PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Caesarean section rates analysed using Robson's Ten Group Classification System: A cross-sectional study at a tertiary hospital in Ethiopia
AUTHORS	Abdo, Abdella; Hinderaker, Sven; Tekle, Achamyelesh; Lindtjørn, Bernt

VERSION 1 – REVIEW

REVIEWER	Caroline Homer Burnet Institute, Australia
REVIEW RETURNED	16-May-2020

| GENERAL COMMENTS | Thank you for the opportunity to review this paper. The Robson classification is increasingly being used by many countries to rack their caesarean section (CS) rate. I commend the authors for undertaking this study in a hospital in Ethiopia.

I must say that I was shocked with the CS rates reported in the paper. These are higher than many high income countries and further highlights the challenges in addressing CS rates in all countries. In addition, the very low rate of attempted vaginal birth after CS which is concerning.

In the Introduction, the authors say that CS may be a cost free option for expecting mothers. There is no reference for this and I would challenge this. In most countries, CS fees are higher than those for a vaginal birth.

More information on the cost of care in the hospital is needed. Do women pay fees? Are providers paid additional amounts for CS? The hospital has 6 obstetricians, 80 midwives and 39 nurses – is this enough to provide quality care?

How was fetal compromise defined or established? What sort of fetal assessment methods were available in labour? Did women have one to one midwifery care in labour (I assume not)?

Gestational age assessment is often a challenge in LMICs. What proportion of women had an early ultrasound to establish an accurate gestational age?

I know perinatal mortality rate is not a feature of the Robson classification system but how are these rates in relation to the level of intervention.

Throughout the Discussion, the authors state the Robson recommendation for each category. Using these as a Robson |
|---|---|

recommendation is incorrect and needs more care in describing. The Robson manual (Ref 18 in the paper), specifically states that: "the rates of CS in each of the Robson groups in the WHO MCS refer to an average obtained from over 60 health facilities in low- and middle-income countries and therefore cannot and should not be taken as a recommendation to be followed by everyone around the world." (On page 37 on the WHO Robson manual).
On page 44 on the WHO Robson manual this caution is again given – "Please keep in mind the CS rates mentioned in the next pages have not been validated against outcomes and should not be taken as a recommendation."
The discussion needs rewriting with these caveats in mind.

What is driving the high CS rate – I can see what is driving the arte in terms of Robson classification but what are the professional, social, organisational and cultural issues that are contributing? This would be useful to explore in the Discussion rather than just going through each classification. Equally, what can be done about these issues?

There are a number of issues to do with spelling and terminology. For example, fetal should be spelt with the o – fetal rather than foetal. Most journal have also moved away from using 'deliver' to 'give birth'. Rather than 'delivering women' I suggest using 'women giving birth'. This is throughout the paper and needs attention. Please also do not make women invisible. For example, the first paragraph, I suggest using 'the proportion of women giving birth' rather than 'the proportion of births'. Data are plural – so 'data were' rather than 'data was'.

REVIEWER	Dr Ramón Escuriet
	School of Health Sciences Blanquerna-Universitat Ramon Llull
REVIEW RETURNED	26-May-2020

| GENERAL COMMENTS | This study is of great interest to researchers working in the field and also to those responsible for planning health services. Several aspects are suggested for the authors' consideration with the intention of improving the understanding of this work.

Page 4. Line 30-31. Suggestion for a better understanding of the context: It is stated that the hospital provides tertiary health services to a total of 15 million people population. If this is correct, please provide some additional information on the socioeconomic context. This coverage for such a large population may be strange for readers unfamiliar with the context of the country where the study is conducted.
Line
Page 5. Line 27-28. Please explain why CS before labour was included as an option within the variable "onset of labour"
Table 1. Suggestion. % mark should be included in the table together with the numbers in the "percent" column . Review if it should be "percent" or "percentage"

Page 9. Line 40. Please consider using the same concept always "primigravidae" when referring to nulliparous

