BMJ Open

Women's perceptions and self-reports of excessive bleeding during and after delivery: findings from a mixed-methods study in Northern Nigeria

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-047711
Article Type:	Original research
Date Submitted by the Author:	06-Dec-2020
Complete List of Authors:	Yargawa, Judith; University College London, Institute for Global Health; London School of Hygiene & Tropical Medicine, Maternal, Adolescent, Reproductive and Child Health (MARCH) Centre Fottrell, Edward; University College London, Institute for Global Health Hill, Z; University College London, Institute for Global Health
Keywords:	OBSTETRICS, PUBLIC HEALTH, QUALITATIVE RESEARCH, STATISTICS & RESEARCH METHODS, SOCIAL MEDICINE

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Women's perceptions and self-reports of excessive bleeding during and after delivery: findings from a mixed-methods study in Northern Nigeria

Judith Yargawa[1,2*], Edward Fottrell[1], Zelee Hill[1]

[1] Institute for Global Health, University College London, London, United Kingdom
[2] Maternal, Adolescent, Reproductive and Child Health (MARCH) Centre, London School of Hygiene & Tropical Medicine, London, United Kingdom

* Corresponding author (judith.yargawa.14@ucl.ac.uk)

ABSTRACT

Objectives: To explore lay perceptions of bleeding during and after delivery, and measure the frequency of self-reported indicators of bleeding.

Setting: Yola, North-East Nigeria

Participants: Women aged 15-49 years who delivered in preceding two years of data collection period (2015-2016), and their family members who played key roles.

Methods: Data on perceptions of bleeding were collected through seven FGDs, 21 in-depth interviews and 10 family interviews. Sampling was purposive and data were analysed thematically. A household survey was then conducted with 640 women using cluster sampling on postpartum bleeding indicators developed from the qualitative data; data were analysed descriptively.

Results: Perceptions of excessive bleeding fell under four themes: quantity of blood lost; rate/duration of blood flow; symptoms related to blood loss; and receiving birth interventions/hearing comments from birth attendants. Young and less educated rural women had difficulty quantifying blood loss objectively, including when shown quantities using bottles. Respondents felt that acceptable blood loss levels depended on the individual woman and whether the blood is 'good' or 'diseased/bad.' Respondents believed that 'diseased' blood was a normal result of delivery and universally took steps to help it 'come out.' In the quantitative survey, indicators representing less blood loss were reported more frequently than those representing greater loss, e.g., more women reported staining their clothes (33.6%) than the bed (18.1%) and the floor (6.2%). Overall, indicators related to quantity and rate of blood flow had higher frequencies compared to symptom and intervention/comment-related indicators.

Conclusion: Women quantify bleeding during and after delivery in varied ways and some women do not see bleeding as problematic. This makes selecting indicators to measure bleeding which are salient to women difficult. The range of indicators and varied frequencies highlight the challenges of measuring excessive bleeding from self-reports. More work is needed in improving and testing validity of questions.

Key words: Obstetric haemorrhage, excessive bleeding, blood loss, intrapartum haemorrhage, postpartum haemorrhage, qualitative study, household survey, mixed-methods

Word count*:* 3,824

Strengths and limitations of this study

- Around 60% of deliveries in the study setting take place at home; our community-based recruitment attempted to capture cases that do not make it to health facilities, hence differ from the facility-based measurement approaches dominating literature.
- This study is one of the few studies to explore perceptions of bleeding during and after delivery in-depth, which helped identify several lay methods in which women and families conceptualise excessive bleeding during and after delivery.
- The qualitative phase helped inform design of the questionnaire used in the community-based survey; a mixed-methods approach helped provide key methodological implications for future studies aiming to measure excessive bleeding during and after delivery.
- We recruited a mainly urban sample and did not interview other respondents such as birth attendants.
- In the quantitative phase, we used prompting to assess experience of excessive bleeding and this may have increased reporting.

INTRODUCTION

Haemorrhage accounts for about 25% of global maternal deaths,[1] with most of the estimated 295,000 annual deaths occurring in low income settings[2] and within 24 hours of delivery.[3] Haemorrhage is also a leading cause of severe maternal morbidity, maternal near misses and emergency obstetric interventions.[4-7] These adverse outcomes could be reduced by having a skilled attendant at birth, active management of the third stage of labour and if women recognised and were able to access timely care for danger signs during home births and following postpartum hospital discharge. Studies have found that women across Sub-Saharan African settings have good knowledge that exessive bleeding is a danger sign,[8-14] but few studies have explored how women conceptualise excessive bleeding and determine whether it is occuring.

There has been a renewed global interest in measuring maternal morbidity, with recent achievements including standardisation of key definitions,[15, 16] development of tools,[15, 17] and large scale studies.[18-20] Prevalence data on excessive bleeding have primarily been obtained from facility sources as these are considered more reliable than self-reports from women.[21] However, facility data may not be representative as institutional delivery is still below 60% in several Sub-Saharan African countries.[22, 23] Studies which validated women's self-reports of excessive bleeding against medical records, examinations and observations have found overestimation and specificity issues[24-26], which resulted in such questions being removed from surveys.[27] These studies are relatively old and few were informed by qualitative research, the use of which has been recently advocated for by measurement experts.[28, 29] This mixed-methods study aimed to explore women's perceptions of bleeding during delivery and within the first 24 hours post-delivery, and use these insights to measure the frequency of self-reported indicators of excessive bleeding in Northern Nigeria.

METHODS

The study area, study designs and eligibility criteria

Data were collected in Yola, Adamawa state, North-east Nigeria between December 2015 and November 2016. Yola, with a population of 823,220 people, is divided into two Local Government Areas - Yola North, the urban administrative and commercial capital of the state, and Yola South, the traditional headquarters which is a mixture of urban and rural areas.[30] Yola has one tertiary hospital, one state hospital, numerous primary health care facilities and several private health facilities. Demographic and health indicators for Yola are not readily available; however, in Adamawa State, 47.0% of women aged 15-49 years have no education and only 20.7% have completed secondary school.[31] 82.1% received antenatal care from a skilled providers in their last pregnancy but only 40.5% delivered with a skilled attendant.[31] This low utilization stems from a combination of factors including deprivation, disrespectful/abusive care, socio-cultural reasons, ethnicity, not having a perceived need for facility delivery and poor accessibility.[32-38]

A qualitative phase consisted of focus group discussions (FGDs), in-depth interviews (IDIs) and family interviews and was followed by a household survey. In both phases, eligible women were those aged 15-49 years, married, Yola residents who had given birth within the two years preceding the study. Women in the qualitative sample were not part of the quantitative sample.

The qualitative phase: sampling, data collection and analysis

The IDI respondents were sampled to give a range of ages, self-reported morbidity experiences and educational levels (none, primary, secondary, post-secondary). Sampling grids with estimated sample sizes for each subgroup were developed but data were collected until saturation was reached. The family interviews entailed discussions with family members who played key roles in the maternal experiences of a subset of IDI participants; selection depended on the woman's unique circumstances and/or household factors, e.g. family members serving as her birth attendant. The FGDs were stratified by residence (urban/rural) and age. One FGD was conducted with women who had completed at least a bachelor's degree in order to obtain a different perspective from women who had lower educational levels. Respondents were recruited through a women's empowerment community centre, snowball sampling and community liaisons.

Data were collected in English or Hausa based on the respondent's fluency using a pre-tested semi-structured topic guide. IDI topics included what the respondent remembered about her blood loss during delivery, how she would quantify it (small, normal or excessive), why she felt it was small, normal or excessive and whether she was worried/scared about the amount lost. Women were shown bottles of 500mL and 1,000mL, the clinical cut-offs for postpartum haemorrhage and severe postpartum haemorrhage respectively,[3] to see if this helped quantify blood loss. Similar questions were asked for the first 24 hours post-delivery. The family interviews were primarily designed to explore care-seeking for morbidities, but were included in the analysis where this was in relation to bleeding. In the FGDs, respondents were asked how much blood they would expect a woman to lose during delivery and in the first 24 hours after delivery, how a woman would know if her blood loss was normal or excessive, and how they would quantify blood loss. They were also shown the 500mL and 1,000mL bottles.

All sessions were audio-recorded and the IDIs and FGDs were translated and transcribed in English primarily by the first author; around eight IDIs were transcribed by assistants and these were double-checked line-by-line against the audio-recording to ascertain completeness and validity. The family interviews were left in audio format and analysed directly from the recordings as they did not focus on bleeding per se and only contained a few relevant sections. Data were analysed using thematic analysis primarily informed by Braun and Clarke (2006) using both deductive and inductive approaches.[39] A coding tree was developed inductively from analyses of pre-test transcripts; these codes then formed the deductive codes applied to subsequent transcripts. Any new codes that emerged inductively during analysis were added to the tree. Data were managed using NVivo 10.

The quantitative phase: sampling, data collection and analysis

Three-stage cluster sampling was conducted at the ward (smallest administrative unit), settlement and participant levels using probability proportional to size (PPS) sampling. 12 of 22 wards were selected in stage one, five settlements from each ward in stage two (corresponding to 60 clusters in total) and 11 eligible participants were selected from each cluster in stage 3. The sampling frame and population size for wards and settlements were obtained from the local authorities and within settlements participants were selected using the Expanded Program of Immunisation method.[40, 41] The sample size was calculated as 660 based on: 5% precision; 5% significance level; 1.5 design effect; 10% non-response rate; and a conservative prevalence of maternal health problems of 50%.

We developed a questionnaire by reviewing literature, adapting questions from existing surveys and consulting relevant researchers. The questionnaire was then refined with further insights from the qualitative phase to aid comprehension and validated using cognitive interviews.[42, 43] We asked a range of questions across the domains that emerged from the qualitative findings in order to compare the frequencies they elicited. This included the extent of staining and soaking of clothes and surfaces, nature and consistency of blood flow, medical procedures received and symptoms of shock.

The questionnaire was paper-based and administered face-to-face by four female data collectors in Hausa or English in the respondents' homes. Data were entered using EpiData 3.1 and organised and analysed descriptively using Stata 14, with weighting and adjustment as appropriate.

Informed consent and ethical approval

Informed consent was obtained from all respondents. Ethical approval was obtained from the Adamawa State Ministry of Health (Reference Number: S/MoH/HS/1131) and the University College London Research Ethics Committee (Project ID: 6846/003), and verbal approval from appropriate community leaders. Pseudonyms have been used in reporting direct quotes.

Patient and public involvement

A preliminary study was conducted prior to the main data collection to pretest the interview topic guide for comprehension and length. Feedback was solicited from respondents after the interview sessions on areas including the nature of the questions asked, clarity of instructions and whether respondents objected to answering any question. Their inputs helped inform refinement of the interview topic guide.

RESULTS

Characteristics of respondents

21 IDIs were conducted and respondents ranged from 16-40 years of age, half lived in rural areas, 14 had minimal/no education, and eight had home deliveries. Ten family interviews were conducted with co-wives, husbands or other females in the women's families. Seven FGDs of 5-8 women (44 women in total) were conducted with women aged 15-48 years. In six of the FGDs, almost all respondents had no/primary education and in one group consisted of more educated respondents. Four FGDs were in urban areas and three in rural areas. Most women in the urban FGDs had given birth in health facilities while the rural FGDs had an almost even split between home and health facility deliveries. In the IDIs, there was one refusal due to competing priorities and one respondent's house could not be located. One FGD respondent did not show up.

In the quantitative phase, there were 15 refusals and three exclusions due to incapacitation; this corresponded to 642 women being surveyed - a 97% response rate. Two questionnaires were incomplete and/or unidentifiable, hence data from 640 women were included. The characteristics of the women are shown in Table 1: 77% were 20-34 years of age, 75% were Muslim, 75% resided in urban areas, 52% had no or primary education, 58% did not work,

63% had a facility birth in their most recent delivery, 19% had one child and 28% five or more children.

Table 1: Socio-demographic and obstetric characteristics of survey respondents (n=640)

Characteristic	Frequency	Weighted Proportion % (95% CI)
Age (years)		
15-19	52	8.5 (5.3- 13.4)
20-34	476	76.7 (73.4- 79.7)
35-49	93	14.8 (10.8- 20.0)
Religion		
Islam	476	74.7 (58.8- 85.9)
Christianity	161	25.3 (14.1- 41.3)
Residence		
Rural	161	25.0 (8.0- 56.1)
Urban	479	75.0 (43.9- 92.0)
Highest educational level completed/currently attending		
Never attended school/ non-western education	199	32.6 (23.6- 43.1)
Primary	137	19.4 (15.0- 24.6)
Secondary	243	39.3 (30.4- 48.9)
Post-secondary	58	8.8 (5.1- 14.9)
Literacy		
Can read in any language	255	44.2 (34.8- 54.0)
Cannot read in any language	341	55.8 (46.0- 65.2)
Main occupation		
Unemployed/house-wife	361	58.0 (54.3- 61.6)
Unskilled	202	31.3 (24.7- 38.9)
Skilled	72	10.7 (6.6- 16.9)
Gravidity		
1	91	14.9 (11.9- 18.6)
2-4	322	51.3 (46.3- 56.2)
5-9	191	28.5 (23.8- 33.8)
≥10	34	5.3 (3.6- 7.8)
Parity		
1	115	18.8 (15.1- 23.3)
2-4	336	53.6 (49.4- 57.8)
5-9	165	24.6 (20.3- 29.5)
≥10	19	3.0 (1.7- 5.1)
Place of last delivery		
Home/TBA's place	228	36.5 (27.0- 47.2)
Public health facility	350	54.0 (46.3- 61.6)
Private health facility	55	9.4 (5.8- 15.0)
Birth Attendant		
Unskilled	194	32.1 (22.8- 43.0)
Nurse/midwife/community health worker	381	58.7 (50.1- 66.8)
Doctor	54	9.2 (5.5- 15.1)

* Missing data: 19 in age, 3 in woman's highest educational level, 5 in main occupation, 44 in literacy (likely due to some respondents being 'semi-literate' and questionnaire did not have the option), 2 in religion (1 other), 2 in gravidity, 5 in parity, 11 in birth attendant and 7 in place of delivery.

General perceptions on bleeding

Three themes emerged from the qualitative data relating to perceptions of bleeding: divergent views as to whether some bleeding after delivery is beneficial or harmful; the existence of 'good' and 'bad' blood; and acceptable levels of blood loss being individually determined.

Respondents had varied opinions about whether blood *'needs'* to come out after delivery. One group of women felt bleeding was beneficial: "*if it does not come out a lot, it disturbs me in the stomach"* (FGD 6); *"if the blood doesn't pour a lot, it just stays [in the stomach] and hurts*" (Family Interview #10). A second group felt blood loss was dangerous, and a final group acknowledged that bleeding was a paradox: "*blood has this dilemma: it is problematic when it comes out and it is problematic when it doesn't come out*" (FGD 1); "*it needs to pour but it should not pour too much*" (Family interview #7). These varied viewpoints sometimes led to disagreement during FGDs:

> ***Lilian**: I think it is better for her to bring out the blood*
> ***Interviewer**: OK. Why do you say so?*
> ***Lilian**: Because of the dirt inside.*
> ***Interviewer**: OK*
> ***Hadiza**: But for some, don't you see that if the blood has snapped [becomes uncontrollable] and comes out, that's a problem? If it hasn't snapped, it stays still. For some, it is usually the bleeding that causes them to transfuse the person*
> ***Amal**: She'll just be feeling dizziness*
> ***Hadiza**: She'll just be dizzy. It is the bleeding that causes them to add the blood* (FGD 5, rural, no/primary education, 20-34 years group, parity 1-9).

Respondents categorized blood as being 'good' or 'diseased/bad/dirty' based on its colour and consistency. 'Good' blood is red, bright, fresh and comes from "*the blood in circulation.*" 'Diseased/bad/dirty' blood is blackish, dark, clotted and comes from a diseased area – "*disease is what is pouring.*" Diseased blood was considered a normal result of delivery and this blood was thought to cause abdominal pain if retained; consequently removal of this blood was universally done post-delivery through hot water baths, massages and drinks, except in Caesarean-section deliveries:

> *If it were just blood dripping (hisses briefly), I wouldn't have appreciated the practice. But to have seen CLOTTED BLOOD coming out [during my wife's hot water postpartum bath], I think I appreciated it. And I encouraged her [to remove the blood]… there was some bleeding inside and it got stuck there, which I think it will not be good afterwards. So those traditional practices, I think they are good* (Family interview #8, husband, urban, educated family).

There was also a perception that women have different quantities of blood in their bodies and those with a lot of blood can lose more blood during and after delivery:

> ***Farida**: …It depends on how everyone's blood is. One can bleed a lot, no problem. But another person, when she bleeds, you must have problem. [she later likens this to how women's menstrual flow also differs]* (FGD 7, rural, no education, 15-19 years group, parity 1 each).

Birth attendants, particularly skilled birth attendants, were thought to *'scoop'* the diseased blood out during delivery which would affect levels of postpartum bleeding – if the *'scooping'* had been done well, a woman would lose less blood. Similarly, a few respondents reported that during a Caesarean-section blood is usually evacuated and blood flow controlled.

Perceptions of normal and too much blood loss

Women determined if too much blood had been lost in four ways: the visible quantity lost; the rate and duration of blood flow; the presence of symptoms related to blood loss; and receiving an intervention to ameliorate the blood loss or hearing comments from birth attendants (Table 2).

Related to quantity of blood lost

Respondents quantified the blood they lost during delivery by comparing it to volumes such as drip bags or hospital kidney bowls. For bleeding within the first 24 hours postpartum, some women made comparisons to their menstrual flow. More educated respondents estimated in litres, while 15-19 year olds and some rural women struggled to quantify blood loss at all, using terms such as "*if it pours too much"* despite probing on quantities. Overall, there was no consensus on how to quantify blood loss but when shown 500mL and 1,000mL bottles, FGD respondents reached consensus that 1,000mL was too much blood to lose, while responses to the 500mL bottle included "*some blood is still left inside, it has not finished coming out.*" IDI responses were similar, although there was some variation in perceptions of which bottle constituted too much blood loss.

