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CLINICAL ARTICLE

Prevalence of maternal near miss and community-based risk factors in Central Uganda

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ABSTRACT

Objective: To examine the prevalence of maternal near-miss (MNM) and its associated risk factors in a community setting in Central Uganda. *Methods:* A cross-sectional research design employing multi-stage sampling collected data from women aged 15–49 years in Rakai, Uganda, who had been pregnant in the 3 years preceding the survey, conducted between August 10 and December 31, 2013. Additionally, in-depth interviews were conducted. WHO-based disease and management criteria were used to identify MNM. Binary logistic regression was used to predict MNM risk factors. Content analysis was performed for qualitative data. *Results:* Survey data were collected from 1557 women and 40 in-depth interviews were conducted. The MNM prevalence was 287.7 per 1000 pregnancies; the majority of MNMs resulted from hemorrhage. Unwanted pregnancies, a history of MNM, primipara, pregnancy danger signs, Banyakore ethnicity, and a partner who had completed primary education only were associated with increased odds of MNM (all $P < 0.05$). *Conclusions:* MNM morbidity is a significant burden in Central Uganda. The present study demonstrated higher MNM rates compared with studies employing organ-failure MNM-diagnostic criteria. These findings illustrate the need to look beyond mortality statistics when assessing maternal health outcomes. Concerted efforts to increase supervised deliveries, access to emergency obstetric care, and access to contraceptives are warranted.

1. Introduction

Every year, at least 15% of women who become pregnant experience life-threatening complications, the majority of these occurrences are in low-resource settings [1]. These complications can result in either death or maternal near-miss (MNM). MNM refers to a woman who nearly died but ultimately survived life-threatening pregnancy complications [2]. In Sub-Saharan Africa, the incidence of MNM ranges from 1.1% to 33.4% of all deliveries [3]. In Uganda, the incidence of MNM and its risk factors remain unclear. MNM events are associated with high healthcare costs, poor maternal and infant outcomes, lost productivity, increased burden on healthcare systems, and increased risk of maternal death [4]. However, relatively little attention has been paid to MNM, particularly its prevalence and associated risk factors.

Previous hospital-based studies in Uganda have reported MNM rates of 10.1% [5] and 33.4% [6]. However, these rates are likely underestimates for two reasons. First, these studies employed an organ-dysfunction classification system for identifying MNMs; this system is difficult to implement in settings with limited diagnostic equipment. Second, women not using healthcare facilities during pregnancy were not included in these study designs. Over half of all pregnant women in Uganda do not attend four prenatal care visits, 43% deliver at home, 66% do not receive post-natal care, and 89% have no access to obstetrics services [7,8]. With such limitations, new study approaches are warranted. Community-based studies take into account all women who have had a pregnancy, regardless of where delivery occurs. Additionally, disease and management criteria for identifying MNM events take into account MNM complications that do not necessarily result in organ dysfunction [9]. An approach combining community-based studies and WHO near-miss criteria is likely to result in better MNM-prevalence estimations and associated risk factors in the general population. The aim of the present study was to examine the prevalence of MNM, as well as risk factors associated with MNM, in one district in rural Uganda.

2. Materials and methods

A cross-sectional study design was used to collect survey data in Central Uganda between August 10 and December 31, 2013 from women aged 15–49 years who had been pregnant in the 3 years preceding the survey. Ethical approval for the study was provided by North West University, Mafikeng, South Africa, and Rakai district leadership granted permission to conduct the study. Informed consent was

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obtained from all participants verbally, and strict confidentiality was maintained throughout data collection and analysis.

A multi-stage sampling process was used to select women to be invited to complete the survey. First, as the district in Uganda with the worst performance in terms of maternal health indicators from the District League Table [10], Rakai district was selected for the survey. Second, the rural and urban sub-counties with the highest number of pregnancies were selected; thereafter, a sampling frame of women aged 15–49 years who had been pregnant in the 3 years preceding the survey was generated from a complete household listing. Third, a random sampling of 19 out of 58 enumeration areas, stratified by place of residence, was performed; all women who met the inclusion criteria in the selected enumeration areas were contacted for interview. Individuals who agreed to participate were interviewed in their homes by trained interviewers. Following the interviews, 40 participants who had experienced MNMs identified from the quantitative sample were purposively selected to participate in in-depth interviews to gather qualitative data.

Rakai district is a predominantly rural district with similar reproductive health indicators to other parts of Central Uganda. Only a third of women in the district undergoing delivery do so under supervision, and the ratio of midwives to pregnant women is 1:360 [11]. This region includes one of Uganda's largest ethnic groups–the Baganda. Data were collected from Kalisizo town council and Lwamaggwa sub-county. Kalisizo town council is serviced by a government hospital, private health facilities, and a relatively good transport network. By contrast, Lwamaggwa sub-county is rural, with a poor road network, and no access to electricity; it is serviced by a health center III–a facility offering basic maternal health services–and health center IIs, which operate at a parish level.

The dependent variable in the present study was a binary outcome of MNM; this was determined by the research team's review of participant responses to questions focused on MNM disease and management criteria [2]. The independent variables included maternal characteristics (timing of pregnancy, intimate partner violence, alcohol intake, experience of pregnancy danger signs, a history of MNM complications, parity, and chronic diseases) and sociodemographic characteristics (marital status, occupation, religion, ethnicity, wealth status, partner's education, and occupation).

