Chapter 6. How do the numbers compare? Estimating the incidence of induced abortion in Zambia using indirect methodologies that rely on community-based and facility-based data

Introduction

This chapter, presented in the format of an extended scientific article, compares estimates of abortion incidence in Zambia generated using different indirect methodological approaches. The chapter first describes each method and how they were adapted to improve data collection in the Zambian context. To avoid repetition with previous chapters, references are made to the relevant method sections in chapter 5 and in the background (chapter 2). A fuller description of the methods will be described in the paper that will be submitted for peer-review publication. Additional information on the methods and descriptive results are also included in appendices 5 and 6. Thereafter the chapter presents estimates of the incidence of abortion in Central, Copperbelt and Lusaka province, discusses their differences and finally reflects on the strengths and limitations of these methodological approaches as well as the relevance of their substantive findings for Zambia.

London School of Hygiene and Tropical Medicine
Keppel Street, London WC1E 7HT
www. lshtm.ac.uk

Registry
T: +44(0)20 7299 4646
F: +44(0)20 7299 4656
E: registry@lshtm.ac.uk

LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

COVER SHEET FOR EACH 'RESEARCH PAPER' INCLUDED IN A RESEARCH THESIS

Please be aware that one cover sheet must be completed for each 'Research Paper' included in a thesis.

1. For a 'research paper' already published

1.1. Where was the work published?

1.2. When was the work published?

1.2.1. If the work was published prior to registration for your research degree, give a brief rationale for its inclusion

1.3. Was the work subject to academic peer review?

1.4. Have you retained the copyright for the work? Yes / No

If yes, please attach evidence of retention.

If no, or if the work is being included in its published format, please attach evidence of permission from copyright holder (publisher or other author) to include work

2. For a 'research paper' prepared for publication but not yet published

2.1. Where is the work intended to be published?

International perspectives on sexual and reproductive health

2.2. Please list the paper's authors in the intended authorship order

Onikepe O. Owolabi, Jenny Cresswell, Mardieh Dennis, Akin Bankole, Oona Campbell, Bellington Vwalika, Veronique Filippi

2.3. Stage of publication –

Not yet submitted

4. **For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)**

As first author on this paper, I developed the idea for the paper, undertook the analysis, wrote the first draft of the manuscript and incorporated co-author comments

NAME IN FULL (Block Capitals) ONIKEPE OLUWADAMILOLA OWOLABI.
STUDENT ID NO: .260480.

CANDIDATE'S SIGNATURE  **Date** 5th January 2016

SUPERVISOR/SENIOR AUTHOR'S SIGNATURE (3 above)

6.1 Introduction to the paper

Abortion laws in Sub-Saharan African countries are often restrictive, and the induced abortions that occur there are frequently conducted in clandestine and unsafe conditions, leading to unnecessary deaths among women(5). Whilst complications related to abortion are an important cause of maternal death (2), considerable uncertainty exists around the prevalence of induced abortion, irrespective of whether it takes place within or outside formal health services (2). This is because where abortion is illegal, women are unlikely to report their induced abortions in surveys and abortion providers are unlikely to accurately record illegal procedures (5,13). This makes the monitoring of induced abortion trends, and the evaluation of abortion-related policies and programs challenging (42).

In response to these measurement constraints, indirect approaches are frequently used to generate national estimates of the magnitude of induced abortion (42). However, there is no gold-standard method available in restrictive contexts to validate the results of these approaches. The most frequently used approach called the Abortion Incidence Complications method (AICM) relies on facility-based data from providers and/or medical record source(s) (38,42). Whilst this method has been refined (176) since it was first published (120), some components of the approach still collect data using subjective methods and some of the assumptions applied to this data to generate estimates may not be valid(34). An alternative, community-based network generating method, analogous to the sisterhood method for estimating maternal mortality, and called the "Confidant Method" or the "Anonymous Third Party Reporting Method (ATPR,), has been applied more recently to women respondents within community-based surveys in restrictive contexts (30,119,122). All approaches have strengths and limitations(13,67), so applying multiple methods in the same setting provides an opportunity to compare estimates from these approaches and to better understand the strengths and limitations of each method (Singh et al., 2010). This is rarely done (30), and there is currently only one study comparing the AICM and ATPR. Another potential advantage of applying multiple methods in one context is that, new and more reliable methods, drawing on the strengths of each of approaches, may result.

