**Understanding the complexities of unexplained stillbirth in sub-Saharan Africa; a mixed-methods study**

**Running title:** Unexplained stillbirth in sub-Saharan Africa

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**Abstract**

**Objective:** To understand the complexities surrounding unexplained stillbirth for the development and implementation of culturally acceptable interventions to underpin care in Tanzania and Zambia.

**Design:** Mixed-methods.

**Setting:** Tertiary, secondary and primary care facilities in Mansa, Zambia and Mwanza, Tanzania.

**Sample:** Quantitative; 1997 women giving birth at two tertiary care facilities (one in each country). Qualitative; 48 women and 19 partners from tertiary, secondary and primary care facilities.

**Methods:** Case review using data from a 2000 consecutive case record target. Qualitative interviews with a purposive sample of women and partners, using a grounded theory approach.

**Results:** A total of 261 stillbirths were recorded; Tanzania rate 16%, Zambia 10%, higher than previous country estimates of 2.24% and 2.09%, respectively. Women in both countries who reported a previous stillbirth were more likely to have stillbirth (RR (95% CI): 1.86 (1.23 – 2.81)). Cause of death was unexplained in 28% of cases.

Qualitative findings indicated that not knowing what caused the baby to be stillborn prevented women from grieving. This was compounded by poor communication skills of health professionals who displayed little empathy and skill when counselling bereaved families.

**Conclusion:** Stillbirth risk in both facilities was far higher than national data, with women reporting a previous stillbirth at higher risk. Women want to know the cause of stillbirth and exploration of appropriate investigations in this setting is required. Providing health professionals with support and ongoing training is key to improving the experiences of women and future care.

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**Keywords:** Stillbirth, autopsy, communication, grief, sub-Saharan Africa, mixed-methods.

**Tweetable abstract:** Stillbirths receive little investigation and are often unexplained. Communication with women about the death of their baby is limited.

**Introduction**

Stillbirth remains a major public health problem in low- and middle-income countries (LMICs) with 98% of the 2.6 million estimated stillbirths occurring in these settings. Over half of stillbirths occur during labour and birth and are mostly preventable1. Failure to prioritise stillbirth globally has meant that little has been done to reduce this burden, with many LMICs lacking the resources or political will to address the issue. Although the number of stillbirths has declined by 19.4% in the period 2000 to 2015, this represents an average annual rate of reduction (ARR) of 2%; which is less than both the maternal mortality (3%) and under-five mortality rates (5.5%)1.

Classification and reporting of stillbirth is limited in many LMICs, with differing definitions and inadequate reporting systems2,3. Stillbirths are underreported, particularly in rural areas and where women may not attend facility-based care4. There is also considerable stigma associated with stillbirth in low-income settings and the occurrence is often hidden from local communities5, impacting on recording of deaths. Hence, the stillbirth rate is likely to be higher than that reported.

Women who suffer stillbirth may face health issues and require specialised care in future pregnancies. Whilst there is considerable evidence around the impact of stillbirth in high-income settings, there is limited evidence from LMICs6. Furthermore, the experiences and understanding of stillbirth from the perspective of partners in LMICs requires exploration, particularly given the stigma women face in the community.

The slow reduction in stillbirths in LMICs makes it important to determine both accuracy in numbers and the causes of death in order to tackle this problem. Few papers report causes of stillbirth in detail and note the difficulties in reviewing cause of death7. Availability of post-mortem is extremely limited, and where available, costs are often prohibitive to individuals.

The aim of this mixed-methods study was to understand the complexities surrounding unexplained stillbirths to enable the development and implementation of interventions to support appropriate care for women in Tanzania and Zambia. In order to determine the extent and causes of stillbirth, we collected data from two countries with high stillbirth rates; Tanzania (22.4 per 1000 total births) and Zambia (20.9 per 1000 total births)8, as part of a larger programme of work investigating prevention and management of stillbirth in sub-Saharan Africa.

