Estimating adolescent abortion incidence and unintended pregnancy in Zimbabwe, 2016: a cross-sectional study

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Abstract

Objective: To estimate age-specific abortion incidence in Zimbabwe, and examine differences in abortion among adolescents by marital status and residence.

Design: We utilized a variant of the Abortion Incidence Complications Methodology, an indirect estimation approach, to estimate age-specific abortion incidence. We utilized three surveys: the Health Facility Survey, a census of 227 facilities that provide post abortion care (PAC); the Health Professional Survey, a purposive sample of key informants knowledgeable about abortion (n=118); and the Prospective Morbidity Survey of PAC patients (n=1002).

Setting: PAC-providing health facilities in Zimbabwe.

Participants: Health care providers in PAC-providing facilities and women presenting to facilities with postabortion complications.

Primary and secondary outcome measures: The primary outcome measure was abortion incidence (in rates and ratios). The secondary outcome measure was the proportion of unintended pregnancies that end in abortion.

Results: Adolescent women aged 15-19 had the lowest abortion rate at 5 abortions per 1,000 women aged 15-19 compared to other age groups. Adolescents living in urban areas had a higher abortion ratio compared to adolescents in rural areas, and unmarried adolescent women had a higher abortion ratio compared to married adolescents. Unintended pregnancy levels were similar across age groups, and adolescent women had the lowest proportion of unintended pregnancies that ended in induced abortion (9%) compared to other age groups.

Conclusions: This paper provides the first estimates of age-specific abortion and unintended pregnancy in Zimbabwe. Despite similar levels of unintended pregnancy across age groups, these findings suggest adolescent women have abortions at lower rates and carry a higher proportion of unintended pregnancies to term than older women. Adolescent women are also not a homogeneous group, and youth-focused reproductive health programs should consider the differences in experiences and barriers to care among young people that affect their ability to decide whether and when to parent.

INTRODUCTION

Adolescence is a critical period for laying the foundation for positive sexual and reproductive health (SRH), but adolescents worldwide can face various SRH challenges due to sociocultural and political factors that restrict information and services for adolescents.[1,2] One of these challenges faced by adolescents is unsafe abortion, particularly in legally-restrictive settings, and there is a growing body of literature documenting adolescent abortion experiences in these settings.[2–7] These data on adolescents' experiences with abortion and inequities in care among adolescents fill in information gaps that can inform policies and programs that intend to prevent unsafe abortion and its consequences among adolescent women.[8]

In Zimbabwe, access to safe abortion is restricted and limited to circumstances of saving the woman's physical health or in cases of rape, incest or fetal impairment.[9] Zimbabwe has one of the lowest abortion rates in Africa estimated at 17 abortions per 1,000 women of reproductive age, likely due to high rates of contraceptive use.[10] While adolescents account for 22% of the female population in Zimbabwe, little is known about their experiences with abortion-related care.

There is information, however, on adolescent-specific challenges accessing other SRH services, such as contraception. Despite Zimbabwe's strong family planning program, disparities remain with adolescents aged 15-19 having almost double the unmet need for modern contraception compared to women aged 20-49.[11] To improve adolescent SRH, the Zimbabwean Ministry of Health and Child Care (MoHCC) released an updated National Adolescent and Youth Sexual and Reproductive Health Strategy in 2016 with goals of increasing availability and affordability of SRH and HIV services for adolescents and creating a policy and legal environment that protects the sexual and reproductive health and rights of adolescents.[12] In addition, the MoHCC 2018 Family Planning guidelines include a specific adolescent focus with a strategic goal of reducing unmet need for contraception among adolescents.[13] However, studies have shown that stigma, provider judgement and negative attitudes, and lack of information are persistent barriers for adolescents accessing SRH care in Zimbabwe.[14–16] Due to the current disparities in SRH outcomes and barriers to SRH care experienced by adolescents, we hypothesize that the incidence of abortion and unintended pregnancy will differ between adolescents and all women of reproductive age.

While young women might have different experiences seeking abortion-related services compared to older women, there might also be differences among adolescents across varying identities, such as marital status or residence.[5–7] For instance, a study in Uganda found that unmarried PAC patients, both adolescent and nonadolescent, have higher odds of experiencing severe postabortion complications than nonadolescent married women.[5] There is evidence that contraceptive need and use and sexual behavior, both determinants of unintended pregnancy, vary by marital status and residence among adolescents in Zimbabwe. Among sexually-active adolescent women who want to avoid pregnancy, unmarried adolescents have almost double the level of unmet need for modern contraception (39%) compared to married adolescent women (22%).[11] A higher proportion of adolescent women living in rural areas have ever had sex (39%) compared to adolescents living in urban areas (22%).[11] Adolescents of different marital or residence statuses might also experience varying levels of stigma around accessing abortion-related services in Zimbabwe.[16,17] We therefore hypothesize that the incidence of abortion and unintended pregnancy will differ between married and unmarried adolescents, as well as between adolescents living in rural or urban areas. Understanding the

intersecting identities of adolescents has important program and policy implications for reducing unsafe abortions and unintended pregnancy in this age group.[5,16]

This paper seeks to find out if adolescent women aged 15-19 have abortions and experience unintended pregnancy at different levels compared to other age groups in Zimbabwe, and also if there are differences among adolescents, particularly looking at the subgroups of marital status (currently married or unmarried) and residence (urban or rural). We explore the following research questions:

1) What is the incidence of abortion among adolescents compared to other age groups in Zimbabwe?
2) How does abortion incidence differ by marital status or residence among adolescents and compared to all women of reproductive age?
3) What proportion of unintended pregnancies among adolescents end in abortion compared to other age groups? Does that differ by subgroups within adolescents, such as by marital status or residence?

This study provides the first age-specific estimates of abortion and unintended pregnancy in Zimbabwe. These findings have the potential to inform policies and programs aimed at addressing unsafe abortion among adolescents and improving adolescent SRH in Zimbabwe.

METHODS

We utilized an age-specific variant of the Abortion Incidence Complications Methodology (AICM), an indirect estimation approach, to estimate age-specific abortion rates.[5,6] The AICM has been used in over 25 countries with restrictive abortion laws to indirectly measure the incidence of abortion.[10,18–32] This indirect method obtains the national number of facility-based postabortion care (PAC) cases and estimates the proportion of abortions that would result in women having complications and receiving PAC.[23] An age-specific variant of the AICM was employed in Ethiopia and Uganda, and we followed the approach in those studies.[5,6]

We calculated abortion incidence by five-year age groups (15-19, 20-24, 25-29, 30-34, and 35-49). We also calculated abortion incidence by marital status and residence subgroups within two age groups: adolescent women (aged 15-19) and all women of reproductive age (15-49). We defined the marital status subgroup dichotomously based on PAC patient's self-report of being currently married/in union or not currently married. We categorized the dichotomous residence subgroup based on PAC patients self-report of living in urban or rural areas.

