PLOS GLOBAL PUBLIC HEALTH

RESEARCH ARTICLE

"*It's complicated. . .*": Exploring second stage caesarean sections and reasons for non-performance of assisted vaginal births in Kenya: A mixed methods study

Fiona M. Dickinson[1]*, Helen Allott[1], Paul Nyongesa[2], Martin Eyinda[3], Onesmus M. Muchemi[3], Stephen W. Karangau[4], Evans Ogoti[5], Nassir A. Shaban[6], Pamela Godia[3], Lucy Nyaga[3], Charles A. Ameh[1,7]

1 Liverpool School of Tropical Medicine (LSTM), Pembroke Place, Liverpool, United Kingdom, **2** Moi Teaching and Referral Hospital, Eldoret, Kenya, **3** LSTM Kenya, Nairobi, Kenya, **4** Muriranjas Sub-county Hospital, Muranga County, Kenya, **5** Moi University, Moi Ave, Kenya, **6** Msambweni County Referral Hospital, Msambweni, Kenya, **7** University of Nairobi, Nairobi, Kenya

* fiona.dickinson@lstmed.ac.uk

Citation: Dickinson FM, Allott H, Nyongesa P, Eyinda M, Muchemi OM, Karangau SW, et al. (2023) "*It's complicated. . .*": Exploring second stage caesarean sections and reasons for non-performance of assisted vaginal births in Kenya: A mixed methods study. PLOS Glob Public Health 3(11): e0001495. https://doi.org/10.1371/journal.pgph.0001495

Editor: Julia Robinson, PLOS: Public Library of Science, UNITED STATES

Received: December 20, 2022

Accepted: October 25, 2023

Published: November 17, 2023

Data Availability Statement: All data relevant to the study are included in the article.

Funding: CA - FCDO grant (Reducing Maternal & Neonatal Death in Kenya, number 202549). FD - award from LSTM. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. FD, HA, ME, OM, PG, LN, CA received a salary from FCDO grant.

Abstract

Unnecessary Caesarean Section (CS) can have adverse effects on women and their newborns. Assisted vaginal birth/delivery (AVB/AVD) using a suction device or obstetric forceps is a potential alternative when delays or complications occur in the second stage of labour. Unlike CS, AVB using a suction device does not require regional or general anaesthesia, can often be performed by midwives, and does not scar the uterus, lowering the risk of maternal mortality and morbidity, in this and subsequent pregnancies. This study examined the appropriateness and outcomes of second stage CS (SSCS), and reasons for low levels of AVB use, in Kenya. Using a mixed methods study design, we reviewed case notes from women having SSCS births and AVB, and conducted key informant interviews with healthcare providers, from 8 purposively selected hospitals in Kenya. Randomly selected SSCS and all AVB case notes were reviewed by a panel of four experienced obstetricians, and appropriateness of the procedure assessed. Semi-structured interviews were conducted with obstetricians, medical officers and midwives, and analysed using a thematic approach. Review of 67 SSCS case notes showed 10% might have been conducted as AVBs, with a further 58% unable to be classified due to inadequate/inconsistent record keeping or excessive delay following initial CS decision. Outcomes following SSCS showed perinatal mortality rate of 89.6/1,000 births, with 11% of infants and 9% of mothers experiencing complications. Non-referred cases of AVB showed good outcomes. The findings of the 20 interviews explored the experience and confidence of healthcare providers in performing AVBs, and adequacy of the training they received. Key reasons for non-performance included lack of functioning equipment, lack of trained staff or their rotation to other departments. Reasons for non-performance of AVB were complex and often multiple. Any solutions to these problems will need to address various local, regional and national issues.

Competing interests: I have read the journal's policy and the authors of this manuscript have the following competing interests: Charles Ameh is an editor for Plos Global Public Health.

Introduction

Globally, caesarean section (CS) rates continue to rise, with the procedure accounting for 21% of all births in 2021, an increase of 14% since 1990 [1]. In some countries such as Brazil and Egypt, CS births now outnumber vaginal births. However, increasing rates are not uniform with the greatest increases being in eastern and western Asia (45%, 35%) and northern Africa (45%), whilst other regions such as sub-Saharan Africa (SSA) had the lowest rate of increase (3.6%) [2]. CS rates for Kenya vary considerably depending on the setting but the most recent national data available from the World Health Organisation give a rate of 8.7% in 2009 [3]. Whilst the appropriate use of CS can be lifesaving for the mother and infant, it does come with increased risks, particularly in low-resource settings [1].

CS associated risk in LMIC

CS are associated with a maternal mortality rate of 10.9 per 1,000 procedures in sub-Saharan Africa compared to 0.3 per 1,000 procedures in LMIC in Europe and central Asia [4]. Emergency CS in all LMIC are twice as likely to result in a maternal death compared to elective CS [4]. Additionally, CS performed in the second stage of labour (SSCS) i.e., after full dilation of the cervix, are 12 times more likely to end in maternal death compared to those done in first stage [4]. Other adverse maternal and neonatal outcomes are also significantly increased with SSCS, including admission to intensive care, hysterectomy and perinatal death [4]). In addition to mortality and short-term morbidity, there are also longer-term risks associated with caesarean section, including uterine rupture in subsequent labour [5] and abnormal placentation [6]. Given these risks, it is important that caesarean birth, especially SSCS, is restricted to those situations where there is no safe alternative means of giving birth, and unnecessary CS are avoided.

By contrast, in SSA, AVB was found to have taken place within the previous three months, in only 53% of 1728 hospitals and 6% of nearly 10,000 health centres surveyed [7]. Overall institutional rates of AVB were around 1% and it was clear that in a great many hospitals and health centres AVB was not being practiced at all. Reasons for a lack of AVB included a lack of available or trained staff, a lack of available functional equipment and policies restricting authorisation to perform the procedure [7].

Assisted vaginal birth

As key interventions to shorten the second stage of labour, assisted vaginal birth (AVB) and CS are important aspects of emergency obstetric care [8]. They may be indicated for maternal fatigue, maternal medical indications, suspected fetal hypoxia or prolonged duration of the second stage. Failure to intervene, when necessary, could be associated with poor outcomes for both mother and baby [2]. Depending on the level of descent of the fetal head, in many cases, giving birth by means of AVB may be an alternative to SSCS. Significantly fewer maternal complications have been found after AVB than after SSCS (0.8% v's 4.2%, $p = 0.003$), whereas perinatal outcomes, including deaths overall, are comparable for the two groups [9]. Given the evidence in LMIC, surrounding the risks associated with SSCS and AVB, relatively few AVBs are conducted in many low-resource settings, especially in SSA [7]. The ability to perform AVB is a basic emergency obstetric care function that should be provided in all healthcare facilities providing intrapartum care [8].