**Methods**

A convergent parallel-design mixed-methods study was undertaken, to enable a comprehensive understanding of the topic through the interpretation of different but complementary data. Quantitative data collection took place in a tertiary facility in Mansa region, Zambia and Lake Zone, Tanzania, providing care for local women, women previously identified as high risk from pregnancy complications and women transferred from primary and secondary facilities with complications in labour. Qualitative data recruitment took place in antenatal and postnatal clinics in the tertiary facility in each region, along with a primary and secondary facilities and the community. Primary facilities included small local clinics providing basic care only for low-risk women. Secondary facilities provided a greater range of care during labour, but women at high-risk or with pregnancy complications required transfer to tertiary facilities. Recruitment and data collection for both aspects of the study were completed by research assistants, trained and mentored by the UK and local research teams. The research assistants were all midwives (Zambia =2, Tanzania=3) with experience in recruitment and data collection.

*Quantitative data collection and analysis*

Quantitative data, to determine extent and cause of stillbirth in two regions, were collected via a retrospective consecutive case-note review, as part of a larger programme of work, between July and September 2018 at the main tertiary facility in each region. As this was a retrospective review participant consent was not required, as confirmed by the ethics committees in each country. The target sample size of 1000 case-notes in each country was chosen to enable good precision of the estimation of the risk of intrapartum stillbirth in each country, and to enable predictive modelling of factors related to stillbirth to be performed (results to be presented elsewhere). Data were collected from all women attending the participating facilities in the intrapartum period with a pregnancy of ≥28 weeks gestation during the study duration. For the purposes of the research, we used the WHO definition of stillbirth as a baby born with no signs of life at or after 28 weeks' gestation1. The case report form (CRF) was adapted from the WHO ICD-PM audit form10. The form was reviewed and agreed by the stakeholder groups (UK and in-country) and the local Patient and Public Involvement (PPI) groups for applicability. Piloting of the CRF was undertaken in both countries (n=15) prior to data collection. Data were entered into a web-based software - Research Electronic Data Capture 11 by trained research assistants in-country. Records were reviewed weekly online by the UK Research Associate (VAD) for missing data. Data validation of 10% of the total records was completed after data collection had ceased, demonstrating an error rate of less than 1% in both countries.

Data were anonymised and transferred into R Version 3.5.112 for analysis. Only data related to stillbirth are presented in this paper. Descriptive statistics were produced outlining how population characteristics differed by country. Characteristics of those with and without stillbirth allowed for comparison between groups. Data from pregnancies resulting in twins and neonatal death were excluded from this comparison.

*Qualitative data collection and analysis*

Qualitative data were collected based on a Straussian grounded theory approach13, which allows for interpretation of complex social phenomena using an inductive and deductive approach13,14. The research assistants recruited and obtained informed consent from women and partners from tertiary and district facilities, local clinics and the community, representing both urban and rural areas. The participants in the qualitative sample were different from those in the quantitative aspect of the study. An initial purposive sample of 3 participants per group, in each country, were recruited: pregnant women, postnatal women with a live birth, postnatal women with a stillbirth, postnatal women with a near-miss mortality, partners of pregnant women and partners of postnatal women. Participants were required to be 18 years of age and competent to consent. Theoretical sampling continued recruitment until data saturation was achieved15. Semi-structured interviews were conducted in local language in the community setting, with demographic data collected to allow for contextualization of findings. An interview guide and prompts enabled researchers to explore key areas, whilst providing freedom to the participant to discuss areas of importance. This was adapted in line with developing theory. Translation and back translation of transcripts confirmed accuracy and ensured quality. Constant comparative analysis using the Strauss and Corbin13 approach was conducted by the UK and country leads and findings confirmed by local PPI groups.

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*Patient and Public Involvement (PPI)*

PPI groups were established in both countries with the aim of providing input into the study design and conduct, informed by cultural understanding.

**Results**

**Quantitative**

Data from 1997 records were analysed, following exclusions for three miscarriages misclassified as stillbirths. A total of 261 (161 Tanzania, 100 Zambia) stillbirths were recorded during the data collection period, of which 240 were singleton births (Table 1). The stillbirth rate was higher than anticipated; 16.1% in Tanzania and 10.0% in Zambia, compared with WHO estimates of 2.24% (Tanzania) and 2.09% (Zambia)8. Stillbirth occurred in 17.8% of twin births compared with 12.4% of singleton births.

