Maternal Morbidity: Self-Reported Leakage and Obstetric-Linked Morbidity Among Women Aged 15–49 Years in Ethiopia, 2024–25

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Abstract

Background: Maternal mortality is an indispensable indicator of reproductive health, but mortality alone does not capture the non-fatal burden of childbirth-related injury. The 2024–25 Ethiopia Demographic and Health Survey (EDHS) includes questions on constant leakage of urine or stool from the vagina, a symptom potentially consistent with fistula or other forms of urinary or fecal incontinence. In this study, this self-reported symptom is referred to as "leakage"; it does not refer to amniotic fluid and is not considered clinically confirmed obstetric fistula. Obstetric fistula and fistula-like leakage are uncommon population events with potentially profound physical, psychological, social, and economic consequences. Their rarity and the routing of symptom questions in household surveys create important measurement and modeling challenges.

Methods: We analyzed nationally representative 2024–25 Ethiopia Demographic and Health Survey individual-recode data for 21,395 women aged 15–49. Following a sequential semantic, routing, denominator, and internal-consistency audit, we defined current leakage, ever leakage, and confirmed obstetric-linked leakage. Survey weights, primary sampling units, and strata were incorporated in estimation. We calculated weighted prevalence and 95% confidence intervals nationally and descriptively by age, education, household wealth, residence, and parity. Education was dichotomized as no education versus any formal education; wealth as the bottom 40% versus upper 60%. A conventional multivariable model and regional prevalence rankings were prespecified as inappropriate because only 136 obstetric-linked events were identified nationally and subgroup event counts were sparse.

Results: Current leakage was reported by 0.61% of women (95% CI: 0.42–0.79; 164 events), ever leakage by 0.83% (0.62–1.04; 240 events), and confirmed obstetric-linked leakage by 0.48% (0.34–0.61; 136 events). Among women ever reporting leakage, 51.0% reported onset after delivery and 6.4% after stillbirth. Obstetric-linked leakage was descriptively higher among women with no education than any formal education (0.74% vs 0.35%), among low-wealth than high-wealth women (0.81% vs 0.31%), among rural than urban women (0.61% vs 0.22%), and among women with four or more live births than those with one to three (0.95% vs 0.55%). Only three obstetric-linked events occurred among adolescents aged 15–19.

Conclusions: The EDHS identifies a small but consequential population reporting current or previous vaginal leakage, more than half of whom linked onset to delivery or stillbirth. The analysis also demonstrates why rare maternal morbidities should not be forced into highly parameterized regression or regional rankings when event support is inadequate. Population surveys can establish burden and broad inequality patterns, but clinical confirmation and subnational programmatic surveillance are needed to characterize causes, geographic concentration, treatment access, and outcomes.

Keywords: maternal morbidity; obstetric fistula; urinary incontinence; fecal incontinence; Ethiopia; Demographic and Health Survey; rare outcomes; survey epidemiology

Introduction

Maternal health assessment has traditionally focused on mortality indicators. This emphasis is understandable: maternal death is an unambiguous and catastrophic endpoint, and its prevention remains a central global health priority. Yet survival does not imply freedom from severe morbidity. Pregnancy and childbirth can leave women with acute or chronic injuries that persist for years, impair physical functioning, disrupt family and economic life, and generate stigma and social exclusion. Obstetric fistula is among the most severe and socially consequential of these conditions. It is classically defined as an abnormal communication between the genital tract and the urinary tract or rectum and, in low-resource settings, is most often associated with prolonged obstructed labor without timely access to effective obstetric care (World Health Organization [WHO], 2006, 2018).

The epidemiology of obstetric fistula is unusually difficult to measure. Cases are rare in population samples, affected women may be geographically or socially marginalized, and clinical confirmation is seldom available in large household surveys. A systematic review by Adler et al. (2013) emphasized that population-level burden estimates have historically been constrained by fistula rarity and the limited number of rigorous studies. More recent validation work has reinforced the distinction between symptom screening and clinical diagnosis. In a clinical-validation study of fistula screening questions, symptom-based instruments showed useful screening performance, but other national work has demonstrated that the positive predictive value of self-reported symptoms can be low when clinical confirmation is applied (Baker et al., 2022; Tunçalp et al., 2022). This distinction is crucial: constant leakage reported in a household survey is epidemiologically informative, but it should not automatically be labeled a clinically confirmed obstetric fistula.

