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# Severity and management of post-abortion complications among women in Zimbabwe, 2016: A cross-sectional study

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## ABSTRACT

**Objectives:** Abortion complications cause significant morbidity and mortality. We aimed to assess the severity and factors associated with induced and spontaneous abortion complications, and the management of post-abortion care (PAC) in Zimbabwe.

**Design:** Prospective, facility-based 28-day survey among women seeking PAC and their providers.

**Setting:** 127 facilities in Zimbabwe with the capacity to provide PAC, including all central and provincial hospitals, and a sample of primary health centers (30%), district/general/mission hospitals (52%), private (77%) and NGO (68%) facilities.

**Participants:** 1002 women presenting with abortion complications during the study period.

**Main outcome measures: S**everity of abortion complications and associated factors, delays in care-seeking, and clinical management of complications.

**Results:** Overall, 59% of women had complications classified as mild, 19% as moderate, 19% as severe, 3% as near-miss and 0.2% died. A median of 47 hours elapsed between experiencing complication and receiving treatment; many delays were due to a lack of finances. Women who were rural, younger, not in union, less educated, at later gestational ages, or who had more children were significantly more likely to have higher severity complications. Most women were treated by doctors (91%). The main management procedure used was dilatation and curettage/evacuation (75%), while 12% had manual or electrical vacuum aspiration (MVA/EVA) and 11% were managed with misoprostol. At discharge, 43% of women received modern contraception.

**Conclusion:** Zimbabwean women experience considerable abortion-related morbidity, particularly young, rural, or less educated women. Abortion-related morbidity and concomitant mortality could be reduced in Zimbabwe by liberalizing the abortion law, providing PAC in primary health centers, and training nurses to use medical evacuation with misoprostol and MVA. Regular in-service training on PAC guidelines with follow-up audits are needed to ensure compliance and availability of equipment, supplies, and trained staff.


### *Strengths and limitations of this study*

1. This nationally representative study covered all provinces in Zimbabwe, included all central and provincial hospitals which have a high PAC caseload, and avoided concerns encountered in retrospective studies assessing abortion-related morbidity due to missing patient records.
2. Our revised morbidity criteria reduce potential overestimation of severity by removing unreliable stand-alone criteria such as fever and tachycardia.
3. We were unable to distinguish between induced and spontaneous abortions.
4. Information on women with mild complications that resolved spontaneously, severe complications leading to death outside the facility, or any other case of PAC occurring outside of a facility were not captured.

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**Keywords**: Zimbabwe, abortion, post-abortion care, severity

## INTRODUCTION

Unsafe abortion remains an important cause of maternal morbidity and mortality.[1] Globally, between 2010 and 2014, about 25.1 million unsafe abortions occurred annually, largely (97%) in developing countries.[2] Nearly 22,000 women died due to unsafe abortions in 2014,[3] and many more suffered serious injuries. Approximately 12% of maternal deaths globally are attributed to abortion (this includes ectopic pregnancies).[4] Of the estimated 6.2 million unsafe abortions in Africa yearly, one-third occur in Eastern Africa, where Zimbabwe is located.[2]

In Zimbabwe, abortion is highly restricted, and permitted only in cases of rape, incest, when the mother's life is at risk, or when the child may be born with serious mental or physical disabilities.[5] Restrictive abortion laws are not associated with lower levels of abortion[6], but are associated with increased abortion-related morbidity and mortality. Zimbabwe failed to meet the 2015 Millennium Development Goal of reducing the maternal mortality ratio (MMR) by 75%. In fact, while most countries experienced declines in maternal mortality[7], Zimbabwe's MMR increased from 450 per 100,000 live births in 1990[8] to 651 in 2015.[9] Estimates of maternal mortality attributable to abortion complications in Zimbabwe range from 6 to 23%, although these estimates come from older studies with methodological limitations.[10,11]

One approach to reducing abortion-related morbidity and mortality involves improving access to and quality of post-abortion care; such efforts are ongoing in Zimbabwe. National guidelines for comprehensive PAC have been in place since 2001, and were updated in 2014.[12] These guidelines emphasize medical management of abortion complications with misoprostol, preference for MVA over D&C for first trimester abortions, and provision of family planning services.[12] However, in many settings health practitioners do not always adopt or maintain use of efficacious, cost-effective innovations.[13] Furthermore, during the past decade, Zimbabwe has undergone economic stagnation,[14] potentially affecting health delivery systems, including PAC provision. Access to PAC may also be limited due to stigma, costs, and other factors leading to delays in seeking care.[15] No recent studies have examined post-abortion complications in Zimbabwe. We conducted a national survey to assess the severity and management of post-abortion complications, and to understand the factors associated with experiencing severe complications.

## METHODS

We employed the Prospective Morbidity Methodology (PMM) to collect information from PAC patients and their providers on complications from spontaneous and induced abortions treated in a health facility. This methodology was developed by the World Health Organization (WHO)[16], modified by Ipas[17–21], and further refined by the Guttmacher Institute.[22,23] We conducted this study in conjunction with a project estimating the incidence of induced abortion in Zimbabwe; those methods and results are provided elsewhere.[24] We obtained ethical approval from the Medical Research Council of Zimbabwe, the Joint Research Ethics Committee for the University of Zimbabwe, College of Health Sciences and the Parirenyatwa Group of Hospitals and the Guttmacher Institute's Institutional Review Board.

*Data collection*

We conducted a facility-based, prospective survey for 28 days between August and September 2016 among women seeking PAC in Zimbabwe. We compiled a comprehensive list of the 245 facilities in Zimbabwe with the capacity to provide PAC[24] (**Supplemental Table 1**). We then selected all central (n=5) and provincial (n=8) hospitals, and identified a random sample of primary health centers (30%), district/general/mission hospitals (52%), private facilities (77%), and NGO facilities (68%; includes for-profit and not-for-profit facilities). Overall, we selected 133 facilities, of which 127 participated, resulting in a facility-level response rate of 95%.

All women presenting with incomplete, inevitable, missed, complete, or septic abortion during the study period were eligible for inclusion. We could not distinguish between induced or spontaneous abortions, which are often clinically indistinguishable to providers. Furthermore, women often underreport induced abortion due to stigma and fear of being reported to police; for example, 52% of adolescent girls in Zimbabwe believe an unmarried woman seeking treatment in public facilities for post-abortion complications will be reported to police.[25] Since information reported by both women and providers may not reliably distinguish between induced and spontaneous abortions, results presented are for all PAC patients. We note that complications from induced abortions may be more severe than those from spontaneous abortions.[26]

Data were collected by one to two nurses in each facility who coordinated with facility PAC providers to track participants. Once the patient was treated and in a stable condition, the interviewer sought informed consent to conduct a face-to-face interview with her, as well as her consent to separately interview her health care provider about her case and review her medical file. All women seeking PAC in each facility were recorded in a tracking form, including women who were near-misses and too ill to be interviewed and women who died before being interviewed. Among an unweighted total of 1018 eligible patients, 1002 were interviewed (98%) and 986 consented for the provider interview (97%) (**Supplemental Table 1**). Study staff and Ministry of Health and Child Care provincial Reproductive Health Officers supervised data collection.

*Key variables*

*Outcome: post-abortion complication severity*

We developed a five-level classification system of post-abortion complication severity: mild, moderate, severe, near-miss, or death (**Table 1**). These classifications were adapted from the original criteria proposed by Rees et al. in 1997 which has been used in prior studies.[18,20–22,27] We expanded our criteria to include the adapted WHO near-miss criteria[28] for a developing country context.[29,30] Near-miss cases have similar morbidities to cases that result in death but occur more frequently and survive because of the treatment they receive. They are therefore useful to assess quality of care for abortion-related emergencies and to understand circumstances around abortion-related deaths.[31] These modifications aimed to improve the objectivity of the clinical criteria and overall reliability and content validity. We avoided use of standalone clinical signs (e.g., fever and tachycardia) which may lead to overestimation of severity. Furthermore, we removed 'evidence of a foreign body' as a sole criterion for severe complications, as this may not indicate severe morbidity, and is based on subjective provider reports, which may be affected by provider stigma and restrictive abortion laws.

**Table 1. Criteria for classification of abortion-related morbidity**

| |
|---|
| **Mild morbidity (requires all criteria)** |
| • Temperature 35.1-38.9 degrees Celsius with NO clinical signs of infection[1]<br>• No system or organ failure[2]<br>• Systolic blood pressure ≥ 90mmHg<br>• Hemorrhage not requiring any transfusion |
| **Moderate morbidity (requires ≥1 criterion)** |
| • Temp. 37.3–38.9 degrees Celsius<br>• Clinical signs of infection[1]<br>• No organ or system failure[2]<br>• No sign of shock[3]<br>• Haemorrhage not requiring any transfusion |
| **Severe Morbidity (requires ≥1 criterion)** |
| • Temperature ≥39 C or ≤35C AND a clinical sign of infection[4]<br>• Sepsis/septicemia with no signs of septic shock[3]<br>• Pelvic abscess or pelvic peritonitis with no signs of shock[3]<br>• Clinical anemia without hemorrhagic shock[3]<br>• Uterine perforation WITHOUT laparotomy or repair of perforated uterus, repair of gut perforation, hysterectomy |
| **Near-Miss (Requires ≥1 criterion)** |
| • Hemorrhagic shock[3]<br>• Septic shock[3]<br>• Generalized peritonitis<br>• Uterine perforation with laparotomy or repair of uterine perforation, repair of gut perforation or hysterectomy<br>• Organ/system failure[2]<br>• Massive blood transfusion[5] |
| **Death** |

[1] 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.

[2] 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 (DIC).

[3] Shock can manifest as: a persistent systolic blood pressure <=80 mmHg alone OR a persistent systolic blood pressure <=90 mmHg with a pulse rate at least 120 bpm, and restlessness, reduced consciousness, cold clammy peripheries, requiring administration of IV fluids.

[4] For severe, the clinical sign of infection also includes sepsis or pelvic abscess or pelvic peritonitis, or uterine perforation.

[5] Massive blood transfusion refers to replacement of ≥ 2 units of blood.

**Note**: Due to data quality concerns with temperature recordings not aligning with expected clinical symptoms, we expanded the definition of normal temperature (35.1-37.2 C) to more accurately capture very low temperatures, which are a sign of shock or infection. To be classified as having severe morbidity, a patient had to have a very low or very high temperature along with a clinical sign of infection, or any of the other criteria. This prevents patients with only recorded low temperature and no other symptoms from being inaccurately captured as a severe case. A normal temperature (i.e. a mild morbidity category) was imputed for three cases with missing temperature and who also had no other clinical symptoms. There were four other cases that did not fall into any of the categories based on their clinical criteria. Three cases had low temperature (<35 C) but no other signs of complications so the medical doctors on the study team determined these cases should be classified as mild morbidity. One case had tachycardia, stayed in the hospital for greater than 24 hours and was given oral and IV antibiotics but had normal temperature and no other complications. The medical doctors on the team determined this case should be classified as moderate morbidity.

*Covariates*

We collected information on socio-demographic and reproductive health-related characteristics and about various delays that may occur in obtaining care for post-abortion complications, including reasons for those delays. Furthermore, we inquired about amount of income lost to the respondent or her household as a result of experiencing health problems (excluding the actual costs of treatment or transportation). Variables that merit additional explanation are described below.

*Trimester.* This was measured using clinician-estimated gestational age in weeks (1st trimester: 1-12 weeks, 2nd trimester: 13-27 weeks, 3rd trimester: 28 weeks-term). Under 5% of unweighted cases (47/1002) were missing the clinician's estimate; for 36 we used women's self-reported gestational age, and the remaining 11 were missing.

