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

TITLE (PROVISIONAL)	Delays in Emergency Obstetrics referrals in Addis Ababa hospitals, Ethiopia: a facility-based, cross-sectional study
AUTHORS	Assefa, Endalkachew Mekonnen; Berhane, Yemane

VERSION 1 – REVIEW

REVIEWER	RICHARD KALISA RUHENGERI HOSPITAL, RWANDA
REVIEW RETURNED	16-Sep-2019

GENERAL COMMENTS	Major issues: Professional English editing is needed. Background • The necessity of the study is in question. Still feel like the background does not provide for a clear problem statement (could possibly be due to language). Method • The sampling procedure and the rationale for its use are unclear. • Add the exclusion criteria. • Line 20-24 on page 3; The authors do define the three delays based on time of action I was wondering if this is standard time by WHO and if yes, then add the reference and if not provide further explanations why that cut off duration. • Line 24-31 on page 3, I do suppose that you meant that you applied the WHO MNM tool as per reference 40 amongst all women admitted at the two hospitals to identify which cases were PLTMC and SMO. If yes, did you meet any challenges especially due to lack of laboratory tests and management options from your study sites. To address this concern, I would suggest to the authors to apply instead the recommended tool for sub-Saharan countries called the adapted sub-Saharan Africa MNM tool by Tura AK, et al. BMC Pregnancy Childbirth 2017; 17:445. In that case we will know the really magnitude of maternal morbidities from their setting then go to proceed to analyze the three delays amongst those SMO cases and that would be the greatest strength of your study. • Please provide a copy of the interview questionnaire used in this study as an additional file. Results and Discussion • The result and discussion should be rewritten after the results from sub-Saharan Africa maternal near miss tool have been applied and the methods section are clarified.

	• To avoid replications to results, figure 1 results can be omitted and added on to Table 5 • The similarities and differences of this study needs to be brought out more clearly so that the reader can see how it adds to the current evidence. • I noted that you used different reference styles so kindly use only BMJ Open reference style through out the entire manuscript • Reference 9 and 34 are the same so one of them can be removed Conclusion • The results of the study do not support the conclusion of the study • Add possible recommendations at the end of the conclusions and further studies

REVIEWER	Dr Yobi Alexis SAWADOGO University Joseph KI-ZERBO Ouagadougou Burkina Faso
REVIEW RETURNED	25-Oct-2019

GENERAL COMMENTS	In the text We recommend to replace "pregnant mothers " by pregnant women According to the formula the sample size is 384 not 403 Somes references (1,, 2 and 7) are too old. There is no publication date in the reference 42.

REVIEWER	Dr. Alex Ernest The University of Dodoma, College of Health Sciences, Dodoma, Tanzania.
REVIEW RETURNED	23-Nov-2019

GENERAL COMMENTS	The study is relevant and address important obstetric issues. The following are my reservation 1. The title doesn't reflect the objectives. The authors in additional to delays, they looked on causes of obstetric emergency and severe maternal outcomes. However these are not captured in the title. 2. The authors should define SMO of interest in this study. This is not clear . For instance, blood transfusion. How many unit to call it SMO? 3. The discussion should focus more on why authors get those findings rather than comparing. 4. The document need language proofreading

REVIEWER	Nicolas Ray University of Geneva, Switzerland
REVIEW RETURNED	27-Nov-2019

GENERAL COMMENTS	First, I would like to say that this type of study is very important to understand a referral system and the three delays, and I thank the authors for it as it could bring important insights from an East-African country. However, after reviewing the paper, I have to reject it as it stands now, as it is not of sufficient quality for BMJ Open. There are several issues that I'm listing below in the hope this can help the authors reworking on the manuscript and analyses. Introduction

I was expecting more recent references and consideration of more recent papers that have investigated these three delays in the framework of obstetric referral systems. More particularly on the second delay, there have been numerous papers that have looked at that through the lens of geographic accessibility, and it would be interesting to consider that in the Introduction and the Discussion. See for example the following articles (and references therein):

