ORIGINAL RESEARCH ARTICLE

Estimating the incidence of abortion-related complications using the prospective morbidity survey method in Southern Ethiopia

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Abstract

Despite legal reforms, unsafe abortion remains a significant public health problem in Ethiopia, straining healthcare systems and impacting women's well-being. Recent data on the magnitude of this problem are scarce. Therefore, this study aimed to assess the incidence and factors associated with abortion-related complications in public hospitals in Southern Ethiopia. Using the prospective morbidity survey (PMS) methodology, data were obtained from 322 women who presented in 10 public hospitals over a two months period (December 2023 - February 2024). The results show that the projected annual estimate of abortion related complications was 1,986 (95% CI: 1741, 2142), translating to a complications ratio of 153 per 1,000 live births. Out of the 322 women, 67 (20.8%) were classified as having near-miss morbidity (MNM), 167 (50.8%) had potentially life threatening complications (PLTC), while 35 (10.9%) and 57 (17.7%) women had moderate and mild morbidities respectively. Ordinal logistic regression identified younger age, rural residence, unemployment, later trimester abortion, lack of contraception use, unintended pregnancy, and expulsion of some products of conception as factors associated with increased severity of complications. These findings highlight the high burden of severe abortion complications and underscore the critical need for improved access to comprehensive family planning, safe abortion services, and timely, quality post-abortion care, particularly for vulnerable populations in Southern Ethiopia. *(Afr J Reprod Health 2025; 29 [9s]: 15-31).*

Keywords: Unsafe Abortion, Maternal Near-Miss, Pregnancy-Unintended, Prospective Morbidity Survey

Résumé

Malgré les réformes juridiques, l'avortement à risque demeure un problème de santé publique majeur en Éthiopie, mettant à rude épreuve les systèmes de santé et impactant le bien-être des femmes. Les données récentes sur l'ampleur de ce problème sont rares. Par conséquent, cette étude visait à évaluer l'incidence et les facteurs associés aux complications liées à l'avortement dans les hôpitaux publics du sud de l'Éthiopie. Grâce à la méthodologie de l'enquête prospective de morbidité (EPM), des données ont été recueillies auprès de 322 femmes qui se sont présentées dans 10 hôpitaux publics sur une période de deux mois (décembre 2023 - février 2024). Les résultats montrent que l'estimation annuelle projetée des complications liées à l'avortement était de 1 986 (IC à 95 % : 1 741, 2 142), soit un taux de complications de 153 pour 1 000 naissances vivantes. Français Sur les 322 femmes, 67 (20,8 %) ont été classées comme ayant une morbidité quasi-accidentelle (MNM), 167 (50,8 %) ont eu des complications potentiellement mortelles (PLTC), tandis que 35 (10,9 %) et 57 (17,7 %) femmes ont eu respectivement des morbidités modérées et légères. La régression logistique ordinale a identifié l'âge jeune, la résidence rurale, le chômage, l'avortement au dernier trimestre, l'absence d'utilisation de contraception, la grossesse non désirée et l'expulsion de certains produits de conception comme des facteurs associés à une gravité accrue des complications. Ces résultats soulignent le lourd fardeau des complications graves liées à l'avortement et soulignent la nécessité cruciale d'améliorer l'accès à une planification familiale complète, à des services d'avortement sécurisé et à des soins post-avortement rapides et de qualité, en particulier pour les populations vulnérables du sud de l'Éthiopie. *(Afr J Reprod Health 2024; 29 [9s]: 15-31).*

Mots-clés: Avortement à risque, quasi-accident maternel, grossesse non désirée, enquête prospective sur la morbidité

Introduction

The term "abortion" encompasses both intentional termination (induced abortion) and spontaneous pregnancy loss (miscarriage).[1] In Ethiopia, abortion is defined as a pregnancy loss prior to fetal viability, meaning before 28 weeks from the last menstrual period (LNMP), or a birth-weight less than 1000 grams if LNMP is unknown.[2] While methods vary with gestational age, the World Health

Organization (WHO) discourages laws restricting abortion based solely on gestational limits.[3]

Abortions can be safe or unsafe. Safe abortions use WHO-recommended methods appropriate for the pregnancy stage, performed by trained personnel.[3, 4] Unsafe abortions occur when a person lacking the necessary skills performs them, or they are conducted in an environment lacking minimum medical standards (or both). In 2022, the WHO released updated guidelines consolidating the current evidence and best practices for provision of quality abortion care, which have the potential to transform the universal access to abortion care. In this guideline, for the first time, WHO included self-management of medical abortion as a fully recommended model of abortion care.[3]

Unsafe abortion is a leading but preventable cause of maternal deaths and morbidities. It can lead to physical and mental health complications and social and financial burdens for women, communities and health systems. Abortions in many settings have become safer and more widely available, especially given the rise of medication abortion.[5] However, lack of access to safe, timely, affordable, and respectful abortion care still continues to be a critical public health and human rights issue in most vulnerable populations. Global estimates from 2010–2014 demonstrate that 45% of all induced abortions are unsafe.[6] Of all unsafe abortions, one third were performed under the least safe conditions, i.e., by untrained persons using dangerous and invasive methods.[6]

Despite the improvements in access to safe abortion services, the burden of abortion-related complication is still rising. In developing regions, it is estimated that 220 women die for every 100,000 unsafe abortions and seven million women per year were treated in hospital facilities for complications of unsafe abortion.[6] According to the recent multi-country survey (MCS) conducted by the WHO in 2021 in the African region, out of 13,657 women with abortion- related complications, 323 (2.4%) women were classified with severe maternal outcomes, maternal near-miss and maternal death, while 957 (7.0%) had potentially life- threatening complications.[7]

In comparison with to other African countries, maternal mortality remains persistently high in Ethiopia, and unsafe abortion continues to be one of its top five causes.[8] According to a national study on abortion conducted in 2008, 42% of unintended pregnancies ended in abortion, contributing to an abortion ratio of 13 abortions per 100 live births.[9] Ethiopia took a significant step in reproductive health in 2005 by enacting a revised abortion law (Proclamation No. 340/2003, effective May 2005). This revision broadened the grounds under which abortion can be legally performed, moving beyond the extremely restrictive 1957 Penal Code. The key provisions of the 2005 law allow for legal abortion in cases of: rape/incest, fetal impairment, risk to the mother's life or health, physical/mental disability of the woman, and minority.[2] The primary aim of this legal reform was to improve access to safe abortion services and, consequently, to reduce morbidity and mortality associated with unsafe abortion practices that were prevalent under the previous restrictive law.