Zambia is a constitutionally Christian country with one of the most liberal abortion laws in Sub-Saharan Africa. The 1972 Termination of Pregnancy Act, amended in 1994 and 2005, permits termination if the pregnancy constitutes a risk to the woman's physical or mental health, or life; involves a risk to the physical or mental health the woman's existing children; if there is substantial risk that the unborn child would suffer from physical or mental abnormalities as to be seriously handicapped, or if rape occurs (17). However, its implementation is impeded by a requirement for three medical practitioner signatories before receiving a non-emergency elective termination of pregnancy. These requirements, limited knowledge about the abortion law (21) and strong social stigma associated with pregnancy termination seriously impede access to safe and legal abortions for most women (20,141). There are no recent studies of the incidence of induced abortion in Zambia, but abortion complications have been previously estimated to account for 30% of maternal deaths and 50% of acute gynaecological admissions (17,145).

6.2 Objective

The objective of this study is to estimate and compare the incidence of induced abortion in three provinces in Zambia (Central, Copperbelt and Lusaka provinces) using health facility and community-based approaches and to provide an empirical basis for exploring the strengths and limitations of these different approaches. We adapted the design and data collection approaches of three different methodologies for this study. Health facility estimates were generated using the AICM and prospective morbidity methodology (PMM), whilst community-based estimates were generated using the ATPR.

6.3 Methods

6.3.1 Study design

Health facility based methods

6.3.1.1 Abortion Incidence Complications Method (AICM)

As discussed in chapter 2, the AICM has been employed in several low- and middle-income countries to estimate induced abortion incidence (30–32,120,121,177) . The data required for this approach are collected via two cross-sectional surveys: a health facilities survey (HFS) and a health professionals' survey (HPS). We adapted AICM tools from

previous studies to reflect the Zambian context and to include questions on medical abortion, especially misoprostol which is increasingly used (46,63). The final English version of both tools and additional information on how questions were adapted for each tool can be found in Appendix 8, sections A, B and C. Fieldwork for the AICM took place in two phases. The HFS was administered to clinically trained data collectors during the near-miss morbidity study training in each province in November 2013 (from the study described in Chapter 5). We administered the HPS tool to local experts on abortion between January and March 2014.

6.3.1.1.1 Health facilities survey (HFS)

The HFS solicits information from healthcare workers on the number of women treated for abortion complications at health facilities. At each hospital, we asked one to three staff members who were knowledgeable about the provision of post-abortion care (PAC) in their facility to participate. These were typically nurses/midwives, clinical officers, or doctors who worked in wards admitting women for abortion-related complications.

The relevant questions in the HFS tool are: *"In the **past month** how many patients with abortion-related complications (include all post abortion care patients whether they are due to spontaneous or induced abortions) do you estimate were treated at your facility*?" and *"In an **average or typical month** how many patients with abortion-related complications (include all post abortion care patients whether they are due to spontaneous or induced abortions) do you estimate were treated at your facility?"*

6.3.1.1.2 Health professionals survey (HPS)

The HPS was designed to elicit the respondents' perceptions of the likelihood that women who have abortions will have complications serious enough to require treatment in health facilities, taking into consideration the likely methods used and the socio-economic situation of women (urban non-poor, urban poor, rural non-poor and rural poor). It further collects information on the probability that the women who have serious complications will receive care in health facilities (178).