The extent to which blood stained, soaked through or dripped from clothing, pads or surfaces was also used to quantify bleeding, as illustrated by this respondent who felt too much blood was lost if clothes were so soaked they looked like they had been washed in blood: "*you're picking …[it][clothe] from blood, as if you're washing it in it"*. The frequency with which pads needed to be changed postpartum, or the number used at one time were also used to quantify blood loss, with FGD respondents reporting that changing pads three or four times per day or doubling or tripling them would mean too much blood was being lost.

Women also compared their blood loss to previous deliveries, for multiparas, and to other women: *"I lost more blood in that [delivery] of Tim than Tony*" and "*it was for this one [delivery] that it [blood] poured a lot, but it did not pour a lot for these ones [other deliveries]*."

Related to rate and duration of blood flow

This theme was related to the perceived force with which blood flowed, and was mostly used to describe bleeding within the first 24 hours postpartum. Too much blood loss was when blood was "*rushing,"* or flowed "*like passing urine"* or "*like water, like tap*." Duration of bleeding was also used as an indicator, with bleeding expected to have stopped by the baby's naming ceremony (seven days postpartum) or by the 40 days postpartum recuperation and purification period.

Symptoms related to blood loss

Respondents also used symptoms to determine if too much blood had been lost; these were similar to biomedical symptoms of shock. The most common symptoms mentioned were being unable to get up/feeling like falling down, fainting, dizziness, headache and weakness. Other

symptoms mentioned included hearing changes, paleness, body pains and shaking: "*your body will also be shaking. Just like that, you'll see yourself shaking*."

Some women spontaneously reported that they had been worried about the amount of blood they had lost, while others reported being frightened on probing using statements such as "*I was totally agitated*" and "*it shocked me you know*…"

Birth interventions received and comments from birth attendants

Respondents who delivered in facilities reported that they would know if they had bled too much if: they had received a blood transfusion; their relatives were asked to look for blood donors; they were referred to a higher level facility because of the bleeding; they were given 'blood tonic' tablets or supplements to increase their blood; they were given injections or tablets to stop the bleeding; or health staff needing to 'scoop' their blood out. Some women used comments made by birth attendants to make judgements on their blood loss either because health workers "*didn't say the blood is short in my body*" or said they had lost a lot of blood or "*should be given food that will increase your blood*."

Table 2: Overview of respondents' perceptions of excessive bleeding

Theme	Description	Sample quotes
Related to quantity of blood lost	Methods used to quantify bleeding. This also included the extent to which blood stained or soaked through clothing, pads or surfaces, and comparison of one's bleeding to previous deliveries or those of other women	**Taniyo**: Well, I thought I lost almost 50cL oh [500mL], because I, I stood up, it was dripping like water. …Yes. I was having pad but it was coming out underneath like water, I'm telling you. The pad was soaked, my pant, everything, the ground, the- everywhere was just wet. Not bed oh, now I came down from the bed, everything on the ground was wet … with the blood. Yes. I believe then-… I lost almost 50cL or more than… (FGD 4, urban, bachelor's degree minimum, 20-34 years group, parity 1-2). **Rachel**: For some, it depends on your delivery. From the 1st to the 2nd to the 3rd to the 4th to the 5th, all, you'll be able to know the way blood pours for you. The delivery you first started, you'll be able to mark the blood that poured previously and then the most recent one, the one you're currently in. Yes, you'll be able to differentiate it (FGD 6, rural, no/primary education, 35-49 years group, parity 6-10).
Related to rate and duration of blood flow	The perceived force with which the blood was coming out, and whether or not bleeding goes beyond an expected end-point	**Interviewer**: But apart from looking at the pad, is there another way a woman will know if she's bleeding a lot?... **Isatu**: Yes, you'll feel it pouring…. **Amina**: You'll feel it in your body that it's rushing. **Interviewer**: How, like how? **Hasiya**: Someone will feel it like water, like passing urine. The way it's coming out (FGD 3, urban, a range of education levels, 15-19 years group, parity 1-3).
Symptoms related to blood loss	Signs and symptoms signalling much bleeding. Also includes the extent to which the bleeding made women or others scared or worried	**Maimuna**: After delivery, the doctors usually ask someone to lie down for at least 6 hours. …When [you] lie down and you need to pass urine or something, they say, "Stand up, go ahead and do it." If you've lost too much blood, the moment you get up, you'll faint. That way, they'll know that you've lost too much blood…I experienced this with this baby [points to the baby she's holding]. When I came up- I was lying on the bed. Then they told me, "you've been discharged." Then they said, "Get up, let's go." I got up and I could see people, but later on I was on the ground. I fell down and fainted (FGD 1, urban, mostly no/primary education, 20-34 years group, parity 3-7).
Birth interventions received and comments from birth attendants	Interventions done by maternity staff and comments from birth attendants	**Respondent**: … So after delivering, then I started bleeding. So I have to call them [*maternity staff]*, then they gave me some injections to stop it and some tablets. **Interviewer**: OK. But now the bleeding, …would you say it was normal or much or small? That's the bleeding now. **Respondent**: It's much. **Interviewer**: OK why do you say that? **Respondent**: Because some people, with- you'll see their bleed[ing] is just small, the blood that will come out is small, some is just normal and some much. Because they have to like inject me and give me some tablets that will stop the bleeding (IDI 17, urban, post-secondary education, 40 years, parity 4).

Frequency of self-reported indicators of excessive bleeding after delivery

We developed a survey instrument to measure self-reported postpartum bleeding using a series of questions that reflected the domains which emerged from the qualitative research. Table 3 shows the self-reported prevalence of each indicator by domain. For most domains, reported prevalence decreased as severity of the indicator increased. For example, more women (33.6%) reported staining their clothes, than reported staining the bed (18.1%), than reported staining the floor (18.1%). The less severe indicators (stained clothes, blood trickled down leg, and feeling weak) were reported by around a third of women; while the more severe indicators (staining the floor, using triple pads, and fainting) were reported by between 3.3% and 6.2% of women. Overall the indicators related to the quantity and rate of blood flow had higher frequencies compared to symptom and intervention/comment-related indicators.

Table 3: Self-reported prevalence of each bleeding indicator within 24 hours of delivery

Indicator	Frequency (n)	Weighted Proportion % (95% CI)
Quantity of blood lost		
Stained clothes	214	33.6 (28.9- 38.7)
Stained the bed	120	18.1 (14.3- 22.6)
Stained floor	43	6.2 (4.7- 8.2)
Doubled pad	287	45.7 (37.1- 54.6)
Tripled pad	21	3.3 (1.6- 6.7)
Frequent big, thick clots of blood	359	63.0 (58.0- 67.7)
Rate of blood flow		
Blood trickled down leg	213	33.1 (27.5- 39.3)
Blood rushed like tap water/urine	198	31.6 (25.6- 38.3)
Intervention or comments from maternity staff		
Birth attendant returned to scoop out the blood	102	14.5 (9.7- 21.3)
Staff commented that blood levels were reduced	32	8.5 (5.7- 12.7)
Symptoms of blood loss		
So weak could not get up and walk	179	29.9 (23.7- 36.9)
Dizziness	146	23.3 (19.8- 27.3)
Shivering	93	14.7 (11.2- 19.0)
Palms looked white/pale	75	12.4 (9.0- 16.9)
Fainted	27	4.6 (3.2- 6.5)

DISCUSSION

This study explored lay perceptions of bleeding during delivery and within the first 24 hours post-delivery using mixed-methods. Women had divergent views on blood loss, categorised some blood *'bad blood'* as needing to come out after delivery and felt that the impact of blood loss was dependent on how much blood individual women had. The concept of 'bad blood' as something that needs to be removed from the womb has been reported elsewhere in Africa.[44, 45] In Uganda, the 'bad blood' was seen as accumulated blood from not menstruating during pregnancy.[45] These views that some types of blood loss are acceptable and required, and that some women can manage blood loss better than others may delay care seeking for some women and highlights that perceptions of excessive bleeding may vary considerably across women and types of blood.

We found that perceptions relating to quantifying excessive bleeding were related to: quantity of blood lost; rate and duration of blood flow; symptoms related to blood loss; and birth interventions received/comments from birth attendants. The themes that emerged related to how women quantified blood loss (quantity lost, rate and duration of flow and symptoms related to blood loss) are similar to those reported in other studies – although the specific measures used within these categories varied by study. Quantity was measured in terms of clots, comparison to menstrual flow and the need to change pads frequently in Uganda;[45] by whether the blood would fill a 'food can' and the number of soaked pieces of clothes in the Gambia;[46] and by the extend items were soaked in North-west Nigeria.[47] Rate of flow was mentioned in Uganda[45] as blood flowing "like an open tap," or past the delivery area in the Gambia,[46] and heavy flow in North-west Nigeria.[47] Symptoms of blood loss were fainting, dizziness, collapsing, being unable to sit up, and falling unconscious in Uganda[45] and paleness, shivering, weakness and falling unconscious in North-west Nigeria.[47]

While the symptoms related to blood loss are in line with the biomedical descriptions of shock, most measures used by mothers were subjective and some women struggled to quantify blood loss at all. This subjectivity may make recognition of haemorrhage difficult. The use of multiple subjective measures is also problematic for measurement. It is not clear in literature what the current health promotion messaging on excessive bleeding is in the setting. A few sources elsewhere suggest that the recommendations on postpartum danger signs are quite varied: a counselling handbook by the World Health Organization says care should be sought immediately when the bleeding has 'increased' or is 'more than normal,'[48] while a March of Dimes resource for new mothers describes such bleeding as 'heavier than a normal period' or 'gets worse' over time.[49] This study highlights the need for standard messaging to address subjectivity.

In the quantitative phase, we measured the frequency of self-reported indicators of excessive postpartum bleeding based on women's recall of their experiences within the first 24 hours post-delivery. We found that different measures of excessive bleeding had very varied frequencies; that within a domain, reported prevalence decreased as severity of the indicator increased; and that indicators related to rate of blood flow and quantity of blood lost had higher frequencies compared to indicators related to symptoms of blood loss and birth interventions received/comments from birth attendants. That prevalence is lower for the more severe indicators within each domain and for the domains related to interventions and symptoms of blood loss is reassuring. However, the prevalence of some measures were surprisingly high, for example, 32% of women reported blood rushing like a tap or urine and it is likely that these overestimate excessive bleeding from a biomedical perspective. This confirms the difficulty in measuring excessive bleeding in surveys reported in validity studies.[24-26] The use of multiple descriptive measures shows the wide range of estimates that can be obtained based on choice

of question, and it does not appear to have made the measures more objective. A large population-based study across eight Sub-Saharan and South Asian countries, the AMANHI study asks a combination of questions to establish severe bleeding including wetting of clothes and floor, loss of consciousness and whether the woman needed an 'operation' to stop the bleeding;[20] our study suggests that these data may be difficult to interpret.

Our study is one of the few studies to explore perceptions of bleeding during and after delivery in-depth. It showed perceptions could contribute to delays in a decision to seek timely care.[50] As obstetric haemorrhage is a leading cause of maternal mortality and severe morbidity, tailoring messages to address perception of bleeding could potentially save lives. We recruited a mainly urban sample and did not interview respondents such as birth attendants. In the quantitative phase, we used prompting to assess experience of excessive bleeding and this may have increased reporting. Use of self-reports may have also been influenced by reporting and recall bias, limitations that are inherent in cross-sectional studies.

CONCLUSION

Women conceptualise bleeding and quantify excessive bleeding during and after delivery using a variety of subjective identification methods; these may make recognition of haemorrhage for prompt care-seeking and reporting of haemorrhage in community-based surveys difficult. The quantitative findings highlight the challenges of measuring excessive bleeding from self-reports and support the findings from validity studies that self-reported measures may be unreliable and lack validity for estimating the burden of obstetric haemorrhage.

Acknowledgements

We would like to thank all respondents for providing valuable insights, as well as the data collection team, transcription assistants, data entry team and community liaisons for the immense support given.

Author Contributions

All authors designed the project and developed the study tools. JY collected the data/supervised the data collection, with substantial inputs from EF and ZL. JY drafted the initial manuscript and all authors reviewed, edited and approved the final manuscript.

Funding

This study was funded by the University College London Graduate Research Scholarship.

Competing interests

The authors declare that they have no competing interests.

Patient consent for publication

Not required

Ethics approval

Ethical approval was received from the Adamawa State Ministry of Health and the University College London Research Ethics Committee, and verbal approval from appropriate community leaders.

Data sharing statement

Data sharing requests could be addressed to the corresponding author.

Table legends

Table 1: Socio-demographic and obstetric characteristics of survey respondents
Table 2: Overview of respondents' perceptions of excessive bleeding
Table 3: Self-reported prevalence of each bleeding indicator within 24 hours of delivery

REFERENCES

1. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller A-B, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. *Lancet Glob Health*. 2014;2(6):e323-e33
2. World Health Organization. Trends in maternal mortality 2000 to 2017: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division World Health Organization. Geneva: World Health Organization, 2019.
3. World Health Organisation. WHO recommendations for the prevention and treatment of postpartum haemorrhage. 2012. [Accessed April 2020]. Available from: http://apps.who.int/iris/bitstream/10665/75411/1/9789241548502_eng.pdf.
4. Sotunsa JO, Adeniyi AA, Imaralu JO, Fawole B, Adegbola O, Aimakhu CO, et al. Maternal near-miss and death among women with postpartum haemorrhage: a secondary analysis of the Nigeria Near-miss and Maternal Death Survey. *BJOG*. 2019;126(Suppl 3):19-25
5. Oladapo OT, Adetoro OO, Ekele BA, Chama C, Etuk SJ, Aboyeji AP, et al. When getting there is not enough: a nationwide cross-sectional study of 998 maternal deaths and 1451 near-misses in public tertiary hospitals in a low-income country. *BJOG*. 2016;123(6):928-38
6. Maswime S, Buchmann E. A systematic review of maternal near miss and mortality due to postpartum hemorrhage. *Int J Gynaecol Obstet*. 2017 Apr;137(1):1-7
7. Rocha Filho EA, Costa ML, Cecatti JG, Parpinelli MA, Haddad SM, Pacagnella RC, et al. Severe maternal morbidity and near miss due to postpartum hemorrhage in a national multicenter surveillance study. *Int J Gynaecol Obstet*. 2015 Feb;128(2):131-6
8. Geleto A, Chojenta C, Musa A, Loxton D. WOMEN's Knowledge of Obstetric Danger signs in Ethiopia (WOMEN's KODE):a systematic review and meta-analysis. *Syst Rev*. 2019 Feb 25;8(1):63
9. Kabakyenga JK, Ostergren PO, Turyakira E, Pettersson KO. Knowledge of obstetric danger signs and birth preparedness practices among women in rural Uganda. *Reprod Health*. 2011 Nov 16;8:33
10. Bintabara D, Mpembeni RNM, Mohamed AA. Knowledge of obstetric danger signs among recently-delivered women in Chamwino district, Tanzania: a cross-sectional study. *BMC Pregnancy Childbirth*. 2017 Aug 29;17(1):276
11. Masoi TJ, S.M. SMK, Ibolinga AE, Lilungulu AG. The pattern and level of knowledge on obstetric and newborn danger signs and birth preparedness among pregnant women in Dodoma Municipal: a cross sectional study. *East African Health Research Journal*. 2020;4(1)
12. Rabiu A, Ladu HI. Knowledge of obstetric danger signs among pregnant women attending antenatal clinic in Murtala Muhammad Specialist Hospital, Kano, Nigeria. *Pyramid Journal of Medicine*. 2019;2(19)
13. Phanice OK, Zachary MO. Knowledge of obstetric danger signs among pregnant women attending antenatal care clinic at health facilities within bureti sub-county of Kericho County, Kenya. *Research in Obstetrics and Gynecology*. 2018;6(1):16-21
14. Aborigo RA, Moyer CA, Gupta M, Adongo PB, Williams J, Hodgson A, et al. Obstetric danger signs and factors affecting health seeking behaviour among the Kassena-Nankani of Northern Ghana: a qualitative study. *Afr J Reprod Health*. 2014 Sep;18(3):78-86
15. Chou D, Tuncalp O, Firoz T, Barreix M, Filippi V, von Dadelszen P, et al. Constructing maternal morbidity - towards a standard tool to measure and monitor maternal health beyond mortality. *BMC Pregnancy Childbirth*. 2016;16(45):1-10
16. Say L, Souza JP, Pattinson RC, W. H. O. Working Group on Maternal Mortality and Morbidity Classifications. Maternal near miss--towards a standard tool for monitoring quality of maternal health care. *Best Pract Res Clin Obstet Gynaecolog*. 2009 Jun;23(3):287-96