Data

The AICM approach relies on three key data inputs: the number of PAC cases, the proportion of all abortions that results in treated complications, and the age-distribution (as well as marital status and place of residence) of PAC patients. These data inputs come from three surveys that were conducted in Zimbabwe in 2016. The data on the number of PAC cases came from a Health Facility Survey (HFS), which was a census of 227 facilities that provide PAC.[10] This was combined with estimates of the proportion of abortions that resulted in complications that received treatment from a Health Professional Survey (HPS), which was a purposive sample of 118 key informants knowledgeable about abortion provision in Zimbabwe. The data on the characteristics of women receiving PAC came from the Prospective Morbidity Survey (PMS), a nationally representative survey of 1,002 PAC patients in health facilities with PAC capacity. Sociodemographic characteristics of PAC patients from the PMS can be

found in Supplementary File 1. Further details on the study design and sampling for the HFS and HPS can be found in Sully et al.[10] and in Madziyire et al. for the PMS.[33] The Medical Research Council of Zimbabwe, the Joint Research Ethics Committee for the University of Zimbabwe, College of Health Sciences, the Parirenyatwa Group of Hospitals and the Guttmacher Institute's Institutional Review Board provided ethical approval for the three surveys.

We used age-specific fertility rates from the 2015 Zimbabwe Demographic and Health Survey (ZDHS) [11] and age-specific population numbers of women of reproductive age from the Zimbabwe National Statistic Agency's (ZNSA) Population Projections Report to calculate the age-specific number of births.[34]

Analysis: Abortion Incidence Complications Methodology

This first step of the age-specific variant of the AICM estimated the number of PAC cases by age group. This was done by multiplying the national number of PAC cases in Zimbabwe[10] by the weighted age-distribution of PAC patients in the PMS.[33] To calculate the number of urban and rural PAC patients within the 15-19 and 15-49 age groups, we multiplied this age-specific number of PAC cases times the proportion of PAC patients within that age group who self-reported living in rural or urban areas. We did the same for PAC patient's self-reported marital status.

Second, we estimated the age-specific number of PAC cases due to induced abortion. To do this, we first estimated the proportion of second trimester miscarriages (13-22 weeks) by age group[6,35] and then adjusted this by the proportion of those miscarriages likely to receive treatment. In the absence of data on access to PAC, we assumed the proportion of women receiving care was equal to the age and subgroup specific proportion of women who give birth in a facility from the ZDHS.[11] The result was subtracted from the total number of PAC cases to obtain the number that was due to induced abortion.

The third step was estimating abortions that do not result in facility-based care. This could be due to two reasons: 1) the person having the abortion did not have complications and therefore did not need facility-based treatment, or 2) the person having the abortion had complications but did not receive facility-based treatment. In Zimbabwe in 2016, it was estimated that for every one woman receiving an abortion, there were 4.7 women who had abortions that did not result in facility based-care (see Supplementary File 2). This estimate, referred to as the multiplier, was applied to all age groups and marital status subgroups in the absence of age-specific and marital status-specific multipliers. We also calculated new multipliers for rural women and urban women separately, using the underlying data from the HPS, which was collected separately by residence. Since the HPS is a purposive sample, we could not estimate 95% CI around the multiplier. We therefore conducted a bootstrapping simulation of 10,000 draws with replacement from the HPS respondents and calculated a multiplier with each draw.[10] The upper and lower bounds presented contain 95% of the multiplier values from the bootstrapping. Further details on the multiplier calculations are in Supplementary File 2.

Fourth, to estimate the total number of induced abortions by age and subgroup, we multiplied the number of induced abortions that received PAC times the respective multiplier for that age and subgroup. We then adjusted all estimates to account for abortions occurring outside of Zimbabwe, estimated from the HPS as 12% of all abortions, which we assumed was the same across all age and subgroups due to lack of data availability.[10] Supplementary File 2 provides more details on the steps

of the AICM, data sources and assumptions, and adjustments made to align all summed age groups and subgroups to national totals.

We calculated age-specific abortion rates per 1,000 women by dividing the total number of induced abortions by the age-specific population size, which was taken from the ZNSA Population Projections Report.[34] We also wanted to account for risk of pregnancy given the lower levels of reported recent sexual activity, defined as sex in the past 12 months, among adolescents (32%) compared to women 20-49 years old (88%).[11] Therefore, we also calculated separate estimates of age-specific abortion rates among women who reported having sex in the previous 12 months.[11] We estimated age and subgroup specific abortion ratios per 100 live births by dividing the number of induced abortions by the age and subgroup specific number of births.[11,34] To calculate the number of births by marital status and residence among 15-19 and 15-49 age groups, we multiplied the age-specific number of births by the age-specific proportion of births to married or unmarried women (or the proportion of births among women who lived in urban or rural areas) from the ZDHS.[11] Lastly, we estimated unintended pregnancy by age and subgroup using the age and subgroup specific abortion estimates, age and subgroup specific data on births by intention status from the ZDHS[11], and estimated miscarriages, which were estimated to be 20% of births and 10% of abortions and applied uniformly across age groups.[36]

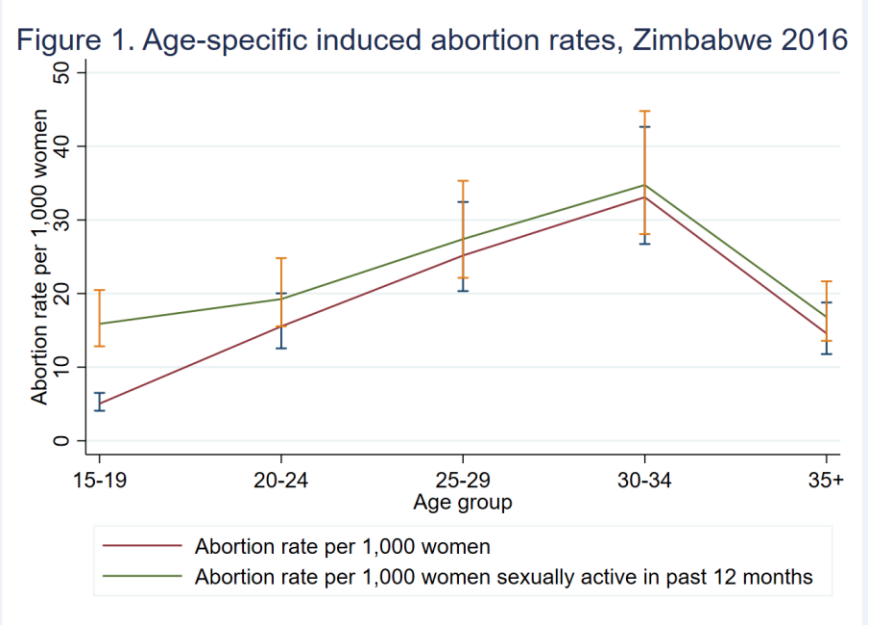
Analysis: Testing Assumptions in the Multiplier

Using the national multiplier for all age and marital status groups assumes that complication rates and treatment seeking do not differ by age or marital status. We tested the validity of these assumptions utilizing PAC patient data, the only available source of representative data on abortion complications and treatment among women in Zimbabwe.