As highlighted by a study in 2014 by Tekulu et al., which assessed changes in morbidity and abortion care in Ethiopia after the legal reform, the proportion of abortions that occur outside of health facilities has declined dramatically, suggesting that women with unintended pregnancies now have greater access to safe abortions than they did in 2008. The number of women who obtain post-abortion care has also increased from 58,000 in 2008 to 125,000 in 2014. Furthermore, the abortion rate rose from 22 per 1,000 women of reproductive age in 2008 to 28 per 1,000 in 2014. This increase in the abortion rate is likely attributable to the expanded access to safe and legal abortion services.[10] These positive changes underscore the law's success in improving the landscape of abortion care in Ethiopia by channeling women towards safer services within health facilities.

The inherent social and political sensitivities surrounding induced abortion often hinder the conduct of high-quality research to accurately measure its incidence and associated complications.[11] To overcome these challenges, the World Health Organization (WHO) and other international organizations have developed specific

methodologies for estimating the burden of unsafe abortion-related morbidity and mortality in the community. One such key methodology is the Prospective Morbidity Survey (PMS). The PMS is a facility-based surveillance method designed to prospectively identify and document women presenting to health facilities with complications from induced or spontaneous abortions, thereby providing estimates of the magnitude of severe morbidity and mortality attributable to unsafe abortion. It achieves this by systematically collecting data on patients' clinical presentation, interventions received, and outcomes, allowing for classification of the severity of complications.[11]

In Ethiopia, two national-level studies on abortion complications were conducted in 2008 and 2014 both utilizing the Prospective Morbidity Survey (PMS) methodology.[9, 10] However, these earlier national studies, along with other facility-based studies conducted in Ethiopia,[16, 21] primarily relied on an outdated morbidity classification system (categorizing complications as mild, moderate, or severe). The criteria used to classify the severity levels in these systems were often inconsistent and not fully aligned with evolving international standards. Recognizing the limitations of such disparate classifications, the WHO updated its methodology in 2016 to incorporate the "near-miss concept" as a standardized, more objective approach for measuring very severe, life-threatening conditions resulting from abortion.[1] This near-miss classification focuses on identifying women who experienced life-threatening complications but survived, offering a more precise measure of severe morbidity and providing comparable data across different settings. Therefore, by explicitly making severe abortion-related morbidity and mortality (adopting criteria consistent with the updated WHO near-miss classification) its primary focus, this study aims to fill the methodological gap of previous Ethiopian studies and ensure its findings are directly comparable with current WHO multi-country survey studies and international best practices for measuring maternal morbidity.

Given the methodological advancements in measuring severe abortion-related morbidity and the pressing need for current data, this study aimed to define and accurately measure abortion-related complications to document the spectrum of risks associated with unsafe abortion in the study area. With over a decade elapsed since the last national-level assessment of abortion complications, a significant evidence gap exists regarding the current magnitude of post-abortion maternal complications and the safety and quality of post-abortion care across Ethiopia, particularly in the Wolaita Zone. Therefore, this study aimed to estimate the magnitude of abortion-related complications and elucidate their associated factors in hospitals found in the Wolaita Zone, Southern Ethiopia.

Methods

Study area

The study was conducted in Wolaita Zone, Southern Ethiopia. The Zone is divided in to 16 Woredas/ districts and 7 town administrations with 375 kebeles (the lowest administrative structure in Ethiopia). The total population of the Zone is estimated to be about 2.2 million,[12] and the estimated number of women of child bearing age (15-49 years) is 510,668.[13] There are 13 hospitals (three private, one NGO and nine public), 77 health centers and 350 health posts, and several private clinics, pharmacies and drug vendors working in the Zone (WZHD; 2021. unpublished report). All 13 hospitals in the Zone provide Comprehensive Emergency Obstetric and Newborn Care (CEmONC) which includes evacuation of products of conception (post abortion care). The 77 health centers provide Basic Emergency Obstetric and Newborn Care (BEmONC) services.

Study design and study period

This research employed a facility-based cross-sectional study design within which the Prospective Morbidity Survey (PMS) method was applied. Data collection occurred over a two-month (60-day) period, from December 11, 2023, to February 8, 2024 (Tahisas 01 - Tir 30, 2016 E.C.).

The Prospective Morbidity Survey (PMS) is a well-established abortion research methodology. It was originally proposed and rigorously tested in the

1980s by a WHO Task Force as a robust method to measure the levels and health consequences of unsafe induced abortion, particularly valuable in settings where distinguishing between morbidity from miscarriages and from unsafely or illegally induced abortions is challenging.[11] The methodology is designed to systematically identify, categorize, and quantify complications related to abortion within health facilities. It operationalizes this by classifying cases based on their level of severity through a combination of data collection methods that involves: medical record review, provider interview, and client exit interview.

Inclusion and exclusion criteria

All women who presented with signs and symptoms of abortion-related complications and who were willing to participate were included in the study. Women who refused to participate in the study, women who were admitted with the diagnosis of threatened abortion, and women with other complications of early pregnancy loss such as ectopic pregnancy and molar pregnancy were excluded from the study.

Sample size and sampling technique

Health facility selection

The prevalence of severe maternal outcomes may vary depending on several factors, but it is generally expected to be around 7.5 cases/1000 deliveries.[14] Based on the above assumption and to ensure each facility could contribute sufficient data to the study during the data collection period, participating facilities were selected based on the following criteria:

- Facilities reporting >500 deliveries per year,
- Facilities reporting at least 7 post-abortion patients per month,
- Facilities providing the signal functions for comprehensive emergency obstetric care, which include removal of retained products and surgical capability,
- Availability of safe abortion and/or post-abortion care services.