Since 2012, the Liverpool School of Tropical Medicine (LSTM) has been providing a programme of theoretical and practical emergency obstetric and newborn care (EmONC) training, including AVB, to healthcare providers in 25 healthcare facilities across five counties in Kenya [10]. Despite having trained 1193 members of staff in the most recent intervention, the

rates of AVB remained very low. The data showed that in the eight highest volume facilities, during the period June to November 2020, 12,161 births occurred. Of these, 25.6% (n = 3114) of births were conducted by CS whilst only 0.31% (n = 38) were conducted by AVB, with three of the eight facilities not conducting any AVBs.

The objectives of this study were to explore the appropriateness and outcomes of SSCS and AVB; to understand clinician's perceptions and practice of AVB; and to describe reasons for non-performance of AVB, in selected high-volume facilities, in Kenya.

Methods

This study used a mixed methods approach, combining a cross-sectional, retrospective review of randomly selected case notes from women who had undergone either SSCS or AVB, with key informant interviews with healthcare providers involved in the provision of intrapartum care.

Ethics statement

Ethical approval was sought and obtained from the LSTM Research Ethics Committee (ref: 21–041) and the Moi University Institutional Research Ethics Committee (ref: IREC/2021/115). Written informed consent was obtained from all study participants.

Study setting

The eight healthcare facilities included in this study were classed as either county level or sub-county hospitals, with seven operating at a comprehensive Emergency Obstetric and Newborn Care (CEmONC) level (able to offer CS and AVB) and one at a basic EmONC (BEmONC) level, offering AVB but not CS [8]. All hospitals were part of our Maternal and Newborn Health Programme, funded by the Foreign, Commonwealth & Development Office, and implemented in five of the 47 counties across Kenya.

Previous programmatic monitoring and evaluation found that the most frequently cited reason for non-performance of AVB was a lack of clients needing the procedure. This seemed unlikely given the number of women who gave birth and the AVB rates expected, based on other LMICs. Therefore, eight hospitals were selected from the 25 healthcare facilities in the programme, that had the highest number of births (an average of more than 130 births per month) to minimise the likelihood of non-performance due to lack of women needing the procedure. The lower-level health facility was included because it had a high volume of births per month and might be more likely to perform AVB as it did not provide CS.

Sample size and data collection

Case note review. The study period of June to November 2020, was chosen to avoid the restrictions surrounding the initial onset of the Coronavirus pandemic and a healthcare providers strike which occurred in December 2020. Due to the small scale of the study, it was not possible to include all of the over 3,000 CS cases, born during the study period. CS case notes were selected using a systematic random sampling technique [11], to give a selection of notes across the six-month period. We utilised either the Kenya Health Information System where possible, or the hospital maternity registers, as a sampling frame.

Initial sample size calculations were based on a sample of SSCS case notes but due to difficulties in identifying appropriate cases and locating the relevant notes in hospitals, a sample of all CS (elective, first and second stage CS) notes had to be taken. A pragmatic target of 135 emergency CS cases per hospital was set for each of the seven CEmONC hospitals, giving an overall sample of 945 CS cases. From these, the SSCS cases were identified and extracted for analysis.

Health Records Information Officers were asked to retrieve every 'n'th case. This was calculated based on the number of births per month, where 'n' would equal the total number of births divided by the number of cases required.

Once case notes were identified and located, they were copied by hospital staff and sent to a central office in Nairobi. Here they were scanned, given a unique study ID number, and personal identifiable information was electronically redacted. In addition, due to the small number of procedures performed (38 in total), all AVB cases for the study period, were included in the data collection. Data was extracted from the CS and AVB case notes using a pro forma and entered into a spreadsheet to aid analysis.

Key informant interviews. For the key informant interviews (KII), purposive sampling was employed to identify nurses, medical officers and obstetricians who provided clinical care in each of the eight target hospitals. A range of clinicians who were actively involved in the provision of care to women giving birth were identified, in addition to those with managerial responsibility, such as medical superintendents and midwives in-charge of labour wards. The intent of the interviews was to identify staff who might be expected to either perform AVB or in a position to influence its use by others. Using a semi-structured topic guide, the interviews were conducted remotely, due to travel and contact restrictions resulting from the Covid-19 pandemic, via Zoom, Skype or Microsoft Teams. Potential participants were identified by members of the programme team working with the facilities. These were screened by members of the study team and purposively selected to ensure a spread of cadres and facility representation. Participants were sent an invitation to take part in the study along with the participant information sheet and a consent form. They were given the opportunity to ask any questions of the research team before signing and returning the consent form. A date and time convenient to the participant was then arranged for the interview.

The interviews were conducted in English by FD, an experienced qualitative researcher with a background in midwifery in the UK, and HA, an experienced obstetrician, having worked for many years at consultant level in the UK. Both interviewers also have extensive experience of living and working in LMIC. FD had not previously been involved in AVB training in Kenya and was not known to any of the respondents. HA had been involved with AVB training in Kenya and was known to a few of the interview participants. We were conscious that participants would be aware that we were from LSTM and that this might influence their responses, in wanting to make clear their appreciation of the training. We also purposively included participants who had not taken part in LSTM training previously, but as the included facilities were those supported by the programme, non-trained participants were relatively few in number.

Of the 20 key informant interviews nine were conducted with nurses, of whom four were in-charge of labour ward or the maternity department; five were with medical officers, one of whom was a superintendent; and six were with consultant obstetricians. The same topic guide was used for all participants as it focussed on their individual perceptions and experience.

Analysis

Extracted data from the SSCS case notes were reviewed by a panel of four experienced obstetricians, three from Kenya and one from the UK but with experience of working in LMIC including Kenya. Each case was independently reviewed by two members of the panel and a conclusion drawn as to the potential appropriateness of the procedure. Where any discrepancies were identified between panellists, they were discussed by the group as a whole and a consensus formed. Appropriateness of CS, based on the available information, was classified as:

1. **CS** was considered to have been necessary and **appropriate**

2. **Unclear** due to lack of information in the notes
3. **Unclear** due to delay in performing the procedure
4. **AVB** should have been attempted

Data were also extracted from the notes on maternal and neonatal outcomes following both SSCS and AVB. Due to the small number of SSCS case notes included in the records retrieved, statistical analysis was not possible.