Ethiopia has a long history of clinical, epidemiologic, and programmatic attention to obstetric fistula. Earlier rural research documented the health and social consequences experienced by affected women, including divorce or separation, exclusion from community life, depression, and persistent problems even after treatment (Muleta et al., 2007, 2008). Qualitative studies have subsequently described uncontrolled leakage, odor, isolation, stigma, economic loss, psychological distress, and erosion of dignity (Animut et al., 2019; Bashah et al., 2019). These consequences extend beyond the period of active incontinence: post-repair studies have identified continuing reproductive concerns, mental distress, economic vulnerability, and challenges of social reintegration (Donnelly et al., 2015; Debele et al., 2024). A 2026 Ethiopian meta-synthesis similarly concluded that fistula produces intersecting physical, psychological, and socioeconomic burdens, supporting a model of care that extends beyond surgical closure (Abebe et al., 2026).

The Ethiopian health sector has explicitly recognized fistula as a preventable maternal morbidity. The National Strategic Plan for Elimination of Obstetric Fistula 2021–2025 places prevention, treatment, rehabilitation, and reintegration within the broader effort to end preventable maternal mortality and morbidity (Federal Ministry of Health [FMoH], 2021). However, national population estimates remain difficult to interpret. The 2016 EDHS reported that 0.4% of women aged 15–49 had experienced obstetric fistula, with variation by age, residence, education, and region (Central Statistical Agency [CSA] & ICF, 2016). A secondary analysis of the 2016 survey estimated a similar prevalence among recently parous women and fitted multivariable models to a very small number of cases (Aleminew et al., 2021). Such analyses are useful historically, but they also illustrate the tension between policy demand for "determinants" and the statistical fragility of modeling rare events.

The 2024–25 EDHS provides an opportunity to revisit maternal morbidity using a larger contemporary sample and a more explicit fistula/leakage routing structure. Our objective was not simply to produce

another prevalence estimate. We first reconstructed the questionnaire routing to distinguish current from previous leakage and to identify whether reported onset followed delivery or stillbirth. We then estimated national burden and a deliberately limited set of descriptive inequalities. A central methodological objective was to determine how far the data could support inference without manufacturing precision. We therefore treated the decision not to fit a multivariable model as an analytic result of the design and event structure rather than as an omission.

Methods

Study design and data source

We conducted a secondary cross-sectional analysis of the women's individual-recode file from the nationally representative 2024–25 Ethiopia Demographic and Health Survey. The analytic file contained 21,395 women aged 15–49 with a valid response to the current-leakage item. DHS surveys use stratified multistage cluster sampling and standardized household and individual questionnaires to generate nationally representative estimates across population and health domains (The DHS Program, 2026). All analyses incorporated the women's sampling weight (v005/1,000,000), primary sampling unit, and validated survey stratum. Survey-design variance estimation was used throughout.