*Wealth*. We constructed wealth indicators among our participants comparable to the national-level wealth quintiles using data from the 2015 Zimbabwe Demographic and Health Survey (DHS) [9]. We performed principal components analysis (PCA) using information on assets (e.g., car, bicycle, refrigerator, etc.) and household characteristics (type of water source, toilet facility, and roofing material) available in both the DHS and our questionnaire. We generated factor weights for each asset or characteristic[32], and used them to calculate individual wealth scores for each person in the DHS. We split those wealth scores into relative quintiles (poorest, poor, medium, wealthy, wealthiest) and noted the cut points for each quintile. Next we applied those factor weights to variables in our survey data, constructed individual wealth scores, and classified women into a quintile, using the DHS-derived cut points.[9] We conducted this procedure separately for urban women and for rural women, since wealth indicators vary substantially by place of residence. Therefore, our final wealth indicator defines each wealth quintile differently based on urban/rural residence.

*Analysis*

We performed all analyses in Stata version 14.1. We conducted descriptive analyses to determine frequencies for categorical variables and calculated medians (or means) for continuous variables. We applied facility-level weights and calculated standard errors taking into account the complex sample design, including adjusting for stratification by province and facility type, clustering of women at the facility level, and facility non-response, and applying a finite population correction.

To examine factors associated with increasing severity of post-abortion complications, we conducted ordinal regression, using a three-level severity variable (collapsed from the original five-levels to avoid estimation problems due to small cell sizes). The levels were defined as: (1) mild complications, (2) moderate complications, or (3) severe complications including near-miss or death. We assessed variables demonstrated in prior analyses to be significantly associated with abortion severity (urban/rural residence, marital status, educational level, pregnancy duration),[27] and variables we hypothesized may be associated with severity (age, parity, facility type, wealth status, delays in access to care). Variables with a p-value $\leq 0.25$ in bivariate analysis were considered for inclusion in a multivariate model. We assessed for collinearity and confirmed that our model did not violate the proportional odds assumption, and used a planned backward block stepwise regression approach.[33]

## RESULTS

Women presenting with post-abortion complications in our study ranged from 15-47 years old, with adolescents (ages 15-19) accounting for 12% of PAC patients (**Supplemental Table 2**). Most were in union (80%), had partial or complete secondary schooling (71%) and were not formally employed (63%). More rural women were adolescents compared to urban

women (17% rural vs. 8% urban), less likely to have attended university (19% urban vs. 6% rural), and more likely to not be formally employed (77% rural versus 54% urban). Women in our study were wealthier when compared against the national distribution of wealth, with 37% classified in the "wealthiest" quintile, according to place of residence. This was more evident among rural women; nearly half (47%) of rural women were classified in the "wealthiest" quintile. Women reported that most pregnancies resulting in complications for which they were seeking care were wanted at the time of pregnancy (70%), while 15% were wanted later and 15% were not wanted. Most women (65%) were in the first trimester of pregnancy. The largest proportion of patients (40%) were managed in district, general, or mission hospitals (24% urban vs. 65% rural); an additional 29% were served in central hospitals.

Out of a weighted total of 1282 women, 59% had mild morbidity, 19% had moderate morbidity, 19% had severe morbidity, 3% were classified as near-miss, and 0.2% participated in the survey but later died (**Supplemental Figure 1**). There were two additional deaths and 12 near-misses recorded in facility tracking forms. Since no data could be collected on these patients for verification, these near-misses and deaths are not included in this severity distribution.

Women reported that it took a median time of 47 hours from the time of experiencing complications until receiving complete treatment (**Table 2**). This includes all health-seeking delays: realizing care was needed, deciding to seek care, arriving at a facility, being attended to, and completing treatment. The median self-reported delay in realizing care was needed was 8 hours (range: <1 to 2688 hours). The median delay in deciding to seek care after realizing it was needed was 2 hours (range: <1 to 1008). The most common reasons for this delay included lack of money (41%), partner or family member making the decision (13%), lack of transportation (13%), or distance to the facility (12%). The median delay in arriving to a health facility after deciding to seek care was 1 hour (range: <1 to 672). Women who received care in primary health centers reported the longest median delay (4 hours) in arriving to a health facility. The most common reasons for this delay included lack of money (63%), lack of transportation (24%) or distance to facility (16%). All women attending primary health centers reported being delayed in arriving at the health center due to a lack of money. The median delay in being attended to after arriving at a health facility was 0.5 hours (range: <1 to 504), generally due to non-availability of a nurse or doctor (37%) especially in the central/provincial and district hospitals (37% and 41%, respectively). The longest overall delay (median 12 hours, range <1 to 840 hours) occurred between being attended to and receiving complete treatment, with the longest delays in district hospitals (17 hours) and the shortest delays in primary health centers (1 hour). Nearly half (49%) sought care elsewhere before arriving at the current facility, with the majority of these women seeking but not receiving complete care from primary health centers (61%). Among those reporting lost income, the average loss (excluding costs of treatment or travel) was USD $90.82. This was higher in private and NGO facilities ($280.27) and lowest in primary health centers ($41). Average lost income was higher for urban ($104.04) versus rural women ($76.71).

**Table 2. Experiences related to seeking post-abortion care, Zimbabwe 2016, Prospective Morbidity Survey**

| | Total | | Facility type where care was ultimately received | | | |
|---|---|---|---|---|---|---|
| | Weighted N | Hours | Central and provincial hospitals | District hospitals | Primary health center | Private and NGO facilities |
| **Time delays in seeking care (Hours)** [a] | | | | | | |
| Median delay in realizing health care was needed | 1210 | 8 | 11 | 5 | 2 | 24 |
| Minimum | | 0 | 0 | 0 | 0 | 0 |
| Maximum | | 2688 | 2688 | 1344 | 168 | 672 |
| Median delay in decision to seek care after realizing care was needed | 1221 | 2 | 2 | 2 | 2 | 6 |
| Minimum | | 0 | 0 | 0 | 0 | 0 |
| Maximum | | 1008 | 1008 | 672 | 168 | 672 |
| Median delay in arriving to initial health facility after deciding to seek care [b] | 1216 | 1 | 1 | 2 | 4 | 1 |
| Minimum | | 0 | 0 | 0 | 0 | 0 |
| Maximum | | 672 | 504 | 336 | 168 | 672 |
| Median delay in being attended to after arriving at health facility | 1193 | 1 | 1 | 1 | 0.1 | 0.3 |
| Minimum | | 0 | 0 | 0 | 0 | 0 |
| Maximum | | 504 | 504 | 96 | 7 | 24 |
| Median delay in receiving complete treatment after being first attended to | 1206 | 11 | 12 | 17 | 1 | 2 |
| Minimum | | 0 | 0 | 0 | 0 | 0 |
| Maximum | | 840 | 840 | 168 | 2 | 504 |
| **Reasons for delay in deciding to seek care after realizing health care was needed** [c] | Weighted N | % | | | | |
| Did not have money | 77 | 41% | 56% | 34% | - | 16% |
| Partner or family member decides | 24 | 13% | 13% | 16% | - | 4% |
| Lack of transportation | 24 | 13% | 10% | 19% | - | 0% |
| Distance to facility | 22 | 12% | 9% | 18% | - | 0% |
| | | | | | | |
| **Reasons for delay in arriving to health facility** [d] | Weighted N | % | | | | |
| Did not have money | 41 | 63% | 55% | 63% | 100% | 67% |
| Lack of transportation | 15 | 24% | 18% | 47% | 0% | 0% |
| Distance to facility | 10 | 16% | 5% | 38% | 0% | 0% |
| | | | | | | |
| **Reasons for delay in receiving care at facility** [e] | Weighted N | % | | | | |
| No doctor or nurse available | 105 | 37% | 37% | 41% | 0% | 10% |
| Many patients in line for care | 82 | 29% | 31% | 23% | 100% | 42% |
| Did not have money | 40 | 14% | 14% | 16% | 0% | 6% |
| | | | | | | |
| **Sought care at another facility prior to receiving care at current facility** | Weighted N | % | | | | |
| | 636 | 49% | 58% | 46% | 15% | 37% |
| **Of those who reported lost income, amount of income lost to household due to health problems (does not include costs of treatment or travel) (in USD)** [f] | Weighted N | USD | | | | |
| Average loss of income for all respondents | 320 | 90.82 | 60.16 | 94.54 | 41.00 | 280.27 |
| Average loss of income for urban respondents | 165 | 104.04 | 66.02 | 97.36 | - | 318.25 |
| Average loss of income for rural respondents | 155 | 76.71 | 47.23 | 93.16 | 41.00 | 13.12 |

a) These are self-reported time of delays from respondents. Two respondents had total delays greater than their estimated gestational age, and therefore were set to missing.

b) This question asks for their initial visit to a health facility, not necessarily the facility where they were interviewed/received treatment. It can be interpreted as time from decision to seek care to access to health care system.

c) Out of 186 respondents. These are multiple response questions so they will not add up to 100 and the table does not present all responses. There was no data for individuals who sought care at primary health centers regarding reasons for delay in deciding to seek care after realizing health care was needed.

d) Out of 65 respondents. These are multiple response questions so they will not add up to 100 and the table does not present all responses.

e) Out of 120 respondents who said it took longer than a reasonable time to be attended to at facility. These are multiple response questions so they will not add up to 100 and the table does not present all responses.
f) 75% of respondents did not report a loss of income and are therefore not included in this total. If these respondents are imputed as $0 for loss of income, the overall average loss of income is $22.59.

In multivariate analysis, rural women had 122% higher odds (adjusted odds ratio [adjOR] 2.22, 95% CI: 1.70-2.91) of severe morbidity (versus low or moderate morbidity), or of moderate/severe morbidity (versus low morbidity), holding other factors in the model constant (**Table 3**). In other words, a rural woman had over twice the odds of increasingly severe morbidity from complications of abortion versus a similar urban woman. Women older than 30 were significantly less likely (27% lower odds) than women aged 15-19 to have increasingly severe morbidity (adjOR 0.73, 95% CI: 0.55-0.97). Women not in union had 62% higher odds of increasingly severe morbidity compared to women in union (adjOR 1.62, 95% CI: 1.29-2.04). University education was protective, conferring 54% lower odds of increasingly severe morbidity as compared with having no schooling or any primary education (adjOR 0.46, 95% CI: 0.32-0.65). Having children increased the odds of experiencing increasingly severe morbidity by 69%. Women in their second trimester of pregnancy had 31% higher odds of increasingly severe morbidity compared to women in their first trimester (adjOR 1.31, 95% CI: 1.00-1.70).