The recorded causes of stillbirth are presented in table 2. Twenty-eight percent of stillbirths (n=73) were unexplained in that no reason was provided in the case notes (Tanzania 20.5%, n=33; Zambia 40%, n=40). There was no record of post-mortem for all cases of stillbirth in both countries. Reasons were provided in some instances by attending clinicians, but it is unclear as to what extent examination of the stillborn baby occurred and to what extent these were subjective judgements. Therefore, where reasons were provided, it is uncertain as to whether these were causative factors or if they may have contributed to the stillbirth. It is possible that although an explanation was provided within the notes, these may not be completely accurate. Hence, although 72% (n=188) of stillbirths appear to be explained, the attributed causes reported may be incorrect.

The characteristics of the 1885 participants who experienced singleton birth are presented in table 3, following exclusion of twins/neonatal death. The majority of participants were married (89%) and educated to primary school level (98%). Most women (78%) booked for care in the second trimester. Overall, 97.6% (n=200) of participants experiencing stillbirth attended at least one antenatal clinic (ANC) visit, although there was a country difference: 100% (n=145) Tanzania, 91.7% (n=55) Zambia. However, there is also more missing data from Zambia for both booking and antenatal attendance (table 4). A smaller percentage of women experiencing stillbirth in this pregnancy attended for four or more visits (58.6% (n=85) Tanzania, 45.0% (n=27) Zambia). More participants experiencing stillbirth in the current pregnancy were transferred to a higher-level facility during labour than those who did not experience stillbirth (46.2%, n=111 vs. 20.3%, n=334) and were more likely to have an obstetrician present at birth (49.2%, n=118 vs. 30.6%, n=504). More women in Zambia had experienced a previous stillbirth (65; 6.8% vs. 18; 1.9%), with those who had experienced a previous stillbirth being more likely to experience a stillbirth in the current pregnancy (RR (95% CI): Tanzania: 2.17 (1.11 – 4.24), Zambia: 2.19 (1.29 – 3.71)).

For singleton stillbirths, the recorded time of death indicated 42% (n=101) occurred antenatally and 48% (n=114) in labour, with the timing of death unclear in 10% (n=25) cases. The condition of the fetus was noted as macerated in 45% (n=109) and fresh in 54% (n=130) of cases and not recorded in one case. This confirms current understanding that classification of time of death is difficult in LMICs16 and that around half of deaths occur during labour17,7.

**Qualitative**

Forty-eight interviews were conducted with women and 19 with partners across the two countries. Demographics are provided in Table S1. The findings indicated that stillbirth was barely acknowledged by health workers and communication around stillbirth was poor. Failure to explain the reasons for stillbirth perpetuated elements of blame between women and health professionals.

***‘It just happens’***

Data indicated that communication with women about the death of their baby was poor and frequently no explanation for the cause of death was given. The way in which the news was conveyed indicated that stillbirth was a routine occurrence and was afforded no value.

*‘I just came to the hospital and they said, “it just happens”. [Woman, Tanzania]*

In communicating with women, staff displayed an uncaring attitude and a lack of compassion, which may be reflective of the insignificance attributed to the event by health workers or may be a symptom of disrespectful care in general. Cultural belief may also play a part, whereby a stillborn baby is not viewed as human and, hence, is inconsequential. One partner recalled the behaviour of staff.

*‘When she loses the baby, they don’t even sympathize with the mother. They will say it is bad luck, go home, and that’s all.’ [Partner, Tanzania]*

The failure to acknowledge the stillbirth and its impact on the woman compounded the impression of the irrelevance of the loss to health professionals.

*‘On discharge, no one talked or counselled me about my loss; to them it was business as usual.’ [Woman, Zambia]*

***‘Avoiding the question’***

In many cases women were not informed about the stillbirth at the time it occurred. The rationale for this was unclear but, in some situations, health workers appeared to be waiting for a relative to arrive and they would communicate the loss to them. The relative would then inform the woman. A partner described what the midwife said to him when he asked about the baby on arrival at the facility.

*‘The child had died we did not tell her mother; we were waiting for another person to come.’ [Partner, Tanzania]*

On occasions there appeared to be collusion between the staff and relatives over the loss, resulting in concealment of the stillbirth from the woman.