Indicator validation and outcome definitions

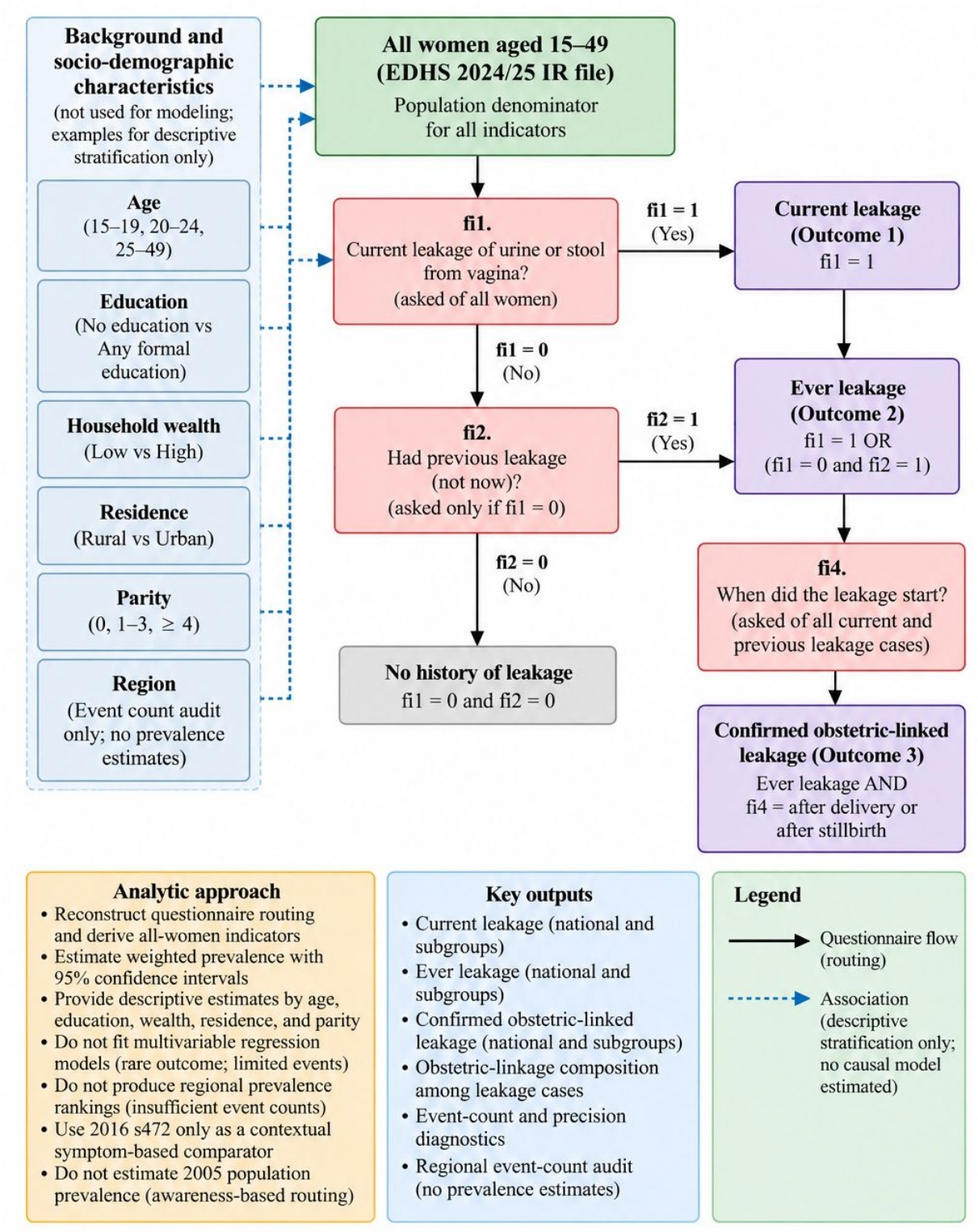
Before prevalence estimation, we conducted a staged measurement audit. First, candidate maternal-morbidity variables were screened semantically to distinguish symptoms actually experienced by respondents from danger signs discussed during antenatal counseling and from service-process items such as screening or specimen collection. This step was necessary because variable labels referring to pregnancy complications can be misleading when their questionnaire context concerns counseling rather than experienced morbidity. Second, the fistula/leakage items were audited for routing, valid denominators, and internal consistency across 2005, 2016, and 2024–25.

The 2024–25 routing showed that the question on previous leakage (fi2) was asked only of women who did not report current leakage (fi1=0). Therefore, fi2 alone cannot represent lifetime prevalence. We reconstructed three mutually coherent outcomes: (1) current leakage, defined as fi1=1; (2) ever leakage, defined as current leakage or previous leakage among women not currently leaking; and (3) confirmed obstetric-linked leakage, defined as ever leakage with reported onset after delivery of a baby or after stillbirth (fi4=1 or 2). All 240 women classified with current or previous leakage had an observed response to the onset question, eliminating the need for a lower- versus upper-bound sensitivity range for obstetric linkage. We use the term "confirmed" only in the internal routing sense—confirmed by the questionnaire sequence—not to imply clinical diagnosis.