**Table 3. Crude and adjusted odds ratios[a] (and 95% CIs) for the relationship between sociodemographic or abortion-related characteristics and severity of abortion complications, among women receiving post-abortion care, Zimbabwe 2016, Prospective Morbidity Survey**

| Characteristic | Crude OR | (95% CI) | p-value | Adjusted OR [c] | (95% CI) | p-value |
|---|---|---|---|---|---|---|
| **Residence** | | | | | | |
| Urban | 1.00 (ref) | | | 1.00 (ref) | | |
| Rural | 2.33 | (1.82, 3.00) | 0.00 | 2.22 | (1.70, 2.91) | 0.00 |
| **Age** | | | | | | |
| 15-19 | 1.00 (ref) | | | 1.00 (ref) | | |
| 20-29 | 0.92 | (0.69, 1.22) | 0.55 | 0.93 | (0.73, 1.18) | 0.52 |
| 30+ | 0.72 | (0.56, 0.94) | 0.01 | 0.73 | (0.55, 0.98) | 0.04 |
| **Marital status [b]** | | | | | | |
| In union | 1.00 (ref) | | | 1.00 (ref) | | |
| Not in union | 1.30 | (1.03, 1.64) | 0.03 | 1.63 | (1.29, 2.04) | 0.00 |
| **Educational level** | | | | | | |
| None or any primary | 1.00 (ref) | | | 1.00 (ref) | | |
| Any secondary schooling | 0.67 | (0.51, 0.88) | 0.01 | 0.94 | (0.72, 1.24) | 0.67 |
| University or more | 0.25 | (0.18, 0.36) | 0.00 | 0.45 | (0.31, 0.65) | 0.00 |
| **Number of living children** | | | | | | |
| None | 1.00 (ref) | | | 1.00 (ref) | | |
| 1-2 | 1.26 | (1.01, 1.57) | 0.04 | 1.68 | (1.33, 2.13) | 0.00 |
| 3+ | 1.37 | (1.04, 1.80) | 0.03 | 1.68 | (1.13, 2.49) | 0.01 |
| **Estimated gestational age** | | | | | | |
| First trimester | 1.00 (ref) | | | 1.00 (ref) | | |
| Second trimester | 1.42 | (1.08, 1.87) | 0.01 | 1.31 | (1.01, 1.71) | 0.04 |
| **Facility where post-abortion care was received** | | | | | | |
| Primary health center | 1.00 (ref) | | | - | | |
| District hospitals | 1.50 | (0.45, 5.00) | 0.50 | - | - | - |
| Provincial and Central hospitals | 0.72 | (0.22, 2.30) | 0.57 | - | - | - |
| Private and NGO facilities | 0.49 | (0.15, 1.61) | 0.24 | - | - | - |
| **Relative wealth quintile** | | | | | | |
| Poorest | 1.00 (ref) | | | 1.00 (ref) | | |
| Poor | 1.17 | (0.86, 1.59) | 0.32 | 1.09 | (0.83, 1.43) | 0.51 |
| Medium | 0.86 | (0.60, 1.24) | 0.42 | 0.84 | (0.59, 1.20) | 0.32 |
| Wealthy | 0.90 | (0.67, 1.21) | 0.48 | 0.88 | (0.65, 1.20) | 0.42 |
| Wealthiest | 0.84 | (0.64, 1.09) | 0.19 | 0.80 | (0.63, 1.02) | 0.08 |
| **Time between deciding to seek care and arrival at a facility [d]** | | | | | | |
| No delay (wait <2 hours) | 1.00 (ref) | | | - | | |
| Less than a day | 1.28 | (1.03, 1.60) | 0.03 | - | - | - |
| 1+ days | 0.90 | (0.57, 1.43) | 0.66 | - | - | - |

a) Model is an ordinal logistic regression where the outcome is three levels: mild complications; moderate complications; severe complications or near-miss or death.

b) In union indicates currently married or living together; not in union indicates never married, with partner and not living together, or separated/divorced/widowed.

c) Bivariate and multivariate models are restricted to cases with no item nonresponse for any of the variables in the table. The weighted N for the multivariate model is 1232.

d) Refers to the initial facility the respondent went to, which might not be the same facility where the respondent ultimately received care.

- Not included in final regression

D&C/D&E was the most common PAC procedure (75%), except in primary health centers (which do not have the capacity to provide this service) (**Table 4**). Only 11% of clients had medical evacuation using misoprostol, although this was 100% among clients in primary health centers. Doctors performed the majority of procedures (91%) and most participants received antibiotics (97%), pain medication (78%) and intravenous (IV) fluids (67%). While 92% of patients were counseled about contraception at discharge, 43% of participants received modern contraception on discharge, with larger proportions receiving methods in primary health centers and private or NGO facilities (61% in each), and smaller proportions receiving methods in central and provincial hospitals (26%).

**Table 4. Treatment and services received by post-abortion care clients, Zimbabwe 2016, Prospective Morbidity Survey**

| | Total | | Facility type | | | |
|---|---|---|---|---|---|---|
| | Weighted N | % | Central and Provincial Hospitals | District Hospitals | Primary Health Center | Private and NGO facilities |
| Patient stayed in facility >24 hours | 577 | 46% | 43% | 61% | 0% | 20% |
| Main procedure used in management of patient's condition[a] | | | | | | |
| Dilation & curettage/evacuation[b] | 760 | 75% | 74% | 78% | 0% | 67% |
| Manual/Electric Vacuum Aspiration | 125 | 12% | 17% | 6% | 0% | 14% |
| Misoprostol | 113 | 11% | 9% | 12% | 100% | 17% |
| Oxytocin | 21 | 2% | 0% | 4% | 0% | 2% |
| Procedure performed primarily by: | | | | | | |
| Doctor[c] | 960 | 91% | 99% | 83% | 0% | 87% |
| Nurse/ Midwife/ Clinical Officer | 93 | 9% | 1% | 17% | 100% | 13% |
| Received intravenous fluids | 848 | 67% | 70% | 71% | 36% | 46% |
| Antibiotics provided | 1232 | 97% | 96% | 99% | 85% | 98% |
| Pain medication provided | 960 | 78% | 79% | 75% | 64% | 91% |
| **Contraceptive services** | | | | | | |
| Patient counseled on contraception at discharge | | | | | | |
| Yes | 1154 | 92% | 88% | 96% | 100% | 91% |
| No | 76 | 6% | 10% | 2% | 0% | 8% |
| Not discharged yet | 25 | 2% | 2% | 2% | 0% | 1% |
| Patient received modern contraception at discharge | | | | | | |
| Yes | 535 | 43% | 26% | 55% | 61% | 61% |
| No | 650 | 52% | 67% | 40% | 39% | 37% |
| Don't know | 69 | 6% | 7% | 5% | 0% | 2% |

a) Out of women who obtained procedures (weighted N=1018).
b) D&C/D&E includes: dilatation and curettage (D&C) (12%), evacuation by sharp curettage (50.5%), digital evacuation (1.5%), and forceps evacuation (10.4%).
c) Includes OB/GYN (34%) and Medical Officers/GPs/Senior Resident Medical Officers (57%).

## DISCUSSION

*Main findings*

About 40% of Zimbabwean women experiencing abortion complications are classified as having moderate or more severe complications. The proportion with severe or near-miss morbidity (21%) is similar to recent studies done in Malawi (21%),[27] and in Kenya (37%).[34] However, proportions of severe cases in those studies were likely overestimated with the older criteria, and therefore the proportion of severe/near-miss cases in Zimbabwe is high in comparison. We identified several characteristics associated with a greater likelihood of increasingly severe abortion complications, including being young, rural, not in union, less educated, having children, or at a later gestational age. Our findings are similar to those from a study in Malawi, which also reported greater risk of abortion-related morbidity among rural women and those not in union.[27] In Zimbabwe, PAC is not offered in most primary health centers, which are more accessible to rural women than higher level facilities. Expanding provision of comprehensive PAC services in rural areas, especially ensuring access for adolescents,[9] may help address this inequity. Empowerment of young women, including through educational opportunities and health literacy, may play a role in maximizing health and reducing unintended pregnancy and recourse to unsafe abortion.

Financial constraints represented the most common reason for delays in care-seeking. Despite the policy that PAC should be free in public facilities; women still pay for transport, additional service fees, and other expenses. The costs of seeking PAC may be inaccessible for many, and women in our sample (i.e., those who successfully sought and received PAC) were wealthier than the national wealth distribution in Zimbabwe, suggesting potential selection of wealthier individuals into receipt of these services. Similarly, facility access for deliveries in Zimbabwe also increases progressively by wealth (60% for women in the lowest quintile; 95% for women in the highest).[9] As lower income women are more likely to have less safe abortions than richer women, enhancing accessibility and affordability of PAC services for poorer women is essential to decrease maternal mortality. Women seeking care in primary health centers reported the longest median delay in arriving at a facility; these facilities tend to be more remote, particularly in rural areas, and most likely require that women have funding for and access to transportation. The median delay to receiving complete treatment (12 hours) could be considerably reduced if medical evacuation with misoprostol is adopted in all facilities. Surgical evacuation of the uterus is usually done at set times to allow organization of operating theatres, while medical evacuation can be offered immediately upon diagnosis of incomplete abortion. A third of clients first sought care at primary health centers but needed to go to higher level facilities to receive PAC; the lack of PAC capacity at many primary health centers further delays management and potentially increases the severity of complications, including the possibility of death. Enabling primary health centers to provide PAC using misoprostol or MVA would reduce costs and improve accessibility, decongest higher level facilities, and presumably reduce maternal mortality.

A Zimbabwean pilot study found that using misoprostol for PAC reduced referral rates in primary health centers (from 98% to 10%) and rural/mission hospitals (from 48% to 3%), while maintaining 96% efficacy. [35] However, in our study, most PAC cases were managed with D&C/D&E and few were managed with MVA/EVA (12%) or misoprostol (11%). Using medical evacuation with misoprostol is considerably less expensive than surgical evacuations while MVA is safer and results in less perioperative blood loss.[36] Zimbabwe lags behind other countries like Malawi[27] and Kenya[34] in adopting MVA. Furthermore, although most clients in our study were managed by medical doctors, training nurses to use misoprostol and MVA, when appropriate and as allowed under current law, will improve PAC availability, shorten delays and consequently reduce severity, particularly in settings without doctors, like primary health centers. Receipt of IV fluids by 67% of patients suggests

potential overuse, as this is generally only necessary for women with moderate or greater severity. Conversely, we observed a potential underuse of analgesics; all patients receiving PAC should receive this,[36] but only 78% did. We recommend in-service training of clinicians in the national PAC guidelines and regular audits to check whether clinicians are following the guidelines, or are experiencing stock outs which prevent them from doing so.

*Strengths*

Our study was nationally representative, involving all provinces in Zimbabwe and sampling all central and provincial hospitals. Prospective data collection in facilities avoided concerns encountered in retrospective studies assessing abortion-related morbidity due to missing patient records. Using a patient interview, provider interview and case notes improved data accuracy. We achieved a high response rate in sampled facilities (95%). The revised morbidity criteria reduced potential overestimation of severity by removing unreliable stand-alone criteria such as fever and tachycardia. In addition, our comparison of treatment provided to national PAC guidelines and consideration of women's delays to care are relevant to policies to improve the clinical management and quality of PAC.

*Limitations*

Our study has several limitations. First, we were unable to distinguish between induced and spontaneous abortions, and as noted above, complications from induced abortions may be more severe than those from spontaneous abortions.[26] We asked women if they had done anything to interfere with the pregnancy, but acknowledgement was extremely rare (4%), potentially owing to fear of legal repercussions. We did not consider this self-reported information to be sufficiently reliable. Second, as a facility-based study, information on women with mild complications that resolved spontaneously, severe complications leading to death outside the facility, or any other case of PAC occurring outside of a facility were not captured. Third, although we used prospective data collection, we were unable to gather information on 2 women who died and 12 women classified as near-misses in tracking forms. Thus, the most severe cases may still be underestimated.

## CONCLUSION

In Zimbabwe, abortion-related morbidity and concomitant mortality could be reduced by liberalizing the abortion law, providing PAC in primary health centers, and training nurses to use medical evacuation with misoprostol and MVA. Regular in-service training on PAC guidelines should be done with follow-up audits to ensure compliance and availability of equipment, supplies, and trained staff. Efforts are needed to reduce unintended pregnancy and unsafe abortion among those more likely to have severe abortion-related complications, including adolescents and women in rural areas, those with less education, or those not in union. Further research should address motivations and barriers for providers to adopt evidence-based best practice for comprehensive PAC.

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## DISCLOSURE OF INTERESTS

The authors have no disclosure of interests to report.

## DATA SHARING

Given the sensitive nature of the data, the dataset is not currently publically available. We are determining ethical clearance to make this data set available to other researchers.

## CONTRIBUTION TO AUTHORSHIP

MGM, ES, and TC were primarily responsible for conceiving of the project, and MGM, TR, ES and TC for carrying out data collection. MGM, OO, and TC were primarily responsible for conceptualizing the updates to the abortion complication severity classification scheme. CBP, TR and ES were primarily responsible for cleaning and analyzing the data. MGM, CBP, and TR drafted the first version of the manuscript. All authors (MGM, CBP, TR, ES, OO, and TC) assisted in the writing and approved the final manuscript.