The first assumption we tested was whether experiencing complications differed between adolescent and nonadolescent PAC patients, and if this differed by marital status among adolescents. We operationalized complications using the severity classifications from Madziyire et al.[33] and considered moderate and severe complications, maternal near-miss and maternal death as having a complication [coded as 1], and a mild complication (defined as no infection, no organ failure, and no blood transfusion needed) as no complication [coded as 0]. Using this complication variable as the dependent variable, we ran multivariable logistic regression models comparing adolescents versus non-adolescents, and then included an interaction term between adolescents and marital status. All models controlled for residence, secondary education, wealth, previous pregnancy, whether the pregnancy was reported as unintended, and being in the second trimester.

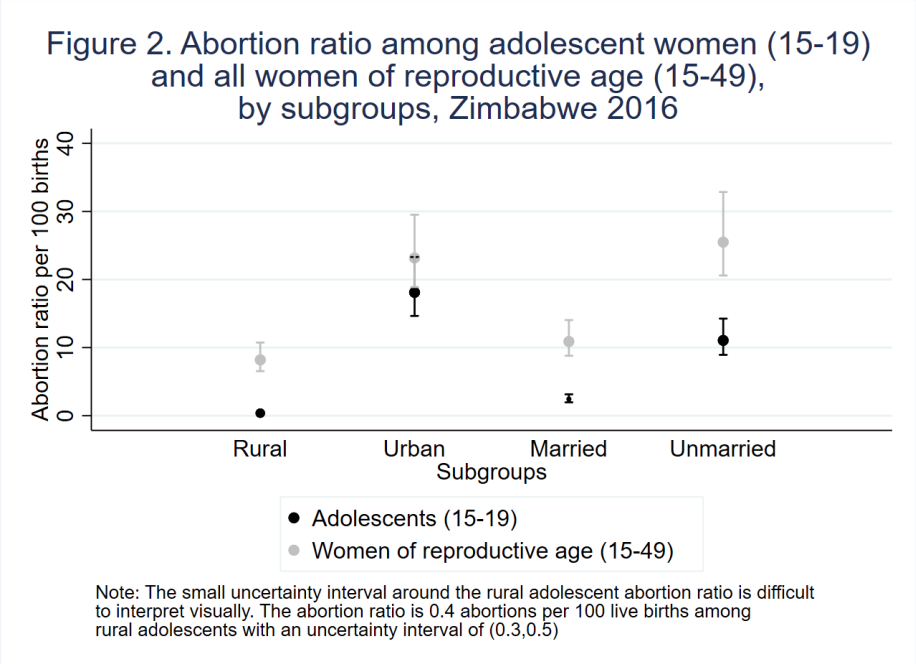
The second assumption we tested was whether adolescent and nonadolescent PAC patients differed in treatment seeking. PAC patients provided information on their delays in seeking care from the 1) time (in hours) it took from realizing they had a complication to deciding to seek treatment and 2) time (in hours) it took from them deciding to seek care to the time they arrived at the facility. These two delays are related to user-related health seeking behaviors (delay 1) as well as access to facilities (delay 2), which when combined capture treatment seeking experiences.[37–39] We ran a Cox proportional hazards model to estimate differences in hazard ratios between adolescents and nonadolescents, and we included an interaction term between adolescents and marital status. All models controlled for residence, secondary education, wealth, previous pregnancy, and whether the pregnancy was reported as unintended.

RESULTS

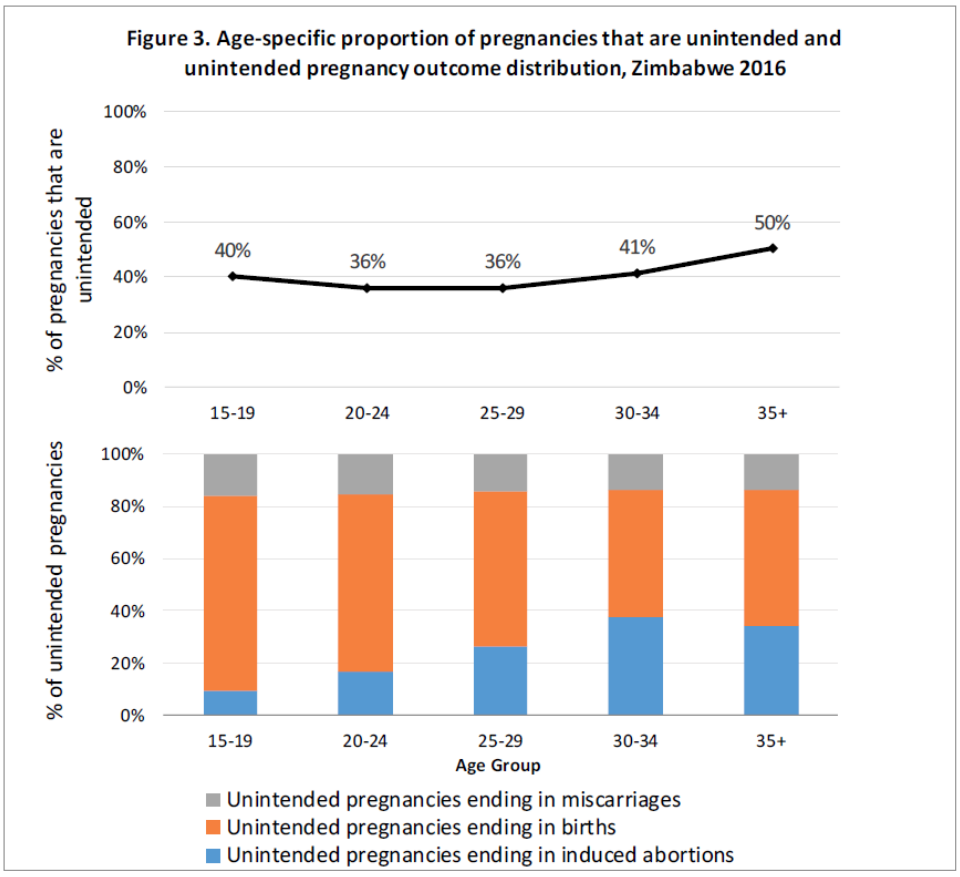


Abortion incidence

In 2016, approximately 4,155 induced abortions occurred among adolescent women in Zimbabwe. Adolescent women aged 15-19 had the lowest abortion rate compared to other age groups at 5 induced abortions per 1,000 women aged 15-19 (UI:4.1, 6.5) (Figure 1). Women aged 30-34 had the highest abortion rate of 33 per 1,000 women aged 30-34 (UI:26.7, 42.6). Among women who reported sexual activity in the past 12 months, the abortion rate for adolescents increased to 15.9 per 1,000 women 15-19 (UI:12.8, 20.5), but remained the lowest abortion rate among all age groups (Figure 1).



An abortion ratio indicates the likelihood of a pregnancy ending in an abortion rather than a live birth. Adolescent women had a lower abortion ratio compared to all women of reproductive age (15-49) in all residence and marital status subgroups (Figure 2). Adolescent women living in urban areas had a higher abortion ratio of 18.1 abortions per 100 live births (UI: 14.6, 23.3) compared to adolescents living in rural areas (0.4 abortions per 100 live births (UI:0.3, 0.5), and this urban/rural difference remained true for all women of reproductive age (Figure 2). Unmarried adolescent women had an abortion ratio of 11.1 per 100 live births (UI:8.9, 14.3) compared to 2.4 per 100 live births among married adolescents (UI:2.0, 3.1). This marital status difference remained consistent among all women of reproductive age, where unmarried women 15-49 had an abortion ratio of 25.5 per 100 live births (UI:20.6, 32.8) compared to 10.9 per 100 live births among married women aged 15-49 (UI:8.8, 14) (Figure 2).