17. World Health Organisation. Evaluating the quality of care for severe pregnancy complications: The WHO near-miss approach for maternal health. World Health Organisation: Geneva, 2011.
18. Souza JP, Gulmezoglu AM, Vogel J, Carroli G, Lumbiganon P, Qureshi Z, et al. Moving beyond essential interventions for reduction of maternal mortality (the WHO Multicountry Survey on Maternal and Newborn Health): a cross-sectional study. *Lancet*. 2013;381(9879):1747-55
19. McCauley M, Madaj B, White SA, Dickinson F, Bar-Zev S, Aminu M, et al. Burden of physical, psychological and social ill-health during and after pregnancy among women in India, Pakistan, Kenya and Malawi. *BMJ Glob Health*. 2018;3(3):e000625
20. Bahl R, Manu AA. Burden of severe maternal morbidity and association with adverse birth outcomes in sub-Saharan Africa and south Asia: protocol for a prospective cohort study (AMANHI Maternal Morbidity study). *J Glob Health*. 2016 Dec;6(2):020601
21. Geller SE, Koch AR, Garland CE, MacDonald EJ, Storey F, Lawton B. A global view of severe maternal morbidity: moving beyond maternal mortality. *Reprod Health*. 2018 Jun 22;15(Suppl 1):98
22. Udo IE, Doctor HV. Trends in health facility births in sub-Saharan Africa: An analysis of lessons learned under the Millennium Development Goal framework. *Africa Journal of Reproductive Health*. 2016;20(3):108-17
23. Joseph G, da Silva IC, Wehrmeister FC, Barros AJ, Victora CG. Inequalities in the coverage of place of delivery and skilled birth attendance: analyses of cross-sectional surveys in 80 low and middle-income countries. *Reprod Health*. 2016 Jun 17;13(1):77
24. Ronsmans C, Achadi E, Cohen S, Zazri A. Women's recall of obstetric complications in south Kalimantan, Indonesia. *Stud Fam Plann*. 1997 Sep;28(3):203-14
25. Seoane G, Castrillo M, O'Rourke K. A validation study of maternal self reports of obstetrical complications: implications for health surveys. *International Journal of Gyneacology and Obstetrics*. 1998;62:229-36
26. Stewart MK, Festin M. Validation study of women's reporting and recall of major obstetric complications treated at the Philippine General Hospital. *Int J Gynaecol Obstet*. 1995 Jun; 48 S53-66
27. Benova L, Moller AB, Moran AC. "What gets measured better gets done better": The landscape of validation of global maternal and newborn health indicators through key informant interviews. *PLoS One*. 2019;14(11):e0224746
28. Lange IL, Gherissi A, Chou D, Say L, Filippi V. What maternal morbidities are and what they mean for women: A thematic analysis of twenty years of qualitative research in low and lower-middle income countries. *PLoS One*. 2019;14(4):e0214199
29. Say L, Chou D, W. H. O. Maternal Morbidity Working Group. Maternal morbidity: Time for reflection, recognition, and action. *Int J Gynaecol Obstet*. 2018;141 (Supplement 1):1-3
30. World Health Organisation Adamawa Office. Master lists of settlements (Yola North and Yola South). 2014
31. National Population Commission, The DHS Program. Nigeria Demographic and Health Survey 2018. 2019. [Accessed August 2020]. Available from: https://dhsprogram.com/pubs/pdf/FR359/FR359.pdf.
32. Adewemimo AW, Msuyu SE, Olaniyan CT, Adegoke AA. Utilisation of skilled birth attendance in Northern Nigeria: A cross-sectional survey. *Midwifery*. 2014;30:e7-e13
33. Ishola F, Owolabi O, Filippi V. Disrespect and abuse of women during childbirth in Nigeria: A systematic review. *PLoS One*. 2017;12(3):e0174084
34. Adedokun ST, Uthman OA. Women who have not utilized health service for delivery in Nigeria: who are they and where do they live? *BMC Pregnancy Childbirth*. 2019;19(93):1-14

35. Fagbamigbe AF, Hurricane-Ike EO, Yusuf OB, Idemudia ES. Trends and drivers of skilled birth attendant use in Nigeria (1990–2013): policy implications for child and maternal health. *International Journal of Women's Health*. 2017;9:843-53
36. Doctor HV, Dahiru T. Utilization of non-skilled birth attendants in Northern Nigeria: A rough terrain to the health-related MDGs. *Afr J Reprod Health*. 2010;14(2):36-45
37. Fapohunda BM, Orobaton NG. When women deliver with no one present in Nigeria: Who, what, where and so what? *PLoS One*. 2013;8(7):e69569
38. Doctor HV, Findley SE, Ager A, Cometto G, Afenyadu GY, Adamu F, et al. Using community-based research to shape the design and delivery of maternal health services in Northern Nigeria. *Reproductive Health Matters*. 2012;20(39):104-12
39. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;3(2):77-101
40. World Health Organisation. Training for mid-level managers (MLM). Module 7: The EPI coverage survey. 2008 [Accessed 28 July 2015]. Available from: http://whqlibdoc.who.int/hq/2008/WHO_IVB_08.07_eng.pdf?ua=1.
41. Lemeshow S, Robinson D. Surveys to measure programme coverage and impact: A review of the methodology used by the Expanded Programme on Immunisation. *World Health Statistics Quarterly*. 1985;38:65-75
42. Tourangeau R. Cognitive sciences and survey methods. In *Cognitive aspects of survey methodology: building a bridge between the disciplines,* Jabine T., Straf, M., Tanur, J. Tourangeau, R., Editors. 1984. Washington, DC: National Academy Press. Cited in Collins, D. Pretesting survey instruments: An overview of cognitive methods. *Quality of Life Research*, 2003, 12 (3), 229-238.
43. Willis GB, Artino AR. What do our respondents think we're asking? Using cognitive interviewing to improve medical eduation surveys. *J Grad Med Educ*. 2013;September 2013:353-6
44. Morris JL, Short S, Robson L, Andriatsihosena MS. Maternal health practices, beliefs and traditions in southeast Madagascar. *Afr J Reprod Health*. 2014;18(3):101-17
45. Ononge S, Okello ES, Mirembe F. Excessive bleeding is a normal cleansing process: a qualitative study of postpartum haemorrhage among rural Uganda women. *BMC Pregnancy Childbirth*. 2016 08 08;16(211):1-11
46. bij de Vaate A, Coleman R, Manneh H, Walraven G. Knowledge, attitudes and practices of trained traditional birth attendants in the Gambia in the prevention, recognition and management of postpartum haemorrhage. *Midwifery*. 2002 Mar;18(1):3-11
47. Sharma V, Leight J, AbdulAziz F, Giroux N, Nyqvist MB. Illness recognition, decision-making, and care-seeking for maternal and newborn complications: a qualitative study in Jigawa State, Northern Nigeria. *J Health Popul Nutr*. 2017 Dec 21;36(Suppl 1):46
48. World Health Organization. A handbook for building skills: Counselling for maternal and newborn health care. 2013. [Accessed November 2020]. Available from: https://apps.who.int/iris/bitstream/handle/10665/44016/9789241547628_eng.pdf?sequence=1
49. March of Dimes. Managing changes after baby. 2020. [Accessed November 2020]. Available from: https://www.marchofdimes.org/it-starts-with-mom/warning-signs-of-health-problems-after-giving-birth.aspx
50. Thaddeus S, Maine D. Too far to walk: Maternal mortality in context. *Soc Sci Med*. 1994;38(8):1091- 110

BMJ Open

Women's perceptions and self-reports of excessive bleeding during and after delivery: findings from a mixed-methods study in Northern Nigeria

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-047711.R1
Article Type:	Original research
Date Submitted by the Author:	16-May-2021
Complete List of Authors:	Yargawa, Judith; University College London, Institute for Global Health Fottrell, Edward; University College London, Institute for Global Health Hill, Z; University College London, Institute for Global Health
Primary Subject Heading:	Global health
Secondary Subject Heading:	Obstetrics and gynaecology, Qualitative research, Research methods, Public health
Keywords:	OBSTETRICS, PUBLIC HEALTH, QUALITATIVE RESEARCH, STATISTICS & RESEARCH METHODS, SOCIAL MEDICINE

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Women's perceptions and self-reports of excessive bleeding during and after delivery: findings from a mixed-methods study in Northern Nigeria

Judith Yargawa[1*], Edward Fottrell[1], Zelee Hill[1]

[1] Institute for Global Health, University College London, London, United Kingdom

* Corresponding author (judith.yargawa.14@ucl.ac.uk)

ABSTRACT

Objectives: To explore lay perceptions of bleeding during and after delivery, and measure the frequency of self-reported indicators of bleeding.

Setting: Yola, North-East Nigeria

Participants: Women aged 15-49 years who delivered in preceding two years of data collection period (2015-2016), and their family members who played key roles.

Methods: Data on perceptions of bleeding were collected through seven focus group discussions (FGDs), 21 in-depth interviews and 10 family interviews. Sampling was purposive and data were analysed thematically. A household survey was then conducted with 640 women using cluster sampling on postpartum bleeding indicators developed from the qualitative data; data were analysed descriptively.

Results: Perceptions of excessive bleeding fell under four themes: quantity of blood lost; rate/duration of blood flow; symptoms related to blood loss; and receiving birth interventions/hearing comments from birth attendants. Young and less educated rural women had difficulty quantifying blood loss objectively, including when shown quantities using bottles. Respondents felt that acceptable blood loss levels depended on the individual woman and whether the blood is 'good' or 'diseased/bad.' Respondents believed that 'diseased' blood was a normal result of delivery and universally took steps to help it 'come out.' In the quantitative survey, indicators representing less blood loss were reported more frequently than those representing greater loss, e.g., more women reported staining their clothes (33.6%) than the bed (18.1%) and the floor (6.2%). Overall, indicators related to quantity and rate of blood flow had higher frequencies compared to symptom and intervention/comment-related indicators.

Conclusion: Women quantify bleeding during and after delivery in varied ways and some women do not see bleeding as problematic. This suggests the need for standard messaging to address subjectivity. The range of indicators and varied frequencies highlight the challenges of measuring excessive bleeding from self-reports. More work is needed in improving and testing validity of questions.

Key words: Obstetric haemorrhage, excessive bleeding, blood loss, intrapartum haemorrhage, postpartum haemorrhage, qualitative study, household survey, mixed-methods

Word count: 4,640

Strengths and limitations of this study

- Around 60% of deliveries in the wider study setting take place at home; our community-based recruitment attempted to capture cases that do not make it to health facilities, hence differ from the facility-based measurement approaches dominating literature.
- This study is one of the few studies to explore perceptions of bleeding during and after delivery in-depth, which helped identify several lay methods in which women and families conceptualise excessive bleeding during and after delivery.
- The qualitative phase helped inform design of the questionnaire used in the community-based survey; a mixed-methods approach helped provide key methodological implications for future studies aiming to measure excessive bleeding during and after delivery.
- We recruited a mainly urban sample and did not interview other respondents such as birth attendants or families of women who had died from excessive bleeding.
- In the quantitative phase, we used prompting to assess experience of excessive bleeding and this may have increased reporting.

INTRODUCTION

Haemorrhage accounts for about 25% of global maternal deaths,[1] with most of the estimated 295,000 annual deaths occurring in low income settings[2] and within 24 hours of delivery.[3] Haemorrhage is also a leading cause of severe maternal morbidity, maternal near misses and emergency obstetric interventions.[4-7] These adverse outcomes could be reduced by having a skilled attendant at birth, active management of the third stage of labour and if women recognised and were able to access timely care for danger signs during home births and following postpartum hospital discharge. Studies have found that women across Sub-Saharan African settings have good knowledge that exessive bleeding is a danger sign,[8-14] but few studies have explored how women conceptualise excessive bleeding and determine whether it is occuring.

There has been a renewed global interest in measuring maternal morbidity, with recent achievements including standardisation of key definitions,[15, 16] development of tools,[15, 17] and large scale studies.[18-20] Prevalence data on excessive bleeding have primarily been obtained from facility sources as these are considered more reliable than self-reports from women.[21] However, facility data may not be representative as institutional delivery is still below 60% in several Sub-Saharan African countries.[22, 23] Studies which validated women's self-reports of excessive bleeding against medical records, examinations and observations have found overestimation and specificity issues[24-26], which resulted in such questions being removed from surveys.[27] These studies are relatively old and few were informed by qualitative research, the use of which has been recently advocated for by measurement experts.[28, 29] This mixed-methods study aimed to explore women's perceptions of bleeding during delivery and within the first 24 hours post-delivery, and use these insights to measure the frequency of self-reported indicators of excessive bleeding in Northern Nigeria.

METHODS

The study area, study designs and eligibility criteria

Data were collected in Yola, Adamawa state, North-east Nigeria between December 2015 and November 2016. Yola, with a population of 823,220 people, is divided into two Local Government Areas - Yola North, the urban administrative and commercial capital of the state, and Yola South, the traditional headquarters which is a mixture of urban and rural areas.[30] Yola has one tertiary hospital, one state hospital, numerous primary health care facilities and several private health facilities. Demographic and health indicators for Yola are not readily available; however, in Adamawa State, 47.0% of women aged 15-49 years have no education and only 20.7% have completed secondary school.[31] 82.1% received antenatal care from a skilled providers in their last pregnancy but only 40.5% delivered with a skilled attendant.[31] This low utilization stems from a combination of factors including deprivation, disrespectful/abusive care, socio-cultural reasons, ethnicity, not having a perceived need for facility delivery and poor accessibility.[32-38]

A qualitative phase consisted of focus group discussions (FGDs), in-depth interviews (IDIs) and family interviews and was followed by a household survey. In both phases, eligible women were those aged 15-49 years, married, Yola residents who had given birth within the two years preceding the study. Women in the qualitative sample were not part of the quantitative sample.

The qualitative phase: sampling, data collection and analysis

This study adopted the interpretative approach, a paradigm which acknowledges the subjectivity and multiplicity of reality,[39] and aims to understand the world from participants' point of view.[40] The IDI respondents were sampled to give a range of ages, self-reported morbidity experiences and educational levels (none, primary, secondary, post-secondary). Sampling grids with estimated sample sizes for each subgroup were developed but data were collected until saturation was reached. The family interviews entailed discussions with family members who played key roles in the maternal experiences of a subset of IDI participants; selection depended on the woman's unique circumstances and/or household factors, e.g. family members serving as her birth attendant. The FGDs were stratified by residence (urban/rural) and age. One FGD was conducted with women who had completed at least a bachelor's degree in order to obtain a different perspective from women who had lower educational levels. Eligible women were approached face-to-face and given further explanations using information sheets and invited to participate. Respondents were recruited through a women's empowerment community centre, snowball sampling and community liaisons.

Data were collected in English or Hausa based on the respondent's fluency using a pre-tested semi-structured topic guide by the first author (female, PhD student at the time, with prior training in qualitative research methods). All IDIs and family interviews were conducted in respondents' homes (except one IDI in a workplace), and the FGDs in homes or the Women's Development Centre. On average, the FGDs lasted one hour, the IDIs 45 minutes and the family interviews 30 minutes. IDI topics included what the respondent remembered about her blood loss during delivery, how she would quantify it (small, normal or excessive), why she felt it was small, normal or excessive and whether she was worried/scared about the amount lost (Supplementary file 1). Women were shown bottles of 500mL and 1,000mL, the clinical cut-offs for postpartum haemorrhage and severe postpartum haemorrhage respectively,[3] to see if this helped quantify blood loss. Similar questions were asked for the first 24 hours post-delivery. The family interviews were primarily designed to explore care-seeking for morbidities, but were included in the analysis where this was in relation to bleeding. In the FGDs, respondents were asked how much blood they would expect a woman to lose during delivery and in the first 24 hours after delivery, how a woman would know if her blood loss was normal or excessive, and how they would quantify blood loss. They were also shown the 500mL and 1,000mL bottles (Supplementary file 1).

All sessions were audio-recorded. Follow-up calls or sessions were carried out with a quarter of the respondents at later days to clarify unclear areas or to acquire further information. The IDIs and FGDs were translated and transcribed in English primarily by the first author; around eight IDIs were transcribed by assistants and these were double-checked line-by-line against the audio-recording to ascertain completeness and validity. The family interviews were left in audio format and analysed directly from the recordings as they did not focus on bleeding per se and only contained a few relevant sections. Data were analysed using thematic analysis primarily informed by Braun and Clarke (2006) using both deductive (guided by the research questions and coding frame) and inductive approaches (guided by the data).[41] A coding tree was developed inductively from analyses of pre-test transcripts; these codes then formed the deductive codes applied to subsequent transcripts. Any new codes that emerged inductively during analysis were added to the tree. Data were managed using NVivo 10.

The quantitative phase: sampling, data collection and analysis

Three-stage cluster sampling was conducted at the ward (smallest administrative unit), settlement and participant levels using probability proportional to size (PPS) sampling. 12 of 22 wards were selected in stage one, five settlements from each ward in stage two (corresponding to 60 clusters in total), and 11 eligible participants were selected from each cluster in stage three using the Expanded Program of Immunisation (EPI) method.[42, 43]. The sampling frame and population size for wards and settlements for stages one and two were obtained from the local authorities. Data collectors were given standard operating procedures to select eligible women at stage three using the EPI method. Once households were identified, information about the study was provided and the eligibility criteria were asked. Eligible women were approached face-to-face and given further explanations using information sheets and invited to participate. The sample size was calculated as 660 based on: 5% precision; 5% significance level; 1.5 design effect; 10% non-response rate; and a conservative prevalence of maternal health problems of 50%.

We developed a questionnaire by reviewing literature, adapting questions from existing surveys and consulting relevant researchers. The questionnaire was then refined with further insights from the qualitative phase to aid comprehension and validated using cognitive interviews, which aimed to assess whether the questionnaire was measuring what it intended to measure by exploring the question-and-answer process to identify potential sources of error.[44-47] We asked a range of questions across the domains that emerged from the qualitative findings in order to compare the frequencies they elicited. This included the extent of staining and soaking of clothes and surfaces, nature and consistency of blood flow, medical procedures received and symptoms of shock (Supplementary file 2).

The questionnaire was paper-based and administered face-to-face by four female data collectors in Hausa or English in the respondents' homes. Data were entered using EpiData 3.1 and organised and analysed descriptively using Stata 14, with weighting and adjustment as appropriate.

Informed consent and ethical approval

Informed consent was obtained from all respondents. Ethical approval was obtained from the Adamawa State Ministry of Health (Reference Number: S/MoH/HS/1131) and the University College London Research Ethics Committee (Project ID: 6846/003), and verbal approval from appropriate community leaders. Pseudonyms have been used in reporting direct quotes.

Patient and public involvement

A preliminary study was conducted prior to the main data collection in a different setting to pretest the interview topic guide for comprehension and length. Feedback was solicited from respondents after the interview sessions on areas including the nature of the questions asked, clarity of instructions and whether respondents objected to answering any question. Their inputs helped inform refinement of the interview topic guide.

RESULTS

Characteristics of respondents

21 IDIs were conducted and respondents ranged from 16-40 years of age, half lived in rural areas, 14 had minimal/no education, and eight had home deliveries. Ten family interviews were conducted with co-wives, husbands or other females in the women's families. Seven FGDs of 5-8 women (44 women in total) were conducted with women aged 15-48 years. In six of the FGDs, almost all respondents had no/primary education and in one group consisted of more educated respondents. Four FGDs were in urban areas and three in rural areas. Most women in the urban FGDs had given birth in health facilities while the rural FGDs had an almost even split between home and health facility deliveries. In the IDIs, there was one refusal due to competing priorities and one respondent's house could not be located. One FGD respondent did not show up.