## ETHICS APPROVAL

We obtained ethical approval from the institutional ethics board of the Guttmacher Institute (20 May 2016), the Medical Research Council of Zimbabwe (28 April 2016, approval number MRCZ/A/2061) and from the Joint Research Ethics Committee for the University of Zimbabwe, College of Health Sciences and Parirenyatwa Group of Hospitals (4 April 2016, reference number JREC/379/15).

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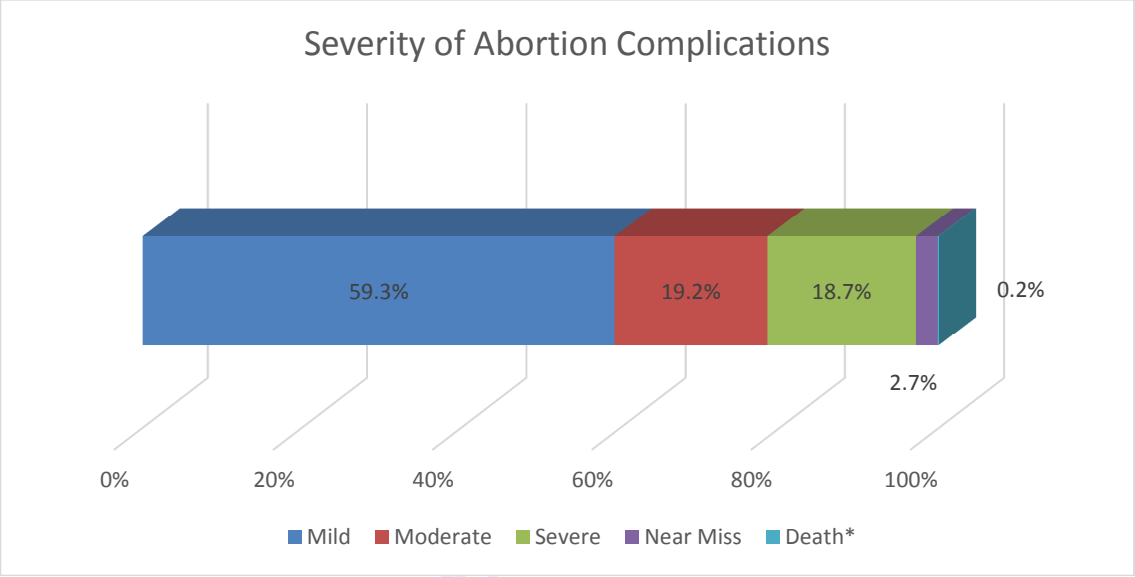
**Supplemental Figure 1. Severity Classification, Zimbabwe 2016, Prospective Morbidity Study**




* There were 2 additional deaths during the study period that were recorded in tracking forms at facilities but no data was collected on these women. There were also 12 reported near-misses in the tracking forms but no data was collected on these women as they were too sick to consent. The near-misses reported on the tracking forms are likely an overestimate as they are based only on provider reports, rather than a clinical assessment. Of those classified as near-miss by the provider in the sample, only 10% (n=9) were objectively classified as near-miss based on the clinical criteria. Therefore, due to over-reporting, it is likely the facility reported near-misses is actually just 1 case (10% of 12).

**Supplemental Table 1. Distribution of eligible, sampled, and participating facilities, Zimbabwe 2016, Prospective Morbidity Survey**

| Facility type | Facility Level | | | | | Individual Level (unweighted) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | # facilities that provide PAC | % sampled | # sampled facilities [a] | Response rate | # interviewed facilities | Total Number of Cases | Eligible respondents [b] | Response rate [c] | # interviewed women |
| Primary health center (public) | 63 | 30% | 18 | 100% | 18 | 14 | 13 | 100% | 13 |
| District/general/mission hospital (public) | 91 | 52% | 47 | 100% | 47 | 312 | 276 | 99% | 274 |
| Provincial hospital (public) | 8 | 100% | 8 | 100% | 8 | 231 | 217 | 99.5% | 216 |
| Central hospital (public) | 5 | 100% | 5 | 100% | 5 | 444 | 374 | 100% | 374 |
| Private hospitals | 40 | 77% | 27 | 96% | 26 | 121 | 103 | 96% | 99 |
| NGO facility (for profit or not-for-profit) | 38 | 68% | 28 | 82% | 23 | 61 | 35 | 74% | 26 |
| **Total** | **245** | **56%** | **133** | **95%** | **127** | **1183** | **1018** | **98%** | **1002** |

a) Ten facilities were not eligible for the study as they did not have the capacity to provide post-abortion care. Facilities were added to the PMS after sampling to adjust for misclassification by province. In provinces in which facilities had been misclassified, we sampled 100% of facilities at the level where misclassification occurred.

b) Ineligible respondents include patients that interviewers missed in the facility, near-misses who were too sick to be interviewed, or maternal deaths. One respondent was ineligible as she had psuedocyesis (a pseudo-pregnancy), and therefore did not meet eligibility criteria of having an abortion complication.

c) Of the 1018 eligible respondents, 16 respondents refused to be interviewed.

**Supplemental Table 2. Sociodemographic and reproductive characteristics of women seeking post-abortion care, Zimbabwe 2016, Prospective Morbidity Survey**

| | Total | | Residence | |
|---|---|---|---|---|
| **Characteristic** | Weighted N | % | Urban (%) | Rural (%) |
| TOTAL | 1302 | 100% | 60% | 40% |
| **Age** | | | | |
| 15-19 | 155 | 12% | 8% | 17% |
| 20-24 | 287 | 22% | 23% | 21% |
| 25-29 | 307 | 24% | 24% | 23% |
| 30-34 | 299 | 23% | 25% | 20% |
| 35+ | 249 | 19% | 19% | 20% |
| **Marital status**[a] | | | | |
| In union | 1027 | 80% | 78% | 83% |
| Not in union | 257 | 20% | 22% | 17% |
| **Educational level** | | | | |
| No education | 9 | 1% | 0% | 1% |
| Any primary schooling | 184 | 14% | 7% | 25% |
| Any secondary schooling | 927 | 71% | 74% | 68% |
| University or more | 177 | 14% | 19% | 6% |
| **Religion** | | | | |
| Apostolic | 431 | 33% | 24% | 48% |
| Pentecostal | 374 | 29% | 35% | 20% |
| Protestant | 194 | 15% | 16% | 13% |
| Catholics/other Christian/Muslim/other | 261 | 20% | 23% | 16% |
| None | 36 | 3% | 2% | 3% |
| **Work status** | | | | |
| Unemployed, unpaid family worker/housewife, or student | 816 | 63% | 54% | 77% |
| Full-time, part-time, or self-employed worker | 479 | 37% | 46% | 23% |
| **Relative wealth quintile (adjusted by urban/rural status)**[b] | | | | |
| Poorest | 183 | 14% | 17% | 10% |
| Poor | 182 | 14% | 14% | 13% |
| Medium | 184 | 14% | 16% | 11% |
| Wealthy | 271 | 21% | 22% | 19% |
| Wealthiest | 482 | 37% | 31% | 47% |
| **Number of living children** | | | | |
| None | 364 | 28% | 27% | 29% |
| 1-2 | 644 | 50% | 55% | 41% |
| 3-4 | 259 | 20% | 16% | 26% |
| 5+ | 29 | 2% | 1% | 3% |
| **Region** | | | | |
| Matebeleland (Bulawayo, Mat North, Mat South, Midlands) | 400 | 31% | 33% | 27% |
| Mashonaland and Harare (Mash East, Mash West and Mash Central) | 643 | 49% | 52% | 46% |
| South Eastern region (Manicaland and Masvingo) | 259 | 20% | 15% | 27% |
| **Intentions**[c] **related to pregnancy that resulted in seeking care** | | | | |
| Wanted then | 900 | 70% | 68% | 72% |
| Wanted later | 192 | 15% | 14% | 16% |
| Did not want at all | 188 | 15% | 17% | 12% |
| Don't know | 13 | 1% | 1% | 1% |
| **Estimated gestational age** | | | | |
| First trimester | 841 | 65% | 69% | 60% |
| Second trimester[d] | 446 | 35% | 31% | 40% |
| **Facility where post-abortion care was received** | | | | |
| Primary health center | 44 | 3% | 2% | 6% |
| District/general/mission hospital | 523 | 40% | 24% | 65% |
| Provincial hospital | 216 | 17% | 17% | 16% |
| Central hospital | 374 | 29% | 42% | 9% |
| Private hospital | 115 | 9% | 12% | 4% |
| NGO facility (for profit or not-for-profit) | 30 | 2% | 3% | 1% |

a) In union indicates currently married or living together; not in union indicates never married, with partner and not living together, or separated/divorced/widowed.
b) Wealth quintiles are relative to the national distribution of wealth in the country, as reported in the 2015 Zimbabwe DHS. The variable reported here is adjusted for differences in wealth between urban and rural individuals; that is, individuals in the "wealthiest" category who are urban are not equivalent to individuals in the "wealthiest" category who are rural.
c) At the time of becoming pregnant.
d) One respondent was at 28 weeks gestation, but is included in second trimester for analytical purposes.

**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies***

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 4 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 4 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 4-5 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 5 |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants | 5 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 5-7 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 5-7 |
| Study size | 10 | Explain how the study size was arrived at | 5 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 7 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 7 |
| | | (*b*) Describe any methods used to examine subgroups and interactions | 5-7 |
| | | (*c*) Explain how missing data were addressed | 8 |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy | 7 |
| | | (*e*) Describe any sensitivity analyses | |
| **Results** | | | |

| | | | |
|---|---|---|---|
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 5 |
| | | (b) Give reasons for non-participation at each stage | 5 |
| | | (c) Consider use of a flow diagram | |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 7-8 |
| | | (b) Indicate number of participants with missing data for each variable of interest | 5,14 |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 8-12 |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 10 |
| | | (*b*) Report category boundaries when continuous variables were categorized | 8-9 |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 8-12 |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 13 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 14 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 13-14 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 13-14 |
| **Other information** | | | 14-15 |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 15 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

# Severity and management of post-abortion complications among women in Zimbabwe, 2016: a cross-sectional study

| | |
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| | |

# Severity and management of post-abortion complications among women in Zimbabwe, 2016: A cross-sectional study

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## ABSTRACT

**Objectives:** Abortion complications cause significant morbidity and mortality. We aimed to assess the severity and factors associated with abortion complications (induced or spontaneous), and the management of post-abortion care (PAC) in Zimbabwe.

**Design:** Prospective, facility-based 28-day survey among women seeking PAC and their providers.

**Setting:** 127 facilities in Zimbabwe with the capacity to provide PAC, including all central and provincial hospitals, and a sample of primary health centers (30%), district/general/mission hospitals (52%), private (77%) and NGO (68%) facilities.

**Participants:** 1002 women presenting with abortion complications during the study period.

**Main outcome measures: S**everity of abortion complications and associated factors, delays in care-seeking, and clinical management of complications.

**Results:** Overall, 59% of women had complications classified as mild, 19% as moderate, 19% as severe, 3% as near-miss and 0.2% died. A median of 47 hours elapsed between experiencing complication and receiving treatment; many delays were due to a lack of finances. Women who were rural, younger, not in union, less educated, at later gestational ages, or who had more children were significantly more likely to have higher severity complications. Most women were treated by doctors (91%). The main management procedure used was dilatation and curettage/evacuation (75%), while 12% had manual or electrical vacuum aspiration (MVA/EVA) and 11% were managed with misoprostol. At discharge, providers reported that 43% of women received modern contraception.

**Conclusion:** Zimbabwean women experience considerable abortion-related morbidity, particularly young, rural, or less educated women. Abortion-related morbidity and concomitant mortality could be reduced in Zimbabwe by liberalizing the abortion law, providing PAC in primary health centers, and training nurses to use medical evacuation with misoprostol and MVA. Regular in-service training on PAC guidelines with follow-up audits are needed to ensure compliance and availability of equipment, supplies, and trained staff.