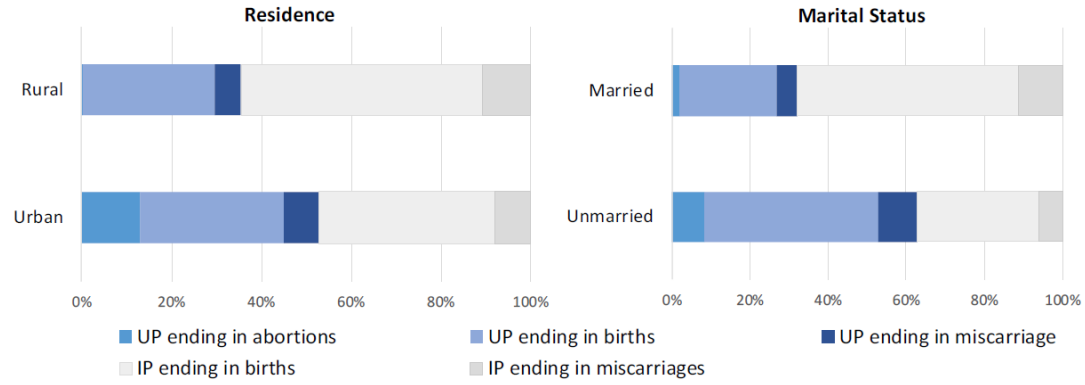
Unintended pregnancy

There were an estimated 45,387 unintended pregnancies among adolescent women, which was 17% of the estimated total 267,497 unintended pregnancies in Zimbabwe in 2016 (data not shown). Adolescent women had the lowest percent of unintended pregnancies that ended in induced abortion (9%) compared to all other age groups (ranging from 17% among 20-24 year olds to 38% among 30-34 year olds) (Figure 3).

Unmarried adolescents had almost double the proportion of pregnancies that were unintended (63%) compared to married adolescents (32%) (Figure 4). Just over half of pregnancies (53%) were unintended among urban adolescent women compared to 35% among rural adolescents (Figure 4). One-quarter

(25%) of unintended pregnancies among adolescents living in urban areas ended in abortion compared to 1% among adolescents living in rural areas (Figure 4). Thirteen-percent of unintended pregnancies among unmarried adolescents ended in abortion, compared to just 6% among married adolescents (Figure 4).

Figure 4. Pregnancy outcome distribution among subgroups of adolescents, Zimbabwe 2016

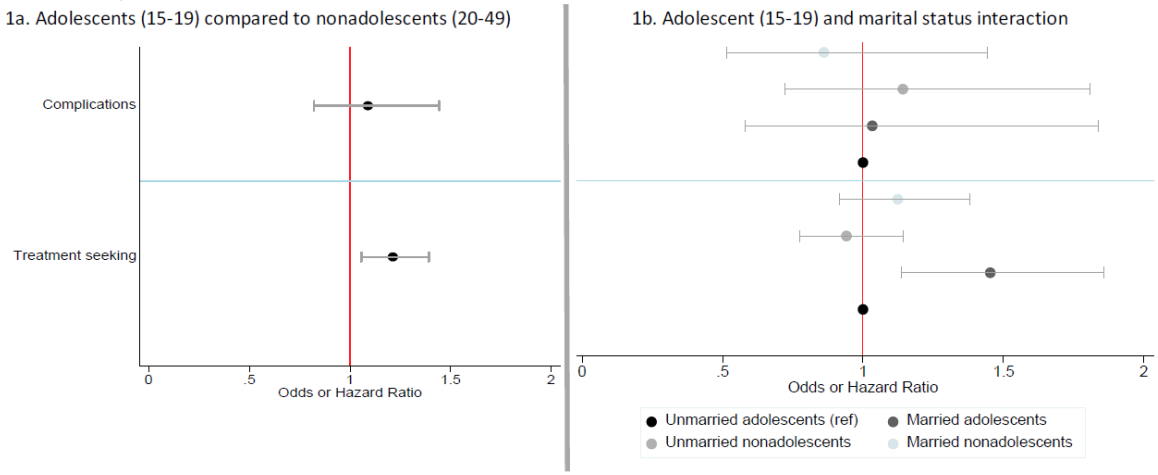


Note: UP = unintended pregnancy, IP = intended pregnancy

Complications and delays to care among PAC patients by age and marital status

We found that adolescent and nonadolescent PAC patients did not significantly differ in their likelihood of experiencing complications (OR: 1.1, 95% CI: 0.82, 1.44) and married versus unmarried adolescents also did not differ (OR: 1.03, 95% CI: 0.58, 1.84) (Figure 5). Adolescent PAC patients are 21% more likely to experience delays in seeking care compared to nonadolescents (HR: 1.21, 95% CI: 1.06, 1.39). Married adolescent PAC patients are 45% more likely to experience delays in seeking care compared to unmarried adolescents (HR: 1.45, 95% CI: 1.14, 1.86) (Figure 5).

Figure 5. Likelihood of complications and delays in treatment seeking between adolescents and nonadolescents, and by marital status, Zimbabwe 2016



Notes: The reference group in 1a. is nonadolescent women (aged 20-49). The reference group in 1b. is unmarried adolescents.
The models with the occurence of complications as the dependent variable controlled for residence, secondary education, wealth, previous pregnancy, whether the pregnancy was reported as unintended, and being in the second trimester. The Cox proportional hazards models for delays in treatment seeking used the same controls, except for second trimester which was not supported by the proportional hazard assumption so removed from the model.

DISCUSSION

This paper provides the first estimates of age-specific abortion and unintended pregnancy in Zimbabwe. Adolescent women are estimated to have the lowest abortion rate of all age groups in Zimbabwe, and while the overall level of unintended pregnancy does not differ greatly by age group, adolescent women had the lowest proportion of unintended pregnancies that ended in induced abortion compared to other age groups. Studies in Ethiopia and Uganda found that adolescent women had the lowest abortion rate when compared to women less than 35 years old, but when accounting for recent sexual activity and therefore risk of pregnancy, these studies found adolescents had the highest abortion rate. [5,6] Despite accounting for recent sexual activity, adolescent women in Zimbabwe still obtain abortions at lower rates compared to all other age groups. Together, these findings suggest that despite similar levels of unintended pregnancy across age groups, adolescent women have abortions at lower rates and carry a higher proportion of unintended pregnancies to term. Unwanted childbearing can have social and economic impacts on young women and their children, such as lower rates of school completion and limited future economic opportunities.[40,41]