Table 2. Suggestion. % mark should be included in the table together with the numbers in the "percent" column . Review if it should be "percent" or "percentage |

	Page 11. Line 36. To review. There is an inconsistency. As explained in the abstract and discussion, the major contributors to the overall CS are groups 1, 3 and 5. In this section authors do include as major contributors groups 1, 5 and 10. Please review
	Page 15. Line 21. Please consider using the concept "evaluate". This paper show stratified data according to RTG. Using the concept of "evaluation" implies more than only showing data. Authors may consider using the term or concept "analyse" or "describe". Otherwise please explain.

VERSION 1 – AUTHOR RESPONSE

Response to comments from the reviewers
Reviewer 1:
Comment: The statement which says CS may be a cost-free option for expecting mothers is not supported by references in the introduction section.
Response: We have included the reference in the revised version of the manuscript (See introduction section Ref.no 5 and 6, page 3, line 10).
Comment: More information on the cost of care in the hospital is needed. Do women pay fees? Are providers paid additional amounts for CS?
Response: Since 2005, the Ethiopian government implemented user fee exemption on services related to delivery services including CS for women who delivered at public health centres and Hospitals (Federal Ministry of Health. Implementation manual for health care financing reports; 2010. Addis Ababa, Ethiopia). However, this exemption does not include indirect (pre-hospitalization) costs such as transportation, lodging and foods. In Hawassa University Referral Hospital, most of the costs related to delivery (both normal and CS) are covered by the hospital. But sometimes, the women are expected to buy drugs when the requested drugs are not available in the hospital dispensary. We have included this information in the revised manuscript (See study setting, page 4, line 24-28).
No payment was given to the providers in addition to their routine salary.
Comment: The hospital has 6 obstetricians, 80 midwives and 39 nurses – is this enough to provide quality care?
Response: We share the concern of the reviewer regarding the number of obstetrician and midwives in the hospital to deliver quality services. This number is below the standard set by Ministry of Health Ethiopia for health facility staffing. According to the national guidelines, and since Hawassa University Referral hospital is specialized hospital, it is expected to have at least 13 obstetricians. The same is true for midwives. The number of midwives presented in the manuscript (80) are not assigned to labour ward only. They are assigned in four departments: 1) MCH (Antenatal clinic, Family planning), 2) labour ward, 3) Postnatal ward, and 4) Gynaecology ward. But, Hawassa University referral hospital is a teaching hospital, and there are obstetrics and gynaecology residents and intern medical students who are directly involved in care of labouring women. We have included this information in the revised manuscript (See methods section, page 5, line 17-18).
Comment: How was foetal compromise defined or established? What sort of foetal assessment methods were available in labour? Did women have one to one midwifery care in labour (I assume not)?
Response: Foetal compromise was defined in this study as the fetus having one of the following conditions: foetal distress, cord prolapse or Intra-uterine growth restriction (IUGR). The hospital has one Cardiotocography (CTG) that was not used. Ultrasound was used on some occasions, but in most of the cases the foetal heartbeat was monitored using fetoscope. We have included this information in the revised manuscript (See Methods section, page 5, line 27-30).

Regarding the ratio of midwives to labouring women's, in this hospital, one midwife is giving care for four labouring women. However, this is not enough to deliver quality care, and there are other providers in the hospital who can work with midwives such us residents and Intern medical students to follow labouring woman and attending births.

Comment: Gestational age assessment is often a challenge in LMICs. What proportion of women had an early ultrasound to establish an accurate gestational age?