### *Strengths and limitations of this study*

1. This nationally representative study covered all provinces in Zimbabwe, included all central and provincial hospitals which have a high PAC caseload, and avoided concerns encountered in retrospective studies assessing abortion-related morbidity due to missing patient records.
2. Our revised morbidity criteria reduce potential overestimation of severity by removing unreliable stand-alone criteria such as fever and tachycardia.
3. We were unable to distinguish between induced and spontaneous abortions.
4. Information on women with mild complications that resolved spontaneously, severe complications leading to death outside the facility, or any other case of PAC occurring outside of a facility were not captured.

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**Keywords**: Zimbabwe, abortion, post-abortion care, severity

## INTRODUCTION

Unsafe abortion remains an important cause of maternal morbidity and mortality.[1] Globally, between 2010 and 2014, about 25.1 million unsafe abortions occurred annually, largely (97%) in developing countries.[2] Nearly 22,000 women died due to unsafe abortions in 2014,[3] and many more suffered serious injuries. Approximately 12% of maternal deaths globally are attributed to abortion (this includes ectopic pregnancies).[4] Of the estimated 6.2 million unsafe abortions in Africa yearly, one-third occur in Eastern Africa, where Zimbabwe is located.[2]

In Zimbabwe, abortion is highly restricted, and permitted only in cases of rape, incest, when the mother's life is at risk, or when the child may be born with serious mental or physical disabilities.[5] Restrictive abortion laws are not associated with lower levels of abortion[6], but are associated with increased abortion-related morbidity and mortality. Zimbabwe failed to meet the 2015 Millennium Development Goal of reducing the maternal mortality ratio (MMR) by 75%. In fact, while most countries experienced declines in maternal mortality[7], Zimbabwe's MMR increased from 450 per 100,000 live births in 1990[8] to 651 in 2015.[9] Estimates of maternal mortality attributable to abortion complications in Zimbabwe range from 6 to 23%, although these estimates come from older studies with methodological limitations.[10,11]

One approach to reducing abortion-related morbidity and mortality involves improving access to and quality of post-abortion care; such efforts are ongoing in Zimbabwe. National guidelines for comprehensive PAC have been in place since 2001, and were updated in 2014.[12] These guidelines emphasize medical management of abortion complications with misoprostol, preference for MVA over D&C for first trimester abortions, and provision of family planning services.[12] However, in many settings health practitioners do not always adopt or maintain use of efficacious, cost-effective innovations.[13] Furthermore, during the past decade, Zimbabwe has undergone economic stagnation,[14] potentially affecting health delivery systems, including PAC provision. Access to PAC may also be limited due to stigma, costs, and other factors leading to delays in seeking care.[15] No recent studies have examined post-abortion complications in Zimbabwe. We conducted a national survey to assess the severity and management of post-abortion complications, and to understand the factors associated with experiencing severe complications.

## METHODS

We employed the Prospective Morbidity Methodology (PMM) to collect information from PAC patients and their providers on complications from spontaneous and induced abortions treated in a health facility. This methodology was developed by the World Health Organization (WHO)[16], modified by Ipas[17–21], and further refined by the Guttmacher Institute.[22,23] We conducted this study in conjunction with a project estimating the incidence of induced abortion in Zimbabwe; those methods and results are provided elsewhere.[24] We obtained ethical approval from the Medical Research Council of Zimbabwe, the Joint Research Ethics Committee for the University of Zimbabwe, College of Health Sciences and the Parirenyatwa Group of Hospitals and the Guttmacher Institute's Institutional Review Board.

### *Data collection*

We conducted a facility-based, prospective survey for 28 days between August and September 2016 among women seeking PAC in Zimbabwe. We compiled a comprehensive list of the 245 facilities in Zimbabwe with the capacity to provide PAC[24] (**Supplemental Table 1**). We sampled facilities

stratified by province and level, selecting all central (n=5) and provincial (n=8) hospitals, and identified a random sample of primary health centers (30%), district/general/mission hospitals (52%), private facilities (77%), and NGO facilities (68%; includes for-profit and not-for-profit facilities). Overall, we selected 133 facilities, of which 127 participated, resulting in a facility-level response rate of 95%.

All women presenting with incomplete, inevitable, missed, complete, or septic abortion during the study period were eligible for inclusion. We could not distinguish between induced or spontaneous abortions, which are often clinically indistinguishable to providers. Furthermore, women often underreport induced abortion due to stigma and fear of being reported to police; for example, 52% of adolescent girls in Zimbabwe believe an unmarried woman seeking treatment in public facilities for post-abortion complications will be reported to police.[25] Since information reported by both women and providers may not reliably distinguish between induced and spontaneous abortions, results presented are for all PAC patients. We note that complications from induced abortions may be more severe than those from spontaneous abortions.[26]

Data were collected by one to two nurses in each facility who coordinated with facility PAC providers to track participants. Once the patient was treated and in a stable condition, the interviewer sought informed consent to conduct a face-to-face interview with her, as well as her consent to separately interview her health care provider about her case and review her medical file. All women seeking PAC in each facility were recorded in a tracking form, including women who were near-misses and too ill to be interviewed and women who died before being interviewed. Among an unweighted total of 1018 eligible patients, 1002 were interviewed (98%) and 986 consented for the provider interview (97%) (**Supplemental Table 1**). Study staff and Ministry of Health and Child Care provincial Reproductive Health Officers supervised data collection.

*Key variables*

*Outcome: post-abortion complication severity*

We developed a five-level classification system of post-abortion complication severity: mild, moderate, severe, near-miss, or death (**Table 1**). These classifications were adapted from the original criteria proposed by Rees et al. in 1997 which has been used in prior studies.[18,20–22,27] We expanded our criteria to include the adapted WHO near-miss criteria[28] for a developing country context.[29,30] Near-miss cases have similar morbidities to cases that result in death but occur more frequently and survive because of the treatment they receive. They are therefore useful to assess quality of care for abortion-related emergencies and to understand circumstances around abortion-related deaths.[31] These modifications aimed to improve the objectivity of the clinical criteria and overall reliability and content validity. For the severe category and above, we shifted away from standalone clinical signs (e.g., fever and tachycardia) which may lead to overestimation of severity. Furthermore, we removed 'evidence of a foreign body' as a sole criterion for severe complications, as this may not indicate severe morbidity, and is based on subjective provider reports, which may be affected by provider stigma and restrictive abortion laws. severity classifications were mutually exclusive, and women were classified into the highest level of severity for which they met criteria.

**Table 1. Criteria for classification of abortion-related morbidity**

| |
|---|
| **Mild morbidity (requires all criteria)** |
| • Temperature 35.1-38.9 degrees Celsius with NO clinical signs of infection[1]<br>• No system or organ failure[2]<br>• Systolic blood pressure ≥ 90mmHg<br>• Hemorrhage not requiring any transfusion |
| **Moderate morbidity (requires >1 criterion)** |
| • Temp. 37.3–38.9 degrees Celsius<br>• Clinical signs of infection1<br>• No organ or system failure2<br>• No sign of shock[3]<br>• Haemorrhage not requiring any transfusion |
| **Severe Morbidity (requires >1 criterion)** |
| • Temperature ≥39 C or ≤35C AND a clinical sign of infection[4]<br>• Sepsis/septicemia with no signs of septic shock3<br>• Pelvic abscess or pelvic peritonitis with no signs of shock3<br>• Clinical anemia without hemorrhagic shock3<br>• Uterine perforation WITHOUT laparotomy or repair of perforated uterus, repair of gut perforation, hysterectomy |
| **Near-Miss (Requires >1 criterion)** |
| • Hemorrhagic shock3<br>• Septic shock3<br>• Generalized peritonitis<br>• Uterine perforation with laparotomy or repair of uterine perforation, repair of gut perforation or hysterectomy<br>• Organ/system failure2<br>• Massive blood transfusion[5] |
| **Death** |

[1] 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.

[2] 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 (DIC).

[3] Shock can manifest as: a persistent systolic blood pressure <=80 mmHg alone OR a persistent systolic blood pressure <=90 mmHg with a pulse rate at least 120 bpm, and restlessness, reduced consciousness, cold clammy peripheries, requiring administration of IV fluids.

[4] For severe, the clinical sign of infection also includes sepsis or pelvic abscess or pelvic peritonitis, or uterine perforation.

[5] Massive blood transfusion refers to replacement of ≥ 2 units of blood.

**Note**: Severity classifications were mutually exclusive. Due to data quality concerns with temperature recordings not aligning with expected clinical symptoms, we expanded the definition of normal temperature (35.1-37.2 C) to more accurately capture very low temperatures, which are a sign of shock or infection. To be classified as having severe morbidity, a patient had to have a very low or very high temperature along with a clinical sign of infection, or any of the other criteria. This prevents patients with only recorded low temperature and no other symptoms from being inaccurately captured as a severe case. A normal temperature (i.e. a mild morbidity category) was imputed for three cases with missing temperature and who also had no other clinical symptoms. There were four other cases that did not fall into any of the categories based on their clinical criteria. Three cases had low temperature (<35 C) but no other signs of complications so the medical doctors on the study team determined these cases should be classified as mild morbidity. One case had tachycardia, stayed in the hospital for greater than 24 hours and was given oral and IV antibiotics but had normal temperature and no other complications. The medical doctors on the team determined this case should be classified as moderate morbidity.

*Covariates*

We collected information on socio-demographic and reproductive health-related characteristics and about various delays that may occur in obtaining care for post-abortion complications, including reasons for those delays. Furthermore, we inquired about amount of income lost to the respondent or her household as a result of experiencing health problems (excluding the actual costs of treatment or transportation). Variables that merit additional explanation are described below.

*Trimester.* This was measured using clinician-estimated gestational age in weeks (1st trimester: 1-12 weeks, 2nd trimester: 13-27 weeks, 3rd trimester: 28 weeks-term). Under 5% of unweighted cases (47/1002) were missing the clinician's estimate; for 36 we used women's self-reported gestational age, and the remaining 11 were missing.

*Wealth*. We constructed wealth indicators among our participants comparable to the national-level wealth quintiles using data from the 2015 Zimbabwe Demographic and Health Survey (DHS) [9]. We performed principal components analysis (PCA) using information on assets (e.g., car, bicycle, refrigerator, etc.) and household characteristics (type of water source, toilet facility, and roofing material) available in both the DHS and our questionnaire. We generated factor weights for each asset or characteristic[32], and used them to calculate individual wealth scores for each person in the DHS. We split those wealth scores into relative quintiles (poorest, poor, medium, wealthy, wealthiest) and noted the cut points for each quintile. Next we applied those factor weights to variables in our survey data, constructed individual wealth scores, and classified women into a quintile, using the DHS-derived cut points.[9] We conducted this procedure separately for urban women and for rural women, since wealth indicators vary substantially by place of residence. Therefore, our final wealth indicator defines each wealth quintile differently based on urban/rural residence.

*Analysis*

We performed all analyses in Stata version 14.1. We conducted descriptive analyses to determine frequencies for categorical variables and calculated medians (or means) for continuous variables. We applied facility-level weights and calculated standard errors taking into account the complex sample design, including adjusting for stratification by province and facility level, clustering of women at the facility level, and facility non-response, and applying a finite population correction.