Therefore, according to the above criteria, there were 13 facilities eligible for the study; 9 public hospitals, 3 private hospitals, and 1 NGO hospital. The three private hospitals refused to participate, resulting in 10 hospitals included in the study (1 referral and 9 primary hospitals).

Participant selection

The minimum sample size required for statistical significance was calculated by using the single population proportion formula. The prevalence for PLTC and MNM cases were taken from previous studies and entered into Epi info 7.2.5.0 as shown in Table 1.

The minimum sample size required for the current study was 236. The expected number of cases based on the previous year's facility reports was 250 per month in the selected hospitals. Further, the data collection period was extended to two months to increase the statistical power of the study. Therefore, all women who presented at the participating hospitals during the 60 day data collection period with signs and symptoms of abortion-related complications and who fulfilled the inclusion criteria constituted the study sample.

Study variables

After reviewing different literatures and PMS studies done in other countries, data was collected on the following variables:

Dependent variables

The main outcome variable of the study is the level of abortion-related complications which are classified as: mild complications, moderate complications, potentially life threatening complications (PLTC), maternal near miss (MNM), and death.

Independent variables

Information from client interview

- Sociodemographic characteristics (age, marital status, occupation, educational level, place of residence)

Table 1*:* Sample size calculations based on the proportions of PLTC and MNM out of total complications across different studies

S.No	Author & Ref.	Country	Proportion of PLTC	Calculated sample size (n)	Proportion of MNM	Calculated sample size (n)
1	Gebrehiwot *et al*.2016[10]	Ethiopia	11%	150	NA	NA
2	Madziyire MG 2018[15]	Zimbabwe	19%	**236**	3%	45
3	Qureshi, Mehrtash *et al*.2021[7]	WHO-MCS(SSA)	7	100	1.9%	28
4	Tariku 2020[16]	Hawasa (Ethiopia)	NA	NA	17.7%	224

Table 2: Criteria for classification of abortion-related morbidity; adapted from Madziyire MG *et al*.[15]

Severity	Condition	Criteria
Mild morbidity	requires all criteria	Temperature 35.1°C–37.2°C with no clinical signs of infection*
		No system or organ failure†
		Systolic blood pressure ≥90mm Hg
		No transfusion required
Moderate morbidity	requires ≥1 criterion	Temperature 37.3°C–38.9°C
		Clinical signs of infection*
		No organ or system failure†
		No sign of shock‡
		No transfusion required
Potentially life-threatening conditions	requires ≥1 criterion	Temperature ≥39°C or ≤35°C and a clinical sign of infection§
		Sepsis/septicemia with no signs of septic shock‡
		Pelvic abscess or pelvic peritonitis with no signs of shock‡
		Clinical anemia without hemorrhagic shock‡
		Uterine perforation without laparotomy or repair of perforated uterus, repair of gut perforation, hysterectomy
Near-miss	requires ≥1 criterion	Hypovolemic shock‡
		Septic shock‡
		Generalized peritonitis
		Uterine perforation with laparotomy or repair of uterine perforation, repair of gut perforation or hysterectomy
		Organ/system failure†
		Massive blood transfusion¶
Death		Loss of the life of a woman as a result of an abortion complication

*******Clinical signs of infection* ***can include: fever >37.3°C and abdominal/uterine tenderness with or without foul smelling vaginal discharge or pelvic abscess or pelvic peritonitis.***

*†System or organ failure can include****: liver failure or renal failure or cardiac arrest/failure or respiratory distress syndrome or coma or disseminated intravascular coagulopathy.***

‡Shock can manifest as: ***a persistent systolic blood pressure ≤80 mm Hg alone or a persistent systolic blood pressure ≤90 mm Hg with a pulse rate at least 120 bpm, and restlessness, reduced consciousness, cold clammy peripheries, requiring administration of IV fluids.***

§*Severe clinical sign of infection* ***also includes sepsis or pelvic abscess or pelvic peritonitis, or uterine perforation.***

¶Massive blood transfusion ***refers to replacement of ≥2 units of blood.***

- Wealth (includes information on asset (e.g. car, bicycle, refrigerator, etc.) and household (HH) characteristics (e.g. type of water source, toilet facility, and roofing material))
- Past reproductive history (number of previous pregnancies, number of previous deliveries, number of previous abortions)
- Recent pregnancy characteristics (pregnancy intention (wanted versus unwanted, planned versus unplanned), prior use of contraception, gestational age (GA), duration of symptoms, etc.)
- Referral status and delay to seek care
- Presence of any intentional attempt to terminate the pregnancy

Information obtained from medical record review and provider interview included the following:

- Clinical information (presenting complaint, provider estimated GA, presence of foreign body)
- Physical examination findings (vital signs, pallor, genital injury, foul smelling discharge)
- Diagnosis (provider classification of the abortion (spontaneous or induced), clinical stage of the abortion)
- Management of complications (type of health professional, place of management, type of evacuation method, use of uterotonic drugs, use of analgesics)
- Post abortion family planning (offered, accepted, type)

Operational definitions

Post abortion complication severity: We used a mutually exclusive five-level classification system of post abortion complication severity as used by WHO MCS-A.[1] These are mild, moderate, severe (PLTC), near miss, or death. We also applied the WHO near-miss criteria[14] for a low and middle-income country context as used by previous studies.[15,17] We classified cases into the highest level of severity or which they met the criteria. Table 2

Gestational age: was measured using clinician-estimated gestational age in weeks (first trimester: 1–12 weeks, second trimester: 13–27 weeks, third trimester: 28 weeks- term)

Data collection tools and procedures

A questionnaire developed by the Guttmacher Institute and used in the Zimbabwe,[15] Ethiopia and Uganda PMS studies was used for data collection. The study team prepared the questionnaire on Kobo Toolbox computer program and the data collectors used the Kobo Collect android application for electronic data collection. The questionnaire included two parts: the patient interview and the provider interview, followed by medical record extraction.