Response: Thanks for sharing the concern we faced in measuring gestational age. As we have discussed in the limitation of this study, measuring gestational age was a big challenge for us. Ultrasound done in early pregnancy before 13 weeks of gestation is more accurate to determine gestational age. This can be done when the woman starts ANC in first trimester. In Ethiopia most of the women start ANC booking in the second or third trimester. In addition, most of the pregnant women are following ANC visit at health centres where ultrasound is not available, even for those who attend ANC at hospitals, ultrasound measurement is not routinely done to measure gestational age. The same holds true in our study also. Very few women had early ultrasound measurement. Hence, we have used the date of LMP and third trimester ultrasound for gestational age calculation for most of the women. For those women who did not remember their LMP date, and also those who did not have third trimester ultrasound measurement, we used a birth weight of ≥2500 grams as a proxy for term pregnancy (See methods section, page 5, line 18-23).

Comment: I know perinatal mortality rate is not a feature of the Robson classification system but how are these rates in relation to the level of intervention?

Response: We plan to publish the neonatal outcomes in a subsequent paper. However, in our study the perinatal mortality was 75 perinatal death/1000 live births and was based on deaths occurring in the hospital. We have included this information in the results (See result section, page 9, 10-11).

Comment: The authors state the Robson recommendation for each category. Using these as a Robson recommendation is incorrect and needs more care in describing throughout the discussion section.

Response: Thank you so much for the comment. Yes, we agree that WHO Robson implementation manual does not recommend to use CS rate indicated in each Robson group as a cut of point; it varies quite a lot according to setting. As we stated in methods section (See methods, page 6, line 2-3), we used WHO Robson implementation manual to compare and interpret our findings. In the discussion, our intention was to interpret our finding in relation to WHO Robson implementation manual through assessing data quality, type of obstetrics population and CS rate in each Robson groups. This is because the manual recommends those three steps before interpreting CS rate and the group which contribute to high overall CS rate. Now we revised the discussion section by using what Robson guideline stated for each Robson's group using track change (See discussion section, page 14-17).

Comment: What is driving the high CS rate? What are the professional, social, organisational and cultural issues that are contributing to this high CS rate? This would be useful to explore in the Discussion rather than just going through each classification. Equally, what can be done about these issues?

Response: Thank you for suggesting us to include driving factors to this high CS rate in our study. Though the aim of our study was to analyse CS rate using Robson classification system, now we have included a discussion about potential driving factors for high CS rate in our study hospital. The overall CS rate in our hospital 32.8% is much higher than WHO recommendation 10-15%. The high CS rate in our study could be because Hawassa University referral hospital is a teaching hospital where residence may perform CS without following strict indications for performing CS for their learning purpose. Another possible driving factors for this high CS rate could be the hospital is a referral hospital where more than a third of women referred to this hospital with different emergency situations that may need emergency management through CS delivery. Nearly three-quarter (73.7%) of CS in this study was performed for non-absolute maternal indications mainly foetal distress, and CS may be performed for some women without appropriate indications. As we have discussed previously, the foetal monitoring was not optimal, and this may have contributed to the high

prevalence of so-called "foetal distress". The other possible explanation for high CS rate in our study could also be due high proportion of urban women (91.6%) who gave birth in the hospital, and urban women could prefer to give birth through CS than the rural women. We included this information in discussion section in the revised manuscript (See discussion, page 17, line 11-25).

We have already included in our recommendation for further assessment of the reasons for this high overall CS rate and hight CS rate in low risk groups (group 1 and 3) in the hospital through auditing the appropriateness of CS indication. Foetal heartbeat monitoring system should be improved to reduce unnecessary CS that could be done due to misdiagnosis of foetal distress (See discussion section, page 18, line 20-26).

Comment: There are a number of issues to do with spelling and terminology. For example, foetal should be spelt with the o – foetal rather than foetal. Most journal have also moved away from using 'deliver' to 'give birth'. Rather than 'delivering women' I suggest using 'women giving birth'. This is throughout the paper and needs attention. Please also do not make women invisible. For example, the first paragraph, I suggest using 'the proportion of women giving birth' rather than 'the proportion of births'. Data are plural – so 'data were' rather than 'data was'.

Response: The spelling 'foetal' is UK English and we have used UK format throughout the manuscript. We have included all other suggested changes throughout the document (See the revised manuscript we made using track change).