The KIIs were recorded and transcribed, and an inductive thematic analysis undertaken [12]. This process involved familiarisation with the data through reading transcripts and listening to recordings, followed by thematic analysis to develop codes. Codes were systematically and reflexively applied to the data and then grouped into themes and sub-themes. This process was carried out using qualitative data analysis software (NVivo, version 12).

Results

From a total of 826 randomly selected CS case notes retrieved, 67 were identified as SSCS (8.1%). In addition, 6 sets of AVB notes were identified and retrieved.

Appropriateness and outcomes of SSCS and AVB

Following review of the available data for the 67 SSCS, in 22 cases (33%) SSCS was considered appropriate (Fig 1). These included cases of fetal arm prolapse and transverse lie, as well as instances where the head was still more than two fifths palpable abdominally. In the two 'unclear' categories, there were 21 cases (31%) where a judgement could not be made by the expert panel as to the appropriateness of SSCS, due to lack of information or contradictions in the medical records. There were also 17 cases (25%) where there was a significant delay between making the decision to perform CS and the procedure being performed. In two of these cases, there was a 5-hour delay from decision to birth, with no reassessment recorded. It was felt that in the 'Unclear due to delay in performing the procedure' cases, further fetal descent might have occurred making AVB possible, thus expediting birth and eliminating the need for SSCS.

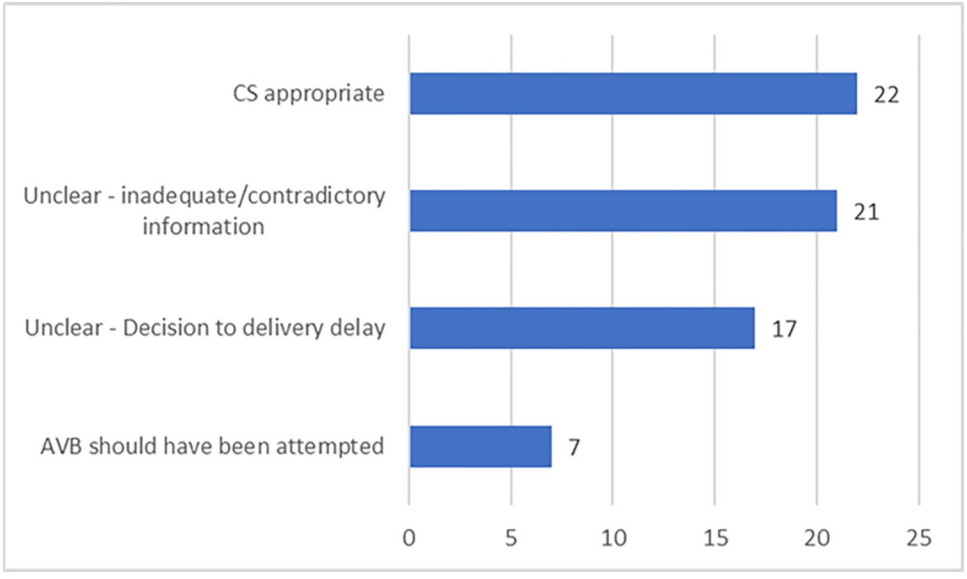

Fig 1. Number of SSCS cases per category.

https://doi.org/10.1371/journal.pgph.0001495.g001

In the final category, there were seven cases (10%) where reviewers felt that, based on the case notes, AVB should have been attempted. Of these, six (86%) were 'referred in' from other facilities and three (43%) had a decision to birth interval (time from making a decision to perform CS to the actual birth) of 2 hours or more. Three of the seven cases also had a total second stage (time from full dilation to birth) of at least 4 hours with two cases of at least 7 hours.

Maternal and perinatal outcomes following SSCS. However, analysis of the outcomes for the 67 SSCS cases revealed that there were six cases (9%) of maternal complications, including five (8%) of postpartum haemorrhage (PPH) but no maternal deaths. Perinatal outcomes among the SSCS showed two (3%) neonatal deaths, four (6%) stillbirths which would equate to a perinatal mortality rate of 89.6 deaths per 1,000 births. A further seven (11%) infants had complications needing treatment and/or admission to the neonatal unit (e.g. for convulsions or asphyxia). Overall birthweights ranged from 1705g to 4470g but did not seem to be associated with adverse outcomes for either mother or baby. Apgar scores for infants born alive and where data was available, was similar across all five groups.

The most common reason given for SSCS was failure to progress or delay in second stage (n = 36, 54.6%), however, six also reported fetal distress or non-reassuring fetal signs. Meconium was also listed as a reason for SSCS in one case although, despite the decision to birth interval being 2 hours, the baby had Apgar scores of 9 at 1 minute and 10 at 5 minutes. Other reasons given for SSCS included issues with presentation such as arm prolapse, transverse lie and breech, and previous CS including one with a known stillbirth.

AVB cases. Six cases of AVB were reviewed, five of which occurred in sub-county hospitals and only one in a county referral hospital. There were no perinatal or maternal deaths with most procedures being performed for either 'delay in second stage of labour' or 'poor maternal effort'. Four of the cases had good outcomes for the mothers and babies, with Apgar scores at 5 minutes of 9 or 10. The two remaining cases, however, were both referrals from approximately 30 minutes away, who were referred for delay in second stage of labour. One of the referred mothers experienced complications with bleeding postpartum which was managed by vaginal packing. Both infants were approximately 2.5kg in weight and had birth asphyxia with poor Apgar scores (5 and 7 at 5 minutes). One of the asphyxiated infants required admission to the Newborn Baby Unit for 5 days.

Clinician's perceptions and practice of AVB

The key informant interviews explored the views of clinicians and managers regarding the use of AVB and reasons why it was not used. Where quotes are given, the interview number, cadre of the respondent (N—nurse, MO–medical officer, OB–obstetrician), and level of health facility (SCH–Sub County Hospital; CRH–County Referral Hospital), are also given to provide context.