6.3.1.2 Prospective morbidity methodology (PMM)

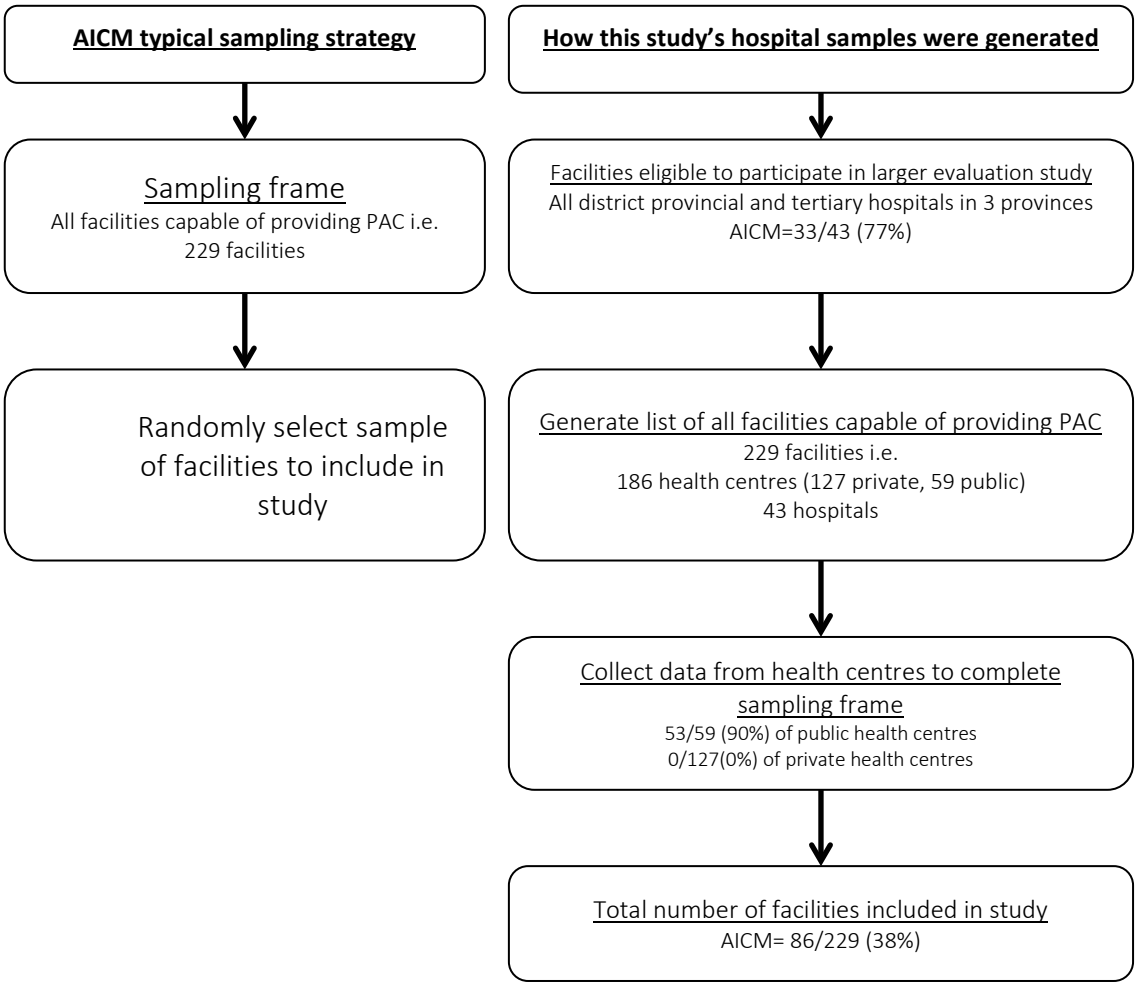
This method was described in chapter 3, section 2.6.1.2 and chapter 5. Additional information on sampling will be discussed in section 6.3.1.3.1. Although the PMM was developed to describe abortion-related morbidity, data from this approach has been combined with HFS data to estimate the number of admissions for abortion-related complications in previous studies (31,32). In this study, we estimated the incidence of abortion with the PMM by using the total number of admissions for abortion-related complications obtained from this approach in place of the HFS data and applying AICM assumptions to this value.