One data collector from each primary hospital and two data collectors from the referral hospital (a total of 11 data collectors) were selected, trained and assigned in the participating hospitals. All the data collectors were BSc midwifes working at the participating hospitals at the gynecology or labor and delivery wards. One obstetrician & gynecologist was also recruited to assist the principal investigator (PI) during training and supervision of fieldwork.

Data analysis procedures

The collected data using Kobo Toolbox was checked for completeness and internal consistency and exported to STATA version 14.2. Then it was carefully cleaned, coded and analyzed. Descriptive statistics, including frequencies and percentages, were used to summarize baseline characteristics.

To estimate the annual prevalence of abortion-related complications, the total number of cases identified during the two-month study period was annualized. This was achieved by multiplying the average monthly number of cases by 12. The formula used was:

Annual number of abortion-related complications= (Total number of cases seen in 2 months/2) ×12

The estimated annual number of abortion-related complications and near-miss cases served as numerators for calculating relevant ratios and rates. For these calculations, the denominators were derived as follows: The total number of live births recorded at each facility during the two-month study period was extracted from delivery registration books. An annual projection of live

births was then calculated by averaging the monthly live births over the study period and multiplying by 12. For the population-based rates, the estimated number of women of childbearing age (15-49 years) in the Wolaita Zone for the corresponding period was obtained from the Ethiopian Statistical Service's 2022 projection[12], and the Federal Ministry of Health's (FMOH) conversion factor[13], totaling 510,668.

Ordinal logistic regression (proportional odds model) was used to analyze the relationship between the independent variables and the ordinal dependent variable representing the severity of abortion-related complications. This model allowed us to assess how changes in the independent variables are associated with the likelihood of experiencing a higher level of complication severity (MNM). The proportional odds model makes the assumption that the effect of each independent variable on the log odds of being in a higher severity category (MNM) compared to a lower severity category (Mild complications) is constant across all levels of the dependent variable. The assumption of proportional odds (POA) was tested using a user contributed Stata command 'gologit2'[18]. The Wald test of parallel lines assumption for the final model in the study was found to be insignificant (X^2=20.07, p-value=0.3289), indicating that the final model does not violate the proportional odds/ parallel lines assumption.

A forward stepwise selection approach was used to build the final model. Variables were selected for inclusion based on theoretical justification and their contribution to the multivariable model, after checking for multicollinearity. The overall goodness of fit of the model was evaluated using a likelihood ratio test. The significance of the association between the independent variables and the outcome variable was determined based on the p-values of the estimated coefficients in the final model. The strength of the association was reported using the corresponding Adjusted Odds Ratio (AOR) with its 95% Confidence Interval (CI).

Ethical considerations

This study was approved by the Institutional Review Board (IRB) of Wolaita Sodo University, College of Health Sciences and Medicine (Reference No. 4/1131/15; Project No. CHSM/ERC/01/15). Official permission letter to undertake the study was also obtained from Wolaita Zone Health department and respective hospitals before commencement of the study.

The client interview component required written informed consent from each respondent. Participants were fully informed about the details of the study and what to expect from the interview by the data collectors. Participation in the survey was entirely voluntary and participants were free to ask questions, to refuse or leave at any time. The exit-interview was conducted during discharge in a separate and quiet room in order to ensure the participants' privacy and confidentiality. Sufficient time was given for questions or clarifications and data collectors were trained to interact with the participants in a compassionate, caring and respectful way. Participants were also asked for their permission to interview their provider about their healthcare, and to extract data from their medical record chart. It was made clear to participants that only routine clinical information would be collected and that any personal identifying information would be removed prior to extracting the data. The confidentiality of the collected information was also assured.

Results

A total of 331 women who presented with signs and symptoms of abortion-related complications to the 10 participating hospitals in Wolaita Zone within the data collection period were included in the study. After excluding nine who did not consent to participate, 322 women were included in the final sample.

Incidence of abortion-related complications

The estimated annual number of abortion-related complications in the facilities was 1,986 (95% CI: 1741, 2142), translating to a complications ratio of 153 per 1,000 live births. Of the 322 women who presented with abortion related complications, 67 (20.8%) were classified as having maternal near miss morbidity, 167 (50.8%) had potentially life-

threatening complications (PLTC), 35 (10.9%) had moderate complications, while 57 (17.7%) had mild complications. No maternal deaths were recorded as a direct result of abortion-related complications during the study period.

To comprehensively describe the burden of severe abortion-related morbidity, we calculated both the near-miss ratio and the near-miss rate: In the study area, the abortion-related near-miss ratio was estimated to be 61.95 per 1,000 live births. This indicates that for every 1,000 live births, approximately 62 women experienced a life-threatening abortion complication but survived. It reflects the direct burden on maternity services relative to the volume of births. The abortion-related near-miss rate was estimated to be 157 per 100,000 women of childbearing age. This provides an understanding of the overall risk of experiencing a severe abortion complication among the reproductive-aged female population.

Socio-demographic characteristics of the participants

As shown in Table 3, the age of women who presented with abortion related complication ranged from 14 to 40 years, with a median age of 27 years (IQR=8). Nearly three fourths (72.7%) were married, 15.2% were single and 12.1% were either divorced or widowed. More than half (52%) of the participants had attended secondary or higher education, 27% had a primary level education, and 21% had never attended school. Some (15.8%) of participants were currently in school at the time of the interview. A majority of women (57%) lived in urban settings (which included Woreda and Zonal towns); while 43% lived in rural Kebeles.

Past and current reproductive characteristics

Of the 322 participants, 64 (20%) had no prior pregnancy while 258 (80%) had had at least one pregnancy. Among the 258 women with previous pregnancy, half had 3 or more children. A total of 75 (23.3%) of the participants had a previous history of abortion.