In the quantitative phase, there were 15 refusals and three exclusions due to incapacitation; this corresponded to 642 women being surveyed - a 97% response rate. Two questionnaires were incomplete and/or unidentifiable, hence data from 640 women were included. The characteristics of the women are shown in Table 1: 77% were 20-34 years of age, 75% were Muslim, 75% resided in urban areas, 52% had no or primary education, 58% did not work, 63% had a facility birth in their most recent delivery, 19% had one child and 28% five or more children.

Table 1: Socio-demographic and obstetric characteristics of survey respondents (n=640)

Characteristic	Frequency	Weighted Proportion % (95% CI)
Age (years)		
15-19	52	8.5 (5.3- 13.4)
20-34	476	76.7 (73.4- 79.7)
35-49	93	14.8 (10.8- 20.0)
Religion		
Islam	476	74.7 (58.8- 85.9)
Christianity	161	25.3 (14.1- 41.3)
Residence		
Rural	161	25.0 (8.0- 56.1)
Urban	479	75.0 (43.9- 92.0)
Highest educational level completed/currently attending		
Never attended school/ non-western education	199	32.6 (23.6- 43.1)
Primary	137	19.4 (15.0- 24.6)
Secondary	243	39.3 (30.4- 48.9)
Post-secondary	58	8.8 (5.1- 14.9)
Literacy		
Can read in any language	255	44.2 (34.8- 54.0)
Cannot read in any language	341	55.8 (46.0- 65.2)
Main occupation		
Unemployed/house-wife	361	58.0 (54.3- 61.6)
Unskilled	202	31.3 (24.7- 38.9)
Skilled	72	10.7 (6.6- 16.9)
Gravidity		
1	91	14.9 (11.9- 18.6)
2-4	322	51.3 (46.3- 56.2)
5-9	191	28.5 (23.8- 33.8)
≥10	34	5.3 (3.6- 7.8)

Parity		
1	115	18.8 (15.1- 23.3)
2-4	336	53.6 (49.4- 57.8)
5-9	165	24.6 (20.3- 29.5)
≥10	19	3.0 (1.7- 5.1)
Place of last delivery		
Home/TBA's place	228	36.5 (27.0- 47.2)
Public health facility	350	54.0 (46.3- 61.6)
Private health facility	55	9.4 (5.8- 15.0)
Birth Attendant		
Unskilled	194	32.1 (22.8- 43.0)
Nurse/midwife/community health worker	381	58.7 (50.1- 66.8)
Doctor	54	9.2 (5.5- 15.1)

* Missing data: 19 in age, 3 in woman's highest educational level, 5 in main occupation, 44 in literacy (likely due to some respondents being 'semi-literate' and questionnaire did not have the option), 2 in religion (1 other), 2 in gravidity, 5 in parity, 11 in birth attendant and 7 in place of delivery.

General perceptions on bleeding

Three themes emerged from the qualitative data relating to perceptions of bleeding: divergent views as to whether some bleeding after delivery is beneficial or harmful; the existence of 'good' and 'bad' blood; and acceptable levels of blood loss being individually determined.

Respondents had varied opinions about whether blood *'needs'* to come out after delivery. One group of women felt bleeding was beneficial: "*if it does not come out a lot, it disturbs me in the stomach"* (FGD 6); *"if the blood doesn't pour a lot, it just stays [in the stomach] and hurts*" (Family Interview #10). A second group felt blood loss was dangerous, and a final group acknowledged that bleeding was a paradox: "*blood has this dilemma: it is problematic when it comes out and it is problematic when it doesn't come out*" (FGD 1); "*it needs to pour but it should not pour too much*" (Family interview #7). These varied viewpoints sometimes led to disagreement during FGDs:

> ***Lilian**: I think it is better for her to bring out the blood*
> ***Interviewer**: OK. Why do you say so?*
> ***Lilian**: Because of the dirt inside.*
> ***Interviewer**: OK*
> ***Hadiza**: But for some, don't you see that if the blood has snapped [becomes uncontrollable] and comes out, that's a problem? If it hasn't snapped, it stays still. For some, it is usually the bleeding that causes them to transfuse the person*
> ***Amal**: She'll just be feeling dizziness*
> ***Hadiza**: She'll just be dizzy. It is the bleeding that causes them to add the blood* (FGD 5, rural, no/primary education, 20-34 years group, parity 1-9).

Respondents categorized blood as being 'good' or 'diseased/bad/dirty' based on its colour and consistency. 'Good' blood is red, bright, fresh and comes from "*the blood in circulation.*" 'Diseased/bad/dirty' blood is blackish, dark, clotted and comes from a diseased area – "*disease is what is pouring.*" Diseased blood was considered a normal result of delivery and this blood was thought to cause abdominal pain if retained; consequently removal of this blood was universally done post-delivery through hot water baths, massages and drinks, except in Caesarean-section deliveries:

> *If it were just blood dripping (hisses briefly), I wouldn't have appreciated the practice. But to have seen CLOTTED BLOOD coming out [during my wife's hot water postpartum bath], I think I appreciated it. And I encouraged her [to remove the blood]… there was some bleeding inside and it got stuck there, which I think it will not be good afterwards. So those traditional practices, I think they are good* (Family interview #8, husband, urban, educated family).

There was also a perception that women have different quantities of blood in their bodies: "*blood, it is body-by-body*" and "*everyone has a blood level that God has given her*." This meant that women were expected to have different levels of bleeding and those with a lot of blood can lose more blood during and after delivery and vice versa:

> ***Farida**: …It depends on how everyone's blood is. One can bleed a lot, no problem. But another person, when she bleeds, you must have problem. [she later likens this to how women's menstrual flow also differs]* (FGD 7, rural, no education, 15-19 years group, parity 1 each).

> *Because you know for someone the blood will pour very much. But for another person, she has insufficient blood it will not pour much. Well my own is like that, it did not pour a lot* (IDI 14, rural, no education, 19 years, parity 1).

Birth attendants, particularly skilled birth attendants, were thought to *'scoop'* the diseased blood out during delivery which would affect levels of postpartum bleeding – if the *'scooping'* had been done well, a woman would lose less blood. Similarly, a few respondents reported that during a Caesarean-section blood is usually evacuated and blood flow controlled.

Perceptions of normal and too much blood loss

Women determined if too much blood had been lost in four ways: the visible quantity lost; the rate and duration of blood flow; the presence of symptoms related to blood loss; and receiving an intervention to ameliorate the blood loss or hearing comments from birth attendants (Table 2).

Related to quantity of blood lost

Respondents quantified the blood they lost during delivery by comparing it to volumes such as drip bags or hospital kidney bowls. For bleeding within the first 24 hours postpartum, some women made comparisons to their menstrual flow. More educated respondents estimated in litres, while 15-19 year olds and some rural women struggled to quantify blood loss at all, using terms such as "*if it pours too much"* despite probing on quantities. Overall, there was no consensus on how to quantify blood loss but when shown 500mL and 1,000mL bottles, FGD respondents reached consensus that 1,000mL was too much blood to lose, while responses to the 500mL bottle included "*some blood is still left inside, it has not finished coming out.*" IDI responses were similar, although there was some variation in perceptions of which bottle constituted too much blood loss.

The extent to which blood stained, soaked through or dripped from clothing, pads or surfaces was also used to quantify bleeding, as illustrated by this respondent who felt too much blood was lost if clothes were so soaked they looked like they had been washed in blood: "*you're*

picking …[it][clothe] from blood, as if you're washing it in it". The frequency with which pads needed to be changed postpartum, or the number used at one time were also used to quantify blood loss, with FGD respondents reporting that changing pads three or four times per day or doubling or tripling them would mean too much blood was being lost.

Women also compared their blood loss to previous deliveries, for multiparas, and to other women: *"I lost more blood in that [delivery] of Tim than Tony*" and "*it was for this one [delivery] that it [blood] poured a lot, but it did not pour a lot for these ones [other deliveries]*."

Related to rate and duration of blood flow

This theme was related to the perceived force with which blood flowed, and was mostly used to describe bleeding within the first 24 hours postpartum. Too much blood loss was when blood was "*rushing,"* or flowed "*like passing urine"* or "*like water, like tap*." Duration of bleeding was also used as an indicator, with bleeding expected to have stopped by the baby's naming ceremony (seven days postpartum) or by the 40 days postpartum recuperation and purification period.

Symptoms related to blood loss

Respondents also used symptoms to determine if too much blood had been lost; these were similar to biomedical symptoms of shock. The most common symptoms mentioned were being unable to get up/feeling like falling down, fainting, dizziness, headache and weakness. Other symptoms mentioned included hearing changes, paleness, body pains and shaking: "*your body will also be shaking. Just like that, you'll see yourself shaking*."

Some women spontaneously reported that they had been worried about the amount of blood they had lost, while others reported being frightened on probing using statements such as "*I was totally agitated*" and "*it shocked me you know…*"

Birth interventions received and comments from birth attendants

Respondents who delivered in facilities reported that they would know if they had bled too much if: they had received a blood transfusion; their relatives were asked to look for blood donors; they were referred to a higher level facility because of the bleeding; they were given 'blood tonic' tablets or supplements to increase their blood; they were given injections or tablets to stop the bleeding; or health staff needing to 'scoop' their blood out. Some women used comments made by birth attendants to make judgements on their blood loss either because health workers "*didn't say the blood is short in my body*" or said they had lost a lot of blood or "*should be given food that will increase your blood*."

Table 2: Overview of respondents' perceptions of excessive bleeding

Theme	Description	Sample quotes
Related to quantity of blood lost	Methods used to quantify bleeding. This also included the extent to which blood stained or soaked through clothing, pads or surfaces, and comparison of one's bleeding to previous deliveries or those of other women	**Taniyo**: Well, I thought I lost almost 50cL oh [500mL], because I, I stood up, it was dripping like water. …Yes. I was having pad but it was coming out underneath like water, I'm telling you. The pad was soaked, my pant, everything, the ground, the- everywhere was just wet. Not bed oh, now I came down from the bed, everything on the ground was wet … with the blood. Yes. I believe then-… I lost almost 50cL or more than… (FGD 4, urban, bachelor's degree minimum, 20-34 years group, parity 1-2). **Rachel**: For some, it depends on your delivery. From the 1st to the 2nd to the 3rd to the 4th to the 5th, all, you'll be able to know the way blood pours for you. The delivery you first started, you'll be able to mark the blood that poured previously and then the most recent one, the one you're currently in. Yes, you'll be able to differentiate it (FGD 6, rural, no/primary education, 35-49 years group, parity 6-10).
Related to rate and duration of blood flow	The perceived force with which the blood was coming out, and whether or not bleeding goes beyond an expected end-point	**Interviewer**: But apart from looking at the pad, is there another way a woman will know if she's bleeding a lot?... **Isatu**: Yes, you'll feel it pouring…. **Amina**: You'll feel it in your body that it's rushing. **Interviewer**: How, like how? **Hasiya**: Someone will feel it like water, like passing urine. The way it's coming out (FGD 3, urban, a range of education levels, 15-19 years group, parity 1-3).
Symptoms related to blood loss	Signs and symptoms signalling much bleeding. Also includes the extent to which the bleeding made women or others scared or worried	**Maimuna**: After delivery, the doctors usually ask someone to lie down for at least 6 hours. …When [you] lie down and you need to pass urine or something, they say, "Stand up, go ahead and do it." If you've lost too much blood, the moment you get up, you'll faint. That way, they'll know that you've lost too much blood…I experienced this with this baby [points to the baby she's holding]. When I came up- I was lying on the bed. Then they told me, "you've been discharged." Then they said, "Get up, let's go." I got up and I could see people, but later on I was on the ground. I fell down and fainted (FGD 1, urban, mostly no/primary education, 20-34 years group, parity 3-7).
Birth interventions received and comments from birth attendants	Interventions done by maternity staff and comments from birth attendants	**Respondent**: … So after delivering, then I started bleeding. So I have to call them [*maternity staff]*, then they gave me some injections to stop it and some tablets. **Interviewer**: OK. But now the bleeding, …would you say it was normal or much or small? That's the bleeding now. **Respondent**: It's much. **Interviewer**: OK why do you say that? **Respondent**: Because some people, with- you'll see their bleed[ing] is just small, the blood that will come out is small, some is just normal and some much. Because they have to like inject me and give me some tablets that will stop the bleeding (IDI 17, urban, post-secondary education, 40 years, parity 4).

Frequency of self-reported indicators of excessive bleeding after delivery

We developed a survey instrument to measure self-reported postpartum bleeding using a series of questions that reflected the domains which emerged from the qualitative research. Table 3 shows the self-reported prevalence of each indicator by domain. For most domains, reported prevalence decreased as severity of the indicator increased. For example, more women (33.6%) reported staining their clothes, than reported staining the bed (18.1%), than reported staining the floor (18.1%). The less severe indicators (stained clothes, blood trickled down leg, and feeling weak) were reported by around a third of women; while the more severe indicators (staining the floor, using triple pads, and fainting) were reported by between 3.3% and 6.2% of women. Overall the indicators related to the quantity and rate of blood flow had higher frequencies compared to symptom and intervention/comment-related indicators.

Table 3: Self-reported prevalence of each bleeding indicator within 24 hours of delivery (n=640)

Indicator	Frequency (n)	Weighted Proportion % (95% CI)
Quantity of blood lost		
Stained clothes	214	33.6 (28.9- 38.7)
Stained the bed	120	18.1 (14.3- 22.6)
Stained floor	43	6.2 (4.7- 8.2)
Doubled pad	287	45.7 (37.1- 54.6)
Tripled pad	21	3.3 (1.6- 6.7)
Frequent big, thick clots of blood	359	63.0 (58.0- 67.7)
Rate of blood flow		
Blood trickled down leg	213	33.1 (27.5- 39.3)
Blood rushed like tap water/urine	198	31.6 (25.6- 38.3)
Intervention or comments from maternity staff		
Birth attendant returned to scoop out the blood	102	14.5 (9.7- 21.3)
Staff commented that blood levels were reduced	32	8.5 (5.7- 12.7)
Symptoms of blood loss		
So weak could not get up and walk	179	29.9 (23.7- 36.9)
Dizziness	146	23.3 (19.8- 27.3)
Shivering	93	14.7 (11.2- 19.0)
Palms looked white/pale	75	12.4 (9.0- 16.9)
Fainted	27	4.6 (3.2- 6.5)

DISCUSSION

This study explored lay perceptions of bleeding during delivery and within the first 24 hours post-delivery using mixed-methods. Women had divergent views on blood loss, categorised some blood *'bad blood'* as needing to come out after delivery and felt that the impact of blood loss was dependent on how much blood individual women had. The concept of 'bad blood' as something that needs to be removed from the womb has been reported elsewhere in Africa.[48, 49] In Uganda, the 'bad blood' was seen as accumulated blood from not menstruating during pregnancy.[49] These views that some types of blood loss are acceptable and required, and that some women can manage blood loss better than others may delay care seeking for some women and highlight that perceptions of excessive bleeding may vary considerably across women and types of blood.[49, 50]

We found that perceptions relating to quantifying excessive bleeding were related to: quantity of blood lost; rate and duration of blood flow; symptoms related to blood loss; and birth interventions received/comments from birth attendants. The themes that emerged relating to how women quantified blood loss (quantity lost, rate and duration of flow and symptoms related to blood loss) are similar to those reported in other studies – although the specific measures used within these categories varied by study. Quantity was measured in terms of clots, comparison to menstrual flow and the need to change pads frequently in Uganda;[49] by whether the blood would fill a 'food can' and the number of soaked pieces of clothes in the Gambia;[51] and by the extent items were soaked in North-west Nigeria.[52] Rate of flow was mentioned in Uganda[49] as blood flowing "like an open tap," or past the delivery area in the Gambia,[51] and heavy flow in North-west Nigeria.[52] Symptoms of blood loss were fainting, dizziness, collapsing, being unable to sit up, and falling unconscious in Uganda[49] and paleness, shivering, weakness and falling unconscious in North-west Nigeria.[52]

While the symptoms related to blood loss are in line with the biomedical descriptions of shock, most measures used by mothers were subjective and some women struggled to quantify blood loss at all. This subjectivity may make recognition of haemorrhage difficult, which has important implications as the first step in seeking care for postpartum haemorrhage is recognising that the bleeding is indeed excessive. The use of multiple subjective measures is also problematic for measurement. The current health promotion messaging on excessive bleeding in the setting is not clear in the literature However, a few sources elsewhere suggest that the recommendations on postpartum danger signs are quite varied: a counselling handbook by the World Health Organization says care should be sought immediately when the bleeding has 'increased' or is 'more than normal,'[53] while a March of Dimes resource for new mothers describes such bleeding as 'heavier than a normal period' or 'gets worse' over time.[54] This study highlights the need for standard messaging to address subjectivity. Clear information on detrimental blood loss quantity could be included in these messages using everyday descriptions or tools that women are familiar with. These descriptions may likely be context-specific, hence it is important to use tailored approaches. In addition, while women correctly identified symptoms associated with excessive bleeding, some of these were extreme manifestations; thus they would need to be reminded not to wait until these symptoms occur before seeking care.

In the quantitative phase, we measured the frequency of self-reported indicators of excessive postpartum bleeding based on women's recall of their experiences within the first 24 hours post-delivery. We found that different measures of excessive bleeding had very varied frequencies; that within a domain, reported prevalence decreased as severity of the indicator increased; and that indicators related to rate of blood flow and quantity of blood lost had higher frequencies compared to indicators related to symptoms of blood loss and birth interventions received/comments from birth attendants. That prevalence is lower for the more severe indicators within each domain and for the domains related to interventions and symptoms of blood loss is reassuring. However, the prevalence of some measures were surprisingly high, for example, 32% of women reported blood rushing like a tap or urine and it is likely that these overestimate excessive bleeding from a biomedical perspective. This confirms the difficulty in measuring excessive bleeding in surveys reported in validity studies.[24-26] The use of multiple descriptive measures shows the wide range of estimates that can be obtained based on choice of question, and it does not appear to have made the measures more objective.

