported both findings. (See table 3)

Results, evidence on the implementation of clean cook stove in LMICs for BP reduction: COMMENT 21: Please explain how you can indirectly measure feasibility, adoption, and sustainability

RESPONSE:

Feasibility was inferred if cookstove intervention was successfully used or carried out within the context of the environment.

Adoption was inferred if participants used the cookstove intervention during the trial period. Sustainability was inferred if the cookstove use was maintained or institutionalized within the setting overtime, post implementation. (See page 12)

COMMENT 22: This part does not necessarily add something. If you want to describe the implementation of cook stoves, you should not limit yourself to studies on blood pressure. Also qualitative studies should then be included.

RESPONSE: Please refer to response for comment 2.

Discussion:

COMMENT 23: All the studies (except the Ghanaian study) reported statistically significant reduction in BP: Yes, both not for both SBP and DBP, please make a distinction between those two

RESPONSE: We have made the appropriate revisions in the results section. (See page 14)

COMMENT 24: The Ghana study was a negative trial □□The Ghana study did not demonstrate any significant effect of improved cook stoves on BP as compared to the traditional wood cooking

RESPONSE: We have made the appropriate changes. (See page 15)

COMMENT 25: Limitations: sample sizes varied from 28 to 519

RESPONSE: We have made the necessary changes. (See page 18)

Tables:

COMMENT 26: Please provide all results in one table, this makes it much more organized

RESPONSE: This has been amended (See page 22-24)

COMMENT 27: It does not make sense to describe statistical improvement in BP in table 2 and table 3 (same information in different tables).

RESPONSE: This has been amended (See page 23-24)

COMMENT 28: Table 2B: Cross-sectional study is not able to measure a risk

RESPONSE: This has been amended. (See page 23)

COMMENT 29: Table 2 describes both BP and hypertension. Please distinguish these two.

RESPONSE: We have made the appropriate edits to this table. (See page 23)

COMMENT 30: Table 3A: Mean difference in BP reduction: do negative values (-3.7 mm Hg) mean that there is an increase, because there is a negative reduction? Better to describe the mean difference.

RESPONSE: We have made the necessary changes to reflect the mean difference in BP. The mean difference reflects a reduction in mean BP. (See page 24)

COMMENT 31: Please provide the p-values and 95%CI for every study (calculate) RESPONSE: We have made the necessary changes in the manuscript and have reported P- values and 95% CI where possible, as some papers only reported the p-values and not the CI's. (See page 11&12)

Grammar/textual mistakes: COMMENT 32: Abstract: systemic reviews □□systematic review

RESPONSE: We have made the change. (See page 2)

COMMENT 33: Abstract: HAP □□Household air pollution (HAP)

RESPONSE: We have made the change. (See page 2)

COMMENT 34: Abstract: was a null study □□did not show significant associations

RESPONSE: We have made the change. (See page 2)

COMMENT 35: Abstract: of the 461 ... one cross-sectional □□cross-sectional studies were identified

RESPONSE: We have made the change. (See page 2)

COMMENT 36: Abstract: effects were positive □□effects were significant

RESPONSE: We have made the change. (See page 3)

COMMENT 37: Strengths: .. article inclusion this increased the □□inclusion. This increased

RESPONSE: We have made the change. (See page 3).

COMMENT 38: Limitations: sample sizes varied from 33 to 324 □□from 28 to 519

RESPONSE: We have made the change. (See page 3)

COMMENT 39: Background: High Blood pressure □□high blood pressure (no capital)

RESPONSE: We have made the change. (See page 4)

COMMENT 40: Results: was associated with a greater SBP and DBP reduction □□better to say: was associated with significant lower levels of SBP and DBP

RESPONSE: This change has been made throughout the manuscript

COMMENT 41: Please check your grammar, e.g. be consistent in using punctuation marks (p value or p-value, consistent use of abbreviations)

RESPONSE: This change has been made throughout the manuscript.

COMMENT 42: Results: the randomized studies in Table 3A (...BP).. □□check parentheses

RESPONSE: We have made the correction. (See page 11-12)

COMMENT 43: Results: the non-randomized studies in Table 3B □□this sentence is not correct

RESPONSE: We have made the correction. (See page 12)

REVIEWER: 2

COMMENT 1: This is an interesting and much needed systematic review of improved cookstove intervention studies in LMIC. The paper is well organized and follows accepted systematic review methodology. However, there are some relatively minor issues that should be addressed before it may be considered for publication.

RESPONSE: The reviewer's comments are appreciated.