Schmitz MM, Serbanescu F, Arnott GE, Dynes, M, Chaote, P, Msuya, AA, Chen, YN (2019). Referral transit time between sending and first-line receiving health facilities: a geographical analysis in Tanzania. BMJ Global Health 4: e001568

Ebener S, Stenberg K, Brun M, Monet J-P, Ray N, Sobel H, Roos N, Gault P, Morrisey Conlon C, Bailey P, Moran AC, Ouedraogo L, Kitong J, Ko E, Sanon D, Jega FM, Azogu O, Ouedraogo B, Osakwe C, Chimwemwe Chanza H, Steffen M, Ben Hamadi I, Tib H, Haj Asaad A, Tan Torres, T (2019). Proposing standardised geographical indicators of physical access to Emergency Obstetric and Newborn Care in low- and middle-income countries. BMJ Global Health 4: e000778

Schmitz MM, Serbanescu F, Kamara V, Kraft JM, Cunningham M, Opio G, Komakech P, Conlon CM, Goodwin MM (2019). Did Saving Mothers, Giving Life Expand Timely Access to Lifesaving Care in Uganda? A Spatial District-Level Analysis of Travel Time to Emergency Obstetric and Newborn Care. Glob Health Sci Pract 7(Suppl 1):S151-S167

Study design
Page 2, line 35: it was not clear to me whether the 40 mentioned health centers were all designated BEmOC facilities. If so, is there any information on the functionality of these BEmOC (are they all assumed to perform their 7 signaling functions correctly) ?
The link between BEmOC and CEmOC should be better explained, and probably the definition of BEmOC and CEmOC should be detailed. It is also not clear to me what you mean on page 2, lines 41-42 when you say "The referral system is designed to work both ways": are there references from CEmOC to BEmOC ?

My big concern is on the choice for the definition of the three delays, which of course impact many results of the study. First, you state that experienced obstetrician and gynaecologists have decided about the time thresholds to apply for these three delays, but on what basis were these decisions made? Can you back up these choices with literature and other studies, or international or national norms?
For the first delay, it's usually understood that it should encompass also the delay taken by the mother to make to decision to go to the first line facility (BeMOC in this case if I understood well that there was no additional reference from another health facility to a BeMOC?). Is there any way to take that information into account as well in your study (was this informed in the questionnaire that the mothers had to fill?).

Discussion
Page 12, line 13: how is it different from other reports or other countries? You are also only citing one study in Ghana here.

	Page 12, Lines 26-34. It would be important to elaborate a bit on the reasons of this second delay (traffic? Effective route of travel actually much longer that straight line distances? Were there difference in this second delay with the time of the day when the reference took place?). Page 12, Lines 36-37: you are stating SMO indicators are higher than in other countries, by you are referencing studies in only 2 other countries. You need more literature review to make that claim. Page 13, lines 7-8-: your claim that first and second delays are seen less frequently than the findings in other countries are far-fetched, in my view, by the fact that you claimed earlier that it's only 2 large referral hospital that have been considered in your study. How this study settings compare to the other studies you are referencing ? Writing This article suffers from a lack a writing quality. There are numerous typos, misshaped sentences, and English mistakes (and I'm not an English speaking native..) that made it difficult to read in many places, just a few examples: - abstract, line 35: 2.9 times more ?? to have… - page 3. Line 20: .. time elapsed time… - page 12: sentence 21-23 must be rephrased. - page 12line 55 to page 13 line 8: this unique sentence needs to be cut in 2-3 sentences. It needs a thorough check and rewrite by a professional editing service.

VERSION 1 – AUTHOR RESPONSE

Reviewer 1:
Reviewer Name: RICHARD KALISA

1. Background
• The necessity of the study is in question. Still feel like the background does not provide for a clear problem statement (could possibly be due to language).

Answers: This type of study may help to identify the most common causes/types of delay in emergency obstetrics services, to prevent/minimize maternal morbidity/mortality.
We modified.