Historical comparability

Cross-survey comparability was assessed rather than assumed. In 2005, the experience item was administered only to women who had first reported awareness of obstetric fistula; its denominator therefore cannot yield an all-women population prevalence and was excluded from formal prevalence comparison. In 2016, the survey asked women whether they had experienced constant leakage of urine or stool from the vagina. This item covered the full female sample and produced a national estimate of approximately 0.4%, consistent with the published EDHS table (CSA & ICF, 2016). Because the 2016 wording and routing are not strictly identical to the reconstructed 2024–25 current/ever measures, we retained 2016 as a symptom-based contextual comparator rather than treating the two surveys as a harmonized trend series.

Figure 1. Directed Acyclic Graph (DAG): EDHS 2024/25 Fistula/Leakage Measurement and Analytic Framework.



Note: The DAG represents the measurements and analyses used in EDHS 2024/25. It is descriptive and does not imply a causal model or multivariable analysis.

Descriptive stratification

We estimated the three 2024–25 outcomes nationally and across a restricted set of policy-relevant strata. Age was summarized primarily as 15–19, 20–24, and 25–49 years to preserve the youth-centered focus while avoiding unnecessary fragmentation of rare events. Education was dichotomized as no education (v106=0) versus any formal education (v106>0). Household wealth was dichotomized as low wealth—the poorest and poorer quintiles, representing the bottom 40%—versus high wealth—the middle, richer, and richest quintiles, representing the upper 60%. Residence was urban versus rural. Parity was grouped as no prior live birth, one to three live births, and four or more live births. These categories were selected before interpretation to balance substantive relevance against event support.

Statistical analysis and the decision not to fit a multivariable model

Weighted proportions, standard errors, and 95% confidence intervals were estimated using the complex survey design. Unweighted event counts were retained alongside weighted estimates because event support is essential for interpreting rare-outcome precision. We also calculated relative standard errors and applied descriptive precision flags. Subgroup estimates based on fewer than 10 events were treated as sparse, and estimates based on fewer than five events were not emphasized.

We explicitly rejected a conventional multivariable "determinants" model. This decision was made after outcome reconstruction showed only 136 confirmed obstetric-linked events nationally, with substantially fewer events after stratification. A model incorporating age, education, wealth, residence, parity, and region would consume many parameters relative to the effective number of events, while survey clustering and unequal weighting further reduce the information available for stable estimation. The result would be vulnerable to sparse-data bias, unstable odds ratios, wide confidence intervals, quasi-separation, and strong dependence on model specification. The problem would be especially acute for adolescents, among whom only three obstetric-linked events were observed. Rather than converting descriptive contrasts into apparently independent "effects," we therefore report them as population inequalities. This approach aligns with the broader epidemiologic principle that model complexity must be supported by outcome information and with the measurement literature cautioning against overinterpreting symptom-based fistula classification (Adler et al., 2013; Baker et al., 2022).

For the same reason, we did not produce regional prevalence rankings. The event-count audit showed that regional subdivision generated sparse cells and that no contemporary region contained 30 or more unweighted obstetric-linked events. A regional league table would therefore invite interpretation of unstable point estimates as meaningful geographic differences. Regional targeting is better informed by triangulating population survey evidence with clinical, program, referral, and routine health-system data.

Results

National prevalence and obstetric linkage

Among 21,395 women aged 15–49, 164 reported current leakage, corresponding to a weighted prevalence of 0.61% (95% CI: 0.42–0.79). When current leakage was combined with previous leakage among women not currently leaking, 240 women were classified as ever having experienced leakage, for a weighted prevalence of 0.83% (95% CI: 0.62–1.04). Of these, 136 reported that leakage began after delivery or stillbirth. Confirmed obstetric-linked leakage therefore affected an estimated 0.48% of women aged 15–49 (95% CI: 0.34–0.61).

The onset distribution provides important etiologic context without establishing a clinical diagnosis. Among women with ever leakage, 51.0% reported onset after delivery of a baby and 6.4% after stillbirth;

together, 57.4% were classified as obstetric-linked. The remaining 42.6% reported onset after neither delivery nor stillbirth. Thus, equating all survey-reported vaginal leakage with obstetric fistula would overstate the obstetric component and obscure other possible causes of urinary or fecal incontinence.