Self-reported data might still be useful for estimating excessive bleeding at the population level. Their usefulness perhaps lies in holistically assessing a list of indicators rather than considering indicators on a stand-alone basis. The indicators could be assigned scores, a composite score could then be computed, and level of blood loss established from a severity scale with validated cut-offs (for instance, mild, moderate, severe). Scales are already being used to assess maternal conditions such as postpartum depression, although we acknowledge that these conditions are different in terms of aetiology and manifestation. It appears a few studies in the literature are starting to use a range of questions rather than focusing on single ones for measuring excessive bleeding. In their large population-based study across eight Sub-Saharan and South Asian countries, the AMANHI study asked a combination of questions to establish severe bleeding including wetting of clothes and floor, loss of consciousness and whether the woman needed an 'operation' to stop the bleeding.[20] In addition, innovative, low-cost methods could be developed to standardise subjective descriptions of excessive bleeding for measurement purposes. These might be more relevant for visual and soaking estimation methods and there are a few useful examples in the literature.[55, 56]

Until universal institutional delivery is achieved in low income settings and more objective measurement methods that work seamlessly in community settings are developed, self-reported data are likely to still be needed for population-level measurement of maternal conditions such as excessive bleeding. Our findings followed the trends that we would expect (indicators of quantity of blood lost and rate of flow showed higher frequencies than symptoms and interventions) and showed the expected dose response within a particular domain of blood loss; these offer some hope. More objective methods are still necessary but this will depend on the purpose for measurement. Kerr and Weeks (2016) argue that "a single definition is no longer enough" for postpartum haemorrhage as different definitions are needed for different purposes: to make decisions about the point to commence treatment; for quality of care audits; and for research purposes.[57] It will be necessary to first clarify the aim of measurement, and appropriate methods can then be selected.

Our study is one of the few studies to explore perceptions of bleeding during and after delivery in-depth. It showed perceptions that could contribute to delays in decision to seek timely care.[58] As obstetric haemorrhage is a leading cause of maternal mortality and severe morbidity,

tailoring messages to address perception of bleeding could potentially save lives. We recruited a mainly urban sample and did not interview respondents such as birth attendants or families of women who had died from excessive bleeding, as they would have added valuable information on recognition and care-seeking for excessive bleeding. Interviewing these additional respondents would be beyond the scope of this paper and as we recruited respondents from the community, it would have been difficult to identify the families of women who had died from excessive bleeding from non-facility settings. In the quantitative phase, we used prompting to assess experience of excessive bleeding and this may have increased reporting. Use of self-reports may have also been influenced by reporting and recall bias, as it may have been difficult to recollect how much blood was lost within the first 24 hours several months later. In addition, recollections could have been influenced by other factors such as medical diagnosis of postpartum haemorrhage and whether or not birth attendants communicated estimates of blood loss to women. These limitations are, however, inherent in cross-sectional studies.

CONCLUSION

Women conceptualise bleeding and quantify excessive bleeding during and after delivery using a variety of subjective identification methods; these may make recognition of haemorrhage for prompt care-seeking difficult hence highlighting the need for standard messaging to address subjectivity. The quantitative findings highlight the challenges of measuring excessive bleeding from self-reports. More work is needed in improving and testing validity of questions, and developing alternative methods for analysing indicators from self-reports.

Acknowledgements

We would like to thank all respondents for providing valuable insights, as well as the data collection team, transcription assistants, data entry team and community liaisons for the immense support given.

Author Contributions

All authors designed the project and developed the study tools. JY collected the data/supervised the data collection, with substantial inputs from EF and ZH. JY drafted the initial manuscript and all authors reviewed, edited and approved the final manuscript.

Funding

This study was funded by the University College London Graduate Research Scholarship and University College London Overseas Research Scholarship.

Competing interests

The authors declare that they have no competing interests.

Patient consent for publication

Not required

Ethics approval

Ethical approval was received from the Adamawa State Ministry of Health (Reference Number: S/MoH/HS/1131) and the University College London Research Ethics Committee (Project ID: 6846/003), and verbal approval from appropriate community leaders.

Data sharing statement

Data sharing requests could be addressed to the corresponding author.

Table legends

Table 1: Socio-demographic and obstetric characteristics of survey respondents (n=640)

Table 2: Overview of respondents' perceptions of excessive bleeding

Table 3: Self-reported prevalence of each bleeding indicator within 24 hours of delivery (n=640)

Supplementary file legends

Supplementary file 1: Focus group discussion and interview guides

Supplementary file 2: Survey questionnaire

REFERENCES

1. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller A-B, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. *The Lancet Global Health*. 2014;2(6):e323-e33
2. World Health Organization. Trends in maternal mortality 2000 to 2017: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division World Health Organization. Geneva: World Health Organization, 2019.
3. World Health Organisation. WHO recommendations for the prevention and treatment of postpartum haemorrhage. 2012. [Accessed April 2020]. Available from: http://apps.who.int/iris/bitstream/10665/75411/1/9789241548502_eng.pdf.
4. Sotunsa JO, Adeniyi AA, Imaralu JO, Fawole B, Adegbola O, Aimakhu CO, et al. Maternal near-miss and death among women with postpartum haemorrhage: a secondary analysis of the Nigeria Near-miss and Maternal Death Survey. *BJOG*. 2019;126(Suppl 3):19-25
5. Oladapo OT, Adetoro OO, Ekele BA, Chama C, Etuk SJ, Aboyeji AP, et al. When getting there is not enough: a nationwide cross-sectional study of 998 maternal deaths and 1451 near-misses in public tertiary hospitals in a low-income country. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2016;123(6):928-38
6. Maswime S, Buchmann E. A systematic review of maternal near miss and mortality due to postpartum hemorrhage. *Int J Gynaecol Obstet*. 2017 Apr;137(1):1-7
7. Rocha Filho EA, Costa ML, Cecatti JG, Parpinelli MA, Haddad SM, Pacagnella RC, et al. Severe maternal morbidity and near miss due to postpartum hemorrhage in a national multicenter surveillance study. *Int J Gynaecol Obstet*. 2015 Feb;128(2):131-6
8. Geleto A, Chojenta C, Musa A, Loxton D. WOMEN's Knowledge of Obstetric Danger signs in Ethiopia (WOMEN's KODE):a systematic review and meta-analysis. *Syst Rev*. 2019 Feb 25;8(1):63
9. Kabakyenga JK, Ostergren PO, Turyakira E, Pettersson KO. Knowledge of obstetric danger signs and birth preparedness practices among women in rural Uganda. *Reprod Health*. 2011 Nov 16;8:33
10. Bintabara D, Mpembeni RNM, Mohamed AA. Knowledge of obstetric danger signs among recently-delivered women in Chamwino district, Tanzania: a cross-sectional study. *BMC Pregnancy Childbirth*. 2017 Aug 29;17(1):276
11. Masoi TJ, S.M. SMK, Ibolinga AE, Lilungulu AG. The pattern and level of knowledge on obstetric and newborn danger signs and birth preparedness among pregnant women in Dodoma Municipal: a cross sectional study. *East African Health Research Journal*. 2020;4(1)
12. Rabiu A, Ladu HI. Knowledge of obstetric danger signs among pregnant women attending antenatal clinic in Murtala Muhammad Specialist Hospital, Kano, Nigeria. *Pyramid Journal of Medicine*. 2019;2(19)
13. Phanice OK, Zachary MO. Knowledge of obstetric danger signs among pregnant women attending antenatal care clinic at health facilities within bureti sub-county of Kericho County, Kenya. *Research in Obstetrics and Gynecology*. 2018;6(1):16-21
14. Aborigo RA, Moyer CA, Gupta M, Adongo PB, Williams J, Hodgson A, et al. Obstetric danger signs and factors affecting health seeking behaviour among the Kassena-Nankani of Northern Ghana: a qualitative study. *Afr J Reprod Health*. 2014 Sep;18(3):78-86
15. Chou D, Tuncalp O, Firoz T, Barreix M, Filippi V, von Dadelszen P, et al. Constructing maternal morbidity - towards a standard tool to measure and monitor maternal health beyond mortality. *BMC Pregnancy and Childbirth*. 2016;16(45):1-10
16. Say L, Souza JP, Pattinson RC, W. H. O. Working Group on Maternal Mortality and Morbidity Classifications. Maternal near miss--towards a standard tool for monitoring quality

of maternal health care. *Best practice & research Clinical obstetrics & gynaecology*. 2009 Jun;23(3):287-96
17. World Health Organisation. Evaluating the quality of care for severe pregnancy complications: The WHO near-miss approach for maternal health. World Health Organisation: Geneva, 2011.
18. Souza JP, Gulmezoglu AM, Vogel J, Carroli G, Lumbiganon P, Qureshi Z, et al. Moving beyond essential interventions for reduction of maternal mortality (the WHO Multicountry Survey on Maternal and Newborn Health): a cross-sectional study. *The Lancet*. 2013;381(9879):1747-55
19. McCauley M, Madaj B, White SA, Dickinson F, Bar-Zev S, Aminu M, et al. Burden of physical, psychological and social ill-health during and after pregnancy among women in India, Pakistan, Kenya and Malawi. *BMJ Global Health*. 2018;3(3):e000625
20. Bahl R, Manu AA. Burden of severe maternal morbidity and association with adverse birth outcomes in sub-Saharan Africa and south Asia: protocol for a prospective cohort study (AMANHI Maternal Morbidity study). *J*. 2016 Dec;6(2):020601
21. Geller SE, Koch AR, Garland CE, MacDonald EJ, Storey F, Lawton B. A global view of severe maternal morbidity: moving beyond maternal mortality. *Reprod Health*. 2018 Jun 22;15(Suppl 1):98
22. Udo IE, Doctor HV. Trends in health facility births in sub-Saharan Africa: An analysis of lessons learned under the Millennium Development Goal framework. *Africa Journal of Reproductive Health*. 2016;20(3):108-17
23. Joseph G, da Silva IC, Wehrmeister FC, Barros AJ, Victora CG. Inequalities in the coverage of place of delivery and skilled birth attendance: analyses of cross-sectional surveys in 80 low and middle-income countries. *Reprod Health*. 2016 Jun 17;13(1):77
24. Ronsmans C, Achadi E, Cohen S, Zazri A. Women's recall of obstetric complications in south Kalimantan, Indonesia. *Studies in family planning*. 1997 Sep;28(3):203-14
25. Seoane G, Castrillo M, O'Rourke K. A validation study of maternal self reports of obstetrical complications: implications for health surveys. *International Journal of Gyneacology and Obstetrics*. 1998;62:229-36
26. Stewart MK, Festin M. Validation study of women's reporting and recall of major obstetric complications treated at the Philippine General Hospital. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 1995 Jun;48 S53-66
27. Benova L, Moller AB, Moran AC. "What gets measured better gets done better": The landscape of validation of global maternal and newborn health indicators through key informant interviews. *PLoS One*. 2019;14(11):e0224746
28. Lange IL, Gherissi A, Chou D, Say L, Filippi V. What maternal morbidities are and what they mean for women: A thematic analysis of twenty years of qualitative research in low and lower-middle income countries. *PLoS One*. 2019;14(4):e0214199
29. Say L, Chou D, W. H. O. Maternal Morbidity Working Group. Maternal morbidity: Time for reflection, recognition, and action. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 2018;141 (Supplement 1):1-3
30. World Health Organisation Adamawa Office. Master lists of settlements (Yola North and Yola South). 2014
31. National Population Commission, The DHS Program. Nigeria Demographic and Health Survey 2018. 2019. [Accessed August 2020]. Available from: https://dhsprogram.com/pubs/pdf/FR359/FR359.pdf.
32. Adewemimo AW, Msuyu SE, Olaniyan CT, Adegoke AA. Utilisation of skilled birth attendance in Northern Nigeria: A cross-sectional survey. *Midwifery*. 2014;30:e7-e13

33. Ishola F, Owolabi O, Filippi V. Disrespect and abuse of women during childbirth in Nigeria: A systematic review. *PLoS One*. 2017;12(3):e0174084
34. Adedokun ST, Uthman OA. Women who have not utilized health service for delivery in Nigeria: who are they and where do they live? *BMC Pregnancy and Childbirth*. 2019;19(93):1-14
35. Fagbamigbe AF, Hurricane-Ike EO, Yusuf OB, Idemudia ES. Trends and drivers of skilled birth attendant use in Nigeria (1990–2013): policy implications for child and maternal health. *International Journal of Women's Health*. 2017;9:843-53
36. Doctor HV, Dahiru T. Utilization of non-skilled birth attendants in Northern Nigeria: A rough terrain to the health-related MDGs. *Afr J Reprod Health*. 2010;14(2):36-45
37. Fapohunda BM, Orobaton NG. When women deliver with no one present in Nigeria: Who, what, where and so what? *PLoS One*. 2013;8(7):e69569
38. Doctor HV, Findley SE, Ager A, Cometto G, Afenyadu GY, Adamu F, et al. Using community-based research to shape the design and delivery of maternal health services in Northern Nigeria. *Reproductive Health Matters*. 2012;20(39):104-12
39. Ulin PR, Robinson ET, Tolley EE. Qualitative methods in public health. San Francisco: Jossey-Bass; 2005.
40. Green J, Thorogood N. Qualitative methods for health research. London: SAGE Publications Ltd; 2004.
41. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology*. 2006;3(2):77-101
42. World Health Organisation. Training for mid-level managers (MLM). Module 7: The EPI coverage survey. 2008. [Accessed 28 July 2015]. Available from: http://whqlibdoc.who.int/hq/2008/WHO_IVB_08.07_eng.pdf?ua=1.
43. Lemeshow S, Robinson D. Surveys to measure programme coverage and impact: A review of the methodology used by the Expanded Programme on Immunisation. *World Health Statistics Quarterly*. 1985;38:65-75
44. Tourangeau R. Cognitive sciences and survey methods. In *Cognitive aspects of survey methodology: building a bridge between the disciplines,* Jabine T., Straf, M., Tanur, J. Tourangeau, R., Editors. 1984. Washington, DC: National Academy Press. Cited in Collins, D. Pretesting survey instruments: An overview of cognitive methods. *Quality of Life Research*, 2003, 12 (3), 229-238.
45. Willis GB, Artino AR. What do our respondents think we're asking? Using cognitive interviewing to improve medical eduation surveys. *Journal of Graduate Medical Education*. 2013;September 2013:353-6
46. Fowler FJ, Mangione TW. Standardised survey interviewing: Minimising interviewer-related error. Applied Social Research Methods Series, 18. Newbury: Sage. In Collins, D. (2003). *Quality of Life Research*. 1990;12:229-38
47. Collins D. Pretesting survey instruments: An overview of cognitive methods. *Quality of Life Research*. 2003;12:229- 38
48. Morris JL, Short S, Robson L, Andriatsihosena MS. Maternal health practices, beliefs and traditions in southeast Madagascar. *Afr J Reprod Health*. 2014;18(3):101-17
49. Ononge S, Okello ES, Mirembe F. Excessive bleeding is a normal cleansing process: a qualitative study of postpartum haemorrhage among rural Uganda women. *BMC Pregnancy and Childbirth*. 2016 08 08;16(211):1-11
50. Thaddeus S, Nangalia R. Perceptions matter: Barriers to treatment of postpartum haemorrhage. *Journal of Midwifery & Women's Health*. 2004;49(4):293-7
51. bij de Vaate A, Coleman R, Manneh H, Walraven G. Knowledge, attitudes and practices of trained traditional birth attendants in the Gambia in the prevention, recognition and management of postpartum haemorrhage. *Midwifery*. 2002 Mar;18(1):3-11

52. Sharma V, Leight J, AbdulAziz F, Giroux N, Nyqvist MB. Illness recognition, decision-making, and care-seeking for maternal and newborn complications: a qualitative study in Jigawa State, Northern Nigeria. *J Health Popul Nutr*. 2017 Dec 21;36(Suppl 1):46

53. World Health Organization. A handbook for building skills: Counselling for maternal and newborn health care. 2013. [Accessed November 2020]. Available from: https://apps.who.int/iris/bitstream/handle/10665/44016/9789241547628_eng.pdf?sequence=1

54. March of Dimes. Managing changes after baby. 2020. [Accessed November 2020]. Available from: https://www.marchofdimes.org/it-starts-with-mom/warning-signs-of-health-problems-after-giving-birth.aspx

55. Prata N, Mbaruku G, Campbell M. Using the kanga to measure postpartum blood loss. *Int J Gynaecol Obstet*. 2005;89:49-50

56. Wilcox L, Ramprasad C, Gutierrez A, Oden M, Richards-Kortum R, Sangi-Haghpeykar H, et al. Diagnosing postpartum hemorrhage: a new way to assess blood loss in a low-resource setting. *Matern Child Health J*. 2017 Mar;21(3):516-23

57. Kerr RS, Weeks AD. Postpartum haemorrhage: a single definition is no longer enough. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2017 Apr;124(5):723-6

58. Thaddeus S, Maine D. Too far to walk: Maternal mortality in context. *Social Science and Medicine*. 1994;38(8):1091- 110

Supplementary file 1: Focus group discussion and interview guides

Note: This study was part of a larger project on maternal morbidity within the community in Yola, North-east Nigeria and only questions relevant to this paper's focus have been provided below.

A. Focus group discussion guide

1. How much quantity of blood would you expect a woman to 'normally' lose **during delivery**? How would you quantify it? *Hear their responses first before showing bottle.*

- Do you think the blood could fill up this bottle (*show them 500mL bottle),* or another bottle less or more than this one?

2. How much quantity of blood would you expect a woman to 'normally' lose **within 24 hours after delivery** (ie, from the time the placenta comes out to 24 hours after delivery)? How would you quantify it? *Hear responses before showing bottle.*

- Do you think the blood could fill up this bottle (*show them 500mL bottle),* or another bottle less or more than this one?

3. How would a woman know if she is losing too much blood after delivery?

4. Do you think a woman needs to seek help at any point of her bleeding? If yes, when?

B. Interview guide

1. Now let's talk about your blood loss **during delivery**.

- What can you say generally about the blood you lost during your last delivery?
- Would you say the blood loss was normal or too small or too much? *Why do you say that?*
- If you were to quantify the blood loss, how would you quantify it? (*show 500mL and 1,000mL bottles if woman finds it difficult to quantify blood loss)*
- Were you worried about the amount of blood you lost?
    - *If yes:* Why were you worried?
    - *If home birth*: What did you do then? Did you seek help/solution? *If yes:* what did you do? At what point?