Table 3: Sociodemographic characteristics of patients who presented with abortion-related complications to the participating hospitals; Wolaita Zone, Southern Ethiopia (December 2023 to February 2024*)*

Variables	Frequency	Percentage
Facility type		
Primary hospital	197	61.2%
Referral hospital	125	38.8%
Age (in years)		
≤19	59	18.3%
20-29	135	41.9%
≥30	128	39.8%
Marital status		
Single	49	15.2%
Married/Cohabitating	234	72.7%
Separated/ divorced/ widowed	39	12.1%
Place of residence		
Rural kebele	138	42.9%
Peri-urban (Woreda town)	124	38.5%
Urban (Zonal town or above)	60	18.6%
Educational level		
No formal education	66	20.5%
Primary education	88	27.3%
Secondary education	96	29.8%
Higher education	72	22.4%
Gainful occupation		
Yes	162	50.3%
No	160	49.7%

Only 96 (29.8%) of the women had taken a pregnancy test to confirm the current pregnancy (the pregnancy they sought care for). The majority (53.4%) reported that they knew they were pregnant when their period was late. Among those who had taken a pregnancy test, the most commonly reported (86 (89.5%)) method was a urine test (either self or provider administered). We asked the women about their decision immediately after knowing they were pregnant; the majority (70%) wanted to get pregnant and give birth but the rest (30%) either did not want to get pregnant at all, did not want to be pregnant now but wanted a baby later, or wanted to get pregnant but later changed their mind.

Table 4: Contraceptive histories of women who presented to health facilities found in Wolaita Zone with abortion related complications, Southern Ethiopia (December 2023 to February 2024)

Variable/ Response	Frequency	Percentage
How did you know you were pregnant?		
Took a pregnancy test	96	29.8
Period was late	172	53.4
Intuitively knew (just know)	14	4.3
I experienced pregnancy symptoms	40	12.4
What was your decision about getting pregnant?		
Wanted to get pregnant and give birth	226	70.2
Did not want to get pregnant at all	44	13.7
Did not want to be pregnant now, but wanted a baby later	36	11.2
Wanted to get pregnant but later changed mind	16	5.0
At the time you became pregnant, were you using a method of contraception?		
Yes	142	44.1
No	180	55.9
Which methods were you using at the time you became pregnant? (n=142)		
Injectable (Depo-Provera/ DMPA-IM)	88	61.9
Implant (1rod-Implanone, 2rod-Jadelle)	28	19.7
Oral contraceptive pills	18	12.7
Others (IUCD, Condoms, Traditional methods)	8	5.6

A majority (56%) of participants reported not using a method of contraception just before their current pregnancy. The most common reasons for not using any contraceptive method were fear of side effects, wanting more children, partner opposition, or perceptions that they could not get pregnant. As shown in Table 4, among 142 women who using a contraceptive method before the current pregnancy, the most common methods reported were injectables (62%) and implants (20%).

History of current pregnancy loss

Analysis of the history of current pregnancy loss indicated that vaginal bleeding and lower abdominal pain were the predominant presenting symptoms for women seeking care. A total of 40 (12.4%) participants explicitly reported having intentionally terminated their current pregnancy. Within this subset, the majority (65%) had employed pharmacological methods, including mifepristone, misoprostol, or unidentified pills. The decision-making process for pregnancy termination was distributed as follows: 35% were made by the woman alone, 20% by the partner/husband alone, and 20% jointly by the couple.

Provider interview and medical record review

Based on the provider interviews and medical record review, the average duration of the complaints before arrival to the health facilities was 2 days (SD=2.1). During presentation, 226 (70.2%) of the women had evidence of expulsion of some products of conception. The median gestational age at presentation determined either clinically or by ultrasound was 12 weeks.

On examination, evidence of a foreign body was found on 12 women, and 8 of them had evidence of mechanical injury. 56 (17.4%) of the participants had signs of infection (which included fever >37.3°C and abdominal/uterine tenderness with or without foul smelling vaginal discharge or pelvic abscess or pelvic peritonitis) (Table 5).

The most common complications recorded by the care providers were haemorrhage, fever and anemia. Forty (12.4%) women were transfused with 2 or more units of blood during their stay. A substantial minority of participants had evidence of major complications: 61 (19.0%) had hemorrhagic shock and 17 (5.2%) had septic shock. Two patients presented with uterine perforation and developed generalized peritonitis. Among the total participants 6 (1.9%) developed organ/system failure.

Likelihood of induced abortion

Distinguishing between spontaneous and induced abortion can be challenging given the identical

Table 5: Results of initial assessment by provider of women with abortion complication at hospitals found in Wolaita Zone, Southern Ethiopia (December 2023 to February 2024)

Variable	Response	Frequency	Percentage
Gestational age (n=310)	1st trimester	192	61.9
	2nd trimester	118	39.1
Evidence of foreign body	Yes	12	3.7
Evidence of cervical or vaginal mechanical injury	Yes	8	2.5
Evidence of offensive or foul smelling products of conception	Yes	51	15.8
Did you find any sign of infection on examination?	Yes	56	17.4
What was the patient's mental status upon arrival?	Alert	200	62.1
	Agitated	62	19.3
	Lethargic	60	18.6