6.3.1.3 Sample selection and data collection

6.3.1.3.1 Hospital sample (HFS and PMM)

Four levels of Zambian facility are expected to treat post-abortion complications: health centres, level one (district), level two (provincial) and level three (tertiary) hospitals (17). However, the capacity of health centres varies depending on their location and the availability of infrastructure, equipment and supplies, and skilled staff. We sampled hospitals (district, provincial and tertiary facilities) and health centres separately. Of the forty-three hospitals eligible to participate in our study, 35 (81%) participated in the PMM and 33 (77%) in the AICM (two hospitals in the PMM did not provide the data required for the AICM). Most hospitals that refused to participate were private district hospitals, and the majority were in Lusaka province; they were reluctant to provide information they considered potentially legally implicating. Overall, the total number of facilities capable of treating post-abortion complications in the three provinces was 229, of which 82% (n=186) were health centres, 13% (n=30) district hospitals, 4% (n=10) provincial hospitals and 1% (n=3) tertiary hospitals. Of these 229 facilities, this study included data from 86 facilities. Figure 6-1 shows how the sample in this study was achieved. Appendix 8 section D contains a table and chart providing additional information on how hospitals were identified for this study, and the sampling fraction achieved for each type of facility.

Figure 6-1 Flow diagram outlining how the sample for the AICM was achieved



6.3.1.3.2 Sample for HPS

We purposively sampled individuals knowledgeable about the abortion situation in Zambia across a diverse range of sectors: public health, private providers, NGO's, policymaking and advocacy. The research team prepared a list of health professionals in the private and public sector by consulting with our local co-investigator (BV) and research organization. A list of 23 persons from the three study provinces was generated, out of whom 19 (83%) participated.

6.3.1.4 Other data sources

We obtained estimates of the number of women of reproductive (WRA) aged 15-49 in 2013 using data from the 2010 Zambia Census of Population and Housing. We projected the number of live births in the population by applying age-specific fertility rates obtained from the 2013-14 Zambia Demographic and Health Surveys (ZDHS) to WRA in 5-year age groups. The distribution of women aged 15-49 by residence and wealth quintiles came from the 2013-14 ZDHS.

6.3.1.5 Analysis

6.3.1.5.1 AICM analysis

Figure 6-2 presents step-by-step calculations for how the HFS and HPS data were used to derive estimates of the incidence of induced abortion. Step 1 and 2 describes how we estimated the total number of abortion-related complications in all the facilities. This value was weighted by the inverse of the product of the sampling fraction and the response rate for the facilities stratified by ownership/level to provide estimates of abortion-related admissions for the three provinces. Private health centres did not contribute to these weights, as we did not assume that their admission caseloads were similar to publicly owned health centres. The incidence of abortion from the AICM reported in the results section is hence a relatively conservative estimate. To compare the incidence of abortion estimated under less conservative assumptions, we conducted a sensitivity analysis by assuming public and private health centres have similar caseloads, and merging them into one category to generate new weights. These new weights were then applied to the 186 health centres in the sample.

Step 3 shows how we separated the total numbers of abortion-related admissions into complications from induced abortion and spontaneous abortions (miscarriages), by applying the AICM assumptions. The first assumption presumes that most miscarriages which will require health facility care are late miscarriages (13-22 weeks gestational age) (42). Late miscarriages are estimated to constitute approximately 3.41% of all live births[4]

[4] This percentage is derived from clinical studies on the biological pattern of miscarriages which suggest that late pregnancy loses account for 2.9% of all recognized pregnancies (91,92). Since live births are estimated to account for 84.8% of all pregnancies, 13-22 week miscarriages hence account for 3.4% of all live births

(91,92). The second assumption posits that not all women with late miscarriages will seek care in a health facility. The proportion of women estimated to seek care for late miscarriages was obtained from the HPS (71.8%).

To calculate the multiplier applied in step 4, we obtained the percentages of women estimated to i) need, and ii) receive, treatment for induced abortion complications amongst women who had abortions in four-socioeconomic subgroups (urban non-poor, urban poor, rural non-poor and rural poor) from the HPS. We weighted these percentages by the relative size of each group within population, using the 2013-14 ZDHS data. The inverse of the sum of the weighted percentages provided the multiplier (4.4). This meant that for every woman who had an induced abortion and received care from health facilities for induced abortion complications, 4.4 did not get care. This was either because they did not need, did not want or could not get care.