Views on AVB. Most of the respondents acknowledged the benefits of AVB, with the avoidance of the attendant abdominal scar and potential complications associated with CS, particularly when performed in the second stage of labour. We asked respondents how they would feel about having an AVB themselves or for their wife/partner. Most said they would be accepting of the procedure providing that the necessary indications were met and that the operator was competent. They recognised the reduced risk of having an AVB rather than a CS.

"*If I had the confidence, in whoever is attending to me, I would give a go ahead. Yeah because of instead of going for a caesarean, to nurse the scar when I can be done an AVD and deliver well." (KII 5, N, SCH)*

Others had their doubts about the procedure, and one respondent stated that

"*I wouldn't let it get to that; I would have delivered her by caesarean before." (KII 6, OB, SCH)*

Interviewees were also asked about their perceptions of the views of their local community regarding AVB. There were some differences of opinion, but most felt that the local community had no real understanding of about AVB and what it involved.

"*Most of them are not learned, they don't understand these things. Even if you get a consent, you tell them 'mama I want to use this to help your baby come out, please co-operate', they don't understand." (KII 1, MO, CRH)*

Some felt that the recipients would accept whatever was advised by the doctor or would end the pain of labour.

"*Most of our ladies when you ask for their consent to do the assisted vaginal delivery, they just tell you, just do anything so that you can take out the baby. Because they are in so much pain at that time, so they will take anything that can be done so they can take out the baby." (KII 17, MO, SCH)*

It was thought that some women would prefer AVB to CS, through fear of going to the operating theatre and a having an anaesthetic, and for others there was the concern of the potential limiting effect CS might have on the size of their family.

"*The ones who want to give birth to fifteen children, they want to avoid caesarean section as much as possible because they know that is going to limit the number of children they are going to get. So, if you give them any other option apart from caesarean section they would gladly take it." (KII 8, MO, CRH)*

A few interviewees felt that some women had a fear of the device and the potential damage it might cause to their baby or themselves, or had heard adverse reports from friends.

"*Some clients they decline vacuum because of the, just misconceptions. I think maybe the stories in the community that once it's done maybe the baby will come out with brain injuries." (KII 3, N, CRH)*

There seemed to be little, in any, antenatal teaching for the women on different ways of giving birth, with explanations regarding AVB and its implications being provided when women were in advanced labour.

Experience and training. Of the 17 respondents who provided information, 14 had conducted an AVB at some point in their career, with a few performing regularly, but others had not performed the procedure for two or more years.

Several of the interviewees had undergone EmONC training provided by LSTM, and a few had also done the LSTM Advanced Obstetric Surgical course or other AVB training. Both the standard and advanced LSTM courses cover theoretical and hands-on training on AVB, and overall, interviewees found the courses to be beneficial, particularly the practical aspects.

"*Oh, I learnt something, it was helping me a lot. Because actually I did not know how to do it at first, but out of your training I managed to do two, two cases." (KII 17, MO, SCH)*

However, despite most of the respondents having received AVB training previously, the need for additional training was commented on repeatedly. Some interviewees felt that they needed further training provided by external organisations such as LSTM or other NGOs, whilst others thought that on-the-job training would be preferable.

"*I've done about three [AVB] since the training of [county], but I've done many from when I left medical school, but we were using the old equipment, we were not using the Kiwi. The Kiwi one I've used on three patients or so. I'm quite competent actually, personally I am okay, only a bit of refresher then everything will fall in place." (KII 4, OB CRH)*

In-house training was reported in a few of the facilities, with accounts of continuing medical education (CME) sessions, where medical interns tended to present on theoretical aspects of a particular subject, with little or no opportunities to practice skills. Although these seemed to be open to all cadres, limited staffing levels meant that in practice staff were sometimes too busy to attend.

Reasons for non-performance

During the routine facility assessments, the most common reason given for not performing AVB within a facility was a lack of patients for whom the intervention was indicated. However, this was rarely mentioned by interviewees, with the majority expressing that they thought more AVB should be performed. Several reasons were offered by respondents for not performing AVB, including a lack of functional equipment, insufficient staff, lack of knowledge, skill or confidence, lack of training and fear of complications.

Lack of equipment. The lack of operational equipment was a recurring theme, expressed by the interviewees as a reason for not performing AVB. One of the difficulties described in these settings, was that the preferred device for performing AVB, the Kiwi obstetric suction cup device, is designed to be single-use. However, due the cost of replacements and difficulties in procuring new devices, they are often sterilised and re-used.

"*We sterilize using high level disinfection and we reuse it. . . I think it can do up to 12 patients*" (KII 11, N, CRH)

In some instances, though, this led to problems where the device was no longer functioning properly. On another occasion, an interviewee explained that problems with a dysfunctional device had led to a woman having to undergo a SSCS following a failed AVB, resulting in the loss of the baby.

When asked about the use of obstetric forceps, most respondents said that they either did not have them in their facility or that they were not used. One medical officer stated that they had used them once and a consultant admitted that they had never been trained in their use.

In two of the hospitals, the staff had requested replacement Kiwi devices, but they were not available, and they had been provided with Malmstrom vacuum extractors instead. Although these are reusable, they require two people to operate and were not favoured by the staff interviewed.

Staffing. The levels of staffing were discussed during the interviews, with almost all interviewees reporting inadequate levels. Interviewees commonly described 1–3 nurses on duty per shift with fewer at night than during the day. These nurses may have covered only the labour ward in the large County Referral Hospitals but in the smaller facilities, they were also expected to cover the antenatal and postnatal wards.

This shortage of staff was exacerbated in some instances by the rotation of experienced staff to different departments, either as part of the normal medical training process or because of industrial strike action. The frequency of rotation varied from weekly to 6 monthly resulting in a lack of AVB trained staff.

"*The problem we have is high turnover of the MOs, so the ones we are having currently, I think they are not trained.*" (KII 3, N, CRH)

In one instance the rotation of non-specialist medical staff was reported as a reason for non-medically indicated CS, as the rotated doctor was more interested in practising their surgical skills.

The combination of low overall staffing levels and the rotation of trained staff was also reported as leading to a lack of support and on-the-job training opportunities for less experienced colleagues.

Instances were described where a shortage of MOs, lead to a lack of medical staff on duty at times, resulting in the referral of women who developed complications in the second stage of labour.

"*So, at night it's always nurses and if we find any difficulty we always refer." (KII 2, N, SCH)*

This was also raised as an issue by receiving facilities, where due to delays caused by the women being transferred from one facility to another (up to 2 hours or more), AVB was not even attempted but the patient was taken straight to the operating theatre for caesarean section.