Table 1. National prevalence of self-reported leakage and obstetric-linked leakage, Ethiopia EDHS 2024–25

Indicator	Denominator	Events	Weighted %	95% CI
Current leakage	21,395	164	0.61	0.42–0.79
Ever leakage: current or previous	21,395*	240	0.83	0.62–1.04
Obstetric-linked leakage	21,395*	136	0.48	0.34–0.61

**Ever-leakage status was reconstructed from fi1 and routed fi2 responses; virtually all women had resolvable status. Obstetric-linked leakage indicates reported onset after delivery or stillbirth and is not a clinical fistula diagnosis.*

Age and youth

Confirmed obstetric-linked leakage increased across the broad age categories, but event support differed sharply. Among adolescents aged 15–19, the weighted prevalence was approximately 0.01% and was based on only three events. Among women aged 20–24, prevalence was 0.24% (18 events), compared with 0.72% among women aged 25–49 (115 events). The adolescent estimate is therefore best interpreted as a sparse observation in a group with limited cumulative exposure to childbirth, not as evidence of an intrinsically low individual risk following pregnancy or delivery.

Education, wealth, residence, and parity

Descriptive socioeconomic gradients were evident for the obstetric-linked outcome. Prevalence was 0.74% among women with no education compared with 0.35% among women with any formal education. Women in the low-wealth group had an estimated prevalence of 0.81%, compared with 0.31% in the high-wealth group. Rural prevalence was 0.61%, compared with 0.22% in urban areas. These patterns point in a common direction—greater reported burden among socioeconomically and geographically disadvantaged women—but the analysis was not designed to determine whether any one characteristic independently explains the others.

Parity showed the strongest descriptive gradient. Confirmed obstetric-linked leakage was essentially absent among women with no prior live birth, although that estimate was based on a single event. Prevalence was 0.55% among women with one to three live births and 0.95% among women with four or more live births. This pattern is compatible with increasing cumulative exposure to pregnancy and childbirth, but parity is also associated with age, socioeconomic position, fertility preferences, and access to obstetric services; causal interpretation is therefore unwarranted in these cross-sectional data.

Table 2. Descriptive prevalence of confirmed obstetric-linked leakage by selected characteristics, Ethiopia EDHS 2024–25

Characteristic	Events	Weighted %	95% CI
Age 15–19	3	0.01	0.00–0.03
Age 20–24	18	0.24	0.05–0.42
Age 25–49	115	0.72	0.50–0.93
No education	77	0.74	0.45–1.03
Any formal education	59	0.35	0.20–0.50
Low wealth (bottom 40%)	84	0.81	0.50–1.11
High wealth (upper 60%)	52	0.31	0.17–0.45
Urban	31	0.22	0.07–0.38
Rural	105	0.61	0.43–0.80
No prior live birth	1	<0.01	0.00–0.01
1–3 live births	57	0.55	0.31–0.79
4+ live births	78	0.95	0.60–1.31

Note. Estimates are descriptive and survey-weighted. Do not use sparse-event estimates, particularly for ages 15–19 and nulliparous women, for comparative inference. No adjusted model was fitted.

Historical context

The 2016 EDHS reported a national prevalence of 0.4% for experienced obstetric fistula among women aged 15–49 (CSA & ICF, 2016). Our reconstruction of the 2016 symptom item yielded 0.43% (95% CI: 0.30–0.57; 70 events), confirming consistency with the published survey estimate. The 2024–25 EDHS, however, asks specifically about constant leakage of urine or stool from the vagina, distinguishing women currently experiencing this symptom from those who experienced it previously and subsequently asking when the leakage began. Throughout this analysis, "leakage" refers to this self-reported urinary or fecal leakage and not to leakage of amniotic fluid; nor, in the absence of clinical confirmation, is it assumed to represent obstetric fistula. We therefore do not interpret the difference between the 2016 estimate and any 2024–25 indicator as a measured temporal increase or decline.