To examine factors associated with increasing severity of post-abortion complications, we conducted ordinal regression, using a three-level severity variable (collapsed from the original five-levels to avoid estimation problems due to small cell sizes). The levels were defined as: (1) mild complications, (2) moderate complications, or (3) severe complications including near-miss or death. We assessed variables demonstrated in prior analyses to be significantly associated with abortion severity (urban/rural residence, marital status, educational level, pregnancy duration),[27] and variables we hypothesized may be associated with severity (age, parity, facility level, wealth status, delays in access to care). Variables with a p-value $\leq 0.25$ in bivariate analysis were considered for inclusion in a multivariate model. We assessed for collinearity and confirmed that our model did not violate the proportional odds assumption, and used a planned backward block stepwise regression approach.[33]

## RESULTS

Women presenting with post-abortion complications in our study ranged from 15-47 years old, with adolescents (ages 15-19) accounting for 12% of PAC patients (**Supplemental**

**Table 2**). Most were in union (80%), had partial or complete secondary schooling (71%) and were not formally employed (63%). More rural women were adolescents compared to urban women (17% rural vs. 8% urban), less likely to have attended university (19% urban vs. 6% rural), and more likely to not be formally employed (77% rural versus 54% urban). Women in our study were wealthier when compared against the national distribution of wealth, with 37% classified in the "wealthiest" quintile, according to place of residence. This was more evident among rural women; nearly half (47%) of rural women were classified in the "wealthiest" quintile. Women reported that most pregnancies resulting in complications for which they were seeking care were wanted at the time of pregnancy (70%), while 15% were wanted later and 15% were not wanted. Most women (65%) were in the first trimester of pregnancy. The largest proportion of patients (40%) were managed in district, general, or mission hospitals (24% urban vs. 65% rural); an additional 29% were served in central hospitals.

Out of a weighted total of 1282 women, 59% had mild morbidity, 19% had moderate morbidity, 19% had severe morbidity, 3% were classified as near-miss, and 0.2% participated in the survey but later died (**Supplemental Figure 1**). There were two additional deaths and 12 near-misses recorded in facility tracking forms. Since no data could be collected on these patients for verification, these near-misses and deaths are not included in this severity distribution.

Women reported that it took a median time of 47 hours from the time of experiencing complications until receiving complete treatment (**Table 2**). This includes all health-seeking delays: realizing care was needed, deciding to seek care, arriving at a facility, being attended to, and completing treatment. The median self-reported delay in realizing care was needed was 8 hours (range: <1 to 2688 hours). The median delay in deciding to seek care after realizing it was needed was 2 hours (range: <1 to 1008). The most common reasons for this delay included lack of money (41%), partner or family member making the decision (13%), lack of transportation (13%), or distance to the facility (12%). The median delay in arriving to a health facility after deciding to seek care was 1 hour (range: <1 to 672). Women who received care in primary health centers reported the longest median delay (4 hours) in arriving to a health facility. The most common reasons for this delay included lack of money (63%), lack of transportation (24%) or distance to facility (16%). All women attending primary health centers reported being delayed in arriving at the health center due to a lack of money. The median delay in being attended to after arriving at a health facility was 0.5 hours (range: <1 to 504), generally due to non-availability of a nurse or doctor (37%) especially in the central/provincial and district hospitals (37% and 41%, respectively). The longest overall delay (median 11 hours, range <1 to 840 hours) occurred between being attended to and receiving complete treatment, with the longest delays in district hospitals (median 17 hours) and the shortest delays in primary health centers (median 1 hour). Nearly half (49%) sought care elsewhere before arriving at the current facility, with the majority of these women seeking but not receiving complete care from primary health centers (61%). Among those reporting lost income, the average loss (excluding costs of treatment or travel) was USD $90.82. This average was higher in private and NGO facilities ($280.27) and lowest in primary health centers ($41). Average lost income was higher for urban ($104.04) versus rural women ($76.71).

**Table 2. Experiences related to seeking post-abortion care, Zimbabwe 2016, Prospective Morbidity Survey**

| | Total | | Facility type where care was ultimately received | | | | |
|---|---|---|---|---|---|---|---|
| | Weighted N | Hours | Central and provincial hospitals | District hospitals | Primary health center | Private and NGO facilities | p-value |
| **Time delays in seeking care (Hours)** [a] | | | | | | | |
| Median delay in realizing health care was needed | 1210 | 8 | 11 | 5 | 2 | 24 | 0.00 |
| Minimum | | 0 | 0 | 0 | 0 | 0 | |
| Maximum | | 2688 | 2688 | 1344 | 168 | 672 | |
| Median delay in decision to seek care after realizing care was needed | 1221 | 2 | 2 | 2 | 2 | 6 | 0.06 |
| Minimum | | 0 | 0 | 0 | 0 | 0 | |
| Maximum | | 1008 | 1008 | 672 | 168 | 672 | |
| Median delay in arriving to initial health facility after deciding to seek care [b] | 1216 | 1 | 1 | 2 | 4 | 1 | 0.98 |
| Minimum | | 0 | 0 | 0 | 0 | 0 | |
| Maximum | | 672 | 504 | 336 | 168 | 672 | |
| Median delay in being attended to after arriving at health facility | 1193 | 1 | 1 | 1 | 0.1 | 0.3 | 0.33 |
| Minimum | | 0 | 0 | 0 | 0 | 0 | |
| Maximum | | 504 | 504 | 96 | 7 | 24 | |
| Median delay in receiving complete treatment after being first attended to | 1206 | 11 | 12 | 17 | 1 | 2 | 0.72 |
| Minimum | | 0 | 0 | 0 | 0 | 0 | |
| Maximum | | 840 | 840 | 168 | 2 | 504 | |
| **Reasons for delay in deciding to seek care after realizing health care was needed** [c] | Weighted N | % | | | | | |
| Did not have money | 77 | 41% | 56% | 34% | - | 16% | 0.00 |
| Partner or family member decides | 24 | 13% | 13% | 16% | - | 4% | 0.05 |
| Lack of transportation | 24 | 13% | 10% | 19% | - | 0% | 0.01 |
| Distance to facility | 22 | 12% | 9% | 18% | - | 0% | 0.02 |
| | | | | | | | |
| **Reasons for delay in arriving to health facility** [d] | Weighted N | % | | | | | |
| Did not have money | 41 | 63% | 55% | 63% | 100% | 67% | 0.21 |
| Lack of transportation | 15 | 24% | 18% | 47% | 0% | 0% | 0.05 |
| Distance to facility | 10 | 16% | 5% | 38% | 0% | 0% | 0.04 |
| | | | | | | | |
| **Reasons for delay in receiving care at facility** [e] | Weighted N | % | | | | | |
| No doctor or nurse available | 105 | 37% | 37% | 41% | 0% | 10% | 0.01 |
| Many patients in line for care | 82 | 29% | 31% | 23% | 100% | 42% | 0.04 |
| Did not have money | 40 | 14% | 14% | 16% | 0% | 6% | 0.35 |
| | | | | | | | |
| **Sought care at another facility prior to receiving care at current facility** | Weighted N | % | | | | | |
| | 636 | 49% | 58% | 46% | 15% | 37% | 0.00 |
| **Of those who reported lost income, amount of income lost to household due to health problems (does not include costs of treatment or travel) (in USD)** [f] | Weighted N | USD | | | | | |
| Average loss of income for all respondents | 320 | 90.82 | 60.16 | 94.54 | 41.00 | 280.27 | 0.06 |
| Average loss of income for urban respondents | 165 | 104.04 | 66.02 | 97.36 | - | 318.25 | 0.00 |
| Average loss of income for rural respondents | 155 | 76.71 | 47.23 | 93.16 | 41.00 | 13.12 | 0.10 |

a) These are self-reported time of delays from respondents. Two respondents had total delays greater than their estimated gestational age, and therefore were set to missing.

b) This question asks for their initial visit to a health facility, not necessarily the facility where they were interviewed/received treatment. It can be interpreted as time from decision to seek care to access to health care system.
c) Out of 186 respondents. These are multiple response questions so they will not add up to 100 and the table does not present all responses. There was no data for individuals who sought care at primary health centers regarding reasons for delay in deciding to seek care after realizing health care was needed.
d) Out of 65 respondents. These are multiple response questions so they will not add up to 100 and the table does not present all responses.
e) Out of 120 respondents who said it took longer than a reasonable time to be attended to at facility. These are multiple response questions so they will not add up to 100 and the table does not present all responses.
f) 75% of respondents did not report a loss of income and are therefore not included in this total. If these respondents are imputed as $0 for loss of income, the overall average loss of income is $22.59.

In multivariate analysis, rural women had 122% higher odds (adjusted odds ratio [adjOR] 2.22, 95% CI: 1.70-2.91) of severe morbidity (versus low or moderate morbidity), or of moderate/severe morbidity (versus low morbidity), holding other factors in the model constant (**Table 3**). In other words, a rural woman had over twice the odds of increasingly severe morbidity from complications of abortion versus a similar urban woman. Women older than 30 were significantly less likely (27% lower odds) than women aged 15-19 to have increasingly severe morbidity (adjOR 0.73, 95% CI: 0.55-0.98). Women not in union had 63% higher odds of increasingly severe morbidity compared to women in union (adjOR 1.63, 95% CI: 1.29-2.04). University education was protective, conferring 54% lower odds of increasingly severe morbidity as compared with having no schooling or any primary education (adjOR 0.45, 95% CI: 0.31-0.65). Having children increased the odds of experiencing increasingly severe morbidity by 68% (1-2 children adjOR: 1.68, 95% CI: 1.33-2.13; 3+ children adjOR: 1.68, 95% CI: 1.13-2.49). Women in their second trimester of pregnancy had 31% higher odds of increasingly severe morbidity compared to women in their first trimester (adjOR 1.31, 95% CI: 1.01-1.71).

**Table 3. Crude and adjusted odds ratios[a] (and 95% CIs) for the relationship between sociodemographic or abortion-related characteristics and severity of abortion complications, among women receiving post-abortion care, Zimbabwe 2016, Prospective Morbidity Survey**

| Characteristic | Crude OR | (95% CI) | p-value | Adjusted OR [c] | (95% CI) | p-value |
|---|---|---|---|---|---|---|
| **Residence** | | | | | | |
| Urban | 1.00 (ref) | | | 1.00 (ref) | | |
| Rural | 2.33 | (1.82, 3.00) | 0.00 | 2.22 | (1.70, 2.91) | 0.00 |
| **Age** | | | | | | |
| 15-19 | 1.00 (ref) | | | 1.00 (ref) | | |
| 20-29 | 0.92 | (0.69, 1.22) | 0.55 | 0.93 | (0.73, 1.18) | 0.52 |
| 30+ | 0.72 | (0.56, 0.94) | 0.01 | 0.73 | (0.55, 0.98) | 0.04 |
| **Marital status [b]** | | | | | | |
| In union | 1.00 (ref) | | | 1.00 (ref) | | |
| Not in union | 1.30 | (1.03, 1.64) | 0.03 | 1.63 | (1.29, 2.04) | 0.00 |
| **Educational level** | | | | | | |
| None or any primary | 1.00 (ref) | | | 1.00 (ref) | | |
| Any secondary schooling | 0.67 | (0.51, 0.88) | 0.01 | 0.94 | (0.72, 1.24) | 0.67 |
| University or more | 0.25 | (0.18, 0.36) | 0.00 | 0.45 | (0.31, 0.65) | 0.00 |
| **Number of living children** | | | | | | |
| None | 1.00 (ref) | | | 1.00 (ref) | | |
| 1-2 | 1.26 | (1.01, 1.57) | 0.04 | 1.68 | (1.33, 2.13) | 0.00 |
| 3+ | 1.37 | (1.04, 1.80) | 0.03 | 1.68 | (1.13, 2.49) | 0.01 |
| **Estimated gestational age** | | | | | | |
| First trimester | 1.00 (ref) | | | 1.00 (ref) | | |
| Second trimester | 1.42 | (1.08, 1.87) | 0.01 | 1.31 | (1.01, 1.71) | 0.04 |
| **Facility where post-abortion care was received** | | | | | | |
| Primary health center | 1.00 (ref) | | | - | | |
| District hospitals | 1.50 | (0.45, 5.00) | 0.50 | - | - | - |
| Provincial and Central hospitals | 0.72 | (0.22, 2.30) | 0.57 | - | - | - |
| Private and NGO facilities | 0.49 | (0.15, 1.61) | 0.24 | - | - | - |
| **Relative wealth quintile** | | | | | | |
| Poorest | 1.00 (ref) | | | 1.00 (ref) | | |
| Poor | 1.17 | (0.86, 1.59) | 0.32 | 1.09 | (0.83, 1.43) | 0.51 |
| Medium | 0.86 | (0.60, 1.24) | 0.42 | 0.84 | (0.59, 1.20) | 0.32 |
| Wealthy | 0.90 | (0.67, 1.21) | 0.48 | 0.88 | (0.65, 1.20) | 0.42 |
| Wealthiest | 0.84 | (0.64, 1.09) | 0.19 | 0.80 | (0.63, 1.02) | 0.08 |
| **Time between deciding to seek care and arrival at a facility [d]** | | | | | | |
| No delay (wait <2 hours) | 1.00 (ref) | | | - | | |
| Less than a day | 1.28 | (1.03, 1.60) | 0.03 | - | - | - |
| 1+ days | 0.90 | (0.57, 1.43) | 0.66 | - | - | - |

a) Model is an ordinal logistic regression where the outcome is three levels: mild complications; moderate complications; severe complications or near-miss or death.

b) In union indicates currently married or living together; not in union indicates never married, with partner and not living together, or separated/divorced/widowed.

c) Bivariate and multivariate models are restricted to cases with no item nonresponse for any of the variables in the table. The weighted N for the multivariate model is 1232.

d) Refers to the initial facility the respondent went to, which might not be the same facility where the respondent ultimately received care.