2. Method

2.1. The sampling procedure and the rationale for its use are unclear.

Answer: We didn't use different types of probability sampling because there is no co-ordinate, complete and isolated registration system for emergency referred pregnant mothers which made to lost many delivered mothers among interviewed mothers. All pregnant mothers are seeing at emergency OPD (including pregnant mothers and gynecology cases and also who had follow up in the selected hospital) if they presented with emergency symptoms. So, thus made difficult to use

different sampling procedures, especially probability sampling.
2.2. Add the exclusion criteria.

Answer: We didn't include the exclusion criteria because
1. We mentioned inclusion criterias (i.e.) all criteria's which didn't fulfill inclusion criteria are excluded
2. It will be a repetition because it is the opposite way of inclusion
3. Journal format doesn't require
Note; if the editorials request/suggest to include, we'll include the exclusion criteria
2.3. Line 20-24 on page 3; The authors do define the three delays based on time of action I was wondering if this is standard time by WHO and if yes, then add the reference and if not provide further explanations why that cut off duration.

Answer: The three delays time frame were operationally defined through a consultative process involving obstetrician & gynecologists who had working experience of 7-20 years because
1. We couldn't find standard cut-points for the three delays(even from WHO),
2. The three-delay time cut-point operationally defined, thus are experts working in the two selected hospitals for long years. We assumed they had better knowledge in their respective hospitals setup how much time will take for admission, it is also there daily activity receiving complicated obstetrics cases and managing them (they usually ask mothers after how many time interval they detect danger signs, went to health facilities etc).
3. The professionals are also the best estimators about the time it will take after referral from health facilities because they have monthly catchment meeting to identify the referral gaps and daily they give feedbacks for referring health facilities.
2.4. Line 24-31 on page 3, I do suppose that you meant that you applied the WHO MNM tool as per reference 40 amongst all women admitted at the two hospitals to identify which cases were PLTMC and SMO. If yes, did you meet .....

Answer: we saw the above mentioned MNM tool but we didn't use it because our study is a cross-sectional study (at a point study) including only referred cases before they discahrged. On the above mentioned MNM tool we need to follow for 42 days (6 weeks) post- partum/after delivery.

2.5. Please provide a copy of the interview questionnaire used in this study as an additional file
Answers: we already attached as an additional file.

3.Results and Discussion
1. The result and discussion should be rewritten after the results from sub-Saharan Africa maternal near miss tool have been applied and the methods section are clarified.
Answer: we already mentioned why we didn't use it.
2. To avoid replications to results, figure 1 results can be omitted and added on to Table 5
Answer: See above(2.6. answer)
3. The similarities and differences of this study needs to be brought out more clearly so that the reader can see how it adds to the current evidence.
Answer: done
4. I noted that you used different reference styles so kindly use only BMJ Open reference style throughout the entire manuscript
Answer: Done
5. Reference 9 and 34 are the same so one of them can be removed
Answer: Done

Conclusion

1. The results of the study do not support the conclusion of the study

Answer: all points mentioned under conclusion are from results.

2. Add possible recommendations at the end of the conclusions and further studies
Answer: Done

Reviewer: 2
Reviewer Name: Dr Yobi Alexis SAWADOGO

1. In the text We recommend to replace "pregnant mothers " by pregnant women

Answer: corrected

2. According to the formula the sample size is 384 not 403
Answer: corrected

3. Somes references (1,, 2 and 7) are too old. There is no publication date in the reference 42.
Answer: even the references are many years old but they are important related to the topic. Related to references 42 it was given from BMJ open to use as format for writing of the research.

Reviewer: 3
Reviewer Name: Dr. Alex Ernest
1. The title doesn't reflect the objectives. The authors in additional to delays, they looked on causes of obstetric emergency and severe maternal outcomes. However these are not captured in the title.
Answer: we want the title is précised and inclusive. We included the above mentioned under objectives.
2. The authors should define SMO of interest in this study. This is not clear. For instance, blood transfusion. How many unit to call it SMO?