COMMENT 2: There are a number of grammatical mistakes, lack of verbs, conjunctions, etc. throughout. A careful copy edit should be done.

RESPONSE: This has been addressed throughout the manuscript

COMMENT 3: The introduction is too brief and really doesn't set the stage for the study. For example, it does not define what an improved cookstove is. The literature review misses a number of recent publications on improved cookstove promotion campaigns and evaluations. RESPONSE: We have added a paragraph and a definition for improved cookstoves, additionally we have also included a paragraph in the discussion section on how this systematic review contributes to the field. (See pages 4-6 & 17-18)

COMMENT 4: The methods section does not describe how data were analyzed, although there is a section that mentions analysis in the title. Once data were extracted and coded, what was done in



terms of analysis? Also, the coding is not described in any depth. This section needs substantial elaboration.

RESPONSE: We could not do a meta- analysis because of the heterogeneity of the studies included; therefore this systematic review was descriptive. The section under methods on page 7 describes the selection criteria for the articles included in this review.

COMMENT 5: The discussion of implications and future research is quite limited. What kind of future research should be done? Perhaps studies on interventions that examine the effects of improved cookstove use on reduced BP among certain at-risk populations? This part of the discussion is not well developed.

RESPONSE: We have expanded on this portion of the discussion. (See page 17-18)

COMMENT 6: Early in the methods section, authors refer to Table 4. But there is no table with that number in the list of tables. Please check all table call outs and labels.

RESPONSE: Apologies for the confusion, table 4 actually referred to Figure 1. This correction has been amended. (See page 6)

### VERSION 2 – REVIEW

<b>REVIEWER</b>	W. D. Evans The George Washington University, USA
<b>REVIEW RETURNED</b>	20-Nov-2018

<b>GENERAL COMMENTS</b>	The manuscript is much improved and the reviewers were highly responsive to the previous comments. There are a few minor formatting and typographical errors. The paper should be published after a careful copy edit.
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<b>REVIEWER</b>	Prof. Onno van Schayck/ Esther Boudewijns Maastricht University, Maastricht
<b>REVIEW RETURNED</b>	22-Nov-2018