- Not included in final regression

D&C/D&E was the most common PAC procedure (75%), except in primary health centers (which do not have the capacity to provide this service) (**Table 4**). Only 11% of clients had medical evacuation using misoprostol, although this was 100% among clients in primary health centers. Doctors performed the majority of procedures (91%) and most participants received antibiotics (97%), pain medication (78%) and intravenous (IV) fluids (67%). While 92% of patients were counseled about contraception at discharge, providers reported that 43% of participants received modern contraception on discharge, with larger proportions receiving methods in primary health centers and private or NGO facilities (61% in each), and smaller proportions receiving methods in central and provincial hospitals (26%).

**Table 4. Treatment and services received by post-abortion care clients, Zimbabwe 2016, Prospective Morbidity Survey**

| | Total | | Facility type | | | | p-value |
|---|---|---|---|---|---|---|---|
| | Weighted N | % | Central and Provincial Hospitals | District Hospitals | Primary Health Center | Private and NGO facilities | |
| Patient stayed in facility >24 hours | 577 | 46% | 43% | 61% | 0% | 20% | 0.00 |
| Main procedure used in management of patient's condition[a] | | | | | | | 0.00 |
| Dilation & curettage/evacuation[b] | 760 | 75% | 74% | 78% | 0% | 67% | |
| Manual/Electric Vacuum Aspiration | 125 | 12% | 17% | 6% | 0% | 14% | |
| Misoprostol | 113 | 11% | 9% | 12% | 100% | 17% | |
| Oxytocin | 21 | 2% | 0% | 4% | 0% | 2% | |
| Procedure performed primarily by: | | | | | | | 0.00 |
| Doctor[c] | 960 | 91% | 99% | 83% | 0% | 87% | |
| Nurse/ Midwife/ Clinical Officer | 93 | 9% | 1% | 17% | 100% | 13% | |
| Received intravenous fluids | 848 | 67% | 70% | 71% | 36% | 46% | 0.01 |
| Antibiotics provided | 1232 | 97% | 96% | 99% | 85% | 98% | 0.01 |
| Pain medication provided | 960 | 78% | 79% | 75% | 64% | 91% | 0.08 |
| | | | | | | | |
| **Contraceptive services** | | | | | | | |
| Patient counseled on contraception at discharge | | | | | | | 0.00 |
| Yes | 1154 | 92% | 88% | 96% | 100% | 91% | |
| No | 76 | 6% | 10% | 2% | 0% | 8% | |
| Not discharged yet | 25 | 2% | 2% | 2% | 0% | 1% | |
| Patient received modern contraception at discharge[d] | | | | | | | 0.01 |
| Yes | 535 | 43% | 26% | 55% | 61% | 61% | |
| No | 650 | 52% | 67% | 40% | 39% | 37% | |
| Don't know | 69 | 6% | 7% | 5% | 0% | 2% | |

a) Out of women who obtained procedures (weighted N=1018).
b) D&C/D&E includes: dilatation and curettage (D&C) (12%), evacuation by sharp curettage (50.5%), digital evacuation (1.5%), and forceps evacuation (10.4%).
c) Includes OB/GYN (34%) and Medical Officers/GPs/Senior Resident Medical Officers (57%).
d) The definition of "modern" contraception was not included in the question; so it is possible that providers may have interpreted this term slightly variably.

## DISCUSSION

*Main findings*

About 40% of Zimbabwean women experiencing abortion complications are classified as having moderate or more severe complications. The proportion with severe or near-miss morbidity (21%) is similar to recent studies done in Malawi (21%),[27] and in Kenya (37%).[34] However, proportions of severe cases in those studies were likely overestimated with the older criteria, and therefore the proportion of severe/near-miss cases in Zimbabwe is high in comparison. We identified several characteristics associated with a greater likelihood of increasingly severe abortion complications, including being young, rural, not in union, less educated, having children, or at a later gestational age. Our findings are similar to those from a study in Malawi, which also reported greater risk of abortion-related morbidity among rural women and those not in union.[27] In Zimbabwe, PAC is not offered in most primary health centers, which are more accessible to rural women than higher level facilities. Expanding provision of comprehensive PAC services in rural areas, especially ensuring access for adolescents,[9] may help address this inequity. Empowerment of young women, including through educational opportunities and health literacy, may play a role in maximizing health and reducing unintended pregnancy and recourse to unsafe abortion. [35]

Financial constraints represented the most common reason for delays in care-seeking. Despite the Ministry of Health and Child Care national policy that PAC should be free in public facilities; women still pay for transport, additional service fees, and other expenses. The costs of seeking PAC may be inaccessible for many, and women in our sample (i.e., those who successfully sought and received PAC) were wealthier than the national wealth distribution in Zimbabwe, suggesting potential selection of wealthier individuals into receipt of these services. Similarly, facility access for deliveries in Zimbabwe also increases progressively by wealth (61% for women in the lowest quintile; 95% for women in the highest).[9] As lower income women are more likely to have less safe abortions than richer women, enhancing accessibility and affordability of PAC services for poorer women is essential to decrease maternal mortality. Women seeking care in primary health centers reported the longest median delay in arriving at a facility; these facilities tend to be more remote, particularly in rural areas, and most likely require that women have funding for and access to transportation. The median delay to receiving complete treatment (11 hours) could be considerably reduced if medical evacuation with misoprostol is adopted in all facilities. Surgical evacuation of the uterus is usually done at set times to allow organization of operating theatres, while medical evacuation can be offered immediately upon diagnosis of incomplete abortion. A third of clients first sought care at primary health centers but needed to go to higher level facilities to receive PAC; the lack of PAC capacity at many primary health centers further delays management and potentially increases the severity of complications, including the possibility of death. Enabling primary health centers to provide PAC using misoprostol or MVA would reduce costs and improve accessibility, decongest higher level facilities, and presumably reduce maternal mortality.

A Zimbabwean pilot study found that using misoprostol for PAC reduced referral rates in primary health centers (from 98% to 10%) and rural/mission hospitals (from 48% to 3%), while maintaining 96% efficacy. [36] However, in our study, most PAC cases were managed with D&C/D&E and few were managed with MVA/EVA (12%) or misoprostol (11%). Using medical evacuation with misoprostol is considerably less expensive than surgical evacuations while MVA is safer and results in less perioperative blood loss.[37] Zimbabwe lags behind other countries like Malawi[27] and Kenya[34] in adopting MVA. Furthermore, although most clients in our study were managed by medical doctors, training midwives and nurses to use misoprostol and MVA, when appropriate and as allowed under current law, will improve PAC availability, shorten delays and consequently reduce severity, particularly in settings

without doctors, like primary health centers. Receipt of IV fluids by 67% of patients suggests potential overuse, as this is generally only necessary for women with moderate or greater severity. Conversely, we observed a potential underuse of analgesics; all patients receiving PAC should receive this,[37] but only 78% did. We recommend in-service training of clinicians in the national PAC guidelines and regular audits to check whether clinicians are following the guidelines, or are experiencing stock outs which prevent them from doing so.

*Strengths*

Our study was nationally representative, involving all provinces in Zimbabwe and sampling all central and provincial hospitals. Prospective data collection in facilities avoided concerns encountered in retrospective studies assessing abortion-related morbidity due to missing patient records. Using a patient interview, provider interview and case notes improved data accuracy. We achieved a high response rate in sampled facilities (95%). The revised morbidity criteria reduced potential overestimation of severity by removing unreliable stand-alone criteria such as fever and tachycardia. In addition, our comparison of treatment provided to national PAC guidelines and consideration of women's delays to care are relevant to policies to improve the clinical management and quality of PAC.

*Limitations*

Our study has several limitations. First, we were unable to distinguish between induced and spontaneous abortions, and as noted above, complications from induced abortions may be more severe than those from spontaneous abortions.[26] We asked women if they had done anything to interfere with the pregnancy, but acknowledgement was extremely rare (4%), potentially owing to fear of legal repercussions. We did not consider this self-reported information to be sufficiently reliable. Second, as a facility-based study, information on women with mild complications that resolved spontaneously, severe complications leading to death outside the facility, or any other case of PAC occurring outside of a facility were not captured. Third, although we used prospective data collection, we were unable to gather information on 2 women who died and 12 women classified as near-misses in tracking forms. Thus, the most severe cases may still be underestimated.

*Generalizability of results*

We collected data from over half of all PAC-providing facilities in Zimbabwe, including all higher level facilities, and our results are nationally representative. Regarding generalizability of our findings beyond Zimbabwe, facility-based measures of abortion morbidity are influenced both by abortion safety and women's access to treatment, which varies across contexts. Our findings on the severity of post-abortion complications are likely generalizable to other countries facing similar resource constraints, and with similar levels of abortion safety. The impact of recent declines in Zimbabwe's health care system on abortion morbidity are difficult to quantify, but should be considered in applying these findings elsewhere. Furthermore, little is known about levels of misoprostol access for termination of pregnancy across the region, including Zimbabwe. If misoprostol use, and therefore abortion safety, is different in Zimbabwe compared to other countries, this may also limit generalizability. However, our findings on the characteristics associated with severity and the delays in access to care are likely generalizable to other countries in the region, where access to care is shaped by geography and resources [27] [34]. In addition, Zimbabwe lags behind its regional counterparts in rolling out MVA as the standard of care for surgical evacuation of the uterus.[27] [34]

## CONCLUSION

In Zimbabwe, abortion-related morbidity and concomitant mortality could be reduced by liberalizing the abortion law, providing PAC in primary health centers, and training nurses to use medical evacuation with misoprostol and MVA. Regular in-service training on PAC guidelines should be done with follow-up audits to ensure compliance and availability of equipment, supplies, and trained staff. Besides in-service training as a class-based approach, coaching and mentorship are necessary for performance improvement of health providers. [38] Efforts are needed to reduce unintended pregnancy and unsafe abortion among those more likely to have severe abortion-related complications, including adolescents and women in rural areas, those with less education, or those not in union. Further research should address motivations and barriers for providers to adopt evidence-based best practice for comprehensive PAC.

## ACKNOWLEDGEMENTS

We are grateful to our study team members, Dr. Bernard Madzima and Ms. Margaret Nyandoro at the Ministry of Health and Child Care, Ms. Marjorie Crowell and Dr. Ann Moore and at the Guttmacher Institute, and our study coordinator, Ms. Engeline Mawere, and fieldwork supervisor Ms. Olga Chisango. We are also grateful to all of our data collectors, supervisors, and the individuals who agreed to participate in this study. Finally, we are grateful to Dr. Nirali Chakraborty for her assistance in understanding the development of wealth indices, and to Ms. Tamara Fetters for her helpful feedback in the design stage of this project.