*‘When I woke up, I found two of my fellow women I was with sleeping next to their babies, I looked around I didn’t see mine. When the nurse came in, I asked her where my baby was, she just said I will come back and left but she never came back. In the evening I insisted I wanted to know where my baby was, the nurse then told me that my baby was in intensive care unit for observation and left immediately, I wanted to ask what happened, but she left. It’s like she was avoiding my question. In the night my grandmother brought me some porridge, I took this opportunity to ask her where my baby. She told me the same that my baby was in an intensive care unit for observation. The following day my grandmother came, she thought I was sleeping and then I overhead her telling my neighbour that I delivered a stillbirth, but told her not to tell me.’ [Woman, Zambia]*

For many women, the failure to inform them in a timely manner meant they had no opportunity to see their baby and relatives had often already buried the infant before the woman left hospital.

***‘I needed a proper answer’***

When women were made aware of the stillbirth, they discussed wanting to understand the reasons for the death of their baby. However, they did not feel they could ask the staff due to their attitude, bringing about a feeling of helplessness in the women.

*‘I am even feeling frightened to ask the nurses they are too harsh…. I am afraid I can't even ask, what am I going to ask, the child is already dead, even if I ask what will I do the child is already dead?’* *[Woman, Tanzania]*

There appeared to be no will on the part of healthcare workers to help women and families understand the reasons for the stillbirth. The lack of provision of investigations, such as post-mortem, further limited parents’ understanding of the cause of the stillbirth.

*‘Nobody knows what killed the baby up to now. We were just told the baby was dead, asked what killed the baby no [one] knew… I wish we could do post-mortem but then, we do not have such services in our facilities.’ [Partner, Zambia]*

Women struggled to understand the pregnancy loss in an absence of an explanation when they felt they had done all they could to ensure a healthy pregnancy.

*‘I have been attending all my clinic appointments. I made sure I ate well. I really don’t know what happened. I needed a proper answer, but I did not get one… they just told me that my baby died in the uterus…. but they didn’t tell me what went wrong with my baby.’ [Woman, Tanzania]*

***‘Blaming’***

Blame was apparent, both of women and of health professionals. Health professionals would infer blame, indicating the stillbirth was the fault of the woman.

*‘I was in shock; it was unbelievable that I lost my baby just like that. The male nurse started blaming me for been lazy in pushing, I was so hurt but I could not speak. [Woman, Stillbirth, Zambia]*

Some women, having presented at the facility, blamed health professionals for the loss. Often, they felt they were neglected or provided with poor care by the individuals caring for them.

*‘The second baby, I gave birth at the hospital, but the nurses contributed to her death because they were not there to assist me when I needed them.’ [Woman, previous stillbirth, Tanzania]*

**Discussion**

***Main Findings***

This study highlighted a considerable difference between country stillbirth estimates and actual stillbirth numbers in the study health facilities. This may be accounted for in terms of rigorous data collection of consecutive births in this study, combined with the transfer of women experiencing problems during labour into the facility. Furthermore, the areas from which the data were collected are in sub-urban and rural settings which are estimated to have an increased stillbirth rate of up to 60% above national rates18.

The lack of availability of post-mortem leaves examination of the infant and clinical judgement as the only explanation of the death, which may be inaccurate. Furthermore, in almost a third of cases no attempt at explanation was provided in the case notes. Given that women who experience a stillbirth are more likely to experience recurrent stillbirth19, this is concerning in respect of adaptation of future care. To improve clinical care and reduce stillbirth it is imperative that the cause is known to ensure appropriate care is instituted in future pregnancies20. The higher risk of stillbirth amongst women with a previous stillbirth, as found in this study, reflects this and indicates a failure to understand and tackle individual health issues impacting on pregnancy. Moreover, the role of health system issues which may impact on stillbirth, such as delays and transfer of care21, remain an issue be addressed. This lack of understanding compromises the aim of reducing global stillbirth rates which is hampered by failure to understand reasons for the death3.

***Strengths and Limitations***

This is one of the largest recent case reviews of stillbirth in Tanzania and Zambia. However, the review was reliant on the availability of information within the notes; with some data less likely to be recorded. This occurred particularly for Zambia and needs to be considered in interpreting the results. The mixed-methods approach is a strength allowing for a more complete understanding of the impact of unexplained stillbirth, aligning these views with those of health care workers would provide an added dimension.