Answer: some modifications/additions done
3. The discussion should focus more on why authors get those findings rather than comparing.

Answer: In the discussion part, we tried to compare and contrast our result with other studies. On the same line we mentioned why thus findings happened (similarities/contrast) related to other studies. If we didn’t see (comparing) related to other studies, it will be repetition of results with some explanations under discussion part.
4. The document need language proofreading
Answer: we tried our best to make the research understandable and clear.

Reviewer: 4
Reviewer Name: Nicolas Ray

1. Introduction
1.1. I was expecting more recent references and consideration of more recent papers that have investigated these three delays in the framework of obstetric referral systems. More particularly on the second delay, there have been numerous papers that have looked at that through the lens of geographic accessibility, and it would be interesting to consider that in the Introduction and the

Discussion. See for example…..
Answers: 1. All you mentioned papers were published after our research result write-up finished and submitted for publication.
2.GIS-software application as a method is not our choice of method due to different limitations(eg. Lack of experts, financial limitations etc)
3. We recommend GIS and spatial-mapping based investigations of the three-delays especially the second delay

2. Study design
2.1. Page 2, line 35: it was not clear to me whether the 40 mentioned health centers were all designated BEmOC facilities. If so, is there any information on the functionality of these BEmOC (are they all assumed to perform their 7 signaling functions correctly) ?
Answers: All health centers expected to give all components of BEmOC services according to the Ethiopian Ministry of health in the decentralization of the health care systems.
Whether thus health centers giving all components of BEmOC services will be another study (This is not our study objective/s).

2.2. The link between BEmoc and CEmoc should be better explained, and probably the definition of BEmOC and CEmOC should be detailed. It is also not clear to me what you mean on page 2, lines 41-42 when you say "The referral system is designed to work both ways": are there references from CEmOC to BEmOC?

Answers: 1) We mentioned the relationship between BEmoc and CEmoc centers to emphasis how the referral system works in between them. The referral system is developed to work both ways according to the country's health referral system. Patients might referred from a health facility which gives BEmoc services to CEmoc centers or from one CEmoc center to other CEmoc centers or from CEmoc centers to BEmoc centers (for low risk mothers who can deliver at BEmoc centers will referred back).
2) We didn't write much /described about BEmoc and CEmoc is
2.1. It will be unnecessary and extra explanation of B/CEmoc
2.2. We didn't want to focus on the B/CEmoc services because it is not our objective.
We just highlighted how the referral system works in between them.

2.3. My big concern is on the choice for the definition of the three delays, which of course impact many results of the study. First, you state that experienced obstetrician and gynaecologists have decided about the time thresholds to apply for these three delays, but on what basis were these decisions made? Can you back up these choices with literature and other studies, or international or national norms?

Answers: The three delays time frame were operationally defined through a consultative process involving obstetrician & gynecologists who had working experience of 7-20 years because
1. We couldn't find standard cut-points for the three delays(even from WHO), instead different variables used(like: getting MgSo4 after order etc)
2. Even operationally defined, thus are experts working in the two selected hospitals for long years. We assumed they had better knowledge in their respective hospitals setup how much time will take for admission, it is also there daily activity receiving complicated obstetrics cases and managing them (they usually ask mothers after how many time interval they detect danger signs, went to health facilities etc).
3. The professionals are also the best estimators about the time it will take after referral from health facilities because they have monthly catchment meeting to identify the referral gaps and daily they give feedbacks for referring health facilities.
Note: We couldn't find standard time cut-points for the three delays.

2.4. For the first delay, it's usually understood that it should encompass also the delay taken by the mother to make to decision to go to the first line facility (BeMOC in this case if I understood well that there was no additional reference from another health facility to a BeMOC?). Is there any way to take that information into account as well in your study (was this informed in the questionnaire that the mothers had to fill?).