<b>GENERAL COMMENTS</b>	<p>RESPONSES TO REVIEWERS' COMMENTS REVIEWER: 1</p> <p>Major problems</p> <p>COMMENT 1: The study excluded studies that did not describe implementation science strategies (adoption, sustainability, feasibility) and therefore does not provide a complete overview of studies that have been performed to assess the effect of improved cook stoves on blood pressure</p> <p>RESPONSE: We agree with the reviewer, however the objective of the paper was to show the effect of clean cookstove interventions on blood pressure as demonstrated in studies that reported implementation science outcomes. (See page 6)</p> <p>- We understand the authors response, but do not see the scientific value of the paper if it does not include all studies of the effect of cook stoves on blood pressure (BP) There is a large chance that separate papers have been published on the effectiveness of cookstoves and the implementation of cookstoves from the same study</p>
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	<p>COMMENT 2: The study excluded qualitative studies, while implementation is often described in qualitative studies  RESPONSE: Because the objective of the paper was to show the effect of clean cookstove interventions on blood pressure, articles must have a quantifiable measure of blood pressure reduction and report on implementation science outcomes, hence we eliminated studies without quantitative blood pressure findings.</p> <p>- We understand the authors response, but do not see any scientific value of only reporting implementation results of papers that also include BP outcomes</p> <p>COMMENT 3: The study included a cross-sectional study, while cross-sectionals studies cannot demonstrate any effect  RESPONSE: We agree with the reviewer, however considering the limited RCTs, utilizing implementation strategies we expanded our inclusion criteria to include non-RCTs. The cross-sectional study we selected explored sustained use of clean fuel stoves, which is our implementation outcome of interest. We, therefore included this study in order to help ascertain association rather than causality. We have added this as a limitation. (See page 18)</p> <p>- We do not agree with the authors that a cross-sectional study can be included because a implementation outcome of interest was described. Cross-sectional studies can not report on effects, and should therefore be excluded from this systematic review</p> <p>COMMENT 4: The study should not be limited to blood pressures studies when describing implementation science strategies  RESPONSE: As previously stated the objective of the paper was to show the effect of clean cookstove interventions on blood pressure as demonstrated in studies that reported implementation science outcomes. (See page 6)</p> <p>- We understand the authors response, but do not see any scientific value of only reporting implementation results of papers that also include BP outcomes</p> <p>COMMENT 5: 'Implementation of use' is not correct (throughout entire manuscript): either implementation or use, but not implementation of use  RESPONSE: We have changed this terminology throughout the paper.</p> <p>COMMENT 7: You do not assess reduction, you assess change, regardless whether this is a reduction or an increase (unless all studies use a one-sided test, this is probably not the case)  RESPONSE: We agree with the reviewer. Blood pressure reduction has been revised to change in blood pressure.</p> <p>- Propensity score is not a study design, and should not be described as such</p> <p>Background</p> <p>COMMENT 8:  We evaluated:</p>
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	<ul style="list-style-type: none"> <li>• The evidence on the effect of clean cook stove use on BP reduction</li> <li>• The evidence for the implementation of clean cook stove for BP reduction in LMICs</li> </ul> <p>The difference between these two is unclear; although there is a difference between use and implementation, this distinction is not made in your results section. Moreover, you evaluate:</p> <ul style="list-style-type: none"> <li>• The effect of clean cook stoves use on blood pressure in LMICs</li> <li>• The effect of clean cook stove implementation on blood pressure in LMICs</li> </ul> <p>RESPONSE: As previously stated, we have clarified our objectives in the background section of the paper as follows: to show the effect of clean cookstove interventions on blood pressure as demonstrated in studies that reported implementation science outcomes. (See page 6)</p> <ul style="list-style-type: none"> <li>- The background is a bit too long</li> <li>- Changed in: evidence for the reporting of implementation science outcomes There is no 'evidence for reporting'. Please change this.</li> </ul> <p>Methods</p> <p>COMMENT 9: Remove 'for example ... other variations'. This does not necessarily add something</p> <p>RESPONSE: We have made this change.</p> <ul style="list-style-type: none"> <li>- You can delete patient and public involvement</li> </ul> <p>COMMENT 10: We excluded qualitative studies: feasibility, sustainability etc. is often assessed in qualitative studies</p> <p>RESPONSE: Please refer to response for comment 2.</p> <p>COMMENT 11: It is unclear how the results precisely describe the implementation science outcomes</p> <p>RESPONSE: We have now clarified on page 5 of the manuscript, what implementation science outcomes are. A paragraph in the background section describing what implementation science outcomes has been included. A subsection of the Results section also outlines the evidence of implementation science outcomes reported in the articles. (See pages 5, 12-14)</p> <p>Results:</p> <p>COMMENT 12: 29 were excluded for the following reasons: no implementation science reported.</p> <p>This is a major concern, authors that have not described any implementation science outcome (feasibility, sustainability or adoption) are excluded from this systematic review. Therefore, the current manuscript does not provide an overall overview</p> <p>RESPONSE: Please refer to response for comment 1.</p> <p>COMMENT 13: Primary outcomes not related to hypertension. It is unclear whether the primary outcome is blood pressure (continuous) or hypertension (yes/no)</p> <p>RESPONSE: We have made a clear distinction that the primary outcome is change in blood pressure as a continuous variable.</p>
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	<p>COMMENT 15: Mean difference in BP reduction □ □ mean difference in BP (not in reduction)  RESPONSE: We agree with the reviewer this change has been made. (See page 9)</p> <p>- We certainly do not agree with the authors. If the study does not report any significant change in SBP, it shouldn't be described as such, even when the authors expect that this will be different on a long term. There is simply no scientific evidence for this on the long term, thus it should be described as such in a systematic review (which aims to describe evidence that is currently available)  Idem for item 18-20</p> <p>COMMENT 18: (Alexander) Post-intervention was ... during cooking. Only for SBP, not for DBP (as displayed in table 3)  RESPONSE: We agree with the reviewer on this observation. However, in the Alexander study, the authors hypothesized that reductions in PM levels during cooking would be associated with reductions in BP. As such we reported both findings. (See table 3)</p> <p>COMMENT 19: (Clark), there was a ... using Eco-stove. Only significant reduction for SBP, not for DBP (as displayed in table 3)  RESPONSE: We agree with the reviewer on this observation. However, in the Clark study, the authors hypothesized that systolic and diastolic blood pressure would be reduced among participants following the introduction of the Eco-stove and that certain subgroups of the population would experience greater reductions in blood pressure following the intervention. As such we reported both findings. (See table 3)</p> <p>COMMENT 20: (Neupane) reported reduced risk of hypertension. Only for DBP, not for SBP (as displayed in table 3)  RESPONSE: We agree with the reviewer on this observation. However, in the Neupane study, the authors hypothesized that the sustained use of biogas for at least ten years would be associated with lower systolic and diastolic blood pressure and a reduced risk of hypertension among adult female cooks. As such we reported both findings. (See table 3)</p> <p>Results, evidence on the implementation of clean cook stove in LMICs for BP reduction: COMMENT 21: Please explain how you can indirectly measure feasibility, adoption, and sustainability  RESPONSE:  Feasibility was inferred if cookstove intervention was successfully used or carried out within the context of the environment.  Adoption was inferred if participants used the cookstove intervention during the trial period.  Sustainability was inferred if the cookstove use was maintained or institutionalized within the setting overtime, post implementation.  (See page 12)</p> <p>COMMENT 22: This part does not necessarily add something. If you want to describe the implementation of cook stoves, you should not limit yourself to studies on blood pressure. Also qualitative studies should then be included.  RESPONSE: Please refer to response for comment 2.</p>
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- This is a major concern. It is not clear if implementation outcomes should have been described clearly in the paper in order for it to be included, because here you indirectly measure implementation outcomes