***Interpretation***

The current position where women receive no offer of investigation to explain stillbirth is being challenged by women’s need for better understanding. A traditional post-mortem, which includes invasive procedures, may not be acceptable in some cultures or to some parents20. One aspect reported to be unacceptable is that of ‘cutting’ the infant22,23. There is growing evidence that alternatives, such as less-invasive autopsy, are effective in determining cause of death and may be more acceptable to women and their families20. Non-invasive and minimally-invasive autopsies which avoid dissection and instead use a combination of imaging, examination, biopsy and cultures may be culturally more appropriate in these settings. Also, these are potentially less costly interventions, which is of relevance to LMICs24. Identification of cause may lead to improvements in care, reducing the health, emotional and economic burden on women, families and society25. Evidence suggests that women who receive and understand autopsy results are less likely to self-blame and may feel some absolution for their antenatal actions26, providing them with emotional closure27,28,23. Health workers need to feel adequately trained to offer investigations. Less invasive techniques may be more acceptable to them in informing and consenting women to the process29, as the cultural influences on women are also likely to affect health professionals’ views and understanding in the same setting. Given the poor understanding of stillbirth in this setting, autopsy is an area for consideration which requires further exploration, particularly with regard to women’s, families’, communities’ and health workers’ views.

Poor communication about their stillbirth was a recurring feature for women. Women reported that health workers appeared to actively avoid the topic. The choice of language used was perceived by women to be dismissive and health workers’ attitudes prevented women from questioning them. Behaviour of staff is important to women and affects their experiences and ability to grieve following stillbirth30. However, health workers face system, emotion and knowledge-based challenges in providing care which may give the impression of a lack of concern for women30. Poor communication by health workers may stem from their own limited communication skills or discomfort in discussing death31. Many health workers find discussing bereavement challenging and have expressed the need for further education to manage communication in such situations30. Limited understanding and awareness of the causes of stillbirth may also impact on their confidence in discussing the issue32. That stillbirth is often unexplained may add to the health professionals’ feelings of inadequacy, and the lack of availability of investigations means health workers are unable to offer women the potential for an explanation of the death. In some settings lack of support, fear of blame and litigation may lead health workers to avoid discussions25. High numbers of stillbirth may lead to compassion fatigue33 which may account for dismissive attitudes and an unwillingness to enter into discussions with distressed women and families.

Women were reluctant to raise questions about their stillbirth with health professionals, despite being keen to understand the cause. This may stem from the culture of blame experienced by women in sub-Saharan Africa within their own communities5. It may also relate to their gender and status which often prevents them from having a voice in the community and health system. Failure to provide explanation for the stillbirth adds to the blame women experience as there is no vindication of them or their perceived actions. That both health workers and some women seemed to accept stillbirth as a routine outcome is concerning and appears to confirm that there is limited will to change the accepted beliefs.

**Conclusion**

Failure to identify cause of death, coupled with a failure to communicate stillbirth appropriately indicates that current care for women experiencing stillbirth is not meeting their needs and may impact of their future health and care. This work highlights two key research recommendations. Firstly, whilst women perceive the existing process of communication as poor, further clarity is required to understand why this is the case. Additional exploration of the issues facing health workers in discussing stillbirth and the development of training interventions to overcome this is recommended. Secondly, the lack of real understanding of the cause of stillbirth requires more attention, not only to inform parents, but also to ensure that women receive appropriate care in future pregnancies. Further work exploring the acceptability of autopsy, including different levels of investigation and economic evaluation, is recommended. This is particularly important given the higher risk of stillbirth in each country amongst women who had previously experienced stillbirth.

In practice, it is recommended that health professionals need to be made aware of the impact of the language that they use and the behaviour they portray to women and the potential impact their actions have on women and families.

Prior to this study, women have had little opportunity to voice their concerns or have them heard. In addressing the identified issues, it is vital that women are the central focus to ensure that future care is developed appropriately to meet their needs.

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**Disclosure of Interests**

The authors declare that they have no competing interests. Completed disclosure of interest forms are available to view online as supporting information.