Prior research in Zimbabwe has found that adolescents face barriers when trying to prevent unintended pregnancies, such as limited access to contraception due to stigma, provider bias, or lack of information[14–16,42]; these same factors might also limit their ability to terminate unintended pregnancies. Cost might also be a barrier since adolescents may have less access to financial resources needed to obtain an abortion, especially given the sustained economic crisis and cash shortages in Zimbabwe.[7,43–45] A qualitative study of Zimbabwean women found that women cited unstable partner relationships and a desire to hide extramarital pregnancies as reasons why they sought an abortion.[46] This could help explain unmarried adolescents' higher likelihood of a pregnancy ending in an abortion instead of a live birth compared to married adolescents. Regarding residence differences, a study of pregnancy termination among South African adolescents found urban adolescents had more knowledge and favorable attitudes towards abortions compared to their rural counterparts, which could help explain the higher abortion incidence among urban adolescents.[47] However, more research is needed to understand the factors that influence adolescents to seek an abortion or continue with the pregnancy, which can also inform how adolescents can be better supported in pregnancy.[48]

There are some potential sources of underestimation of adolescent abortions due to limitations in the data. First, if adolescents are more likely to obtain medical abortions (that would not result in complications), then that would not be captured in the national multiplier, and we could therefore be underestimating the number of adolescent abortions. Second, since the multiplier estimates how many women with induced abortions do not present to health facilities for every one woman who does, and because adolescent PAC patients are more likely to delay seeking PAC, it is possible that the national multiplier for adolescents is an underestimate, which would result in underestimating adolescent abortions. In addition, if the same factors that determine delays for adolescents also determine not seeking care at all, then that might be another potential source of underestimation. However, it is possible that treatment seeking differs between PAC patients and all women who had abortions, limiting our ability to infer potential bias in our estimates from data on PAC patients alone. Third, our assumption that there is no difference in abortions sought in neighboring countries by age might underestimate adolescent abortions if adolescents are more likely to travel for abortion. In addition, this assumption could also underestimate the number of abortions occurring among adolescents living in

rural areas since more rural areas share direct borders with neighboring countries with more liberalized abortion laws (e.g. South Africa).

The age distribution of all women obtaining abortions in Zimbabwe differs slightly from other African countries with comparable data. While adolescents similarly do not disproportionally obtain abortions in the Congo Republic, Ethiopia, Gabon, Ghana and Uganda, women aged 20-29 in these countries had the highest abortion rates,[3,5] whereas the highest abortion rate in Zimbabwe is among 30-34 year olds. Zimbabwean women aged 30-34 primarily use contraception as a means to limit fertility compared to younger women,[11] which suggests that abortion may be used by women in this age group to limit fertility rather than space or delay births in order to maintain desired family size. However, further research is needed to determine why the abortion rate trend peaks at later ages in Zimbabwe.

We also found that adolescents were more likely to experience delays in seeking care for abortion complications compared to nonadolescent PAC patients, whereas studies in Uganda and Kenya found no statistically significant difference in delays to care by age.[4,5] Married adolescent PAC patients also experienced longer delays than unmarried adolescent PAC patients. While more research is needed to understand the reasons for these differences in Zimbabwe, some potential reasons from the literature could include lack of transportation, fear of provider judgement, or cost.[44] Studies have found that addressing women's autonomy in decision making, through education or de-stigmatization of health care seeking, can enable young women to seek health care.[49,50] Other studies have found that the cost of obtaining PAC can be catastrophic to women and their families, so a lack of control over household resources, such as by married adolescents[45], may contribute to delays to PAC.[51] Macroeconomic conditions could also affect care seeking, and the decades of economic decline and resource constraints in Zimbabwe are important to consider in future research.

These findings highlight some important policy recommendations. First, given the high levels of unintended pregnancy among adolescents, particularly unmarried adolescents or adolescents living in urban areas, policies and programs should target the different needs of adolescents across subgroups in order to ensure equitable access to contraceptive counseling and services. For example, an evaluation of the implementation of the National Adolescent SRH Strategy between 2010-2015 encouraged differentiating service delivery based on the social context of adolescents.[52] Therefore, the updated national strategy and subsequent policies should have explicit strategies that ensure access to quality SRH care to diverse groups of adolescents, with a particular focus on those who are most disadvantaged. Second, multi-sectoral policies should focus on breaking down the stigma of adolescent sexual activity and use of SRH services through various avenues, including closing communication gaps with parents, ensuring the provision of comprehensive sexuality education, and conducting health care provider trainings on respectful, non-discriminatory, and stigma-free reproductive health care.[14–16,42] If the factors preventing adolescents to avoid unintended pregnancy also limit their ability to terminate a pregnancy, then addressing these factors could reduce unintended pregnancy and unwanted childbearing among adolescents.

This study has some important limitations. First, there are potential issues of reliability in subgroup calculations. We are using nationally representative data on PAC patients to distribute cases into subgroups, but since the PAC sample size is 1,002 women[33], breaking the data down into subgroups reduces the reliability of the data. Second, since married adolescents are more likely to report their births as planned due to social expectations[1], the proportion of married adolescents reporting

unplanned births is likely a conservative estimate and therefore the estimate of married adolescent unintended pregnancy could be an underestimate. Third, the estimated proportion of abortions occurring outside of Zimbabwe is not age-specific, and this also likely varies by age. Fourth, in examining characteristics and treatment seeking behaviors among PAC patients, we cannot distinguish between women having an induced or spontaneous abortion and treatment seeking behaviors may be different among women seeking treatment for an induced abortion compared to a spontaneous abortion.

Conclusion

This paper provides important information on the age-specific incidence of abortion. Adolescents obtain abortions at lower rates compared to other age groups, even when accounting for recent sexual activity, but have similar levels of unintended pregnancy and carry a higher proportion of unintended pregnancies to term compared to nonadolescents. This unwanted childbearing can have social, economic, and health impacts on young women that can influence their life trajectories.[1] Adolescents need increased access to comprehensive and voluntary contraceptive information and services, as well as information about accessing safe abortion services when possible, given the limited legal conditions available. Adolescent women are also not a homogeneous group, and youth-focused reproductive health policies and programs should consider the differences in experiences and barriers to care among young people that affect their ability to decide whether and when to parent.

REFERENCES

1 Woog V, Singh S, Browne A, *et al.* Adolescent Women's Need for and Use of Sexual and Reproductive Health Services in Developing Countries. Guttmacher Institute 2015. www.guttmacher.org/pubs/AdolescentSRHS-Need-Developing-Countries.pdf.

2 Morris JL, Rushwan H. Adolescent sexual and reproductive health: The global challenges. *Int J Gynecol Obstet* 2015;**131**:S40–2. doi:10.1016/j.ijgo.2015.02.006

3 Chae S, Desai S, Crowell M, *et al.* Characteristics of women obtaining induced abortions in selected low- and middle-income countries. *PLoS ONE* 2017;**12**. doi:10.1371/journal.pone.0172976

4 Levandowski BA, Pearson E, Lunguzi J, *et al.* Reproductive Health Characteristics of Young Malawian Women Seeking Post-abortion Care. *Afr J Reprod Health* 2012;**16**:253-262–262.