Discussion

This nationally representative analysis produces three related but conceptually distinct estimates of fistula-like morbidity in Ethiopia. Approximately six women per 1,000 reported current constant leakage, approximately eight per 1,000 reported current or previous leakage, and approximately five per 1,000 reported leakage whose onset followed delivery or stillbirth. The separation of these measures is more informative than a single label of "obstetric fistula." It preserves the distinction between symptom burden, lifetime experience, and obstetric timing while acknowledging that household survey responses are not clinical diagnoses.

The national obstetric-linked estimate is broadly compatible with Ethiopia's continued recognition of fistula as a maternal-health priority, but direct comparison with earlier studies requires caution. The 2016 EDHS reported 0.4% among all women aged 15–49 (CSA & ICF, 2016), while a secondary analysis restricted to women with a birth in the preceding five years reported 0.42% based on only 32 cases (Aleminew et al., 2021). Earlier rural Ethiopian work and international meta-analyses have produced different estimates depending on population, case definition, and ascertainment method (Muleta et al., 2007; Adler et al., 2013). These variations are not merely statistical noise; they reflect the fundamental

measurement problem created when a rare clinical condition is inferred from symptoms in population surveys.

The 2024–25 routing reconstruction adds an important methodological insight. Had the previous-leakage item been analyzed in isolation, lifetime burden would have been underestimated because women with current leakage were intentionally skipped past that question. Combining current and previous pathways yielded 240 ever-leakage cases, compared with 76 previous-only cases. Moreover, the onset item was observed for all women in either pathway, allowing the obstetric-linked measure to be reconstructed without missing-onset sensitivity assumptions. This illustrates why questionnaire routing should be treated as part of the epidemiologic definition rather than as a data-management detail.

The finding that 57.4% of ever-leakage cases reported onset after delivery or stillbirth is also important. It supports a substantial obstetric component while demonstrating that a large minority of reported leakage was not temporally linked by respondents to those events. Other causes of urinary or fecal leakage—including non-fistula incontinence and surgical, traumatic, or other gynecologic causes—can produce similar symptoms (WHO, 2006). Clinical-validation studies likewise caution that self-reported fistula symptoms can generate false-positive classifications even when screening sensitivity is high (Baker et al., 2022; Tunçalp et al., 2022). Accordingly, our terminology is intentionally conservative.

The descriptive inequality pattern is nevertheless epidemiologically coherent. Higher prevalence among women with no education, low household wealth, rural residence, and higher parity is consistent with a broader literature linking fistula to social disadvantage and barriers to timely obstetric care. The Ethiopian national strategy emphasizes access to quality pregnancy and intrapartum care as central to prevention (FMoH, 2021), while WHO identifies timely obstetric care as a core preventive pathway (WHO, 2018). Earlier Ethiopian studies have described rurality, distance, delayed care, early marriage, limited education, and difficult or prolonged labor among the circumstances surrounding fistula (Muleta, 2006; Muleta et al., 2007; Aleminew et al., 2021). Our findings should be understood as contemporary population-level patterning consistent with these mechanisms, not as proof that the measured socioeconomic characteristics independently caused leakage.

The parity gradient deserves particular attention. Obstetric-linked leakage was highest among women with four or more live births, intermediate among those with one to three, and based on only one event among women reporting no prior live birth. A cumulative-exposure explanation is plausible: more pregnancies and deliveries create more opportunities for obstructed labor, difficult delivery, operative intervention, or other obstetric injury. But parity is not randomly assigned and is entangled with age, fertility, education, residence, wealth, and service use. The descriptive gradient therefore provides a useful targeting signal without supporting a causal dose-response claim.

The youth findings are equally instructive. Only three obstetric-linked events occurred among adolescents aged 15–19. A regression coefficient for this group could easily appear dramatic while being driven by a handful of observations. The appropriate interpretation is not that adolescents are protected from fistula. Rather, most adolescents have had less cumulative exposure to childbirth, and the survey contains too few events to estimate adolescent-specific risk with useful precision. This distinction is particularly important because early pregnancy and delayed access to emergency obstetric care remain recognized prevention concerns in fistula programs (WHO, 2018; FMoH, 2021).