**Contribution to Authorship**

All authors (CB, TL, RL, CK, SW, VAD, SV, KB, CS) contributed to the design of the study. CB, TL, RL, CK, SW analysed the qualitative data. KB, VAD and CS analysed the quantitative data. All authors (CB, TL, RL, CK, SW, VAD, SV, KB, CS) interpreted the data. CB drafted the first version of the manuscript. All authors (CB, TL, RL, CK, SW, VAD, BV, KB, CS) commented on drafts of the manuscript and have read and approved the final version.

**Ethical Approval**

Ethical approval was obtained from the University of Manchester Ethics committee (Ref: 2018-4446-6653, 18/07/18), the National Health Research Authority and IRES (Ref: 00005948, 29/06/18) Zambia and CUHAS/BMC Joint Ethical and Review Committee, (REF: CREC/287/2018, 15/05/18) Tanzania.

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**Table 1.** Birth outcomes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pregnancy Outcome Indicators** | **Both Countries** | | | **Tanzania** | | | **Zambia** | | |
| **Total** | **Singleton** | **Twin** | **Total** | **Singleton** | **Twin** | **Total** | **Singleton** | **Twin** |
| Cases collected | 1,997 | 1938 | 59 | 1,000 | 962 | 38 | 997 | 976 | 21 |
| Total number of babies | 2,056 | 1938 | 118 | 1,038 | 962 | 76 | 1,018 | 976 | 42 |
| - Livebirth (%) | 1740 (85%) | 1645 (85%) | 95 (81%) | 844 (81%) | 784 (81%) | 60 (79%) | 896 (88%) | 861 (88%) | 35 (83%) |
| - Stillbirth (%) | 261 (13%) | 240 (12.4%) | 21 (17.8%) | 161 (16%) | 146 (15%) | 15 (20%) | 100 (10%) | 94 (10%) | 6 (14%) |
| - Neonatal death (%) | 49 (2%) | 48 (2%) | 1 (1%) | 32 (3%) | 31 (3%) | 1 (1%) | 17 (2%) | 17 (2%) | 0 (0%) |
| - Babies with unknown status (%) | 6 (<1%) | 5 (<1%) | 1 (1%) | 1 (<1%) | 1 (<1%) | 0 (0%) | 5 (<1%) | 4 (<1%) | 1 (2%) |

**Table 2.** Reported cause of stillbirth

|  |  |  |  |
| --- | --- | --- | --- |
| **Cause of Stillbirth** | **Both Countries** | **Tanzania** | **Zambia** |
| **N** | **261** | **161** | **100** |
| Foetal distress | 53 (20.3%) | 35 (21.7%) | 18 (18.0%) |
| Obstructed Labour | 32 (12.3%) | 24 (14.9%) | 8 (8.0%) |
| Pre-eclampsia/eclampsia | 31 (11.9%) | 18 (11.2%) | 13 (13.0%) |
| APH | 15 (5.7%) | 13 (8.1%) | 2 (2.0%) |
| Cord prolapse/cord around neck | 13 (5.0%) | 9 (5.6%) | 4 (4.0%) |
| Anaemia | 12 (4.6%) | 9 (5.6%) | 3 (3.0%) |
| Other | 8 (3.1%) | 4 (2.5%) | 4 (4.0%) |
| Systemic Infection | 7 (2.7%) | 5 (3.1%) | 2 (2.0%) |
| Uterine rupture | 7 (2.7%) | 3 (1.9%) | 4 (4.0%) |
| Precipitate labour | 4 (1.5%) | 4 (2.5%) | 0 (0.0%) |
| Malaria | 4 (1.5%) | 2 (1.2%) | 2 (2.0%) |
| PROM | 1 (0.4%) | 1 (0.6%) | 0 (0.0%) |
| Pre-term labour | 1 (0.4%) | 1 (0.6%) | 0 (0.0%) |
| Unknown/unexplained | 73 (28.0%) | 33 (20.5%) | 40 (40.0%) |

APH = Antepartum Haemorrhage. PROM = Premature Rupture of Membranes.