5 Sully EA, Atuyambe L, Bukenya J, *et al.* Estimating abortion incidence among adolescents and differences in postabortion care by age: a cross-sectional study of postabortion care patients in Uganda. *Contraception* Published Online First: 2018. doi:10.1016/j.contraception.2018.07.135

6 Sully E, Dibaba Y, Fetters T, *et al.* Playing it Safe: Legal and Clandestine Abortions Among Adolescents in Ethiopia. *J Adolesc Health* 2018;**62**:729–36. doi:10.1016/j.jadohealth.2017.12.015

7 Mutua MM, Maina BW, Achia TO, *et al.* Factors associated with delays in seeking post abortion care among women in Kenya. *BMC Pregnancy Childbirth* 2015;**15**:241. doi:10.1186/s12884-015-0660-7

8 Every Woman Every Child. The Global Strategy for Women's, Children's and Adolescents' Health 2016-2030. 2015. http://www.everywomaneverychild.org/wp-content/uploads/2017/10/EWEC_GSUpdate_Full_EN_2017_web-1.pdf

9 Zimbabwe Termination of Pregnancy Act [Chapter 15:10]. 1977. http://www.parlzim.gov.zw/acts-list/termination-of-pregnancy-act-15-10

10 Sully EA, Madziyire MG, Riley T, *et al.* Abortion in Zimbabwe: A national study of the incidence of induced abortion, unintended pregnancy and post-abortion care in 2016. *PLOS ONE* 2018;**13**:e0205239. doi:10.1371/journal.pone.0205239

11 Zimbabwe National Statistics Agency, ICF International. Zimbabwe Demographic and Health Survey 2015: Final Report. 2016.

12 GoZ. National adolescent and youth sexual and reproductive health (ASRH) strategy II : 2016-2020 : stepping up for good sexual and reproductive health outcomes for adolescents and youth in Zimbabwe. Harare: : Goverment of Zimbabwe, Ministry of Health and Child Care 2016. http://www.znfpc.org.zw/wp-content/uploads/2019/05/National-ASRH-Strategy-II-2016-2020.pdf (accessed 23 Sep 2019).

13 Ministry of Health and Child Care (MoHCC), UNFPA, UNFPA. Family Planning Guidelines for Zimbabwe. UNFPA 2019. https://zimbabwe.unfpa.org/sites/default/files/pub-pdf/Family%20Planning%20Guidelines%20for%20Zimbabwe.pdf (accessed 19 Sep 2019).

14 Kurebwa J. Knowledge And Perceptions Of Adolescent Sexual And Reproductive Health Issues Among Rural Adolescence In Gutu Rural District Of Zimbabwe. *Int J Adv Res Publ* 2017;**1**:8.

15 Langhaug LF, Cowan FM, Nyamurera T, *et al.* Improving young people's access to reproductive health care in rural Zimbabwe. *AIDS Care* 2003;**15**:147–57. doi:10.1080/0954012031000068290

16 Mashamba A, Robson E. Youth reproductive health services in Bulawayo, Zimbabwe. *Health Place* 2002;**8**:273–83. doi:10.1016/S1353-8292(02)00007-2

17 Wekwete N, Rusakaniko S, Zimbizi G. UNFPA Zimbabwe National Adolescent Fertility Study. Harare: : Ministry of Health and Child Care 2016.

18 Polis C, Mhango C, Philbin J, *et al.* Incidence of Induced Abortion in Malawi, 2015. *PloS One* 2017;**12**:e0173639.

19 Keogh SC, Kimaro G, Muganyizi P, *et al.* Incidence of Induced Abortion and Post-Abortion Care in Tanzania. *PloS One* 2015;**10**:e0133933. doi:10.1371/journal.pone.0133933

20 Moore AM, Gebrehiwot Y, Fetters T, *et al.* The Incidence of Abortion in Ethiopia: Current Levels and Trends. In: *Population Association of America 2015 Annual Meeting*. 2015. http://paa2015.princeton.edu/abstracts/151005 (accessed 23 Jun 2017).

21 Basinga P, Moore AM, Singh SD, *et al.* Abortion incidence and postabortion care in Rwanda. *Stud Fam Plann* 2012;**43**:11–20.

22 Mohamed S, Izugbara C, M Moore A, *et al.* The estimated incidence of induced abortion in Kenya: A cross-sectional study. *BMC Pregnancy Childbirth* 2015;**15**:185. doi:10.1186/s12884-015-0621-1

23 Singh S, Prada E, Juarez F. The Abortion Incidence Complications Method: A Quantitative Technique. In: Singh S, Remez L, Tartaglione A, eds. *Methodologies for Estimating Abortion Incidence and Abortion-Related Morbidity: A Review*. New York and Paris: : Guttmacher Institute and International Union for the Scientific Study of Population 2010. 63–70.

24 Henshaw SK, Singh S, Oye-Adeniran BA, *et al.* The Incidence of Induced Abortion in Nigeria. *Int Fam Plan Perspect* 1998;**24**:156. doi:10.2307/2991973

25 Bankole A, Adewole IF, Hussain R, *et al.* The Incidence of Abortion in Nigeria. *Int Perspect Sex Reprod Health* 2015;**41**:170–81. doi:10.1363/4117015

26 Singh S, Prada E, Mirembe F, *et al.* The Incidence of Induced Abortion in Uganda. *Int Fam Plan Perspect* 2005;**31**:183–91. doi:10.1363/3118305

27 Prada E, Atuyambe LM, Blades NM, *et al.* Incidence of Induced Abortion in Uganda, 2013: New Estimates Since 2003. *PLOS ONE* 2016;**11**:e0165812. doi:10.1371/journal.pone.0165812

28 Levandowski BA, Mhango C, Kuchingale E, *et al.* The Incidence of Induced Abortion in Malawi. *Int Perspect Sex Reprod Health* 2013;**39**:088–96. doi:10.1363/3908813

29 Singh S, Fetters T, Gebreselassie H, *et al.* The Estimated Incidence of Induced Abortion In Ethiopia, 2008. *Int Perspect Sex Reprod Health* 2010;**36**:16–25.

30 Sedgh G, Rossier C, Kaboré I, *et al.* Estimating Abortion Incidence in Burkina Faso Using Two Methodologies. *Stud Fam Plann* 2011;**42**:147–54. doi:10.1111/j.1728-4465.2011.00275.x

31 Sedgh G, Sylla AH, Philbin J, *et al.* Estimates of the Incidence of Induced Abortion And Consequences of Unsafe Abortion in Senegal. *Int Perspect Sex Reprod Health* 2015;**41**:11–9. doi:10.1363/4101115

32 Chae S, Kayembe PK, Philbin J, *et al.* The incidence of induced abortion in Kinshasa, Democratic Republic of Congo, 2016. *PLOS ONE* 2017;**12**:e0184389. doi:10.1371/journal.pone.0184389

33 Madziyire MG, Polis C, Riley T, *et al.* Severity and management of post-abortion complications among women in Zimbabwe, 2016: a cross-sectional study. *BMJ Open*;**8**:e019658. doi:10.1136/bmjopen-2017-019658

34 Zimbabwe National Statistics Agency (ZIMSTAT), UNFPA. Population Projections Thematic Report. Harare: : ZIMSTAT 2015.

35 Harlap S, Shiono P, Ramcharan S. A life table of spontaneous abortions and the effects of age, parity and other variables. In: Porter I, Hook E, eds. *Human embryonic and fetal death*. New York: Academic Press 1980. 145–58.