2. Now let's talk about your blood loss **within 24 hours after delivery** (that is, from the time the baby came out to 24 hours after delivery).

- What can you say generally about the blood you lost within this period?

- Would you say the blood loss was normal or too small or too much? *Why do you say that?*
- If you were to quantify the blood loss, how would you quantify it? (*show 500mL and 1,000mL bottles if woman finds it difficult to quantify blood loss)*
- Were you worried about the amount of blood you lost?
    - *If yes:* Why were you worried?
    - What did you do then? Did you seek help/solution? *If yes:* what did you do? At what point?

3. How was your bleeding in the next few days after delivery? How did it compare with the bleeding within the first 24 hours?

Supplementary file 2: Survey questionnaire

Note: This study was part of a larger project on maternal morbidity within the community in Yola, North-east Nigeria and only questions relevant to this paper's focus have been provided below.

S/N	Question	Response
I would like to ask some questions about the blood you lost within the first 24 hours after your delivery. By within the first 24 hours after delivery, I mean the blood you lost from the time after you delivered and after aspects such as your clean-up in the delivery room or stitching, up to 24 hours later.		
1.	Did your palms look pale or white within 24 hours after the delivery?	Yes No Don't know
2.	Did you experience dizziness within the first 24 hours after the delivery?	Yes No Don't know
3.	Were you shivering, that is shaking from feeling cold, within the first 24 hours after the delivery?	Yes No Don't know
4.	Did you feel very weak within the first 24 hours after the delivery such that you were unable to get up or walk?	Yes No Don't know
5.	Did you faint within the first 24 hours after delivery, that is, become unconscious for a brief period?	Yes No Don't know
6.	I would like to ask some questions about your blood flow within the first 24 hours after your delivery: - Was the blood rushing, for example, like tap water or someone passing urine? - Did the blood trickle/flow down your legs? - Did so many big, thick clots of blood come out frequently? - Did you have to double your pad? - Did you have to triple your pad	 Yes / No / Don't know Yes / No / Don't know Yes / No / Don't know Yes / No / Don't know Yes / No / Don't know
7.	Did you stain any of the following within the first 24 hours after the delivery? - Your cloth? - The bed? - The floor?	 Yes / No / Don't know Yes / No / Don't know Yes / No / Don't know
8.	Did your birth attendant or another maternity staff come back after your delivery to scoop out blood from inside you, that is, did he/she come back after you had been cleaned-up or stitched and then inserted his/her hand into your vagina or massaged your abdomen to expel left-over blood?	Yes No Don't know
9.	*For hospital deliveries only:* Did any maternity staff mention that your blood level had reduced significantly, for example, after testing your PCV?	Yes No Don't know
10.	Did you have to summon/call a maternity staff at some points after the delivery to check you because you were worried about your bleeding?	Yes No Don't know

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the inter view or focus group?	
Duration	21	What was the duration of the inter views or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

BMJ Open

Women's perceptions and self-reports of excessive bleeding during and after delivery: findings from a mixed-methods study in Northern Nigeria

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-047711.R2
Article Type:	Original research
Date Submitted by the Author:	19-Jul-2021
Complete List of Authors:	Yargawa, Judith; University College London, Institute for Global Health Fottrell, Edward; University College London, Institute for Global Health Hill, Z; University College London, Institute for Global Health
Primary Subject Heading:	Global health
Secondary Subject Heading:	Obstetrics and gynaecology, Qualitative research, Research methods, Public health
Keywords:	OBSTETRICS, PUBLIC HEALTH, QUALITATIVE RESEARCH, STATISTICS & RESEARCH METHODS, SOCIAL MEDICINE

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Women's perceptions and self-reports of excessive bleeding during and after delivery: findings from a mixed-methods study in Northern Nigeria

Judith Yargawa[1*], Edward Fottrell[1], Zelee Hill[1]

[1] Institute for Global Health, University College London, London, United Kingdom

* Corresponding author (judith.yargawa.14@ucl.ac.uk)

ABSTRACT

Objectives: To explore lay perceptions of bleeding during and after delivery, and measure the frequency of self-reported indicators of bleeding.

Setting: Yola, North-East Nigeria

Participants: Women aged 15-49 years who delivered in preceding two years of data collection period (2015-2016), and their family members who played key roles.

Methods: Data on perceptions of bleeding were collected through seven focus group discussions (FGDs), 21 in-depth interviews and 10 family interviews. Sampling was purposive and data were analysed thematically. A household survey was then conducted with 640 women using cluster sampling on postpartum bleeding indicators developed from the qualitative data; data were analysed descriptively.

Results: Perceptions of excessive bleeding fell under four themes: quantity of blood lost; rate/duration of blood flow; symptoms related to blood loss; and receiving birth interventions/hearing comments from birth attendants. Young and less educated rural women had difficulty quantifying blood loss objectively, including when shown quantities using bottles. Respondents felt that acceptable blood loss levels depended on the individual woman and whether the blood is 'good' or 'diseased/bad.' Respondents believed that 'diseased' blood was a normal result of delivery and universally took steps to help it 'come out.' In the quantitative survey, indicators representing less blood loss were reported more frequently than those representing greater loss, e.g., more women reported staining their clothes (33.6%) than the bed (18.1%) and the floor (6.2%). Overall, indicators related to quantity and rate of blood flow had higher frequencies compared to symptom and intervention/comment-related indicators.

Conclusion: Women quantify bleeding during and after delivery in varied ways and some women do not see bleeding as problematic. This suggests the need for standard messaging to address subjectivity. The range of indicators and varied frequencies highlight the challenges of measuring excessive bleeding from self-reports. More work is needed in improving and testing validity of questions.

Key words: Obstetric haemorrhage, excessive bleeding, blood loss, intrapartum haemorrhage, postpartum haemorrhage, qualitative study, household survey, mixed-methods

Word count: 4,627

Strengths and limitations of this study

- Around 60% of deliveries in the wider study setting take place at home; our community-based recruitment attempted to capture cases that do not make it to health facilities, hence differ from the facility-based measurement approaches dominating literature.
- This study is one of the few studies to explore perceptions of bleeding during and after delivery in-depth, which helped identify several lay methods in which women and families conceptualise excessive bleeding during and after delivery.
- The qualitative phase helped inform design of the questionnaire used in the community-based survey; a mixed-methods approach helped provide key methodological implications for future studies aiming to measure excessive bleeding during and after delivery.
- We recruited a mainly urban sample and did not interview other respondents such as birth attendants or families of women who had died from excessive bleeding.
- In the quantitative phase, we used prompting to assess experience of excessive bleeding and this may have increased reporting.

INTRODUCTION

Haemorrhage accounts for about 25% of global maternal deaths,[1] with most of the estimated 295,000 annual deaths occurring in low income settings[2] and within 24 hours of delivery.[3] Haemorrhage is also a leading cause of severe maternal morbidity, maternal near misses and emergency obstetric interventions.[4-7] These adverse outcomes could be reduced by having a skilled attendant at birth, active management of the third stage of labour and if women recognised and were able to access timely care for danger signs during home births and following postpartum hospital discharge. Studies have found that women across Sub-Saharan African settings have good knowledge that exessive bleeding is a danger sign,[8-14] but few studies have explored how women conceptualise excessive bleeding and determine whether it is occuring.

There has been a renewed global interest in measuring maternal morbidity, with recent achievements including standardisation of key definitions,[15, 16] development of tools,[15, 17] and large scale studies.[18-20] Prevalence data on excessive bleeding have primarily been obtained from facility sources as these are considered more reliable than self-reports from women.[21] However, facility data may not be representative as institutional delivery is still below 60% in several Sub-Saharan African countries.[22, 23] Studies which validated women's self-reports of excessive bleeding against medical records, examinations and observations have found overestimation and specificity issues[24-26], which resulted in such questions being removed from surveys.[27] These studies are relatively old and few were informed by qualitative research, the use of which has been recently advocated for by measurement experts.[28, 29] This mixed-methods study aimed to explore women's perceptions of bleeding during delivery and within the first 24 hours post-delivery, and use these insights to measure the frequency of self-reported indicators of excessive bleeding in Northern Nigeria.

METHODS

The study area, study designs and eligibility criteria

Data were collected in Yola, Adamawa state, North-east Nigeria between December 2015 and November 2016. Yola, with a population of 823,220 people, is divided into two Local Government Areas - Yola North, the urban administrative and commercial capital of the state, and Yola South, the traditional headquarters which is a mixture of urban and rural areas.[30] Yola has one tertiary hospital, one state hospital, numerous primary health care facilities and several private health facilities. Demographic and health indicators for Yola are not readily available; however, in Adamawa State, 47.0% of women aged 15-49 years have no education and only 20.7% have completed secondary school.[31] 82.1% received antenatal care from a skilled providers in their last pregnancy but only 40.5% delivered with a skilled attendant.[31] This low utilization stems from a combination of factors including deprivation, disrespectful/abusive care, socio-cultural reasons, ethnicity, not having a perceived need for facility delivery and poor accessibility.[32-38]

A qualitative phase consisted of focus group discussions (FGDs), in-depth interviews (IDIs) and family interviews and was followed by a household survey. In both phases, eligible women were those aged 15-49 years, married, Yola residents who had given birth within the two years preceding the study. Women in the qualitative sample were not part of the quantitative sample.

The qualitative phase: sampling, data collection and analysis

This study adopted the interpretative approach, a paradigm which acknowledges the subjectivity and multiplicity of reality,[39] and aims to understand the world from participants' point of view.[40] The IDI respondents were sampled to give a range of ages, self-reported morbidity experiences and educational levels (none, primary, secondary, post-secondary). Sampling grids with estimated sample sizes for each subgroup were developed but data were collected until saturation was reached. The family interviews entailed discussions with family members who played key roles in the maternal experiences of a subset of IDI participants; selection depended on the woman's unique circumstances and/or household factors, e.g. family members serving as her birth attendant. The FGDs were stratified by residence (urban/rural) and age. One FGD was conducted with women who had completed at least a bachelor's degree in order to obtain a different perspective from women who had lower educational levels. Eligible women were approached face-to-face and given further explanations using information sheets and invited to participate. Respondents were recruited through a women's empowerment community centre, snowball sampling and community liaisons.

Data were collected in English or Hausa based on the respondent's fluency using a pre-tested semi-structured topic guide by the first author (female, PhD student at the time, with prior training in qualitative research methods). All IDIs and family interviews were conducted in respondents' homes (except one IDI in a workplace), and the FGDs in homes or the Women's Development Centre. On average, the FGDs lasted one hour, the IDIs 45 minutes and the family interviews 30 minutes. IDI topics included what the respondent remembered about her blood loss during delivery, how she would quantify it (small, normal or excessive), why she felt it was small, normal or excessive and whether she was worried/scared about the amount lost (Supplementary file 1). Women were shown bottles of 500mL and 1,000mL, the clinical cut-offs for postpartum haemorrhage and severe postpartum haemorrhage respectively,[3] to see if this helped quantify blood loss. Similar questions were asked for the first 24 hours post-delivery. The family interviews were primarily designed to explore care-seeking for morbidities, but were included in the analysis where this was in relation to bleeding. In the FGDs, respondents were asked how much blood they would expect a woman to lose during delivery and in the first 24 hours after delivery, how a woman would know if her blood loss was normal or excessive, and how they would quantify blood loss. They were also shown the 500mL and 1,000mL bottles (Supplementary file 1).

All sessions were audio-recorded. Follow-up calls or sessions were carried out with a quarter of the respondents at later days to clarify unclear areas or to acquire further information. The IDIs and FGDs were translated and transcribed in English primarily by the first author; around eight IDIs were transcribed by assistants and these were double-checked line-by-line against the audio-recording to ascertain completeness and validity. The family interviews were left in audio format and analysed directly from the recordings as they did not focus on bleeding per se and only contained a few relevant sections. Data were analysed using thematic analysis primarily informed by Braun and Clarke (2006) using both deductive (guided by the research questions and coding frame) and inductive approaches (guided by the data).[41] A coding tree was developed inductively from analyses of pre-test transcripts; these codes then formed the deductive codes applied to subsequent transcripts. Any new codes that emerged inductively during analysis were added to the tree. Data were managed using NVivo 10.

The quantitative phase: sampling, data collection and analysis

Three-stage cluster sampling was conducted at the ward (smallest administrative unit), settlement and participant levels using probability proportional to size (PPS) sampling. 12 of 22 wards were selected in stage one, five settlements from each ward in stage two (corresponding to 60 clusters in total), and 11 eligible participants were selected from each cluster in stage three using the Expanded Program of Immunisation (EPI) method.[42, 43]. The sampling frame and population size for wards and settlements for stages one and two were obtained from the local authorities. Data collectors were given standard operating procedures to select eligible women at stage three using the EPI method. Once households were identified, information about the study was provided and the eligibility criteria were asked. Eligible women were approached face-to-face and given further explanations using information sheets and invited to participate. The sample size was calculated as 660 based on: 5% precision; 5% significance level; 1.5 design effect; 10% non-response rate; and a conservative prevalence of maternal health problems of 50%.

We developed a questionnaire by reviewing literature, adapting questions from existing surveys and consulting relevant researchers. The questionnaire was then refined with further insights from the qualitative phase to aid comprehension and validated using cognitive interviews, which aimed to assess whether the questionnaire was measuring what it intended to measure by exploring the question-and-answer process to identify potential sources of error.[44-47] We asked a range of questions across the domains that emerged from the qualitative findings in order to compare the frequencies they elicited. This included the extent of staining and soaking of clothes and surfaces, nature and consistency of blood flow, medical procedures received and symptoms of shock (Supplementary file 2).

The questionnaire was paper-based and administered face-to-face by four female data collectors in Hausa or English in the respondents' homes. Data were entered using EpiData 3.1 and organised and analysed descriptively using Stata 14, with weighting and adjustment as appropriate.

Informed consent and ethical approval

Informed consent was obtained from all respondents. Ethical approval was obtained from the Adamawa State Ministry of Health (Reference Number: S/MoH/HS/1131) and the University College London Research Ethics Committee (Project ID: 6846/003), and verbal approval from appropriate community leaders. Pseudonyms have been used in reporting direct quotes.

Patient and public involvement

A preliminary study was conducted prior to the main data collection in a different setting to pretest the interview topic guide for comprehension and length. Feedback was solicited from respondents after the interview sessions on areas including the nature of the questions asked, clarity of instructions and whether respondents objected to answering any question. Their inputs helped inform refinement of the interview topic guide.

RESULTS

Characteristics of respondents

21 IDIs were conducted and respondents ranged from 16-40 years of age, half lived in rural areas, 14 had minimal/no education, and eight had home deliveries. Ten family interviews were conducted with co-wives, husbands or other females in the women's families. Seven FGDs of 5-8 women (44 women in total) were conducted with women aged 15-48 years. In six of the FGDs, almost all respondents had no/primary education and in one group consisted of more educated respondents. Four FGDs were in urban areas and three in rural areas. Most women in the urban FGDs had given birth in health facilities while the rural FGDs had an almost even split between home and health facility deliveries. In the IDIs, there was one refusal due to competing priorities and one respondent's house could not be located. One FGD respondent did not show up.

In the quantitative phase, there were 15 refusals and three exclusions due to incapacitation; this corresponded to 642 women being surveyed - a 97% response rate. Two questionnaires were incomplete and/or unidentifiable, hence data from 640 women were included. The characteristics of the women are shown in Table 1: 77% were 20-34 years of age, 75% were Muslim, 75% resided in urban areas, 52% had no or primary education, 58% did not work, 63% had a facility birth in their most recent delivery, 19% had one child and 28% five or more children.

Table 1: Socio-demographic and obstetric characteristics of survey respondents (n=640)

Characteristic	Frequency	Weighted Proportion % (95% CI)
Age (years)		
15-19	52	8.5 (5.3- 13.4)
20-34	476	76.7 (73.4- 79.7)
35-49	93	14.8 (10.8- 20.0)
Religion		
Islam	476	74.7 (58.8- 85.9)
Christianity	161	25.3 (14.1- 41.3)
Residence		
Rural	161	25.0 (8.0- 56.1)
Urban	479	75.0 (43.9- 92.0)
Highest educational level completed/currently attending		
Never attended school/ non-western education	199	32.6 (23.6- 43.1)
Primary	137	19.4 (15.0- 24.6)
Secondary	243	39.3 (30.4- 48.9)
Post-secondary	58	8.8 (5.1- 14.9)
Literacy		
Can read in any language	255	44.2 (34.8- 54.0)
Cannot read in any language	341	55.8 (46.0- 65.2)
Main occupation		
Unemployed/house-wife	361	58.0 (54.3- 61.6)
Unskilled	202	31.3 (24.7- 38.9)
Skilled	72	10.7 (6.6- 16.9)
Gravidity		
1	91	14.9 (11.9- 18.6)
2-4	322	51.3 (46.3- 56.2)
5-9	191	28.5 (23.8- 33.8)
≥10	34	5.3 (3.6- 7.8)
Parity		

1	115	18.8 (15.1- 23.3)
2-4	336	53.6 (49.4- 57.8)
5-9	165	24.6 (20.3- 29.5)
≥10	19	3.0 (1.7- 5.1)
Place of last delivery		
Home/TBA's place	228	36.5 (27.0- 47.2)
Public health facility	350	54.0 (46.3- 61.6)
Private health facility	55	9.4 (5.8- 15.0)
Birth Attendant		
Unskilled	194	32.1 (22.8- 43.0)
Nurse/midwife/community health worker	381	58.7 (50.1- 66.8)
Doctor	54	9.2 (5.5- 15.1)

* Missing data: 19 in age, 3 in woman's highest educational level, 5 in main occupation, 44 in literacy (likely due to some respondents being 'semi-literate' and questionnaire did not have the option), 2 in religion (1 other), 2 in gravidity, 5 in parity, 11 in birth attendant and 7 in place of delivery.

General perceptions on bleeding

Three themes emerged from the qualitative data relating to perceptions of bleeding: divergent views as to whether some bleeding after delivery is beneficial or harmful; the existence of 'good' and 'bad' blood; and acceptable levels of blood loss being individually determined.