To obtain the final estimate of total number of induced abortions in the three provinces in 2014, we multiplied the number of induced abortion-related complications obtained from the HFS data (step 3) by the multiplier (4.4) in step 4. This result is also presented as abortion rate (i.e. number of abortions per 1,000 women aged 15-49) and abortion ratio (i.e. number of abortions per 100 live births). We calculated 95% confidence intervals for the total number of admissions for abortion-related complications (induced and spontaneous) treated in health facilities. We then applied the methodology described above to the low and high confidence interval estimates to produce lower and upper estimates of the abortion incidence rate and ratio.

Figure 6-2 Step-by-step analysis of AICM data

Step 1: *Annual caseloads for each hospital* **(A)**

((Past month's caseload + Average monthly caseload) ÷ 2) X 12

Step 2: *Total number of admissions for abortion-related complications in all facilities in three provinces* **(B)**

Σ (weighted **(A)**) + Σ (weighted annual PAC admissions in all health centres)

Step 3: *Number of admissions for abortion-related complications due to induced abortions*

3a*. Estimate number of late miscarriages in the study population* **(C)**

3.41/100 X (Population estimate of number of live births using DHS and National census data)

3b. *Estimate number of late miscarriages that will seek health facility care using proportion of women estimated to seek care for late miscarriage from HPS* **(D)**

Proportion seeking care (71.8)/100 X **(C)**

3c*. Number of abortion-related admissions due to induced abortions* **(E)**

Total number of admissions for abortion-related complications minus number of admission due to late miscarriage (i.e. **(B)-(D)**)

Step 4: *Estimate the number of induced abortions in the population* **(F)**

Number of abortion-related admissions due to induced abortions **(E)** X multiplier from HPS (4.4)

6.3.1.5.2 PMM Analysis

For this study, the sum of caseload data from hospital registers for the five months of data collection was extracted, and annualized to generate estimates of admissions for abortion-related complications for the three provinces. Data were weighted for each level of hospital) based on the sampling fraction achieved. Thereafter the number of cases in health centres was added to hospital caseload data in each province.

We compared the number of cases admitted for PAC estimated using the AICM and PMM methods of data collection in different categories of hospitals. We calculated the percentage difference between caseload data from both methods at each facility. To obtain the number of induced abortions, we applied the AICM assumptions and multiplier to the number of admissions for induced abortion-related complications estimated using PMM data.

Community-based method

6.3.1.6 Anonymous third party reporting method (ATPR)

The ATPR collects data from women in the community, on their confidants' abortions to generate data on induced abortion. This study applied the ATPR as a module of questions within a community survey in Zambia. The full details of how of how the ATPR tool was adapted for Zambia are provided in Appendix 9, section A.

6.3.1.6.1 Sample selection and data collection

The community survey was a cross-sectional household survey of women 15-44 years with a sample size of 1484 women. A multi-stage sampling design was used, with wards selected using probability proportional to size, using the 2010 census as a sampling frame, as detailed elsewhere(21). One revisit was allowed for each eligible household before replacement. For logistical reasons, only one woman was selected amongst women of reproductive age in each household using a random number table to participate in the ATPR module. This resulted in 931 women interviewed for the ATPR module out of the 1484 women interviewed for the entire community survey. The response rate for the overall community survey was 86%. Fieldwork was conducted between 10th of March and 6th of May 2014. The project coordinator uploaded data from

the tablets in the field daily and the project officer downloaded the data to computers at the Population Council office. We then collected data at frequent intervals to examine the quality.

Table 6-1 provides a comparative description of the three approaches of estimating abortion incidence applied in this study.