## DISCLOSURE OF INTERESTS

The authors have no disclosure of interests to report.

## DATA SHARING

Given the sensitive nature of the data, the dataset is not currently publically available. We are determining ethical clearance to make this data set available to other researchers.

## CONTRIBUTION TO AUTHORSHIP

MGM, ES, and TC were primarily responsible for conceiving of the project, and MGM, TR, ES and TC for carrying out data collection. MGM, OO, and TC were primarily responsible for conceptualizing the updates to the abortion complication severity classification scheme. CBP, TR and ES were primarily responsible for cleaning and analyzing the data. MGM, CBP, and TR drafted the first version of the manuscript. All authors (MGM, CBP, TR, ES, OO, and TC) assisted in the writing and approved the final manuscript.

## ETHICS APPROVAL

We obtained ethical approval from the institutional ethics board of the Guttmacher Institute (20 May 2016), the Medical Research Council of Zimbabwe (28 April 2016, approval number MRCZ/A/2061) and from the Joint Research Ethics Committee for the University of Zimbabwe, College of Health Sciences and Parirenyatwa Group of Hospitals (4 April 2016, reference number JREC/379/15).

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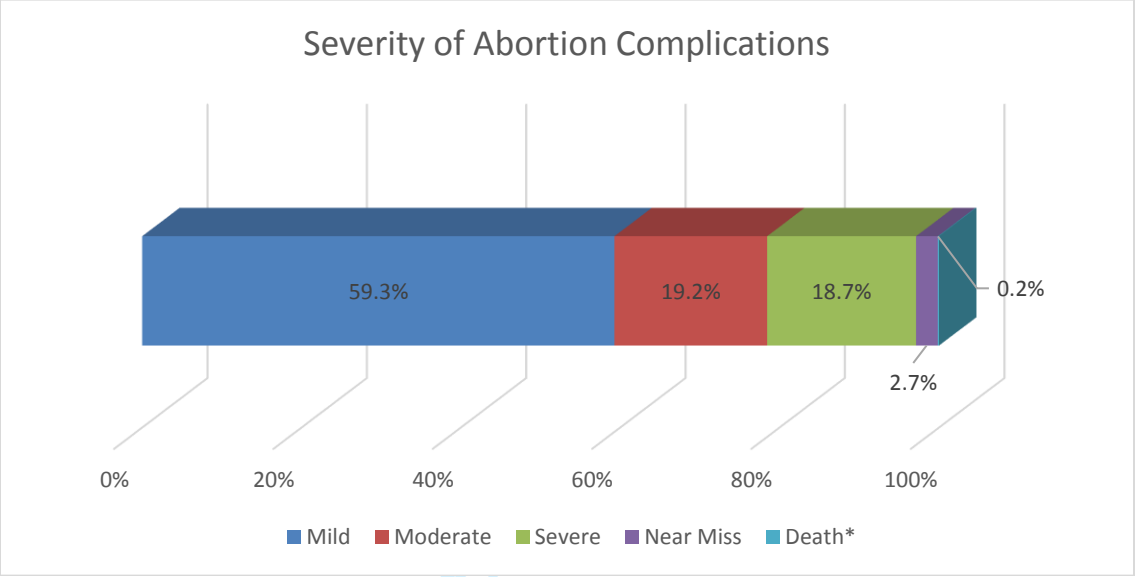
*Severity of abortion complications in Zimbabwe*

**Supplemental Figure 1. Severity Classification, Zimbabwe 2016, Prospective Morbidity Study**




* There were 2 additional deaths during the study period that were recorded in tracking forms at facilities but no data was collected on these women. There were also 12 reported near-misses in the tracking forms but no data was collected on these women as they were too sick to consent. The near-misses reported on the tracking forms are likely an overestimate as they are based only on provider reports, rather than a clinical assessment. Of those classified as near-miss by the provider in the sample, only 10% (n=9) were objectively classified as near-miss based on the clinical criteria. Therefore, due to over-reporting, it is likely the facility reported near-misses is actually just 1 case (10% of 12).

*Severity of abortion complications in Zimbabwe*

**Supplemental Table 1. Distribution of eligible, sampled, and participating facilities, Zimbabwe 2016, Prospective Morbidity Survey**

| Facility type | Facility Level | | | | | Individual Level (unweighted) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | # facilities that provide PAC | % sampled | # sampled facilities [a] | Response rate | # interviewed facilities | Total Number of Cases | Eligible respondents [b] | Response rate[c] | # interviewed women |
| Primary health center (public) | 63 | 30% | 18 | 100% | 18 | 14 | 13 | 100% | 13 |
| District/general/mission hospital (public) | 91 | 52% | 47 | 100% | 47 | 312 | 276 | 99% | 274 |
| Provincial hospital (public) | 8 | 100% | 8 | 100% | 8 | 231 | 217 | 99.5% | 216 |
| Central hospital (public) | 5 | 100% | 5 | 100% | 5 | 444 | 374 | 100% | 374 |
| Private hospitals | 40 | 77% | 27 | 96% | 26 | 121 | 103 | 96% | 99 |
| NGO facility (for profit or not-for-profit) | 38 | 68% | 28 | 82% | 23 | 61 | 35 | 74% | 26 |
| **Total** | **245** | **56%** | **133** | **95%** | **127** | **1183** | **1018** | **98%** | **1002** |

a) Ten facilities were not eligible for the study as they did not have the capacity to provide post-abortion care. Facilities were added to the PMS after sampling to adjust for misclassification by province. In provinces in which facilities had been misclassified, we sampled 100% of facilities at the level where misclassification occurred.

b) Ineligible respondents include patients that interviewers missed in the facility, near-misses who were too sick to be interviewed, or maternal deaths. One respondent was ineligible as she had psuedocyesis (a pseudo-pregnancy), and therefore did not meet eligibility criteria of having an abortion complication.

c) Of the 1018 eligible respondents, 16 respondents refused to be interviewed.

d) The sample was stratified by province and facility type so the total sampling proportion does not add up to a round proportion nationally. We sampled 100% of the central hospitals, provincial hospitals and not-for-profit NGO facilities, and 50% of district hospitals. For primary health centers we sampled 50% in Matabeleland South and Matabeleland North. In Manicaland there were more primary health centers with post-abortion care capacity (N=43), so only 20% of primary health centers were sampled in this province. There were two levels of private facilities (lower and higher levels), so we sampled 100% of high-level private facilities (operating with a similar capacity to provincial hospitals) and 50% of lower-level private facilities and for-profit NGO facilities (operating at a level similar to district hospitals). This table collapses categories of facilities to ensure that no individual facility could be identified.

**Supplemental Table 2. Sociodemographic and reproductive characteristics of women seeking post-abortion care, Zimbabwe 2016, Prospective Morbidity Survey**

| | Total | | Residence | | |
|---|---|---|---|---|---|
| **Characteristic** | Weighted N | % | Urban (%) | Rural (%) | p-value |
| TOTAL | 1302 | 100% | 60% | 40% | |
| **Age** | | | | | 0.00 |
| 15-19 | 155 | 12% | 8% | 17% | |
| 20-24 | 287 | 22% | 23% | 21% | |
| 25-29 | 307 | 24% | 24% | 23% | |
| 30-34 | 299 | 23% | 25% | 20% | |
| 35+ | 249 | 19% | 19% | 20% | |
| **Marital status**[a] | | | | | 0.01 |
| In union | 1027 | 80% | 78% | 83% | |
| Not in union | 257 | 20% | 22% | 17% | |
| **Educational level** | | | | | 0.00 |
| No education | 9 | 1% | 0% | 1% | |
| Any primary schooling | 184 | 14% | 7% | 25% | |
| Any secondary schooling | 927 | 71% | 74% | 68% | |
| University or more | 177 | 14% | 19% | 6% | |
| **Religion** | | | | | 0.00 |
| Apostolic | 431 | 33% | 24% | 48% | |
| Pentecostal | 374 | 29% | 35% | 20% | |
| Protestant | 194 | 15% | 16% | 13% | |
| Catholics/other Christian/Muslim/other | 261 | 20% | 23% | 16% | |
| None | 36 | 3% | 2% | 3% | |
| **Work status** | | | | | 0.00 |
| Unemployed, unpaid family worker/housewife, or student | 816 | 63% | 54% | 77% | |
| Full-time, part-time, or self-employed worker | 479 | 37% | 46% | 23% | |
| **Relative wealth quintile (adjusted by urban/rural status)**[b] | | | | | 0.00 |
| Poorest | 183 | 14% | 17% | 10% | |
| Poor | 182 | 14% | 14% | 13% | |
| Medium | 184 | 14% | 16% | 11% | |
| Wealthy | 271 | 21% | 22% | 19% | |
| Wealthiest | 482 | 37% | 31% | 47% | |
| **Number of living children** | | | | | 0.00 |
| None | 364 | 28% | 27% | 29% | |
| 1-2 | 644 | 50% | 55% | 41% | |
| 3-4 | 259 | 20% | 16% | 26% | |
| 5+ | 29 | 2% | 1% | 3% | |
| **Region** | | | | | 0.00 |
| Matebeleland (Bulawayo, Mat North, Mat South, Midlands) | 400 | 31% | 33% | 27% | |
| Mashonaland and Harare (Mash East, Mash West and Mash Central) | 643 | 49% | 52% | 46% | |
| South Eastern region (Manicaland and Masvingo) | 259 | 20% | 15% | 27% | |
| **Intentions**[c] **related to pregnancy that resulted in seeking care** | | | | | 0.02 |
| Wanted then | 900 | 70% | 68% | 72% | |
| Wanted later | 192 | 15% | 14% | 16% | |
| Did not want at all | 188 | 15% | 17% | 12% | |
| Don't know | 13 | 1% | 1% | 1% | |
| **Estimated gestational age** | | | | | 0.00 |
| First trimester | 841 | 65% | 69% | 60% | |
| Second trimester[d] | 446 | 35% | 31% | 40% | |
| **Facility where post-abortion care was received** | | | | | 0.00 |
| Primary health center | 44 | 3% | 2% | 6% | |

| | | | | | |
|---|---|---|---|---|---|
| District/general/mission hospital | 523 | 40% | 24% | 65% | |
| Provincial hospital | 216 | 17% | 17% | 16% | |
| Central hospital | 374 | 29% | 42% | 9% | |
| Private hospital | 115 | 9% | 12% | 4% | |
| NGO facility (for profit or not-for-profit) | 30 | 2% | 3% | 1% | |

a) In union indicates currently married or living together; not in union indicates never married, with partner and not living together, or separated/divorced/widowed.

b) Wealth quintiles are relative to the national distribution of wealth in the country, as reported in the 2015 Zimbabwe DHS. The variable reported here is adjusted for differences in wealth between urban and rural individuals; that is, individuals in the "wealthiest" category who are urban are not equivalent to individuals in the "wealthiest" category who are rural.

c) At the time of becoming pregnant.

d) One respondent was at 28 weeks gestation, but is included in second trimester for analytical purposes.

**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies***

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 4 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 4 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 4-5 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 5 |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants | 5 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 5-7 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 5-7 |
| Study size | 10 | Explain how the study size was arrived at | 5 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 7 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 7 |
| | | (*b*) Describe any methods used to examine subgroups and interactions | 5-7 |
| | | (*c*) Explain how missing data were addressed | 8 |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy | 7 |
| | | (*e*) Describe any sensitivity analyses | |
| **Results** | | | |

| | | | |
|---|---|---|---|
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 5 |
| | | (b) Give reasons for non-participation at each stage | 5 |
| | | (c) Consider use of a flow diagram | |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 7-8 |
| | | (b) Indicate number of participants with missing data for each variable of interest | 5,14 |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 8-12 |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 10 |
| | | (*b*) Report category boundaries when continuous variables were categorized | 8-9 |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 8-12 |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 13 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 14 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 13-14 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 13-14 |
| **Other information** | | | 14-15 |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 15 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.