Respondents had varied opinions about whether blood *'needs'* to come out after delivery. One group of women felt bleeding was beneficial: "*if it does not come out a lot, it disturbs me in the stomach"* (FGD 6); *"if the blood doesn't pour a lot, it just stays [in the stomach] and hurts*" (Family Interview #10). A second group felt blood loss was dangerous, and a final group acknowledged that bleeding was a paradox: "*blood has this dilemma: it is problematic when it comes out and it is problematic when it doesn't come out*" (FGD 1); "*it needs to pour but it should not pour too much*" (Family interview #7). These varied viewpoints sometimes led to disagreement during FGDs:

> ***Lilian**: I think it is better for her to bring out the blood*
> ***Interviewer**: OK. Why do you say so?*
> ***Lilian**: Because of the dirt inside.*
> ***Interviewer**: OK*
> ***Hadiza**: But for some, don't you see that if the blood has snapped [becomes uncontrollable] and comes out, that's a problem? If it hasn't snapped, it stays still. For some, it is usually the bleeding that causes them to transfuse the person*
> ***Amal**: She'll just be feeling dizziness*
> ***Hadiza**: She'll just be dizzy. It is the bleeding that causes them to add the blood* (FGD 5, rural, no/primary education, 20-34 years group, parity 1-9).

Respondents categorized blood as being 'good' or 'diseased/bad/dirty' based on its colour and consistency. 'Good' blood is red, bright, fresh and comes from "*the blood in circulation.*" 'Diseased/bad/dirty' blood is blackish, dark, clotted and comes from a diseased area – "*disease is what is pouring.*" Diseased blood was considered a normal result of delivery and this blood was thought to cause abdominal pain if retained; consequently removal of this blood was universally done post-delivery through hot water baths, massages and drinks, except in Caesarean-section deliveries:

> *If it were just blood dripping (hisses briefly), I wouldn't have appreciated the practice. But to have seen CLOTTED BLOOD coming out [during my wife's hot water postpartum bath], I think I appreciated it. And I encouraged her [to remove the blood]… there was some bleeding inside and it got stuck there, which I think it will not be good afterwards. So those traditional practices, I think they are good* (Family interview #8, husband, urban, educated family).

There was also a perception that women have different quantities of blood in their bodies: "*blood, it is body-by-body*" and "*everyone has a blood level that God has given her*." This meant that women were expected to have different levels of bleeding and those with a lot of blood can lose more blood during and after delivery and vice versa:

> ***Farida**: …It depends on how everyone's blood is. One can bleed a lot, no problem. But another person, when she bleeds, you must have problem. [she later likens this to how women's menstrual flow also differs]* (FGD 7, rural, no education, 15-19 years group, parity 1 each).

> *Because you know for someone the blood will pour very much. But for another person, she has insufficient blood it will not pour much. Well my own is like that, it did not pour a lot* (IDI 14, rural, no education, 19 years, parity 1).

Birth attendants, particularly skilled birth attendants, were thought to *'scoop'* the diseased blood out during delivery which would affect levels of postpartum bleeding – if the *'scooping'* had been done well, a woman would lose less blood. Similarly, a few respondents reported that during a Caesarean-section blood is usually evacuated and blood flow controlled.

Perceptions of normal and too much blood loss

Women determined if too much blood had been lost in four ways: the visible quantity lost; the rate and duration of blood flow; the presence of symptoms related to blood loss; and receiving an intervention to ameliorate the blood loss or hearing comments from birth attendants (Table 2).

Related to quantity of blood lost

Respondents quantified the blood they lost during delivery by comparing it to volumes such as drip bags or hospital kidney bowls. For bleeding within the first 24 hours postpartum, some women made comparisons to their menstrual flow. More educated respondents estimated in litres, while 15-19 year olds and some rural women struggled to quantify blood loss at all, using terms such as "*if it pours too much"* despite probing on quantities. Overall, there was no consensus on how to quantify blood loss but when shown 500mL and 1,000mL bottles, FGD respondents reached consensus that 1,000mL was too much blood to lose, while responses to the 500mL bottle included "*some blood is still left inside, it has not finished coming out.*" IDI responses were similar, although there was some variation in perceptions of which bottle constituted too much blood loss.

The extent to which blood stained, soaked through or dripped from clothing, pads or surfaces was also used to quantify bleeding, as illustrated by this respondent who felt too much blood was lost if clothes were so soaked they looked like they had been washed in blood: "*you're*

picking …[it][clothe] from blood, as if you're washing it in it". The frequency with which pads needed to be changed postpartum, or the number used at one time were also used to quantify blood loss, with FGD respondents reporting that changing pads three or four times per day or doubling or tripling them would mean too much blood was being lost.

Women also compared their blood loss to previous deliveries, for multiparas, and to other women: *"I lost more blood in that [delivery] of Tim than Tony*" and "*it was for this one [delivery] that it [blood] poured a lot, but it did not pour a lot for these ones [other deliveries]*."

Related to rate and duration of blood flow

This theme was related to the perceived force with which blood flowed, and was mostly used to describe bleeding within the first 24 hours postpartum. Too much blood loss was when blood was "*rushing,"* or flowed "*like passing urine"* or "*like water, like tap*." Duration of bleeding was also used as an indicator, with bleeding expected to have stopped by the baby's naming ceremony (seven days postpartum) or by the 40 days postpartum recuperation and purification period.

Symptoms related to blood loss

Respondents also used symptoms to determine if too much blood had been lost; these were similar to biomedical symptoms of shock. The most common symptoms mentioned were being unable to get up/feeling like falling down, fainting, dizziness, headache and weakness. Other symptoms mentioned included hearing changes, paleness, body pains and shaking: "*your body will also be shaking. Just like that, you'll see yourself shaking*."

Some women spontaneously reported that they had been worried about the amount of blood they had lost, while others reported being frightened on probing using statements such as "*I was totally agitated*" and "*it shocked me you know…*"

Birth interventions received and comments from birth attendants

Respondents who delivered in facilities reported that they would know if they had bled too much if: they had received a blood transfusion; their relatives were asked to look for blood donors; they were referred to a higher level facility because of the bleeding; they were given 'blood tonic' tablets or supplements to increase their blood; they were given injections or tablets to stop the bleeding; or health staff needing to 'scoop' their blood out. Some women used comments made by birth attendants to make judgements on their blood loss either because health workers "*didn't say the blood is short in my body*" or said they had lost a lot of blood or "*should be given food that will increase your blood*."

Table 2: Overview of respondents' perceptions of excessive bleeding

Theme	Description	Sample quotes
Related to quantity of blood lost	Methods used to quantify bleeding. This also included the extent to which blood stained or soaked through clothing, pads or surfaces, and comparison of one's bleeding to previous deliveries or those of other women	**Taniyo**: Well, I thought I lost almost 50cL oh [500mL], because I, I stood up, it was dripping like water. …Yes. I was having pad but it was coming out underneath like water, I'm telling you. The pad was soaked, my pant, everything, the ground, the- everywhere was just wet. Not bed oh, now I came down from the bed, everything on the ground was wet … with the blood. Yes. I believe then-… I lost almost 50cL or more than… (FGD 4, urban, bachelor's degree minimum, 20-34 years group, parity 1-2). **Rachel**: For some, it depends on your delivery. From the 1st to the 2nd to the 3rd to the 4th to the 5th, all, you'll be able to know the way blood pours for you. The delivery you first started, you'll be able to mark the blood that poured previously and then the most recent one, the one you're currently in. Yes, you'll be able to differentiate it (FGD 6, rural, no/primary education, 35-49 years group, parity 6-10).
Related to rate and duration of blood flow	The perceived force with which the blood was coming out, and whether or not bleeding goes beyond an expected end-point	**Interviewer**: But apart from looking at the pad, is there another way a woman will know if she's bleeding a lot?... **Isatu**: Yes, you'll feel it pouring…. **Amina**: You'll feel it in your body that it's rushing. **Interviewer**: How, like how? **Hasiya**: Someone will feel it like water, like passing urine. The way it's coming out (FGD 3, urban, a range of education levels, 15-19 years group, parity 1-3).
Symptoms related to blood loss	Signs and symptoms signalling much bleeding. Also includes the extent to which the bleeding made women or others scared or worried	**Maimuna**: After delivery, the doctors usually ask someone to lie down for at least 6 hours. …When [you] lie down and you need to pass urine or something, they say, "Stand up, go ahead and do it." If you've lost too much blood, the moment you get up, you'll faint. That way, they'll know that you've lost too much blood…I experienced this with this baby [points to the baby she's holding]. When I came up- I was lying on the bed. Then they told me, "you've been discharged." Then they said, "Get up, let's go." I got up and I could see people, but later on I was on the ground. I fell down and fainted (FGD 1, urban, mostly no/primary education, 20-34 years group, parity 3-7).
Birth interventions received and comments from birth attendants	Interventions done by maternity staff and comments from birth attendants	**Respondent**: … So after delivering, then I started bleeding. So I have to call them [*maternity staff]*, then they gave me some injections to stop it and some tablets. **Interviewer**: OK. But now the bleeding, …would you say it was normal or much or small? That's the bleeding now. **Respondent**: It's much. **Interviewer**: OK why do you say that? **Respondent**: Because some people, with- you'll see their bleed[ing] is just small, the blood that will come out is small, some is just normal and some much. Because they have to like inject me and give me some tablets that will stop the bleeding (IDI 17, urban, post-secondary education, 40 years, parity 4).

Frequency of self-reported indicators of excessive bleeding after delivery

We developed a survey instrument to measure self-reported postpartum bleeding using a series of questions that reflected the domains which emerged from the qualitative research. Table 3 shows the self-reported prevalence of each indicator by domain. For most domains, reported prevalence decreased as severity of the indicator increased. For example, more women (33.6%) reported staining their clothes, than reported staining the bed (18.1%), than reported staining the floor (18.1%). The less severe indicators (stained clothes, blood trickled down leg, and feeling weak) were reported by around a third of women; while the more severe indicators (staining the floor, using triple pads, and fainting) were reported by between 3.3% and 6.2% of women. Overall the indicators related to the quantity and rate of blood flow had higher frequencies compared to symptom and intervention/comment-related indicators.

Table 3: Self-reported prevalence of each bleeding indicator within 24 hours of delivery (n=640)

Indicator	Frequency (n)	Weighted Proportion % (95% CI)
Quantity of blood lost		
Stained clothes	214	33.6 (28.9- 38.7)
Stained the bed	120	18.1 (14.3- 22.6)
Stained floor	43	6.2 (4.7- 8.2)
Doubled pad	287	45.7 (37.1- 54.6)
Tripled pad	21	3.3 (1.6- 6.7)
Frequent big, thick clots of blood	359	63.0 (58.0- 67.7)
Rate of blood flow		
Blood trickled down leg	213	33.1 (27.5- 39.3)
Blood rushed like tap water/urine	198	31.6 (25.6- 38.3)
Intervention or comments from maternity staff		
Birth attendant returned to scoop out the blood	102	14.5 (9.7- 21.3)
Staff commented that blood levels were reduced	32	8.5 (5.7- 12.7)
Symptoms of blood loss		
So weak could not get up and walk	179	29.9 (23.7- 36.9)
Dizziness	146	23.3 (19.8- 27.3)
Shivering	93	14.7 (11.2- 19.0)
Palms looked white/pale	75	12.4 (9.0- 16.9)
Fainted	27	4.6 (3.2- 6.5)

DISCUSSION

This study explored lay perceptions of bleeding during delivery and within the first 24 hours post-delivery using mixed-methods. Women had divergent views on blood loss, categorised some blood *'bad blood'* as needing to come out after delivery and felt that the impact of blood loss was dependent on how much blood individual women had. The concept of 'bad blood' as something that needs to be removed from the womb has been reported elsewhere in Africa.[48, 49] In Uganda, the 'bad blood' was seen as accumulated blood from not menstruating during pregnancy.[49] These views that some types of blood loss are acceptable and required, and that some women can manage blood loss better than others may delay care seeking for some women and highlight that perceptions of excessive bleeding may vary considerably across women and types of blood.[49, 50]

We found that perceptions relating to quantifying excessive bleeding were related to: quantity of blood lost; rate and duration of blood flow; symptoms related to blood loss; and birth interventions received/comments from birth attendants. The themes that emerged relating to how women quantified blood loss (quantity lost, rate and duration of flow and symptoms related to blood loss) are similar to those reported in other studies – although the specific measures used within these categories varied by study. Quantity was measured in terms of clots, comparison to menstrual flow and the need to change pads frequently in Uganda;[49] by whether the blood would fill a 'food can' and the number of soaked pieces of clothes in the Gambia;[51] and by the extent items were soaked in North-west Nigeria.[52] Rate of flow was mentioned in Uganda[49] as blood flowing "like an open tap," or past the delivery area in the Gambia,[51] and heavy flow in North-west Nigeria.[52] Symptoms of blood loss were fainting, dizziness, collapsing, being unable to sit up, and falling unconscious in Uganda[49] and paleness, shivering, weakness and falling unconscious in North-west Nigeria.[52]

While the symptoms related to blood loss are in line with the biomedical descriptions of shock, most measures used by mothers were subjective and some women struggled to quantify blood loss at all. This subjectivity may make recognition of haemorrhage difficult, which has important implications as the first step in seeking care for postpartum haemorrhage is recognising that the bleeding is indeed excessive. The use of multiple subjective measures is also problematic for measurement. The current health promotion messaging on excessive bleeding in the setting is not clear in the literature However, a few sources elsewhere suggest that the recommendations on postpartum danger signs are quite varied: a counselling handbook by the World Health Organization says care should be sought immediately when the bleeding has 'increased' or is 'more than normal,'[53] while a March of Dimes resource for new mothers describes such bleeding as 'heavier than a normal period' or 'gets worse' over time.[54] This study highlights the need for standard messaging to address subjectivity. Clear information on detrimental blood loss quantity could be included in these messages using everyday descriptions or tools that women are familiar with. These descriptions may likely be context-specific, hence it is important to use tailored approaches. In addition, while women correctly identified symptoms associated with excessive bleeding, some of these were extreme manifestations; thus they would need to be reminded not to wait until these symptoms occur before seeking care.

In the quantitative phase, we measured the frequency of self-reported indicators of excessive postpartum bleeding based on women's recall of their experiences within the first 24 hours post-delivery. We found that different measures of excessive bleeding had very varied frequencies; that within a domain, reported prevalence decreased as severity of the indicator increased; and that indicators related to rate of blood flow and quantity of blood lost had higher frequencies compared to indicators related to symptoms of blood loss and birth interventions received/comments from birth attendants. That prevalence is lower for the more severe indicators within each domain and for the domains related to interventions and symptoms of blood loss is reassuring. However, the prevalence of some measures were surprisingly high, for example, 32% of women reported blood rushing like a tap or urine and it is likely that these overestimate excessive bleeding from a biomedical perspective. This confirms the difficulty in measuring excessive bleeding in surveys reported in validity studies.[24-26] The use of multiple descriptive measures shows the wide range of estimates that can be obtained based on choice of question, and it does not appear to have made the measures more objective.

Self-reported data might still be useful for estimating excessive bleeding at the population level. Their usefulness perhaps lies in holistically assessing a list of indicators rather than considering indicators on a stand-alone basis. The indicators could be assigned scores, a composite score could then be computed, and level of blood loss established from a severity scale with validated cut-offs (for instance, mild, moderate, severe). Scales are already being used to assess maternal conditions such as postpartum depression, although we acknowledge that these conditions are different in terms of aetiology and manifestation. It appears a few studies in the literature are starting to use a range of questions rather than focusing on single ones for measuring excessive bleeding. In their large population-based study across eight Sub-Saharan and South Asian countries, the AMANHI study asked a combination of questions to establish severe bleeding including wetting of clothes and floor, loss of consciousness and whether the woman needed an 'operation' to stop the bleeding.[20] In addition, innovative, low-cost methods could be developed to standardise subjective descriptions of excessive bleeding for measurement purposes. These might be more relevant for visual and soaking estimation methods and there are a few useful examples in the literature.[55, 56]

Until universal institutional delivery is achieved in low income settings and more objective measurement methods that work seamlessly in community settings are developed, self-reported data are likely to still be needed for population-level measurement of maternal conditions such as excessive bleeding. Our findings followed the trends that we would expect (indicators of quantity of blood lost and rate of flow showed higher frequencies than symptoms and interventions) and showed the expected dose response within a particular domain of blood loss; these offer some hope. More objective methods are still necessary but this will depend on the purpose for measurement. Kerr and Weeks (2016) argue that "a single definition is no longer enough" for postpartum haemorrhage as different definitions are needed for different purposes: to make decisions about the point to commence treatment; for quality of care audits; and for research purposes.[57] It will be necessary to first clarify the aim of measurement, and appropriate methods can then be selected.

Our study is one of the few studies to explore perceptions of bleeding during and after delivery in-depth. It showed perceptions that could contribute to delays in decision to seek timely care.[58] As obstetric haemorrhage is a leading cause of maternal mortality and severe morbidity,

tailoring messages to address perception of bleeding could potentially save lives. We recruited a mainly urban sample and did not interview respondents such as birth attendants or families of women who had died from excessive bleeding, as they would have added valuable information on recognition and care-seeking for excessive bleeding. Interviewing these additional respondents would be beyond the scope of this paper and as we recruited respondents from the community, it would have been difficult to identify the families of women who had died from excessive bleeding from non-facility settings. In the quantitative phase, we used prompting to assess experience of excessive bleeding and this may have increased reporting. Use of self-reports may have also been influenced by reporting and recall bias, as it may have been difficult to recollect how much blood was lost within the first 24 hours several months later. In addition, recollections could have been influenced by other factors such as medical diagnosis of postpartum haemorrhage and whether or not birth attendants communicated estimates of blood loss to women. These limitations are, however, inherent in cross-sectional studies.

CONCLUSION

Women conceptualise bleeding and quantify excessive bleeding during and after delivery using a variety of subjective identification methods; these may make recognition of haemorrhage for prompt care-seeking difficult hence highlighting the need for standard messaging to address subjectivity. The quantitative findings highlight the challenges of measuring excessive bleeding from self-reports. More work is needed in improving and testing validity of questions, and developing alternative methods for analysing indicators from self-reports.