Table 6-1 Comparing the sources of data for estimating abortion incidence

	Methods		
	Hospital based method		**Community-based method**
	AICM	**PMM**	**ATPR**
Source of primary data	1. Health facility survey (HFS): providers at health facilities 2. Health professionals survey (HPS): Experts knowledgeable about abortion	1. Health facility Patient records in extracted by health workers 2. Hospital registers and logbooks	Household survey of women
a) Numerator	HFS: Estimated annual number of admissions for abortion-related complications. Use this & and other information to estimate: • Number of complications from induced abortion and miscarriages treated hospital, • Number of induced abortions, • Number of pregnancies	• Number of admissions for abortion-related complications. • Number of women who had legal abortions in facilities	• Number and characteristics of women with induced abortions in each year of exposure, • Number and characteristics of women's confidants with induced abortion in each year of exposure, • Number and proportion of induced abortions that result in complications, • Techniques of inducing abortions, • Number and proportion of complications treated in different types of health facilities
b) Denominator	Number of women of reproductive age using recent population level surveys or censuses	Number of women of reproductive age using recent population level surveys- or censuses	Person-years of respondents' confidants within survey population
c) Multiplier (to account for proportion of women having an induced abortion but not requiring treatment, or requiring treatment but not obtaining it at all or not from a health facility)	*From HPS: inverse of the proportion of all women estimated to receive treatment for complications of induced abortion	Not available (used the HPS multiplier to estimate induced abortions).	Inverse of the proportion of all induced abortions reported as managed at health facilities in the relevant categories

6.3.1.6.2 Analysis

The numbers of abortions and women-years at risk reported by each respondent were weighted to account for the numbers of women in each respondent's household.

For the denominator, women-years of observation were calculated for the year preceding the survey and the year of the survey, excluding confidants not aged 15-49 years, or who resided outside the three provinces of interest in the given year. Women-years for which the respondent did not know whether the confidant had an abortion were removed from the analysis, hence assuming that women experienced the same abortion rates during these years as years for which the confidant's abortion status was known. We counted the number of reported induced abortions for each eligible confidant-year in the denominator. An abortion rate for the three provinces was estimated, and for different age groups of women. To explore the relationship with abortion-related morbidity and generate a comparable multiplier with the AICM method, we estimated the proportion of abortions that led to health complications, and the proportion of women with complications who received PAC in formal health facilities. We assumed that the distribution of abortion characteristics reported was the same for abortions where the respondent did not know the answer to the questions or the information was missing.

6.4 Results

6.4.1 AICM

6.4.1.1 Incidence of Induced abortion

Using the AICM we estimated 20,092 women (95% CI 13,646-26,537) were treated for complications of induced abortions or miscarriages in health facilities in Central, Copperbelt and Lusaka provinces in 2013 (Table 6-3). Based on the number of live births (218,651) in the three provinces in 2013, we estimated there were 7,456 late miscarriages in 2013, of which 5,352 sought facility-based care. Therefore, 14,740 induced abortion-related complications were treated in health facilities in the three provinces (Table 6-5). According to the HPS, 23% of all women in Central, Copperbelt and Lusaka provinces that had an induced abortion received treatment for complications in 2013. We therefore estimated that there were 64,953 abortions in the three provinces

in Zambia in 2013 to women aged 15-49 with lower and upper estimates of 36,549 and 93,352. This meant that 48 induced abortions per 1000 women aged 15-49 (95% confidence interval 27-68) or 30 abortions per 100 live births (95% confidence interval 17-43) occurred in the three provinces in 2013 (Table 6-5).

6.4.1.2 Comparing the results of weighting private health centres to have similar caseloads with public health centres to the results without

When the number of admissions for abortion-related complications in private health centres is assumed to be similar to that in public hospitals, the abortion incidence rate is estimated to be 68 per 1000 women (95% CI 47-89), compared with a rate of 48 per 1000 women (95%CI 27-68). Table 6-2 shows the differences in estimates of abortion-related morbidity and abortion incidence under both assumptions.