"*This mother has travelled all the way more than 2 hours during second stage, I don't wait, because I know, I just go direct and section this mother." (KII 1, MO, CRH)*

Another reported effect of low staffing levels was the impact of the quality of patient care. Where a small number of nurses were caring for multiple women in labour, adequate monitoring of interventions such as augmentation of labour with oxytocin infusion was not possible. This resulted in the infusion being stopped, poor progress with failure to reach full dilatation or inadequate contractions and consequently the woman having a CS.

"You as a doctor might start the augmentation but then the nurses will stop it because they can't just monitor. They will call you after four hours that the patient has not progressed. . ." *(KII 4, OB, CRH)*

Where inadequate staffing was experienced, a few healthcare providers described the management of workloads by the juggling of patient care between cadres. Doctors were described as wanting an AVB to be done by the nurse, to avoid them having to take the patient to theatre, whilst the nurse wanted the woman to have a CS so that she was one less patient of labour ward.

Confidence. Varying levels of self-confidence were expressed by study respondents. Some were highly confident whilst others were less so. Levels of confidence were sometimes linked to training received and opportunities to practice. Respondents explained that their lack of confidence stemmed from a lack of any training or refresher training in performing AVB. They thought that with the necessary training they would be able to perform the procedure.

Confidence between colleagues was expressed as an issue by some respondents, with a few doctors conveying a lack of trust in some of the nurses' ability to monitor the progress of labour whilst some of the nurses did not trust the doctors to perform an AVB when it was indicated.

A few of the respondents also articulated concerns they perceived colleagues had about potential adverse outcomes relating to the use of AVB, predominantly related to adverse outcomes for the mother and baby, particularly where the procedure was applied inappropriately.

> "*The thing we fear with the AVDs is the haematoma that sometimes is associated and possible dangers of having brain injuries as you do the AVDs, and I think some of these fears are what many practitioners fear. . . If you follow the correct guidelines on who qualifies for AVDs nobody should fear." (KII 18, MO, SCH)*

Two neonatal deaths were reported following AVB, possibly giving rise to some of the concerns, but it was difficult to determine whether these were because of inappropriate use of AVB itself or as a consequence of the labour complications which necessitated the AVB.

Discussion

Key results

Despite the provision of EmONC training, including AVB, in the project supported counties, routine programmatic data showed that the use of AVB remained very low. We reviewed a selection of SSCS and AVB case notes from the included healthcare facilities and found that 10% of SSCS births might have been carried out as AVB, potentially reducing the risk of complications and future morbidity for these women and infants following the procedures. We also found that, whilst many clinicians were in theory appreciative of the benefits of AVB, a complex array of factors impacted on their practice, including staffing, equipment and training.

Interpretation of our results

Potential consequences of unnecessary SSCS. The number of cases in the group categorised as 'AVB should have been attempted' (n = 7/67, 10%) suggests that there are women undergoing unnecessary SSCS. If the cases where it was not possible to determine the appropriate method of birth (due to lack of information or delays) are excluded, the proportion becomes even higher (n = 7/29, 24%). In this study, although there were complications following both SSCS and AVB, the small number of AVB performed made it impossible to compare the outcomes from the procedures statistically. Both of the AVB cases where complications occurred, may have been compromised due to the duration of referral following full dilatation and thus delays in actually performing the procedure. Furthermore, based on studies by Nolens et al [9] and Eze et al [13], if SSCS had been carried out rather than AVB, the further delay and complications from the procedure, may have resulted in worse outcomes. There is no shortage of evidence around the increased risks and poor outcomes associated with unnecessary CS, particularly in LMIC [4,14–16], both at the time of the procedure and in subsequent pregnancies. These risks are increased when the CS is carried out in the second stage of labour, after full dilatation of the cervix [13,17]. There is little doubt about the need to avoid unnecessary CS in low resource settings, particularly SSCS, but there is also a need to ensure that those women who do need a CS, receive one in a timely manner. Arunda et al [18] highlight the demographic factors that impact on the likelihood of women receiving a CS in Kenya and Tanzania, including living in a rural or urban environment, household income and level of

education. They advocate for the removal of financial incentives to conduct CS, reduction in unwanted, particularly adolescent pregnancies, and individualised decision making at a facility level, rather than blanket policies, to promote equitable access to necessary obstetric surgery. Factors such as patient referral, postpartum haemorrhage, the need for intensive care and general anaesthesia at CS are significantly associated with increased risk of maternal mortality following CS in Kenya [19]. Interventions to support decision making around CS have included mandatory second opinion [16], as well as the promotion of AVB where appropriate and raising awareness among women of the risks associated with unnecessary CS [20]. Dindi et al [21] advocate the prospective use of the Robson 10-group classification system for categorising CS, as a means of improving the quality of record keeping and underpinning efforts to improve care quality through audit, an intervention promoted by the WHO [22].

Complex reasons for non-performance of AVB. The qualitative findings from the study clearly demonstrated the complexity of the situations in which many doctors and nurses found themselves. Despite many clinicians expressing support for the performance of AVB, the data collected from the healthcare facilities did not demonstrate this in practice. The barriers to performing AVB described by the interviewees can be categorised at 3 levels, personal (confidence and practice), facility (equipment, on-job-training, leadership) and national (staffing and pre-registration training), illustrated in the conceptual diagram (Fig 2). These levels were not discrete however, with each level potentially having an impact on the other levels and some issues, such as training, being cross-cutting across all three levels.