**Table 3.** Case note review participant characteristics, by outcome (neonatal deaths excluded; singleton births only)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| N (%) | | Both Countries (N=1885) | | Tanzania (N=930) | | Zambia (N=955) | |
| No SB | SB | No SB | SB | No SB | SB |
| 1645 (87.3%) | 240 (12.7%) | 784 (84.3%) | 146 (15.7%) | 861 (90.2%) | 94 (9.8%) |
| Mother's age (years) | Mean (SD) | 27.3 (6.3) | 27.6 (6.3) | 28.1 (5.4) | 28.5 (6.1) | 26.6 (6.9) | 26.2 (6.5) |
| 18-35 | 1448/1645 (88.0%) | 211/240 (87.9%) | 707/784 (90.2%) | 127/146 (87.0%) | 741/861 (86.1%) | 84/94 (89.4%) |
| <18 | 8/1645 (0.5%) | 3/240 (1.2%) | 7/784 (0.9%) | 3/146 (2.1%) | 1/861 (0.1%) | 0/94 (0.0%) |
| >35 | 189/1645 (11.5%) | 26/240 (10.8%) | 70/784 (8.9%) | 16/146 (11.0%) | 119/861 (13.8%) | 10/94 (10.6%) |
| Married | No | 172/1636 (10.5%) | 33/240 (13.8%) | 61/776 (7.9%) | 24/146 (16.4%) | 111/860 (12.9%) | 9/94 (9.6%) |
| Yes | 1464/1636 (89.5%) | 207/240 (86.2%) | 715/776 (92.1%) | 122/146 (83.6%) | 749/860 (87.1%) | 85/94 (90.4%) |
| Unknown | 9 | | 8 | | 1 | |
| Education | None or Prim. | 674/1373 (49.1%) | 124/210 (59.0%) | 366/775 (47.2%) | 83/146 (56.8%) | 308/598 (51.5%) | 41/64 (64.1%) |
| Secondary | 513/1373 (37.4%) | 73/210 (34.8%) | 298/775 (38.5%) | 55/146 (37.7%) | 215/598 (36.0%) | 18/64 (28.1%) |
| Higher or Voc. | 186/1373 (13.5%) | 13/210 (6.2%) | 111/775 (14.3%) | 8/146 (5.5%) | 75/598 (12.5%) | 5/64 (7.8%) |
| Unknown | 302 | | 9 | | 293 | |
| Gravida | Median (IQR) | 2 (1-4) | 3 (1-4) | 2 (1-4) | 3 (1-4) | 3 (1-5) | 3 (1-5) |
| Parity | Median (IQR) | 1 (0-3) | 2 (0-3) | 1 (0-2) | 2 (0-3) | 1 (0-4) | 2 (0-3) |
| History of Stillbirth | No | 1575/1639 (96.1%) | 221/240 (92.1%) | 771/783 (98.5%) | 140/146 (95.9%) | 804/856 (93.9%) | 81/94 (86.2%) |
| Yes | 64/1639 (3.9%) | 19/240 (7.9%) | 12/783 (1.5%) | 6/146 (4.1%) | 52/856 (6.1%) | 13/94 (13.8%) |
| Unknown | 6 | | 1 | | 5 | |