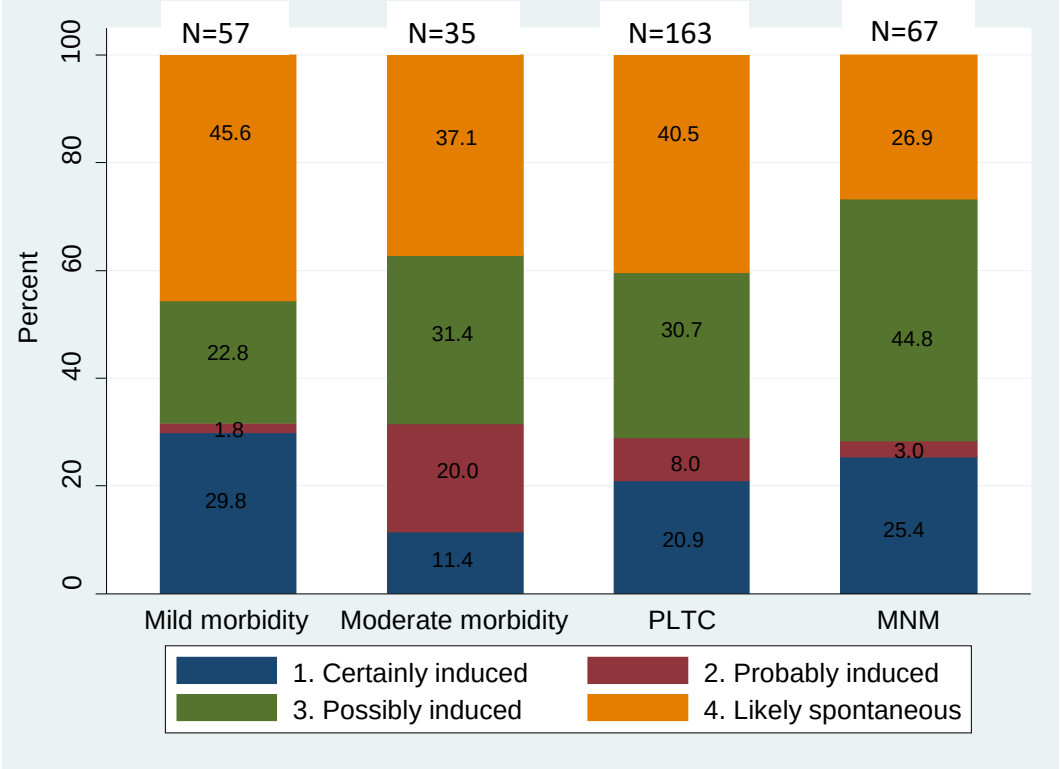

Figure 1: Abortion-related complications by likelihood of induced abortion classification among women who presented to Hospitals found in Wolaita Zone with abortion related complications (December 2023 to February 2024)

modes of clinical presentation. During client interviews, only 40 women (12.4%) admitted intentionally terminating their pregnancies. However, based on the information providers gathered from speaking to patients and the clinical examinations they did, providers classified 46 (14.3%) as most probably induced, 34 (10.6%) as possibly induced, and the majority (224, 69.6%) as most likely spontaneous abortion. Eighteen (5.6%) of the women were not classified by the providers.

Using women's self-report of pregnancy terminations likely resulted in an underestimate of the number of complications resulting from induced abortions given stigma and underreporting. To achieve a more realistic estimate of complications arising from induced abortions, we adopted

Table 6: Factors associated with increased risk of abortion- related complication severity observed among women who sought care at facilities found in Wolaita Zone (December 2023 to February 2024)

Factors	COR	95% CI	AOR	95% CI	p-value
Age in completed years(Ref. age<=19)					
20-29	1.452	0.819, 2.575	0.316	0.112, 0.892	0.029*
>=30	0.877	0.49, 1.571	0.637	0.226, 1.793	0.393
Facility type (Ref. referral)					
Primary hospital	1.511	0.990, 2.307	1.882	0.904, 3.919	0.091
Residence (Ref. Rural)*					
Peri-urban[§]	0.549	0.344, 0.874	0.503	0.254, 0.994	0.048*
Urban[§]	0.368	0.209, 0.649	0.315	0.120, 0.828	0.019*
Gainful occupation (Ref. Yes)					
No	1.589	1.051, 2.402	1.860	1.003, 3.450	0.049*
Marital status (Ref. Single)					
Married/Cohabitating	1.105	0.612, 1.998	1.010	0.334, 3.051	0.986
Separated/ divorced/ widowed	1.022	0.467, 2.236	0.685	0.179, 2.625	0.581
Educational level (Ref. No formal education)					
Primary education	1.206	0.655, 2.221	1.555	0.719, 3.367	0.262
Secondary education	0.787	0.437, 1.417	1.346	0.571, 3.174	0.497
Higher education	0.571	0.305, 1.066	1.150	0.463, 2.856	0.764
Gestational age (Ref. <13weeks)					
>=13weeks	1.616	1.053, 2.480	1.989	1.070, 3.698	0.030*
Number of previous pregnancies (Ref. 0)					
1 or more	1.383	0.834, 2.295	1.808	0.23, 14.54	0.578
Interval from last pregnancy in years (Ref. <1)					
1-2	0.368	0.156, 0.867	0.455	0.157, 1.320	0.147
>=2	0.436	0.188, 1.012	1.068	0.346, 3.294	0.909
At the time you became pregnant were you using a contraceptive method? (Ref. Yes)					
No	1.326	0.878, 2.004	1.748	1.003, 3.107	0.049*
What was your decision about the current pregnancy? (Ref. Wanted to get pregnant and give birth)					
Did not want to get pregnant at all	2.353	1.249, 4.433	3.454	1.280, 9.320	0.014*
Did not want to be pregnant now, but wanted a baby later	1.774	0.880, 3.575	1.051	0.427, 2.589	0.914
Wanted to get pregnant but later changed mind	5.507	2.065, 14.69	3.300	0.958,11.37	0.059
Was there evidence of expulsion of some products of conception? (Ref. No)					
Yes	1.712	1.104, 2.656	2.237	1.109, 4.512	0.025*
Where did you go before arriving to this facility? (Ref. Directly came to this facility)					
In another facility/hospital(s)	1.766	1.125, 2.772	1.882	0.888, 3.986	0.099
Went to pharmacist	1.542	0.462, 5.151	1.625	0.21, 12.75	0.644
Went to TBA or traditional healer	2.597	1.177, 5.731	0.474	0.158, 1.418	0.182
Intercepts					
/cut1*			-0.029	-2.85, 2.79	
/cut2*			0.651	-2.16, 3.47	
/cut3*			3.662	0.81, 6.52	

AOR= Adjusted Odd Ratio, COR= Crude Odd Ratio, [§=] peri-urban represent town administrations in Woredas/ districts; urban include Zonal, regional & higher cities.