Acknowledgements

We would like to thank all respondents for providing valuable insights, as well as the data collection team, transcription assistants, data entry team and community liaisons for the immense support given.

Author Contributions

All authors designed the project and developed the study tools. JY collected the data/supervised the data collection, with substantial inputs from EF and ZH. JY drafted the initial manuscript and all authors reviewed, edited and approved the final manuscript.

Funding

This study was funded by the University College London Graduate Research Scholarship and University College London Overseas Research Scholarship.

Competing interests

The authors declare that they have no competing interests.

Patient consent for publication

Not required

Ethics approval

Ethical approval was received from the Adamawa State Ministry of Health (Reference Number: S/MoH/HS/1131) and the University College London Research Ethics Committee (Project ID: 6846/003), and verbal approval from appropriate community leaders.

Data sharing statement

Data sharing requests could be addressed to the corresponding author.

Table legends

Table 1: Socio-demographic and obstetric characteristics of survey respondents (n=640)

Table 2: Overview of respondents' perceptions of excessive bleeding

Table 3: Self-reported prevalence of each bleeding indicator within 24 hours of delivery (n=640)

Supplementary file legends

Supplementary file 1: Focus group discussion and interview guides

Supplementary file 2: Survey questionnaire

REFERENCES

1. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller A-B, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. *The Lancet Global Health*. 2014;2(6):e323-e33
2. World Health Organization. Trends in maternal mortality 2000 to 2017: Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division World Health Organization. Geneva: World Health Organization, 2019.
3. World Health Organisation. WHO recommendations for the prevention and treatment of postpartum haemorrhage. 2012. [Accessed April 2020]. Available from: http://apps.who.int/iris/bitstream/10665/75411/1/9789241548502_eng.pdf.
4. Sotunsa JO, Adeniyi AA, Imaralu JO, Fawole B, Adegbola O, Aimakhu CO, et al. Maternal near-miss and death among women with postpartum haemorrhage: a secondary analysis of the Nigeria Near-miss and Maternal Death Survey. *BJOG*. 2019;126(Suppl 3):19-25
5. Oladapo OT, Adetoro OO, Ekele BA, Chama C, Etuk SJ, Aboyeji AP, et al. When getting there is not enough: a nationwide cross-sectional study of 998 maternal deaths and 1451 near-misses in public tertiary hospitals in a low-income country. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2016;123(6):928-38
6. Maswime S, Buchmann E. A systematic review of maternal near miss and mortality due to postpartum hemorrhage. *Int J Gynaecol Obstet*. 2017 Apr;137(1):1-7
7. Rocha Filho EA, Costa ML, Cecatti JG, Parpinelli MA, Haddad SM, Pacagnella RC, et al. Severe maternal morbidity and near miss due to postpartum hemorrhage in a national multicenter surveillance study. *Int J Gynaecol Obstet*. 2015 Feb;128(2):131-6
8. Geleto A, Chojenta C, Musa A, Loxton D. WOMEN's Knowledge of Obstetric Danger signs in Ethiopia (WOMEN's KODE):a systematic review and meta-analysis. *Syst Rev*. 2019 Feb 25;8(1):63
9. Kabakyenga JK, Ostergren PO, Turyakira E, Pettersson KO. Knowledge of obstetric danger signs and birth preparedness practices among women in rural Uganda. *Reprod Health*. 2011 Nov 16;8:33
10. Bintabara D, Mpembeni RNM, Mohamed AA. Knowledge of obstetric danger signs among recently-delivered women in Chamwino district, Tanzania: a cross-sectional study. *BMC Pregnancy Childbirth*. 2017 Aug 29;17(1):276
11. Masoi TJ, S.M. SMK, Ibolinga AE, Lilungulu AG. The pattern and level of knowledge on obstetric and newborn danger signs and birth preparedness among pregnant women in Dodoma Municipal: a cross sectional study. *East African Health Research Journal*. 2020;4(1)
12. Rabiu A, Ladu HI. Knowledge of obstetric danger signs among pregnant women attending antenatal clinic in Murtala Muhammad Specialist Hospital, Kano, Nigeria. *Pyramid Journal of Medicine*. 2019;2(19)
13. Phanice OK, Zachary MO. Knowledge of obstetric danger signs among pregnant women attending antenatal care clinic at health facilities within bureti sub-county of Kericho County, Kenya. *Research in Obstetrics and Gynecology*. 2018;6(1):16-21
14. Aborigo RA, Moyer CA, Gupta M, Adongo PB, Williams J, Hodgson A, et al. Obstetric danger signs and factors affecting health seeking behaviour among the Kassena-Nankani of Northern Ghana: a qualitative study. *Afr J Reprod Health*. 2014 Sep;18(3):78-86
15. Chou D, Tuncalp O, Firoz T, Barreix M, Filippi V, von Dadelszen P, et al. Constructing maternal morbidity - towards a standard tool to measure and monitor maternal health beyond mortality. *BMC Pregnancy and Childbirth*. 2016;16(45):1-10
16. Say L, Souza JP, Pattinson RC, W. H. O. Working Group on Maternal Mortality and Morbidity Classifications. Maternal near miss--towards a standard tool for monitoring quality

of maternal health care. *Best practice & research Clinical obstetrics & gynaecology*. 2009 Jun;23(3):287-96
17. World Health Organisation. Evaluating the quality of care for severe pregnancy complications: The WHO near-miss approach for maternal health. World Health Organisation: Geneva, 2011.
18. Souza JP, Gulmezoglu AM, Vogel J, Carroli G, Lumbiganon P, Qureshi Z, et al. Moving beyond essential interventions for reduction of maternal mortality (the WHO Multicountry Survey on Maternal and Newborn Health): a cross-sectional study. *The Lancet*. 2013;381(9879):1747-55
19. McCauley M, Madaj B, White SA, Dickinson F, Bar-Zev S, Aminu M, et al. Burden of physical, psychological and social ill-health during and after pregnancy among women in India, Pakistan, Kenya and Malawi. *BMJ Global Health*. 2018;3(3):e000625
20. Bahl R, Manu AA. Burden of severe maternal morbidity and association with adverse birth outcomes in sub-Saharan Africa and south Asia: protocol for a prospective cohort study (AMANHI Maternal Morbidity study). *J*. 2016 Dec;6(2):020601
21. Geller SE, Koch AR, Garland CE, MacDonald EJ, Storey F, Lawton B. A global view of severe maternal morbidity: moving beyond maternal mortality. *Reprod Health*. 2018 Jun 22;15(Suppl 1):98
22. Udo IE, Doctor HV. Trends in health facility births in sub-Saharan Africa: An analysis of lessons learned under the Millennium Development Goal framework. *Africa Journal of Reproductive Health*. 2016;20(3):108-17
23. Joseph G, da Silva IC, Wehrmeister FC, Barros AJ, Victora CG. Inequalities in the coverage of place of delivery and skilled birth attendance: analyses of cross-sectional surveys in 80 low and middle-income countries. *Reprod Health*. 2016 Jun 17;13(1):77
24. Ronsmans C, Achadi E, Cohen S, Zazri A. Women's recall of obstetric complications in south Kalimantan, Indonesia. *Studies in family planning*. 1997 Sep;28(3):203-14
25. Seoane G, Castrillo M, O'Rourke K. A validation study of maternal self reports of obstetrical complications: implications for health surveys. *International Journal of Gyneacology and Obstetrics*. 1998;62:229-36
26. Stewart MK, Festin M. Validation study of women's reporting and recall of major obstetric complications treated at the Philippine General Hospital. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 1995 Jun;48 S53-66
27. Benova L, Moller AB, Moran AC. "What gets measured better gets done better": The landscape of validation of global maternal and newborn health indicators through key informant interviews. *PLoS One*. 2019;14(11):e0224746
28. Lange IL, Gherissi A, Chou D, Say L, Filippi V. What maternal morbidities are and what they mean for women: A thematic analysis of twenty years of qualitative research in low and lower-middle income countries. *PLoS One*. 2019;14(4):e0214199
29. Say L, Chou D, W. H. O. Maternal Morbidity Working Group. Maternal morbidity: Time for reflection, recognition, and action. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 2018;141 (Supplement 1):1-3
30. World Health Organisation Adamawa Office. Master lists of settlements (Yola North and Yola South). 2014
31. National Population Commission, The DHS Program. Nigeria Demographic and Health Survey 2018. 2019. [Accessed August 2020]. Available from: https://dhsprogram.com/pubs/pdf/FR359/FR359.pdf.
32. Adewemimo AW, Msuyu SE, Olaniyan CT, Adegoke AA. Utilisation of skilled birth attendance in Northern Nigeria: A cross-sectional survey. *Midwifery*. 2014;30:e7-e13

33. Ishola F, Owolabi O, Filippi V. Disrespect and abuse of women during childbirth in Nigeria: A systematic review. *PLoS One*. 2017;12(3):e0174084
34. Adedokun ST, Uthman OA. Women who have not utilized health service for delivery in Nigeria: who are they and where do they live? *BMC Pregnancy and Childbirth*. 2019;19(93):1-14
35. Fagbamigbe AF, Hurricane-Ike EO, Yusuf OB, Idemudia ES. Trends and drivers of skilled birth attendant use in Nigeria (1990–2013): policy implications for child and maternal health. *International Journal of Women's Health*. 2017;9:843-53
36. Doctor HV, Dahiru T. Utilization of non-skilled birth attendants in Northern Nigeria: A rough terrain to the health-related MDGs. *Afr J Reprod Health*. 2010;14(2):36-45
37. Fapohunda BM, Orobaton NG. When women deliver with no one present in Nigeria: Who, what, where and so what? *PLoS One*. 2013;8(7):e69569
38. Doctor HV, Findley SE, Ager A, Cometto G, Afenyadu GY, Adamu F, et al. Using community-based research to shape the design and delivery of maternal health services in Northern Nigeria. *Reproductive Health Matters*. 2012;20(39):104-12
39. Ulin PR, Robinson ET, Tolley EE. Qualitative methods in public health. San Francisco: Jossey-Bass; 2005.
40. Green J, Thorogood N. Qualitative methods for health research. London: SAGE Publications Ltd; 2004.
41. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology*. 2006;3(2):77-101
42. World Health Organisation. Training for mid-level managers (MLM). Module 7: The EPI coverage survey. 2008. [Accessed 28 July 2015]. Available from: http://whqlibdoc.who.int/hq/2008/WHO_IVB_08.07_eng.pdf?ua=1.
43. Lemeshow S, Robinson D. Surveys to measure programme coverage and impact: A review of the methodology used by the Expanded Programme on Immunisation. *World Health Statistics Quarterly*. 1985;38:65-75
44. Tourangeau R. Cognitive sciences and survey methods. In *Cognitive aspects of survey methodology: building a bridge between the disciplines,* Jabine T., Straf, M., Tanur, J. Tourangeau, R., Editors. 1984. Washington, DC: National Academy Press. Cited in Collins, D. Pretesting survey instruments: An overview of cognitive methods. *Quality of Life Research*, 2003, 12 (3), 229-238.
45. Willis GB, Artino AR. What do our respondents think we're asking? Using cognitive interviewing to improve medical eduation surveys. *Journal of Graduate Medical Education*. 2013;September 2013:353-6
46. Fowler FJ, Mangione TW. Standardised survey interviewing: Minimising interviewer-related error. Applied Social Research Methods Series, 18. Newbury: Sage. In Collins, D. (2003). *Quality of Life Research*. 1990;12:229-38
47. Collins D. Pretesting survey instruments: An overview of cognitive methods. *Quality of Life Research*. 2003;12:229- 38
48. Morris JL, Short S, Robson L, Andriatsihosena MS. Maternal health practices, beliefs and traditions in southeast Madagascar. *Afr J Reprod Health*. 2014;18(3):101-17
49. Ononge S, Okello ES, Mirembe F. Excessive bleeding is a normal cleansing process: a qualitative study of postpartum haemorrhage among rural Uganda women. *BMC Pregnancy and Childbirth*. 2016 08 08;16(211):1-11
50. Thaddeus S, Nangalia R. Perceptions matter: Barriers to treatment of postpartum haemorrhage. *Journal of Midwifery & Women's Health*. 2004;49(4):293-7
51. bij de Vaate A, Coleman R, Manneh H, Walraven G. Knowledge, attitudes and practices of trained traditional birth attendants in the Gambia in the prevention, recognition and management of postpartum haemorrhage. *Midwifery*. 2002 Mar;18(1):3-11

52. Sharma V, Leight J, AbdulAziz F, Giroux N, Nyqvist MB. Illness recognition, decision-making, and care-seeking for maternal and newborn complications: a qualitative study in Jigawa State, Northern Nigeria. *J Health Popul Nutr*. 2017 Dec 21;36(Suppl 1):46

53. World Health Organization. A handbook for building skills: Counselling for maternal and newborn health care. 2013. [Accessed November 2020]. Available from: https://apps.who.int/iris/bitstream/handle/10665/44016/9789241547628_eng.pdf?sequence=1

54. March of Dimes. Managing changes after baby. 2020. [Accessed November 2020]. Available from: https://www.marchofdimes.org/it-starts-with-mom/warning-signs-of-health-problems-after-giving-birth.aspx

55. Prata N, Mbaruku G, Campbell M. Using the kanga to measure postpartum blood loss. *Int J Gynaecol Obstet*. 2005;89:49-50

56. Wilcox L, Ramprasad C, Gutierrez A, Oden M, Richards-Kortum R, Sangi-Haghpeykar H, et al. Diagnosing postpartum hemorrhage: a new way to assess blood loss in a low-resource setting. *Matern Child Health J*. 2017 Mar;21(3):516-23

57. Kerr RS, Weeks AD. Postpartum haemorrhage: a single definition is no longer enough. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2017 Apr;124(5):723-6

58. Thaddeus S, Maine D. Too far to walk: Maternal mortality in context. *Social Science and Medicine*. 1994;38(8):1091- 110

Supplementary file 1: Focus group discussion and interview guides

Note: This study was part of a larger project on maternal morbidity within the community in Yola, North-east Nigeria and only questions relevant to this paper's focus have been provided below.

A. Focus group discussion guide

1. How much quantity of blood would you expect a woman to 'normally' lose **during delivery**? How would you quantify it? *Hear their responses first before showing bottle.*

- Do you think the blood could fill up this bottle (*show them 500mL bottle),* or another bottle less or more than this one?

2. How much quantity of blood would you expect a woman to 'normally' lose **within 24 hours after delivery** (ie, from the time the placenta comes out to 24 hours after delivery)? How would you quantify it? *Hear responses before showing bottle.*

- Do you think the blood could fill up this bottle (*show them 500mL bottle),* or another bottle less or more than this one?

3. How would a woman know if she is losing too much blood after delivery?

4. Do you think a woman needs to seek help at any point of her bleeding? If yes, when?

B. Interview guide

1. Now let's talk about your blood loss **during delivery**.

- What can you say generally about the blood you lost during your last delivery?
- Would you say the blood loss was normal or too small or too much? *Why do you say that?*
- If you were to quantify the blood loss, how would you quantify it? (*show 500mL and 1,000mL bottles if woman finds it difficult to quantify blood loss)*
- Were you worried about the amount of blood you lost?
    - *If yes:* Why were you worried?
    - *If home birth*: What did you do then? Did you seek help/solution? *If yes:* what did you do? At what point?

2. Now let's talk about your blood loss **within 24 hours after delivery** (that is, from the time the baby came out to 24 hours after delivery).

- What can you say generally about the blood you lost within this period?

- Would you say the blood loss was normal or too small or too much? *Why do you say that?*
- If you were to quantify the blood loss, how would you quantify it? (*show 500mL and 1,000mL bottles if woman finds it difficult to quantify blood loss)*
- Were you worried about the amount of blood you lost?
    - *If yes:* Why were you worried?
    - What did you do then? Did you seek help/solution? *If yes:* what did you do? At what point?

3. How was your bleeding in the next few days after delivery? How did it compare with the bleeding within the first 24 hours?

Supplementary file 2: Survey questionnaire

Note: This study was part of a larger project on maternal morbidity within the community in Yola, North-east Nigeria and only questions relevant to this paper's focus have been provided below.

S/N	Question	Response
I would like to ask some questions about the blood you lost within the first 24 hours after your delivery. By within the first 24 hours after delivery, I mean the blood you lost from the time after you delivered and after aspects such as your clean-up in the delivery room or stitching, up to 24 hours later.		
1.	Did your palms look pale or white within 24 hours after the delivery?	Yes No Don't know
2.	Did you experience dizziness within the first 24 hours after the delivery?	Yes No Don't know
3.	Were you shivering, that is shaking from feeling cold, within the first 24 hours after the delivery?	Yes No Don't know
4.	Did you feel very weak within the first 24 hours after the delivery such that you were unable to get up or walk?	Yes No Don't know
5.	Did you faint within the first 24 hours after delivery, that is, become unconscious for a brief period?	Yes No Don't know
6.	I would like to ask some questions about your blood flow within the first 24 hours after your delivery: - Was the blood rushing, for example, like tap water or someone passing urine? - Did the blood trickle/flow down your legs? - Did so many big, thick clots of blood come out frequently? - Did you have to double your pad? - Did you have to triple your pad	 Yes / No / Don't know Yes / No / Don't know Yes / No / Don't know Yes / No / Don't know Yes / No / Don't know
7.	Did you stain any of the following within the first 24 hours after the delivery? - Your cloth? - The bed? - The floor?	 Yes / No / Don't know Yes / No / Don't know Yes / No / Don't know
8.	Did your birth attendant or another maternity staff come back after your delivery to scoop out blood from inside you, that is, did he/she come back after you had been cleaned-up or stitched and then inserted his/her hand into your vagina or massaged your abdomen to expel left-over blood?	Yes No Don't know
9.	*For hospital deliveries only:* Did any maternity staff mention that your blood level had reduced significantly, for example, after testing your PCV?	Yes No Don't know
10.	Did you have to summon/call a maternity staff at some points after the delivery to check you because you were worried about your bleeding?	Yes No Don't know

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the inter view or focus group?	
Duration	21	What was the duration of the inter views or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.