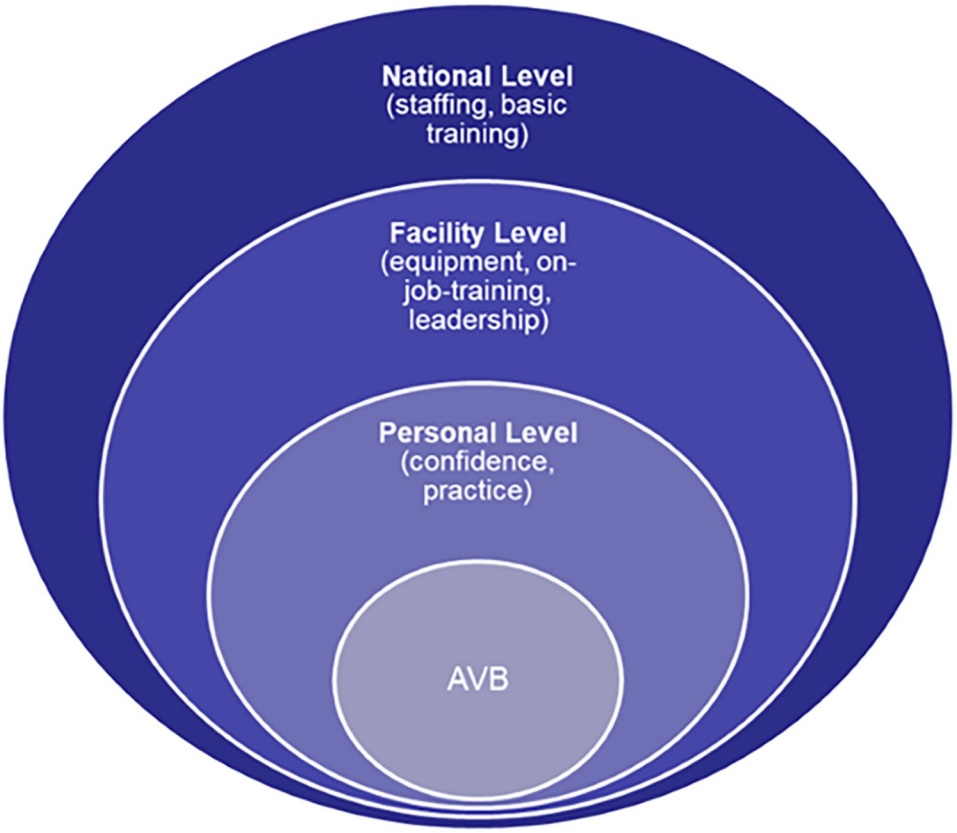

Fig 2. Conceptual diagram of reasons for non-performance of AVB.

https://doi.org/10.1371/journal.pgph.0001495.g002

Equipment. The lack of functioning basic equipment was reported as a barrier to the practice of AVB in some instances, and in line with the findings of research in other high, middle, and low-income countries [7,23,24]. Staff generally expressed a preference for the Kiwi Omni-cup device (a small, hand-held, vacuum extraction device) as it was easy to use and only required a single individual to perform the procedure, but these devices are designed to be single-use. None of the interviewees used obstetric forceps and few were able to or comfortable using the two-person, reusable, Malmstrom vacuum extractors. Budget limitations, often make healthcare facilities in LMIC reluctant to replace equipment after a single use, resulting in staff resorting to sterilising the Kiwis using cold water, chemical sterilisation and re-using them as was found in our study and others [25]. This however, eventually resulted in them failing to develop an adequate vacuum, making them unusable and also potentially risking patient to patient, cross-contamination if not properly decontaminated and sterilised.

Knowledge, skills and training. We found the lack of performance of AVB was in several cases attributed to a lack of knowledge and skills on the part of the clinicians. This was related to a lack of basic training, not just in AVB, but also in the care and assessment of women in labour, although most of the interviewees had received some AVB training as part of the EmONC programme. Significant improvements in knowledge, skills and clinical practice following competency based EmOC training have been found [26], however, knowledge and skills declined over time, following the training [27]. This may suggest weakness in the pre-service training programme or/and suboptimal or lack of effective continuous medical education programmes. In this study, time lapse between training and practicing the skills of AVB, or extended periods of not working in maternity labour ward, were likely to result in reduced confidence levels. Although theoretically there may have been a high proportion of staff within a facility who had received training in performing AVB, the lack of practice and confidence is likely to have been a significant barrier [28], or they may have been working in a non-maternity setting. Any lack of pre-service training on AVB, particularly for nurses and junior doctors cannot be adequately overcome by short, post-registration EmONC courses, particularly where there is inadequate supported clinical practice once qualified, and no mandatory, practical refresher training.

Within this study there also seemed to be a preference for external agencies to provide essential refresher training rather than senior staff within facilities taking a lead in this process, particularly the practical, skills-based aspects. This may have been for a number of reasons including lack of confidence or experience in senior member of staff who might also be reluctant to admit this. The prospect of receiving per diems (financial payments for taking part in externally funded training programmes) and an extended time away from the normal workplace, might all potentially have a bearing on it [29]. The lack of sustainability of a model using primarily external training providers, highlights the need for periodic, practical training and mentorship to be championed and provided at a local level, but for this to succeed, confident, competent mentors, and allocation of staff time to attend, are needed, as well as a method of recognising higher levels of competence.

The rotation of staff to different departments was commented on in several of the interviews in this study and is likely to contribute to difficulties for staff in consolidating newly acquired knowledge and skills, such as AVB. While these rotations may be necessary to manage the limited work force, a system is needed at hospital or district level, to ensure that those deployed to maternity wards are trained and competent to provide EmONC.

Poor record keeping. Overall, the quality of medical record keeping was poor, with almost a third (32%, n = 21) of the cases included in the sample not containing enough information to categorise the appropriateness of the decision for CS. Poor record keeping is not however limited to this study. Similar results have been found in other studies in LMICs [30].

The lack of adequate filing systems and the incomplete or contradictory information that many of the sets of notes in this study contained, is likely to impact efforts to improve the quality of patient care, both directly as complete medical history is not available and through difficulty in conducting clinical audit and research [31]. A study in Burundi [19] found that barriers to good record keeping included lack of training in record keeping, excessive workload, lack of time, demotivation and poor support from administrative polices. Some of the facilities included in this study used a pre-formatted admission sheet which facilitated the systematic recording of important information. The inclusion of a completed partograph in the records was also variable, and unlikely where a woman had been referred from another facility, although no quantitative analysis has been done at this stage. In other studies, the use of a pre-formatted, rubber stamp to print templates onto sheets of paper, significantly improved the quality of record keeping in non-communicable disease clinics.

Strengths and limitations

This study obtained first-hand accounts from healthcare providers of different cadres, who worked clinically on labour wards, providing care for women giving birth. They included obstetricians, medical officers and nurses from eight of the highest volume healthcare facilities, in five counties, across different regions of Kenya. We acknowledge that conducting the interviews remotely might have impacted the findings of this study, although the precise impact is difficult to determine. It is possible that remote interviews gave respondents an enhanced sense of anonymity, and enabled a greater degree of honesty, but conversely face-to-face interviews might have resulted in interviewers building a stronger rapport with respondents. Although questioning healthcare professionals about women's perceptions of AVB is not a substitute for asking the women themselves, it can give insight into the attitudes and beliefs of the staff who care for the women. Further research into the views of women who have given birth by AVB might provide a broader, first-hand perspective on community level acceptability of AVB, but the scarcity of procedure might make recruitment of sufficient participants difficult.