Our decision not to fit a multivariable model therefore strengthens rather than weakens the analysis. Policy-oriented research often treats adjustment as an automatic marker of rigor, but rare outcomes impose an information constraint that statistical software cannot overcome. With 136 obstetric-linked events nationally, a model including region plus several individual-level covariates would generate many

coefficients from limited effective information. Survey clustering, unequal weights, sparse cells, and correlated social predictors would further increase instability. Although penalized or Bayesian methods can sometimes improve rare-event estimation, they would not solve the more fundamental problems of symptom misclassification, cross-sectional temporality, and insufficient regional event support. A parsimonious descriptive analysis is therefore the more defensible answer to the data actually observed.

The same logic applies geographically. Ethiopia's current administrative geography creates strong policy demand for regional estimates, but a national survey is not automatically powered for every rare outcome in every region. The event audit did not support a stable regional ranking of obstetric-linked leakage. For program action, this is an argument for data triangulation rather than analytical abandonment. Treatment-center records, referral data, routine health information, maternal and perinatal death surveillance and response systems, and active fistula case-finding can provide operational detail that a household survey cannot. Population surveys and service data answer different questions and should be used complementarily.

Finally, the burden represented by these prevalence estimates extends beyond continence itself. Ethiopian studies repeatedly document stigma, divorce or marital disruption, depression, isolation, economic loss, and compromised social participation among women affected by fistula (Muleta et al., 2008; Animut et al., 2019; Bashah et al., 2019; Abebe et al., 2026). Even after successful repair, some women continue to experience reproductive, psychological, and socioeconomic difficulties (Donnelly et al., 2015; Debele et al., 2024). The policy response should therefore encompass prevention and timely repair, but also psychosocial care, rehabilitation, and social and economic reintegration.

Limitations

Several limitations should frame interpretation. First, all morbidity outcomes are self-reported. The EDHS identifies constant leakage and reported timing of onset but does not clinically verify vesicovaginal or rectovaginal fistula. Misclassification is therefore possible, and symptom prevalence should not be equated with clinically confirmed fistula prevalence. Second, onset after delivery or stillbirth establishes temporal linkage by respondent report, not a verified obstetric etiology. Third, the cross-sectional design does not establish temporal ordering for socioeconomic characteristics and cannot identify causal determinants. Education, wealth, residence, parity, and age are interrelated and the reported subgroup contrasts are intentionally unadjusted.

Fourth, the outcome is rare. Sparse event counts limit subgroup precision, particularly among adolescents and nulliparous women, and preclude defensible regional ranking. The same constraint motivated rejection of a conventional multivariable model. Fifth, the 2016 and 2024–25 fistula/leakage modules are not sufficiently identical in wording and routing to support a formal trend estimate; the 2005 experience item is additionally restricted by awareness-based routing. Finally, the EDHS does not comprehensively measure the full spectrum of maternal morbidity. These results should not be interpreted as indicating that fewer than 1% of Ethiopian women experience maternal morbidity overall; they describe a specific, severe symptom domain captured by the fistula/leakage module.

Conclusion

The 2024–25 EDHS identifies a small but consequential population of Ethiopian women reporting current or previous constant leakage of urine or stool from the vagina. Current leakage affected an estimated 0.61% of women aged 15–49, ever leakage 0.83%, and reported obstetric-linked leakage 0.48%. More than half of women with ever leakage linked onset to delivery or stillbirth. Descriptive

inequalities were apparent by education, wealth, rural residence, and parity, but the rarity of events does not support interpreting these contrasts as independent determinants.

The principal methodological lesson is equally important: analyze rare maternal morbidity only to the limits of the data. Reconstructing questionnaire routing improved measurement; refusing unstable multivariable and regional models protected interpretation from false precision. For Ethiopia, nationally representative household surveys can quantify broad population burden and inequality, while clinical and routine program data are needed to identify causes, local concentrations, referral failures, treatment gaps, and outcomes. A comprehensive maternal-health surveillance strategy should therefore combine population measurement with active case identification, timely obstetric care, fistula treatment, rehabilitation, and social reintegration.

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