Answer:
1. First delay include the delay in decision to seek care (after recognizing the danger signs /or failure to recognize dangers signs upto reaching to health facility).
As we mentioned above, obstetrics referrals is from BEmoc center to CEmoc, from CEmoc to CEmoc sometimes from CEmoc to BEmoc (for low risk mothers).
2.In the questionnaire information about first delay included(You can check attached file as additional)

3. Discussion
3.1. Page 12, line 13: how is it different from other reports or other countries? You are also only citing one study in Ghana here.

Answer: we include some literatures

3.2. Page 12, Lines 26-34. It would be important to elaborate a bit on the reasons of this second delay (traffic? Effective route of travel actually much longer that straight line distances? Were there difference in this second delay with the time of the day when the reference took place?).

Answer: It is not the objective of this study to elaborate the reasons of second delay and it was also the least type of delay from our study. We didn't study and analyze the difference in the second delay per the time of the day.
3.3. Page 12, Lines 36-37: you are stating SMO indicators are higher than in other countries, by you are referencing studies in only 2 other countries. You need more literature review to make that claim.

Answer: done(The problem we faced was we didn't find adequate literatures on emergency obstetrics services on referred pregnant women.

3.4. Page 13, lines 7-8-: your claim that first and second delays are seen less frequently than the findings in other countries are far-fetched, in my view, by the fact that you claimed earlier that it's only 2 large referral hospital that have been considered in your study. How this study settings compare to the other studies you are referencing?

Answer: The study settings already mentioned under study design and setting in the method section. The settings from other studies was comparable.

4. Writing
4.1. This article suffers from a lack a writing quality. There are numerous typos, misshaped sentences, and English mistakes (and I'm not an English speaking native..) that made it difficult to read in many places, just a few examples:
- abstract, line 35: 2.9 times more ?? to have…

Answer: modified

- page 3. Line 20: .. time elapsed time… Corrected

- page 12: sentence 21-23 must be rephrased.
- page 12line 55 to page 13 line 8: this unique sentence needs to be cut in 2-3 sentences.
Answer: they are inter-related and we used as introductory for upcoming sentences

VERSION 2 – REVIEW

REVIEWER	Richard Kalisa MD, PhD Honorary Senior Lecturer, Department of Pediatrics and Child Health, University of Rwanda
REVIEW RETURNED	18-Jan-2020

GENERAL COMMENTS	Thank you for the opportunity to review this manuscript This is a nice introduction into the concept on the three delays model but the authors should also consider additional paragraph about implementation of the WHO maternal near miss criteria tool which I suppose they used when categorizing severe SMO. This is not mentioned in anywhere in their manuscript. Since 2011, there have been a vast number of studies questioning the applicable of the named tool to the present some suggesting redefining SMO to enable comparisons in the future as seen in the publications below: Nelissen E, et al. Applicability of the WHO Maternal Near Miss Criteria in a Low- Resource Setting. PLoS One 2013; 8(4):e61248. van den Akker T, et al. The WHO maternal near miss approach: consequences at Malawian District level. PLoS One 2013; 8(1):e54805. Kalisa R, et al. Maternal near miss and quality of care in rural Rwanda. BMC Pregnancy Childbirth 2016; 16:324. Tura AK, et al. Adaptation of the WHO maternal near miss tool for use in sub–Saharan Africa: an International Delphi study. BMC Pregnancy Childbirth 2017; 17:445 Schaap T, et al. Defining definitions: a Delphi study to develop a core outcome set for conditions of severe maternal morbidity. BJOG 2019; 126: 394-401. I would expect the authors include one or two additional paragraphs in the introduction and discussion to frame their findings in the context of the existing literature. The study does not give clear implications in the conclusion or recommendations. If the study provides similar findings as other studies, where is the problem? What is the explanation for this? What should be done about this situation? What should be the next steps to address this issue? Please provide a copy of the interview questionnaire used in this study as an additional file. I noted that you used different reference styles so kindly use reference style through your manuscript as per BMJ Open authors guidelines

REVIEWER	Nicolas Ray GeoHealth group Institute of Global Health University of Geneva, Switzerland

REVIEW RETURNED	24-Jan-2020

GENERAL COMMENTS	I thank the authors for this new version that has improved over the previous one, but several of my comments were not entirely addressed, and I believe they should to improve usefulness for the reader. However, I leave it to the handling editor to decide whether or not these should be addressed. The previous comments I'm referring to are: 1.1 adding some more recent references in the introduction 2.1. better explanation of how BEmONC and CEmONC are organized in the country.