Table 6-2. Comparing the incidence of abortion using different weights for private health centres

	Conservative estimate (no data from private health centres)			**Less conservative estimate (applying caseload data from public health centres to private health centres**		
	3 provinces together	**3 provinces together lower 95%CI**	**3 provinces together upper 95%CI**	**3 provinces together**	**3 provinces together lower 95%CI**	**3 provinces together upper 95%CI**
Number of complications treated in all health facilities in 2013	20,092	13,646	26,537	26,468	20,022	32,913
Total number of induced abortions in provinces in 2013	64,953	36,549	93,352	93,048	64,644	121,448
Abortion rate per 1000 women in 2013	48	27	68	68	47	89
Abortion ratio per 100 live births in 2013	30	17	43	43	30	56

6.4.2 PMM

Using the PMM hospital data and data from the health centres, we estimated 15,269 women were treated for complications of induced abortion or miscarriages in Central, Copperbelt and Lusaka provinces in 2014 (Table 6-3). Using the same approach as in AICM to determine the number of the complications that were due to induced abortions we estimated this to be 9,746 complications. Assuming the same multiplier of 4.4 as in the AICM, we estimated 42,943 abortions or 30 abortions per 1,000 women aged 15-49, or 19 abortions per 100 live births based on the PMM (

Table **6-5**).

6.4.3 Comparison of AICM and PMM

Table 6-3 compares the differences in estimated number of hospital admissions for different facility levels from the AICM and PMM method. A difference of 20% was considered acceptable. Overall, the PMM method found fewer cases of abortion-related admissions than the AICM, with a few exceptions in Copperbelt and Lusaka, where the PMM returned a higher count than the AICM. This was particularly the case for government district hospitals in both provinces. The estimates from the PMM and AICM were more similar in tertiary hospitals than in district hospitals. The AICM estimates were at least 50% larger than PMM estimates in private district hospitals in Lusaka, mission district hospitals in all provinces and government district hospitals in Central province.

Table 6-3 Estimated number of cases admitted in each type of facility in different provinces using the AICM and PMM approaches

FACILITY CLASSIFICATION		Number of cases by location*											
Facility ownership	**Facility level**	**Central province**			**Copperbelt province**			**Lusaka Province**			**3 provinces together**		
		AICM	**PMM**	**% diff**	**AICM**	**PMM**	**% diff**	**AICM**	**PMM**	**% diff**	**AICM**	**PMM**	**% diff**
Government	**District**	1978	899	-54	240	565	135	833	1224	47	3113	2656	-15
	Province	984	583	-41	1614	881	-45	912	949	4	3510	2413	-31
	Tertiary	0	0	0	3294	3545	7	4756	3568	-25	8050	7113	-12
Private	**District**	0	0	0	1740	1551	-11	1650	136	-92	3150	1140	-64
	Province	0	0	0	135	187	39	0	0	0	135	187	39
	Tertiary	0	0	0	0	0	0	0	0	0	0	0	0
Mission	**District**	435	219	-50	426	185	-57	150	77	-49	1011	481	-52
	Province	0	0	0	0	0	0	0	0	0	0	0	0
	Tertiary	0	0	0	0	0	0	0	0	0	0	0	0
Total PAC cases**		**3769**	**2074**	**-45**	**7930**	**7396**	**-7**	**9120**	**6774**	**-26**	**20204**	**15269**	**-24**

% diff was calculated as {PMM-AICM}/AICM x 100
§Cells containing numbers greater than zero are coloured to make the table easier to read
**Numbers are weighted to reflect the total number of eligible facilities in each province*
*** Total PAC cases include weighted numbers for health centres to the cases from all other facilities, which are the same for both methods*

6.4.4 ATPR

Respondents to the ATPR were generally older than women in the 2013/14 ZDHS survey ($p<0.001$). The exception to this was the 40-44 age group where the ZDHS had a higher proportion of women (Table 6-4). A greater proportion of respondents lived in Central province (23%) compared with women in the ZDHS (19%) ($p<0.001$). Out of 931 women interviewed, 290 reported having zero confidants to whom they spoke about their sexual and reproductive lives. Respondents listed 2,205 confidants, and each respondent had an average of 2.4 confidants. While the sample of respondents and confidants were similar in age distribution, respondents were more educated than their confidants ($p <0.001$).