36 Leridon H. *Human Fertility: The Basic Component*. Chicago: : University of Chicago Press 1977.

37 Thaddeus S, Maine D. Too far to walk: Maternal mortality in context. *Soc Sci Med* 1994;**38**:1091–110. doi:10.1016/0277-9536(94)90226-7

38 Mgawadere F, Unkels R, Kazembe A, *et al.* Factors associated with maternal mortality in Malawi: application of the three delays model. *BMC Pregnancy Childbirth* 2017;**17**. doi:10.1186/s12884-017-1406-5

39 Pacagnella RC, Cecatti JG, Parpinelli MA, *et al.* Delays in receiving obstetric care and poor maternal outcomes: results from a national multicentre cross-sectional study. *BMC Pregnancy Childbirth* 2014;**14**:159. doi:10.1186/1471-2393-14-159

40 UNESCO. Developing an Education Sector Response to Early and Unintended Pregnancy. Paris: : United Nations Educational, Scientific, and Cultural Organization 2014. http://www.ungei.org/resources/files/Developing_an_education_sector_response_to_early_and_unintended_pregnancy_Global_consultation_4-6_Nov_2014.pdf (accessed 16 Jul 2019).

41 Fall CHD, Sachdev HS, Osmond C, *et al.* Association between maternal age at childbirth and child and adult outcomes in the offspring: a prospective study in five low-income and middle-income countries (COHORTS collaboration). *Lancet Glob Health* 2015;**3**:e366-377. doi:10.1016/S2214-109X(15)00038-8

42 Landa NM, Fushai K. Exploring discourses of sexual and reproductive health taboos/silences among youth in Zimbabwe. *Cogent Med* 2018;**5**:1501188. doi:10.1080/2331205X.2018.1501188

43 World Bank. Macro poverty outlook for Zimbabwe. Washington, DC: : World Bank Group 2016. http://documents.worldbank.org/curated/en/378671475867933282/Macro-poverty-outlook-for-Zimbabwe

44 Olukoya AA, Kaya A, Ferguson BJ, *et al.* Unsafe abortion in adolescents. *Int J Gynecol Obstet* 2001;**75**:137–47. doi:10.1016/S0020-7292(01)00370-8

45 Ganatra B, Hirve S. Induced Abortions among Adolescent Women in Rural Maharashtra, India. *Reprod Health Matters* 2002;**10**:76–85.

46 Chiweshe M, Mavuso J, Macleod C. Reproductive justice in context: South African and Zimbabwean women's narratives of their abortion decision: *Fem Psychol* Published Online First: 28 March 2017. doi:10.1177/0959353517699234

47 Varga CA. Pregnancy Termination among South African Adolescents. *Stud Fam Plann* 2002;**33**:283–98. doi:10.1111/j.1728-4465.2002.00283.x

48 Sedgh G, Finer LB, Bankole A, *et al.* Adolescent Pregnancy, Birth, and Abortion Rates Across Countries: Levels and Recent Trends. *J Adolesc Health* 2015;**56**:223–30. doi:10.1016/j.jadohealth.2014.09.007

49 Al Riyami A, Afifi M, Mabry RM. Women's autonomy, education and employment in Oman and their influence on contraceptive use. *Reprod Health Matters* 2004;**12**:144–54.

50 Lithur NO. Destigmatising abortion: expanding community awareness of abortion as a reproductive health issue in Ghana. *Afr J Reprod Health* 2004;**8**:70–4.

51 Ilboudo PGC, Greco G, Sundby J, *et al.* Costs and consequences of abortions to women and their households: a cross-sectional study in Ouagadougou, Burkina Faso. *Health Policy Plan* 2015;**30**:500–7. doi:10.1093/heapol/czu025

52 Muchabaiwa L, Mbonigaba J. Impact of the adolescent and youth sexual and reproductive health strategy on service utilisation and health outcomes in Zimbabwe. *PLOS ONE* 2019;**14**:e0218588. doi:10.1371/journal.pone.0218588

Supplementary File 1: Demographic and reproductive characteristics of adolescent postabortion care patients (15-19) and nonadolescent (20-49) postabortion care patients, Zimbabwe 2016

Characteristics of respondents	15-19		20-49		p value
	%	N	%	N	
Marital Status					0.00
In union	67%	103	82%	921	
Not in union	33%	52	18%	205	
Residence					0.00
Urban	42%	65	63%	715	
Rural	58%	90	37%	427	
Education					0.00
No education	1%	2	1%	7	
Some/completed primary	20%	30	13%	153	
Some/completed secondary	79%	122	71%	804	
Greater than secondary	1%	1	15%	175	
Religion					0.00
Apostolic	51%	79	69%	785	
Protestant/Pentecostal/Other	49%	76	31%	353	
Previous Pregnancy					0.00
0	76%	118	14%	156	
1+	24%	37	86%	984	
Pregnancy intention					0.32
Unintended	31%	48	29%	329	
Intended	67%	105	70%	795	
Don't Know	1%	2	1%	11	
Using contraception at time of current pregnancy					0.00
No	87%	132	53%	591	
Yes	13%	19	47%	524	
Gestation presented with complications					0.02
First trimester	58%	90	66%	747	
Second trimester	42%	65	34%	379	
Severity of complication					0.30
Mild	55%	84	60%	673	
Moderate	23%	34	19%	211	
Severe/Near-Miss	22%	34	21%	239	
Received postabortion modern contraception					0.70
No	56%	81	55%	566	
Yes	44%	64	45%	470	
Total	12%	155	88%	1141	

Supplementary File 2: Methodological Appendix

I. Abortion Incidence Complications Methodology (AICM) steps and data inputs and sources

Figure 1 illustrates the steps of the age-specific variant of the Abortion Incidence Complications Methodology (AICM). Table 1 outlines the data input and sources used for each corresponding step of the AICM, and the assumptions made with each data source.

Figure 1. Steps of the age-specific variant of the Abortion Incidence Complications Methodology (AICM)