** The confidence intervals for the thresholds (cuts) included zero for all but the highest threshold. While the Wald test suggests no violation of the proportional odds assumption, this indicates the model may not perfectly capture the factors influencing the probabilities of being in a specific outcome category.*

classification criteria from a previous study[19]. This criterion considers women's self-reported actions, provider classifications, and clinical findings like genital injuries or evidence of foreign bodies. Using this approach, 72 women (22.4%) were classified as having a complication resulting from a "certain" induced abortion, while 23 (7.1%), 104 (32.3%), and 123 (38%) of them were categorized as resulting from a probable induced, possible induced, and likely spontaneous abortion, respectively. Figure 1 illustrates the association between the likelihood of induced abortion and complication severity. Notably, 73% of women with near-miss morbidity were classified as having induced abortions (certain, probable, or possible), compared to 54.4% and 62.9% of women with mild and moderate morbidity, respectively. The association was statistically significant in bivariate analysis (Chi sq. =24.19; P value = 0.004).

Factors associated with severity of abortion-related complications

An ordinal logistic regression model was used to identify factors associated with the severity of abortion-related complications. After controlling for multicollinearity, verifying the proportional odds assumption, and adjusting for potential confounders, younger age, rural residence, unemployment, later trimester abortion, lack of contraception use at the time of becoming pregnant, unintended pregnancy, and expulsion of some products of conception prior to arriving at the HF were all associated with a higher risk of severe abortion-related complications at $p<0.05$.

As shown in Table 6, the analysis revealed several factors associated with an increased risk of experiencing more severe complications (defined as Maternal Near-Miss Morbidity (MNM) or Potentially Life Threatening Complications (PLTC)): Age: Women aged 20-30 were 68% less likely to experience severe complications compared to those 19 years old or younger (AOR=0.316; 95% CI: 0.112-0.892). Residence: Compared to rural residents, women residing in peri-urban areas (Woreda towns) had a 50% lower risk (AOR = 0.503; 95% CI: 0.254-0.994), and urban residents (Zonal and above towns) had a 69% lower risk (AOR = 0.315; 95% CI: 0.120-0.828) of severe complications. Employment: Women without gainful employment were 86% more likely to experience severe complications compared to those with employment (AOR = 1.860; 95% CI: 1.003-3.450). Trimester of abortion: Women who had an abortion in the second-trimester were twice as likely to experience severe complications compared to those in the first trimester (AOR = 1.989; 95% CI: 1.070-3.698). Contraceptive use: Women who did not use contraceptives just before the index pregnancy had a 75% higher risk of severe complications compared to those who used contraception (AOR = 1.748; 95% CI: 1.003-3.107). Intention to become pregnant: Women who did not want to get pregnant at all were three times more likely to experience severe complications compared to those who reported they had desired the pregnancy (AOR = 3.454; 95% CI: 1.280-9.320). Expulsion of products of conception: Women presenting with evidence of expulsion of some products of conception prior to arriving at the HF were twice as likely to experience severe complications compared to those with no history of expulsion (AOR = 2.237; 95% CI: 1.109-4.512).

Discussion

This study investigated the incidence of abortion-related complications in Wolaita Zone, Southern Ethiopia. We estimated that a substantial 1,986 cases of abortion-related complications presented annually at the participating hospitals. This translates to a ratio of 153 complications per 1,000 live births and a rate of 3.90 complications per 1,000 women of childbearing age in the study areas. Compared to a national study in Ethiopia (2014) which reported a rate of 3.4 per 1,000 women in 2008 and 5.7 per 1,000 in 2014,[10] our findings suggest a persistent burden of abortion complications. This highlights the ongoing need for improved strategies to prevent unwanted pregnancies and increase access to safe abortion services. Our rate is lower than a Tanzanian study (36 per 1,000 women),[20] which might be due to variations in health-seeking behaviors among the study populations. The other possible explanation is difference in sample size and study area covered. The Tanzanian study was a national level study

with large sample size in which different types of health facilities were included. Furthermore, the complications ratio in this current study was considerably higher than a retrospective study conducted in Addis Ababa (60 per 1,000 live births) from 2003-2007.[21] While the study period gap and the study design difference between the studies makes direct comparisons challenging, the potential increase in complications ratios is of concern. This finding warrants further investigation and highlights the need for interventions to reduce unsafe abortion-related complications burden in the general population.

Our study found a high proportion of severe complications (Near-miss Morbidity (MNM) and Potentially Life-threatening Complications (PLTC)) among women with abortion-related complications. Twenty percent were classified as MNM, and over half (50.6%) had PLTC. This is significantly higher than the two WHO multi-country studies on abortion (MCS-A) in sub-Saharan Africa (SSA) (where only 2.4% and 7% of women had MNM and PLTCs, respectively)[7] and in Latin America and Caribbean (LAC) countries (where only 3.1% had PLTC and 1.1% had MNM respectively).[22] Several factors might explain this discrepancy. First, the studies used different criteria for defining massive blood transfusion (2 units in this study vs. 5 units in MCS-A). Second, our sample size and population characteristics, as well as abortion laws, differ from the MCS-A data.

Our findings also show a higher proportion of severe complications compared to other African studies (Kenya: 37%, Malawi: 21%, Zambia: 16%, Zimbabwe: 19%).[15,17,23,24] This might be due, in part to the sample of facilities we included in our study. While other studies included lower level facilities, this study excluded health centers and private clinics where milder complications are typically managed. Consequently, our data reflect a higher proportion of women with severe complications seeking care at hospitals equipped to treat them. The lower rate of women with mild and moderate complications at participating facilities suggests limited health-seeking behavior for these cases in the study population. This highlights the potential for overestimation of severe complications.

Our study's findings indicate a substantial burden of severe abortion-related complications. When compared to an Ethiopian study in Hawassa that reported 35.6% severe morbidity (with 1.2% mortality),[16] our study suggests a higher proportion of severe outcomes. Even more notably, the proportion of severe complications identified in our study is higher than that reported by the last two national studies in Ethiopia (23% in 2008 and 19% in 2014).[10] While direct comparisons are challenged by differing abortion morbidity classification criteria used in previous studies versus our adoption of the updated WHO near-miss concept, this consistent observation across comparisons suggests either a genuinely higher burden of severe complications in the Wolaita Zone or improved capture of severe cases due to our rigorous prospective methodology. Regardless, this highlights the persistent and possibly escalating public health challenge posed by unsafe abortion-related severe morbidity in the area.