Reviewer 2:

Comment: Page 4. Line 30-31. Suggestion for a better understanding of the context: It is stated that the hospital provides tertiary health services to a total of 15 million people population. If this is correct, please provide some additional information on the socioeconomic context. This coverage for such a large population may be strange for readers unfamiliar with the context of the country where the study is conducted.

Response: In Ethiopia the health service delivery system follows three structures (three tier system): 1) Primary level heath (includes health centres with five satellite health posts; provide services to 25,000 populations, and Primary hospitals, provide services to 100,000 populations). 2) Second level health care (General hospital which provide services up to one million people as referral unit from primary hospitals). 3) Tertiary health care level (Specialized hospital supposed to serve up to five million population as referral unit for General hospitals). Hawassa university referral hospital is one the hospitals which gives tertiary health care services in Ethiopia for nearly 15 million population in the area as referral centre. This is not due to lack of other tertiary hospital in the catchment area, but it is due to the proximity of this hospital to the two densely populated regions in Ethiopia (Southern Nation Nationalities and Peoples region, and Oromia region). However, most of the patients came from Shashamanne and nearby districts in Oromia region, and from Hawassa town and nearby districts. Sometimes patients are also referred to this hospital from up to 400 km far from Hawassa. We have now revised the text so that it reflects the homeplaces of the patients actually coming for deliveries at the hospital (See methods section, page 4, line 17-18).

Comment: Page 5. Line 27-28. Please explain why CS before labour was included as an option within the variable "onset of labour"

Response: We included CS before labour as an option within the variable "onset of labour" following Robson classification system as described in the methods section (See methods, Box 1, page 6). Robson use six obstetrics parameters to classify the women in one of the 10 groups. These parameters are: Parity, previous CS, onset of labour, number of fetuses, gestational age, and foetal lie and presentation. Onset of labour, according to Robson is classified as spontaneous, induced or pre-labour CS. That is why we include pre-labour CS under the category of onset of labour.

Comment: Table 1. Suggestion. % mark should be included in the table together with the numbers in the "percent" column. Review if it should be "percent" or "percentage.

Response: We used number along with percent for each variable. Now, % mark is included in ''percent''column (See result, Table 1, page 9).

Comment: Page 9. Line 40. Please consider using the same concept always "primigravidae" when referring to nulliparous.
Response: The term primigravidae was used wrongly in place of nulliparous in the result section of the manuscript since Table 2 refer the category of variable Parity. Now we replace the term nulliparous instead of primigravidae (See result section, page 9, line 7).

Comment: Table 2. Suggestion. % mark should be included in the table together with the numbers in the "percent" column . Review if it should be "percent" or "percentage
Response: Revision made and % included (See result section, Table 2, page 10)
Comment: Page 11. Line 36. To review. There is an inconsistency. As explained in the abstract and discussion, the major contributors to the overall CS are groups 1, 3 and 5. In this section authors do include as major contributors' groups 1, 5 and 10. Please review.
Response: We reviewed the suggestion given by the reviewer, but we did not get the inconsistency in the major contributors to the overall CS rate. But the result presented on page 11, under the heading 'Robson Ten Group Classification System' first paragraph, may looks the three groups (3,1 and 10) as major contributors to the overall CS rate. In fact, it is not. These groups (3, 1 and 10) are the most represented groups by the type of obstetrics population who gave birth in the hospital (group size). Group size for each Robson groups was calculated from Table 3 using the formula: group size (%) =number of women in the group/total number of women who gave birth in the hospital × 100. Now we included this information in the revised manuscript to avoid ambiguity between group size and major contributors to the overall CS rate (See result section, page 11, line 6).
Comment: Page 15. Line 21. Please consider using the concept "evaluate". This paper show stratified data according to RTG. Using the concept of "evaluation" implies more than only showing data. Authors may consider using the term or concept "analyse" or "describe". Otherwise please explain.
Response: Now, we replace the term 'evaluate' with 'analyse' in the revised manuscript (See discussion, page 14, line 10).
Comment: Mismatch Author Name. The author "AchemyeleshGebretsedik " in your main document is registered as "Gebretsadik, Achamyelesh" in ScholarOne. Please ensure that the author has same registered name.
Response: The name of this author was corrected.
Comment: Please provide figure legend/caption. Please include figure legends at the end of your main manuscript.
Response: We have included the figure legend at the end of the manuscript and in the result section of the revised manuscript (See result section, page 11, line 17-18 and Legends, page 24).