Challenges in obtaining the notes for women who had SSCS resulted in a relatively small sample size for the case note review. In most healthcare facilities, a new set of hospital records was started for each pregnancy. Due to the way in which notes were filed it was not possible to reliably locate the SSCS cases, so it was necessary to retrieve a random selection of emergency CS and identify the SSCS cases at the review stage. Also, a major limiting factor in the interpretation of the SSCS and AVB cases was the quality of the record keeping, including incomplete or missing partographs, or important information on labour progress not recorded. This varied considerably between facilities and in some cases had a notable impact on the reviewers' ability to assess the need for, and outcomes of, the procedures.

Conclusions and implications

An increase in the appropriate use of AVB could avoid unnecessary cases of SSCS and the associated mortality and short- and long-term morbidity, as well as resulting in more efficient use of scarce resources and greater job satisfaction. This study highlighted a variety of issues relating to the under-utilisation of AVB in emergency obstetric care facilities in Kenya. Challenges included the lack of functional equipment, and lack of confident, competent staff on duty in labour wards, within facilities. Other factors included a lack of pre-registration training on the use of AVB, together with inadequate refresher training on practical skills for AVB, for some staff, and the lack of practical leadership in some instances. The complexity of the situation means that there was no single, simple solution to the under-performance of AVB.

Interventions to address the problem will need to be comprehensive and sustainable. They will need to address personal, facility-level, local community and national-level barriers, and promote a culture of AVB within facilities.

Several of the findings from this study have implications for clinical practice and future research. It is anticipated that implementation of the following could improve clinical practice:

- Provision of a hand-held, vacuum-extraction device, designed to be reused, and distributed at a price that is affordable to resource-limited health systems.
- Improvements in family planning provision to avoid unwanted pregnancies.
- Regular, in-house refresher training and mentorship to help maintain knowledge and skills of all staff working in maternity departments.
- Avoiding the rotation of EmONC trained staff to non-maternity departments.
- The use of a pre-formatted, rubber stamp could provide a low cost means of increasing the quality of medical documentation and supported improvement of care quality through standards-based audits.
- Regular audits of case notes to improve clinical practice and record keeping.

A prospective intervention study, that addresses health system challenges, and incorporating a package of evidence-based interventions, could improve the quality of record keeping, prevalence and outcomes of CS and AVB, as well as reducing the risk of adverse outcomes from unnecessary procedures.

Supporting information

S1 Text. Inclusivity in global research.
(DOCX)

Acknowledgments

The authors gratefully acknowledge the members of the LSTM Kenya and UK teams for their support with this study and all of the healthcare providers who contributed their time.

Author Contributions

Conceptualization: Fiona M. Dickinson, Helen Allott, Charles A. Ameh.

Data curation: Pamela Godia.

Formal analysis: Fiona M. Dickinson, Helen Allott, Stephen W. Karangau, Evans Ogoti, Nassir A. Shaban.

Funding acquisition: Fiona M. Dickinson, Charles A. Ameh.

Investigation: Fiona M. Dickinson, Helen Allott, Martin Eyinda, Onesmus M. Muchemi.

Methodology: Fiona M. Dickinson, Helen Allott, Paul Nyongesa, Lucy Nyaga, Charles A. Ameh.

Project administration: Paul Nyongesa, Martin Eyinda, Onesmus M. Muchemi, Pamela Godia.

Supervision: Lucy Nyaga, Charles A. Ameh.

Writing – original draft: Fiona M. Dickinson.

Writing – review & editing: Fiona M. Dickinson, Helen Allott, Paul Nyongesa, Martin Eyinda, Onesmus M. Muchemi, Stephen W. Karangau, Evans Ogoti, Nassir A. Shaban, Pamela Godia, Lucy Nyaga, Charles A. Ameh.