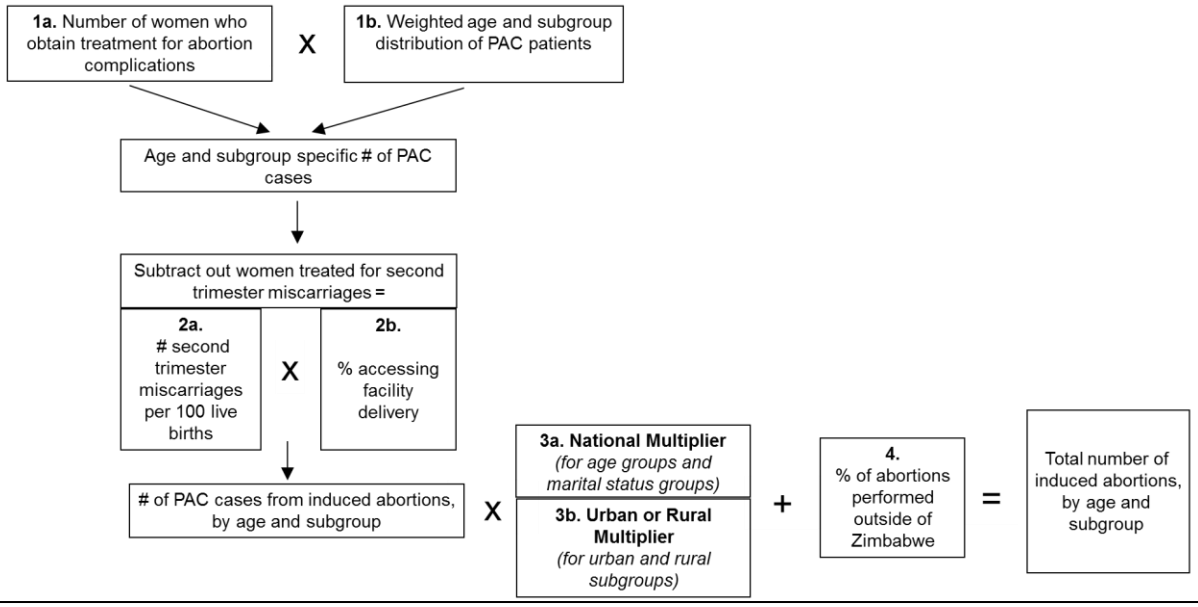


Table 1. Data sources and assumptions made in age-specific variant of AICM

Step of AICM	*Data Input*	*Source*	*Data coverage*	*Assumption*
1a	Number of women who obtain treatment for abortion complications	Sully EA, Madziyire MG, Riley T, et al. Abortion in Zimbabwe: A national study of the incidence of induced abortion, unintended pregnancy and post-abortion care in 2016. PLOS ONE 2018; 13:e0205239. doi:10.1371/journal.pone.0205239	National number	N/A
1b	Weighted age and subgroup distribution of PAC patients	Prospective Morbidity Survey	Age and subgroup* specific	N/A
2a	# second trimester miscarriages per 100 live births	(1) Sully E, Dibaba Y, Fetters T, *et al.* Playing it Safe: Legal and Clandestine Abortions Among Adolescents in Ethiopia. *J Adolesc Health* 2018;62:729–36. doi:10.1016/j.jadohealth.2017.12.015 (2) Harlap S, Shiono P, Ramcharan S. A life table of spontaneous abortions and the effects of age, parity and other variables. In: Porter I, Hook E, eds. Human embryonic and fetal death. New York: Academic Press 1980. 145–58.	Age specific	We assume that the proportion of second trimester miscarriages does not differ by marital status or residence within each age group.

2b	% accessing facility delivery	Zimbabwe National Statistics Agency, ICF International. 2016. Zimbabwe Demographic and Health Survey 2015: Final Report.	Age and subgroup* specific	We use the AICM assumption[1] that facility delivery access is equivalent to access for treatment of second trimester miscarriages.
3a	National Multiplier	Details on calculations and sources in Section 3 below.	National	The national multiplier for all age and marital status groups assumes that complications and treatment seeking do not differ by age or marital status.
3b	Urban or Rural Multiplier	Details on calculations and sources in Section 3 below.	Specific to urban and rural subgroups, but not age specific	The residence-specific multiplier assumes that complications and treatment seeking do not differ by age within rural or urban subgroups.
4	% of abortions performed outside of Zimbabwe	Sully EA, Madziyire MG, Riley T, et al. Abortion in Zimbabwe: A national study of the incidence of induced abortion, unintended pregnancy and post-abortion care in 2016. PLOS ONE 2018;13:e0205239. doi:10.1371/journal.pone.0205239	National	We assume the proportion of abortions performed outside of Zimbabwe does not differ by age or subgroup.
Sources used for Unintended Pregnancy calculations				
N/A	Proportion of births that are unintended	Zimbabwe National Statistics Agency, ICF International. 2016. Zimbabwe Demographic and Health Survey 2015: Final Report.	Age and subgroup* specific	N/A
N/A	Pregnancies ending in miscarriage	Leridon H. Human Fertility: The Basic Component. Chicago: University of Chicago Press; 1977.	National	We assume 20% of live births and 10% of induced abortions end in miscarriages.[1]

*Subgroups refer to marital status (currently married or unmarried) and residence (urban or rural).

II. Adjustments to align summed age groups to the national total

To ensure that the age groups summed to the national total, we made adjustments at two keys points. We adjusted the sum of total number of induced abortions by age group to add up to the national total of induced abortions [2]. We also did this adjustment for unintended births, intended births, unintended miscarriages, and intended miscarriages to ensure the unintended pregnancy, intended pregnancy, and overall pregnancy totals aligned with the national numbers [2]. After adjusting the summed age groups to the national total, we calculated one further adjustment for the subgroups within the 15-19 year old age group and the 15-49 age group. We adjusted at those same two key points to ensure that, for instance, 15-19 unmarried women plus 15-19 married women equaled the 15-19 year old total. We only looked at subgroup differences among the adolescent age group (15-19) and all women of reproductive age (15-49).

III. Calculation of the multipliers

a. National

We used the approach outlined in the methods section and mathematical appendix A of Sully et al. [2], which was used to calculate regional multipliers, in order to calculate the national multiplier for this analysis. We applied the national multiplier to all age groups and marital status subgroups in the absence of age-specific and marital status-specific multipliers

b. Urban and rural multipliers

Since complications and access to treatment likely vary based on residence or wealth status, the proportion of treated complications from induced abortions was estimated for four subgroups of women: rural poor, rural non-poor, urban poor and urban non-poor [2]. We used this subgroup data to construct two new multipliers, a multiplier for all women in rural areas and a multiplier for all women in urban areas. Using rural as an example, we calculated the proportion of rural poor women and rural non-poor women who received treatment for complications, and weighted these by the population proportion of rural women who are poor and non-poor, respectively, to estimate the rural multiplier. We did the same for the urban multiplier. The population of women in each residence and wealth group was from the Zimbabwe Demographic and Health Survey and the Zimbabwe National Statistic Agency, respectively.[3,4]

References

1 Singh S, Prada E, Juarez F. The Abortion Incidence Complications Method: A Quantitative Technique. In: Singh S, Remez L, Tartaglione A, eds. *Methodologies for Estimating Abortion Incidence and Abortion-Related Morbidity: A Review*. New York and Paris: : Guttmacher Institute and International Union for the Scientific Study of Population 2010. 63–70.

2 Sully EA, Madziyire MG, Riley T, *et al.* Abortion in Zimbabwe: A national study of the incidence of induced abortion, unintended pregnancy and post-abortion care in 2016. *PLOS ONE* 2018;**13**:e0205239. doi:10.1371/journal.pone.0205239

3 Zimbabwe National Statistics Agency, ICF International. Zimbabwe Demographic and Health Survey 2015: Final Report. 2016.

4 ZIMSTAT. Poverty and Poverty Datum Line Analysis in Zimbabwe 2011/12. Harare, Zimbabwe: : Zimbabwe National Statistics Agency 2013. https://www.undp.org/content/dam/zimbabwe/docs/Governance/UNDP_ZW_PR_Zimbabwe%20Poverty%20Report%202011.pdf (accessed 1 Aug 2019).