**Table 4.** Attendance for care, by outcome (neonatal deaths excluded; singleton births only)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| N (%) | | Both Countries (N=1885) | | Tanzania (N=930) |  | Zambia (N=955) |  |
| No SB | SB | No SB | SB | No SB | SB |
| 1645 (87.3%) | 240 (12.7%) | 784 (84.3%) | 146 (15.7%) | 861 (90.2%) | 94 (9.8%) |
| Gestation at booking | 1st Tri. | 212/1222 (17.3%) | 38/198 (19.2%) | 155/784 (19.8%) | 28/145 (19.3%) | 57/438 (13.0%) | 10/53 (18.9%) |
| 2nd Tri. | 956/1222 (78.2%) | 147/198 (74.2%) | 586/784 (74.7%) | 106/145 (73.1%) | 370/438 (84.5%) | 41/53 (77.4%) |
| 3rd Tri. | 54/1222 (4.4%) | 13/198 (6.6%) | 43/784 (5.5%) | 11/145 (7.6%) | 11/438 (2.5%) | 2/53 (3.8%) |
| Unknown | 465 | | 1 | | 464 | |
| Any ANC Visits | No | 3/1268 (0.2%) | 5/205 (2.4%) | 0/784 (0.0%) | 0/145 (0.0%) | 3/484 (0.6%) | 5/60 (8.3%) |
| Yes | 1265/1268 (99.8%) | 200/205 (97.6%) | 784/784 (100.0%) | 145/145 (100.0%) | 481/484 (99.4%) | 55/60 (91.7%) |
| Unknown | 412 | | 1 | | 411 | |
| Number of ANC Visits | Mean (SD) | 4.3 (1.2) [377 missing] | 3.5 (1.2) [35 missing] | 4.3 (1.2) | 3.7 (1.0) [1 missing] | 4.5 (1.2) [377 missing] | 3.1 (1.6) [34 missing] |
| <4 | 289/1268 (22.8%) | 93/205 (45.4%) | 208/784 (26.5%) | 60/145 (41.4%) | 81/484 (16.7%) | 33/60 (55.0%) |
| 4+ | 979/1268 (77.2%) | 112/205 (54.6%) | 576/784 (73.5%) | 85/145 (58.6%) | 403/484 (83.3%) | 27/60 (45.0%) |
| Unknown | 412 | | 1 | | 411 | |
| Dist. home to nearest HF | <30 | 1453/1604 (90.6%) | 213/234 (91.0%) | 699/745 (93.8%) | 139/140 (99.3%) | 754/859 (87.8%) | 74/94 (78.7%) |
| 31-60 | 126/1604 (7.9%) | 13/234 (5.6%) | 42/745 (5.6%) | 0/140 (0.0%) | 84/859 (9.8%) | 13/94 (13.8%) |
| 61-119 | 19/1604 (1.2%) | 4/234 (1.7%) | 3/745 (0.4%) | 0/140 (0.0%) | 16/859 (1.9%) | 4/94 (4.3%) |
| 120+ | 6/1604 (0.4%) | 4/234 (1.7%) | 1/745 (0.1%) | 1/140 (0.7%) | 5/859 (0.6%) | 3/94 (3.2%) |
| Unknown | 47 | | 45 | | 2 | |
| Intrapartum Transfer | No | 1308/1642 (79.7%) | 129/240 (53.8%) | 744/782 (95.1%) | 90/146 (61.6%) | 564/860 (65.6%) | 39/94 (41.5%) |
| Yes | 334/1642 (20.3%) | 111/240 (46.2%) | 38/782 (4.9%) | 56/146 (38.4%) | 296/860 (34.4%) | 55/94 (58.5%) |
| Unknown | 3 | | 2 | | 1 | |
| Doc. or Obstetrician Available | No | 1141/1645 (69.4%) | 122/240 (50.8%) | 423/784 (54.0%) | 65/146 (44.5%) | 718/861 (83.4%) | 57/94 (60.6%) |
| Yes | 504/1645 (30.6%) | 118/240 (49.2%) | 361/784 (46.0%) | 81/146 (55.5%) | 143/861 (16.6%) | 37/94 (39.4%) |

**S1.** Participant demographics: interview study

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Tanzania | | Zambia | |
|  | Women  N=21 | Partner  N=10 | Women  N=27 | Partner  N=9 |
| Age, median (range) | 21 (18-41) | 32 (26-50) | 24 (18-45) | 31 (25-56) |
| Marital status  -Married  -Single  -Widowed | 21  0  0 | 10  0  0 | 24  3  0 | 9  0  0 |
| Education  -Primary  -Secondary  -College  -Diploma  -Degree  -Other | 5  15  1  0  0  0 | 1  6  2  0  1  0 | 9  15  1  1  1  0 | 3  4  1  0  1  0 |
| Religion  -Christian  -Muslim | 21  0 | 10  0 | 27  0 | 8  1 |
| Sampling group  -Live birth  -Stillbirth  -Near miss | 7  10  4 | 4  5  1 | 6  13  8 | 3  3  3 |
| Employment  -None/housewife  -Farmer  -Shop worker  -Tailor  -Clerical  -Business  -Nurse/midwife | 8  1  3  3  4  1  1 | 1  4  1  0  0  4  0 | 10  4  5  4  3  1  0 | 0  4  1  0  1  3  0 |