References

1. World Health Organization. Caesarean section rates continue to rise, amid growing inequalities in access. 2021. Available at: https://www.who.int/news/item/16-06-2021-caesarean-section-rates-continue-to-rise-amid-growing-inequalities-in-access (Accessed on 23/3/2023).
2. Betran AP, Ye J, Moller A, Souza JP, Zhang J. Trends and projections of caesarean section rates: global and regional estimates. BMJ Glob Health. 2021; 6:e005671. https://doi.org/10.1136/bmjgh-2021-005671 PMID: 34130991
3. World Health Organization. Maternal, Newborn, Child and Adolescent Health and Aging: Data portal. (2023) Available at: https://platform.who.int/data/maternal-newborn-child-adolescent-ageing/indicator-explorer-new/MCA/births-by-caesarean-section-(-) (Accessed on 23/3/2023).
4. Sobhy S, Arroyo-Manzano D, Murugesu N, Karthikeyan G, Kumar V, Kaur I, et al. (2019) Maternal and perinatal mortality and complications associated with caesarean section in low-income and middle-income countries: a systematic review and meta-analysis. Lancet. 2019; 393(10184):1973–82. https://doi.org/10.1016/S0140-6736(18)32386-9 PMID: 30929893
5. Motomura K, Ganchimeg T, Nagata C. Ota E, Vogel JP, Betran AP, et al. Incidence and outcomes of uterine rupture among women with prior caesarean section: WHO Multicountry Survey on Maternal and Newborn Health. Sci Rep. 2017; 7:44093. https://doi.org/10.1038/srep44093 PMID: 28281576
6. Chen S, Cheng W, Chen Y, Liu X. The risk of abnormal placentation and hemorrhage in subsequent pregnancy following primary elective cesarean delivery. J Matern Fetal Neonatal Med. 2020; 33 (21):3608–3613. https://doi.org/10.1080/14767058.2019.1581167 PMID: 30741050
7. Bailey PE, van Roosmalen J, Mola G, Evans C, de Bernis L, Dao B. Assisted vaginal delivery in low and middle income countries: an overview. BJOG. 2017; 124(9):1335–1344. https://doi.org/10.1111/1471-0528.14477 PMID: 28139878
8. World Health Organisation (WHO) Monitoring emergency obstetric care: a handbook. Geneva: WHO Press; 2009.
9. Nolens B, Namiiro F, Lule J, van den Akker T, van Roosmalen J, Byamugisha J. Prospective cohort study comparing outcomes between vacuum extraction and second-stage cesarean delivery at a Ugandan tertiary referral hospital. IJGO. 2018; 142(1):28–36.
10. Ameh CA, Kerr R, Madaj B, Mdegela M, Kana T, Jones S, et al. Knowledge and Skills of Healthcare Providers in Sub-Saharan Africa and Asia before and after Competency-Based Training in Emergency Obstetric and Early Newborn Care. PLoS One. 2016; 11(12), e0167270. https://doi.org/10.1371/journal.pone.0167270 PMID: 28005984
11. Bowling A. Research methods in health: Investigating health and health services. (4th ed.) Maidenhead: Open University Press; 2014.
12. Green J, Thorogood N. Qualitative methods for health research. (4th ed.) London: Sage; 2018.
13. Eze P, Lawani LO, Chikezie RU, Ukaegbe CI, Iyoke CA. Perinatal outcomes of babies delivered by second-stage Caesarean section versus vacuum extraction in a resource-poor setting, Nigeria–a retrospective analysis. BMC Pregnancy Childbirth. 2020; 20(298). https://doi.org/10.1186/s12884-020-02995-9 PMID: 32410592
14. Arunda MO, Agardh A, Asamoah BO. Cesarean delivery and associated socioeconomic factors and neonatal survival outcome in Kenya and Tanzania: analysis of national survey data, Glob Health Action. 2020; 13:1. https://doi.org/10.1080/16549716.2020.1748403 PMID: 32345146
15. Murphy DJ, Liebling RE, Verity L, Swingler R, Patel R. Early maternal and neonatal morbidity associated with operative delivery in second stage of labour: a cohort study. Lancet 2001; 358(9289):1203–1207. https://doi.org/10.1016/S0140-6736(01)06341-3 PMID: 11675055
16. Souza J, Gülmezoglu A, Lumbiganon P, Carroli G, Fawole B, Ruyan P, et al. Caesarean section without medical indications is associated with an increased risk of adverse short-term maternal outcomes: the 2004–2008 WHO Global Survey on Maternal and Perinatal Health. BMC Med. 2010; 8(71). https://doi.org/10.1186/1741-7015-8-71.
17. Rabiu KA, Adewunmi AA, Akinola OI, Eti AE, Tayo AO. Comparison of maternal and neonatal outcomes following caesarean section in second versus first stage of labour in a Tertiary Hospital in Nigeria. Niger Postgrad Med J. 2011; 18(3):165–171. PMID: 21909144

18. Kleczka B, Musiega A, Rabut G, Wekesa P, Mwaniki P, Marx M, et al. Rubber stamp templates for improving clinical documentation: A paper-based, m-Health approach for quality improvement in low-resource settings. Int J Med Inform. 2018; 114:121–129. https://doi.org/10.1016/j.ijmedinf.2017.10.014 PMID: 29107565

19. Bizimana E, Bimerew M. Knowledge, attitudes and barriers of nurses on benefits of the quality of patient record- keeping at selected public district hospitals in Burundi. Int J Afr Nurs Sci. 2021; 14:100266. https://doi.org/10.1016/j.ijans.2020.100266

20. Kaboré C, Ridde V, Kouanda S, Agier I, Queuille L, Dumont A. Determinants of non-medically indicated cesarean deliveries in Burkina Faso. IJGO. 2016; 135:S58–63. https://doi.org/10.1016/j.ijgo.2016.08.019 PMID: 27836086

21. Dindi NP, Godia P, Allott H, Ameh C. Risk factors for maternal mortality among women who had a caesarean section delivery in Kenya: A case-control study. East Afr Med J. 2020; 97(8):2961–2974.

22. World Health Organization (WHO) Robson classification: implementation manual. Geneva: WHO Press; 2017.

23. Crossland N, Kingdon C, Balaam M-C, Betran AP, Downe S. Women's, partners' and healthcare providers' views and experiences of assisted vaginal birth: a systematic mixed methods review. Reprod Health. 2020; 17(38). https://doi.org/10.1186/s12978-020-00915-w PMID: 32487226

24. Bakke E, Øseth EH, Fofanah T, Sesay I, van Duinen A, Bolkan HA, et al. Vacuum births and barriers to its use: An observational study in governmental hospitals in Sierra Leone. BMJ Open. 2022; 12(11): e060773. https://doi.org/10.1136/bmjopen-2022-060773 PMID: 36414288

25. Nolens B, Lule J, Namiiro F. van Roosmalen J, Byamugisha J. Audit of a program to increase the use of vacuum extraction in Mulago Hospital, Uganda. BMC Pregnancy Childbirth. 2016; 16(258). https://doi.org/10.1186/s12884-016-1052-3 PMID: 27590680

26. Ameh CA, Mdegela M, White S, van den Broek N. The effectiveness of training in emergency obstetric care: a systematic literature review. Health Policy and Plan. 2019; 34(4):257–270. https://doi.org/10.1093/heapol/czz028 PMID: 31056670

27. Ameh CA, White S, Dickinson F, Mdegela M, Madaj B, van den Broek N. Retention of knowledge and skills after emergency obstetric training: a multi-country longitudinal study. PLoS ONE. 2018; 13(10).

28. Feeley C, Crossland N, Betran AP, Weeks A, Downe S, Kingdon C. Training and expertise in undertaking assisted vaginal delivery (AVD): a mixed methods systematic review of practitioners views and experiences. Reprod. Health. 2021; 18(92). https://doi.org/10.1186/s12978-021-01146-3 PMID: 33952309

29. Ridde V. Per diems undermine health interventions, systems and research in Africa: burying our heads in the sand. Tropical Med Intl Health. 2017;15(7).

30. Landry E, Pett C, Fiorentino R, Ruminjo J, Mattison C. Assessing the quality of record keeping for caesarean deliveries: results from a multicenter retrospective record review in five low-income countries. BMC Pregnancy Childbirth. 2014; 14(139). https://doi.org/10.1186/1471-2393-14-139 PMID: 24726010

31. Lundin R, Mariani I, Peven K, Day LT, Lazzerini M. Quality of routine health facility data used for newborn indicators in low- and middle-income countries: A systematic review. J Glob Health. 2022; 12:04019. https://doi.org/10.7189/jogh.12.04019