Data were entered and cleaned using EpiData version 3.1 (The EpiData Association, Odense, Denmark). STATA version 12.0 (StataCorp LP, College Station, TX, USA) was used for analyses. MNM prevalence was computed as the absolute number of MNM events as a proportion of the total number of pregnancies during the study period. A descriptive analysis was conducted and bivariate associations between outcome and independent variables were evaluated using the χ^2 test. At the multivariate level, binary logistic regression was used to predict the MNM risk factors from demographic characteristics (model A) and from the characteristics of both women and their partners (model B). Only sociodemographic variables that were significant at the bivariate level were considered in the multivariate analysis. MNM odds ratios were reported with 95% confidence intervals and $P < 0.05$ was considered statistically significant. A correlation threshold of 0.8 and a multicollinearity threshold of 10, calculated using the variance inflation factor, were used to exclude insignificant variables from the models.

Qualitative data were transcribed and ATLAS.ti version 7 (ATLAS.ti Scientific Software Development GmbH, Berlin, Germany) was used for the analysis. Transcripts were reviewed by at least two members of the research team, and a coding scheme was developed that was deductively based on the risk factors being studied. All transcripts were coded, with discrepancies discussed and resolved by consensus among the research team. Additionally, a trained midwife reviewed each transcript to verify the perceived cause of MNM.

3. Results

The classification criteria for MNM, the causes of MNM, and illustrative quotes from the in-depth interviews are detailed in Table 1. The demographics of the study cohort are detailed in Table 2; the majority of the respondents were married, resided in rural areas, had completed no further than primary education, were employed in the agricultural sector, were of Baganda ethnicity, and were Catholic. The bivariate analysis demonstrated associations between MNM and marital status ($P = 0.029$), residing in a rural area ($P < 0.001$), employment status ($P = 0.012$), religion ($P = 0.024$), ethnicity ($P = 0.001$), wealth status ($P = 0.029$), partner's occupation ($P = 0.039$), and partner's education ($P = 0.001$) (Table 2).

Of the 1557 women who had been pregnant in the 3 years preceding the study period, 434 had experienced MNM events, a prevalence of 278.7 MNM events per 1000 pregnancies (95% confidence interval 256.612–301.228). The clinical causes of MNM were analyzed and hemorrhage was identified as accounting for more than half of the MNM events reported in the study (Fig. 1).

The odds ratios of the MNM risk factors investigated are detailed in Table 3. Increased odds of experiencing a MNM were demonstrated among women with unwanted pregnancies, with a greater increase observed when participants' partners' characteristics (education and employment status) were included in the model.

This increase in the odds of an MNM occurring was supported by the qualitative data, as illustrated by an excerpt from an in-depth interview with a 27-year-old mother, "I told my husband but he didn't care as we had fought a week back. The pains got stronger and the bleeding persisted… By then, I had become very weak. At the clinic, the health worker put a cannula on my hand, but I refused the drip [intravenous drip] because I had no money. Since my husband didn't care, I also decided to let the pregnancy go."

Experiencing pregnancy danger signs was demonstrated to increase the risk of MNM complications (Table 3). Pregnancy danger signs included swelling of the legs or face (edema), blurred vision, difficulty breathing, severe weakness, headache, accelerated or reduced fetal movement, weight loss, rupture of membranes in the absence of labor, excessive vomiting, abdominal pains, and malaria. The odds of experiencing MNM complications where increased by experiencing pregnancy danger signs in both models, with slightly reduced odds in model B, which controlled for patients' partners' characteristics. In the qualitative study, all patients who had experienced MNM reported having experienced at least one of the defined pregnancy danger signs.

Increased odds of experiencing a MNM were also demonstrated among patients with a history of MNM complications in both the A and B models (Table 3). Qualitative data corroborated the above findings. An excerpt from an in-depth interview with a participant who experienced retained-placenta complications during her prior pregnancy and during her most recent pregnancy stated, "For the last three pregnancies, I have had my placenta come out after thirty minutes though this time it took longer than an hour to come out."

Women who were delivering for the first time were more likely to experience a MNM compared to women with a parity of between two and four when controlled for patient characteristics. The odds of a MNM increased further when controlling for patient and partner characteristics. However, no significant relationship was demonstrated between higher parity (≥5) and MNM (Table 3). These findings were contradicted by the qualitative findings; the qualitative data suggested that women with higher parity (≥5) were more likely to experience a MNM than women with a parity of between two and four. A woman from a rural area with eight children who experienced an obstructed labor recounted her delivery experience, "The doctor checked me and said I had to be operated because the baby's arm had come out. I was counselled on child bearing and sterilization. I was worried about my condition... and I knew that anyone who is operated either comes out alive or dead. I stopped child bearing and I accepted to be sterilized."

Ethnicity and partner education were the only sociodemographic characteristics that were associated with the occurrence of MNM. Participants of Banyakore ethnicity were more likely to experience MNM events than women of Baganda ethnicity. Additionally, women

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