VERSION 2 – REVIEW

REVIEWER	Caroline Homer Burnet Institute, Australia
REVIEW RETURNED	10-Aug-2020

GENERAL COMMENTS	Thank you to authors for addressing my comments. Just two things to consider - I was surprised to see in the section in the Discussion about the possible reasons for the high CS rate no mention of the limited health workforce. If every woman was able to have one to one care in labour from a midwife that would make a difference. Also, if women could have support in labour from a companion this is also likely to make a difference in the CS rate. This latter

| | intervention does not come with a cost and there is high level evidence that it would improve outcomes. I suggest making a comment to that effect.

Finally, I think you will find that fetal is spelt without the o - even in UK journals. It is the way fetal is spelt in BMJ journals but I will let the copy editors work that out with you.

All the best. |
| --- | --- |

REVIEWER	Ramon Escuriet National Health System. Catalonia, Spain
REVIEW RETURNED	23-Aug-2020

GENERAL COMMENTS	The authors have responded to all suggestions and provided the necessary explanations when necessary. In my opinion, the article can now be accepted for publication.

VERSION 2 – AUTHOR RESPONSE

Response to comments from the reviewer

Reviewer 1:

Comment: I was surprised to see in the section in the Discussion about the possible reasons for the high CS rate no mention of the limited health workforce. If every woman was able to have one to one care in labour from a midwife that would make a difference.

Response: We thank the reviewer for the suggestion. We agree with the reviewer, in our study hospital, there is no one-to-one midwifery care for every labouring woman due to the shortage of midwives in the hospital. In addition, the care during labour is being given by a team. Midwives, Intern medical students, and Obstetrics and gynaecology speciality residents are involved in the care of the labouring woman. Studies have shown midwifery-led care, one to one or caseload midwifery care during labour significantly reduce caesarean section rate (Bertusevicience, 2018, Jiang, 2018, Tracy, 2013, Mclanchlan, 2012, Sandall, 2010). But in our study, there is no one-to-one midwifery care and midwifery-led care, and this may be a possible reason for the high caesarean section rate. We have included this information in the discussion section of the revised manuscript (See discussion, page 17, line 17-19).

Comment: If women could have support in labour from a companion this is also likely to make a difference in the CS rate. This latter intervention does not come with a cost and there is high-level evidence that it would improve outcomes. I suggest making a comment to that effect.

Response: Though WHO recommends all women to have a campanion of choice throughout labour and childbirth, in Ethioipia in general and in our study hospital in particular, there is limited involvement of a campanion to support labouring woman after admission in the labour ward. This is may be due to limited physical space in the labour ward, which limits privacy and leads to

overcrowdnes in the ward. Studies have shown the support of campanion during labour significantly reduces caesarean section rate and improve the maternal and newbor outcomes (Kadour-peer, 2019, Bohren, 2017, Hodnett, 2012). But in our study hospital, the support of campanion during labour is limited and this might be another possible reason for high caesarean section rate in our study. We have included this information in the discussion section of the revised manuscript (See discussion, page 17, line 20-22).

Comment: I think you will find that fetal is spelt without the o - even in UK journals. It is the way fetal is spelt in BMJ journals but I will let the copy editors work that out with you.

Response: Now, we replaced 'Foetal' with 'Fetal' and included throughout the revised manuscript.