Discussion:

COMMENT 23: All the studies (except the Ghanaian study) reported statistically significant reduction in BP: Yes, both not for both SBP and DBP, please make a distinction between those two  
RESPONSE: We have made the appropriate revisions in the results section. (See page 14)

COMMENT 24: The Ghana study was a negative trial □□The Ghana study did not demonstrate any significant effect of improved cook stoves on BP as compared to the traditional wood cooking

RESPONSE: We have made the appropriate changes. (See page 15)

COMMENT 25: Limitations: sample sizes varied from 28 to 519

RESPONSE: We have made the necessary changes. (See page 18)

Tables:

COMMENT 26: Please provide all results in one table, this makes it much more organized

RESPONSE: This has been amended (See page 22-24)

COMMENT 27: It does not make sense to describe statistical improvement in BP in table 2 and table 3 (same information in different tables).

RESPONSE: This has been amended (See page 23-24)

COMMENT 28: Table 2B: Cross-sectional study is not able to measure a risk

RESPONSE: This has been amended. (See page 23)

COMMENT 29: Table 2 describes both BP and hypertension. Please distinguish these two.

RESPONSE: We have made the appropriate edits to this table. (See page 23)

COMMENT 30: Table 3A: Mean difference in BP reduction: do negative values (-3.7 mm Hg) mean that there is an increase, because there is a negative reduction? Better to describe the mean difference.

RESPONSE: We have made the necessary changes to reflect the mean difference in BP. The mean difference reflects a reduction in mean BP. (See page 24)

- You can calculate 95%CI yourself by using a formula

COMMENT 31: Please provide the p-values and 95%CI for every study (calculate) RESPONSE: We have made the necessary changes in the manuscript and have reported P- values and 95% CI where possible, as some papers only reported the p-values and not the CI's. (See page 11&12)

	<p>- Additional: figure 1 can be deleted from the article</p> <p>Grammar/textual mistakes: COMMENT 32: Abstract: systemic reviews □□systematic review RESPONSE: We have made the change. (See page 2)</p> <p>- Please check all abbreviations and grammar</p>
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## VERSION 2 – AUTHOR RESPONSE

### REVISION 2: RESPONSES TO REVIEWERS' COMMENTS

REVIEWER: 1

Major problems

COMMENT 1: We understand the author's response, but do not see the scientific value of the paper if it does not include all studies of the effect of cookstoves on blood pressure (BP). There is a large chance that separate papers have been published on the effectiveness of cookstoves and the implementation of cookstoves from the same study

RESPONSE 1: The reviewer raises a very important question and we apologize if we did not make this clear in our previous response. Basically, the effectiveness of clean cookstove use on BP is well proven and well established as reported in the 5 studies included in this manuscript (See page 8-10). However, what is unknown is the translation and implementation of this innovation in low and middle-income countries (LMICs). We assert that there is a fundamental and qualitative difference between effectiveness studies and implementation research studies with respect to reported outcomes. For implementation research studies (the focus of our report), the outcomes reported are largely process outcomes (feasibility and adoption) while effectiveness studies are based on clinical outcomes like BP reduction and BP control. Hence the goal of this review is to report on the implementation of clean cookstove use and its effect on BP outcomes in LMICs. We have made this distinction clearer in the introduction section of the revised manuscript (see page 6). Thus, our systematic review is based upon studies that report both the implementation outcomes AND clinical outcomes (BP reduction).