VERSION 2 – AUTHOR RESPONSE

Reviewer 1:
Reviewer Name: RICHARD KALISA (MD, Ph.D.)

1. Question-1
• This is a nice introduction into the concept on the three delays model but the authors should also consider additional paragraph about implementation of the WHO maternal near-miss criteria tool which I suppose they used when categorizing severe SMO. This is not mentioned anywhere in their manuscript. Since 2011, there have been a vast number of studies questioning the application of the named tool to the present some suggesting redefining SMO to enable comparisons in the future as seen in the publications below:………. “I would expect the authors include one or two additional paragraphs in the introduction and discussion to frame their findings in the context of the existing literature.

Answers:
1. We included sentences in the introduction about near-miss. See the highlighted part of the introduction.
2. Severe maternal outcomes (SMO) operationally defined for this manuscript; even some components of SMO are available in different literatures
3. We didn’t use the WHO near-miss criteria tool in this study because

3.1. This is study only focused on pregnant mothers who were referred for labor and delivery.
3.2. We didn’t follow delivered mothers till completion of the postpartum period. It is just a ‘point study’.
3.3. MNM definition included mothers within 42 days of termination of pregnancy (i.e. termination of pregnancy at any trimester within 42 days of termination; but in our study delivery ≥ 28 weeks of gestational age and only among referred pregnant mothers for labor and delivery)
3.4. This study included both MNM and maternal deaths (i.e.SMO) not only near-miss cases.

So, for the above-mentioned reasons we didn’t focus MNM-tools and MNM related literatures.

Question-2
The study does not give clear implications in the conclusion or recommendations. If the study provides similar findings as other studies, where is the problem? What is the explanation for this? What should be done about this situation? What should be the next steps to address this issue?

Answer: We described the implications and recommendations in-detail both in the abstract and conclusion part. See highlighted sentences under the conclusion.

Question-3
Please provide a copy of the interview questionnaire used in this study as an additional file.
Answer: we already provided as an additional file at the time of re-submission previously.

Question-4
I noted that you used different reference styles so kindly use reference style through your manuscript as per BMJ Open authors guidelines.

Answer: we followed BMJ open authors guidelines. (This was corrected on the re-submitted manuscript.

Reviewer: 4
Reviewer Name: Nicolas Ray

1. Question-1
1.1 adding some more recent references in the introduction

Answers: We tried to include relevant literature for our study even 2018 published literatures.

1.2. a better explanation of how BEmONC and CEmONC are organized in the country.
Answers:
1) We added some explanation under 'study-setting'. See the highlighted sentence.
2. All hospitals (primary, secondary and tertiary), MCH and hospital-centers are expected to give CEmOC: On other hand health centers, medium clinics and specialty-clinics are expected to give BEmOC services.

VERSION 3 – REVIEW

REVIEWER	Richard KALISA MD, PhD Honorary Senior Lecturer, Department of Pediatrics and Child Health, University of Rwanda
REVIEW RETURNED	12-Mar-2020

GENERAL COMMENTS	The manuscript needs revision for some typographical errors Please clarify on the number instrumental delivery in table 2 and page 6, line 28-9

VERSION 3 – AUTHOR RESPONSE

Reviewer: 1
Reviewer Name: Richard KALISA MD, PhD

2.1. The manuscript needs revision for some typographical errors

Answer: we revised some typographical errors

2.2. Please clarify on the number instrumental delivery in table 2 and page 6, line 28-9

Answer: the number of instrumental deliveries (both forceps and vacuum) clearly mentioned in the table. The number of instrumental deliveries were 21(16 vacuum and 5 forceps).