Despite no abortion-related deaths encountered in the current study, the high rates of MNM and PLTC are concerning. The MNM ratio in our study (61.95 per 1,000 live births) is considerably higher than the intra-hospital MNM ratio of 14.67 per 1,000 live births observed in Zambia.[17] The rate of abortion related near miss morbidity in terms of 1000 women with complications which is 200 in the current study is also higher than the reported range (5-48 per 1,000 women with complications) in the WHO MCS-A in SSA.[7]

This study found that women aged 20-30 were significantly less likely (AOR=0.316; 95%CI: 0.112-0.892) to experience severe complications compared to those 19 years old or younger. This aligns with findings from Zimbabwe (AOR 0.73, 95% CI: 0.55-0.98) where women over 30 were less likely to have severe complications than those aged 15-19.[15] Younger women face a greater risk of complications from unsafe abortion. Hospital data from developing countries indicates that 38-68% of women treated for abortion complications are under 20.[25] Young girls and adolescents may encounter specific barriers in seeking safe abortion services and care for post-abortion complications, including

provider bias, financial limitations, and fear of stigma, which can lead to delayed care and worsened complications[26]. These findings highlight the need for healthcare facilities to strengthen adolescent and youth-friendly services to ensure a welcoming and supportive environment for young women seeking sexual and reproductive health care. Additionally, educational programs should target young people to increase awareness of when and where to seek appropriate care for abortion-related complications.

This study identified residence and employment status as factors associated with severe complications. Compared to rural residents, women living in peri-urban and urban areas had a significantly lower risk (AOR = 0.503 and 0.315, respectively) (similar findings were reported in Malawi and Zimbabwe).[15, 24] This likely reflects better access to safe abortion services and earlier care-seeking behavior in urban areas. Expanding comprehensive abortion services and equipping rural health centers to provide post-abortion care could be crucial interventions to help reduce the burden of severe complications. Furthermore, unemployed women were almost twice as likely to experience severe complications as those who were employed (AOR = 1.860). Unemployment and financial limitations are known to be associated with unsafe abortion practices.[27] Expanding accessibility of safe abortion and post-abortion care services, particularly for unemployed women free of charge, could be a vital strategy to reduce complications.

Our study identified two additional factors associated with severe complications: contraceptive use and pregnancy intention. Women who did not use contraception before the index pregnancy were significantly more likely to experience severe complications (AOR = 1.748), aligning with findings from Kenya.[23] Similarly, women with unintended pregnancies were three times more likely to have severe complications (AOR = 3.454) compared to those desiring pregnancy. Unintended pregnancy is a known risk factor for unsafe abortion practices, which contribute to complications.[28] Of all unintended pregnancies that occur globally, 61% end up in abortion. This translates to 73 million abortions per year.[29] These findings underscore the importance of comprehensive reproductive health services, including readily available contraception and safe abortion care. As highlighted by the Guttmacher-Lancet Commission,[30] integrating these services into national healthcare systems is crucial. This approach can help reduce unintended pregnancies and the associated risk of unsafe abortion and its complications.

This study also found that women undergoing second-trimester abortion were nearly twice as likely to experience severe complications compared to those in the first trimester (AOR = 1.989). Similarly, women presenting with incomplete abortion (evidence of expelled products of conception) were also at higher risk (AOR = 2.237).

These findings are consistent with observations from the WHO MCS-A studies and other researches in Africa.[7,15,16,22] These results suggest a link between gestational age, incomplete abortion, and the risk of complications. This association might be due to delays in seeking care. Several factors, including limited knowledge about appropriate medical abortion dosages and the timing of post-abortion care, could contribute to these delays. Therefore safe abortion care providers should include accurate information in their standard of care so all clients are informed and aware of what symptoms to look out for and when to seek care.

Study strengths and limitations

This study employed a prospective design, collecting data over two months across 10 hospitals in Wolaita Zone, Southern Ethiopia. This approach offers a key strength by avoiding potential biases associated with missing data that can plague retrospective studies relying solely on medical records. However, the following limitations are important to consider when interpreting the findings. The facility-based design inherently excludes women with mild complications who did not seek care at a facility (e.g., spontaneous resolution). Additionally, it misses cases of severe complications leading to death outside a facility or any other complication occurring outside the healthcare system. Furthermore, the exclusion of data from private facilities could limit the

generalizability of the findings to the entire population, as characteristics of women who utilize private facilities might differ. Similarly, the exclusion of lower-level facilities may have meant that our study missed additional mild cases for which women did not need to go to the hospital, thus overestimating the proportion of severe cases. While the results are directly representative to Wolaita Zone, generalizability to other regions might be limited. However, the findings can be cautiously applied to areas with similar resource constraints and service provision levels for safe abortion and post-abortion care.

Conclusion

This study employed the modified WHO classification system to categorize abortion-related complications. This approach provided valuable insights into the magnitude of maternal near miss (MNM) cases in Wolaita Zone, Ethiopia. The concerningly higher prevalence of severe complications in the current study underscores the ongoing public health challenge of unsafe abortion in the study area. The study also identified several factors associated with a higher risk of severe complications, including younger age, rural residence, unemployment, later trimester abortion, lack of contraception use, unintended pregnancy, and expulsion of some products of conception (incomplete abortion). The higher prevalence of MNM and PLTC suggests a need for improved access to comprehensive family planning, safe abortion services, and timely, quality post-abortion care, particularly for vulnerable populations in Southern Ethiopia.

Competing interests

The authors declare that they have no conflict of interest with the material presented in this paper.

Contribution of authors

Conception and design: JG, BA, DH
Data collection and project management: JG, TU
Statistical analysis: JG, BA, TU
Write up of the manuscript: JG, TU
Review and editing: BE, DH
All the authors have read and agreed to the published version of the manuscript

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