With respect to the scientific value of our study, the findings from our report address a huge gap in the literature about the implementation of clean cookstove use and its effect on BP outcomes in LMICs. To date, the implementation of clean cookstove use is suboptimal in LMICs, and few studies have reported on this specific topic area. This systematic review is the first review to address this gap in the literature and to determine implementation research outcomes in studies that demonstrate the effects of clean cookstove use on BP change.

COMMENT 2: We understand the author's response, but do not see any scientific value of only reporting implementation results of papers that also include BP outcomes

RESPONSE 2: Please see previous response above. We would like to reiterate that the main goal of this study is a review of the studies that evaluated the implementation of clean cookstove use to improve BP outcomes in LMICs. Hence we excluded studies that reported ONLY clinical BP outcomes because those studies did not address implementation outcomes (which is the focus of our review).

COMMENT 3: We do not agree with the authors that a cross-sectional study can be included because an implementation outcome of interest was described. Cross-sectional studies cannot report on effects, and should, therefore, be excluded from this systematic review

RESPONSE 3: We agree with the reviewer that cross-sectional studies cannot demonstrate causality. As such, we have excluded this cross-sectional study from the review.

COMMENT 4: We understand the author's response, but do not see any scientific value of only reporting implementation results of papers that also include BP outcomes

RESPONSE 4: Please see comments and our response to critique #1 and 2 above.

## ABSTRACT

COMMENT 5: Propensity score is not a study design, and should not be described as such

RESPONSE 5: We have made this change (See page 2)

## BACKGROUND

COMMENT 6A: The background is a bit too long

RESPONSE 6A: We initially had a much shorter background, but revised it due to comments from previous reviewers hence its length. We defer to the editor with respect to the length of the background section.

COMMENT 6B: Changed in evidence for the reporting of implementation science outcomes. There is no 'evidence for reporting'. Please change this.

RESPONSE 6B: This has been amended (See page 6)

## METHODS

COMMENT 7: You can delete patient and public involvement

RESPONSE 7: The patient and public involvement section is a requirement by the BMJ open journal. This was specifically requested by the journal. We defer to the editor with respect to this issue.

## RESULTS

COMMENT 8: But still you describe hypertension as the primary outcome (e.g. abstract, examining the use ...on hypertension). You should change this in examining.. on blood pressure (throughout entire paper)

RESPONSE 8: We have made this change throughout the manuscript.

COMMENT 9: We certainly do not agree with the authors. If the study does not report any significant change in SBP, it shouldn't be described as such, even when the authors expect that this will be different on a long term. There is simply no scientific evidence for this on the long term, thus it should be described as such in a systematic review (which aims to describe evidence that is currently available)

Idem for item 18-20

RESPONSE 9: This was a typo and we apologize for this typo, which has now been amended (See page 10).

Results, Evidence on the Implementation of Clean Cookstove In LMICs for BP Reduction



COMMENT 10: This is a major concern. It is not clear if implementation outcomes should have been described clearly in the paper in order for it to be included because here you indirectly measure implementation outcomes

RESPONSE 10: We would like to iterate that we used the term 'implementation outcomes' based upon the conventional definition of this concept. For the purpose of this review, implementation science outcomes are clearly defined and described as recommended by Proctor and colleagues (2011) (See page 5 & 6). These definitions were used to identify studies that evaluated implementation science outcomes in their papers. In order to minimize the confusion, we have removed the words "indirectly" and "infer".

## DISCUSSION

COMMENT 11: You can calculate 95%CI yourself by using a formula

RESPONSE 11: As suggested by the reviewer, we have calculated and reported the CI's for all studies, except the Bolivian study by Alexander et al, (2015), in which the primary analyses for treatment effects on BP were Mann-Whitney tests. The Mann-Whitney is a non-parametric test comparing the medians of two groups (in this case the cohort before the intervention and the cohort following the intervention). As such, generating a CIs from the estimated treatment effect and the p-value is difficult due to the non-normal distribution of the Mann-Whitney (See page 21).

## Grammar/Textual Mistakes

COMMENT 12: Additional: figure 1 can be deleted from the article

RESPONSE 12: Figure 1 is the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram, which is a requirement for systematic review submission to the BMJ journal. This was specifically requested by the journal.

COMMENT 13: Please check all abbreviations and grammar

RESPONSE 13: Thank you! We have addressed this throughout the manuscript.

## REVIEWER 2

COMMENT 1: The manuscript is much improved and the reviewers were highly responsive to the previous comments. There are a few minor formatting and typographical errors. The paper should be published after a careful copy edit.

RESPONSE 1: The reviewer's comments are appreciated. We have addressed this throughout the manuscript.