Table 6-4 Table comparing age distribution of respondents to ATPR with women in 2013/14 ZDHS

Age group	DHS N (%)	Respondents to Confidants module N (%)*	P value
15-19	1618(22.44)	141(14.94)	<0.001
20-24	973(20.36)	269(25.83)	
25-29	876(18.33)	181(19.20)	
30-34	730(15.27)	172(18.25)	
35-39	625(13.08)	124(13.13)	
40-44	407(8.51)	56(5.94)	
Total	4779(100)	943(100)	

** Proportions and counts are weighted for survey design*

The sample of respondents provided information on 304 induced abortions amongst their confidants in 3816 confidant women-years from January 2013 to May 2014 (Table 6-5). This meant that 80 induced abortions per 1000 women years for 2013 and early 2014 occurred in the three provinces. Conducting a sensitivity analysis by including the person-years for which women did not know if their confidant had an abortion, the rate is 78.4 per 1000.

Table 6-5 Results for different measures using the 3 approaches

Measure	AICM	PMM	ATPR
Women aged 15-49	1,367,036[a]		3816
Live births	218,651[a]		
Women hospitalized for complications of induced abortions	14,740	9,746	
Multiplier (number of abortions for every case treated)	4.4		2.7
Number of induced abortions ***95% CI***	64,953 *(36,549, 93,352)*	42,943	304
Induced abortion rate per 1000 women 15-49 ***95% CI***	48 *(27, 68)*	30	80
Induced abortion ratio per 100 live births ***95% CI***	30 *(17, 43)*	19	
Non-conservative induced abortion rate per 1000 women 15-49 AICM (sensitivity analysis) ***95% CI***	68 *(47, 89)*		
Non-conservative induced abortion ratio per 1000 women 15-49 AICM (sensitivity analysis) ***95% CI***	43 *(30,56)*		

[a] *Derived from the Zambia 2010 census of population and housing and the 2013-14 ZDHS.*

Information on the characteristics of the induced abortion was missing for 50% of all abortions reported in the ATPR.

Respondents to the ATPR reported that 56% of women terminated their pregnancies using methods that would have been classified as other (traditional methods and self-medication). These women used traditional herbal concoctions (22%) insertion of plant roots (19%) and high doses of medications e.g. painkillers, and malaria tablets (13%) (Table 6-6). They also reported that 25% of women induced abortions by taking tablets from a health worker. However, we did not specifically ask about misoprostol or other medical abortion drugs in the questionnaire.

Similarly, HPS respondents estimated that at least a quarter of all women except rural-poor women used medical abortion to terminate their pregnancies whilst 50% or more of urban poor, rural poor and rural-non poor were estimated to use other/traditional (non-surgical and non-medical) methods to induce their Table 6-7.

Based on ATPR data, Fifty-six percent of reported induced abortions were followed by health complications and of these 80% were treated in a health facility. Altogether, 42% of all induced abortions received PAC in a health facility, and 37% of women received health care in the cadres of facilities where data was collected using the AICM and PMM. This is equivalent to a multiplier of 2.4.

Table 6-6 Methods used to induce abortion by confidants where respondent knew method (ATPR)

Method	**Number N (%)**
Traditional	**26(41%)**
Traditional method e.g. cassava root	2 (3.2)
Traditional method e.g. other plant root	10 (15.9)
Traditional method e.g. herbal concoction	14 (22.2)
Self-medication	**9 (14%)**
Self-medication e.g. strong tea/Coca-Cola/alcohol	1 (1.6)
Self-medication e.g. overdose of medications e.g. painkillers, malaria tablets	8 (12.7)
Health Worker	**24(38%)**
Health worker e.g. curettage or aspiration	2 (3.2)

Health worker e.g. injection	6 (9.5)
Health worker e.g. tablets	16 (25.4)
TOTAL	**63 (100)**

Table 6-7 HPS respondent's views on types of abortions obtained by different categories of women

Type of abortions obtained by different categories of women	Urban Poor (%)	Urban Non-Poor (%)	Rural Poor (%)	Rural Non-Poor (%)
Medical abortion	25.4	55.3	11.1	28.2
Surgical abortion	15.9	25.9	7.4	15.4
Other kinds of abortion	58.7	18.8	81.6	56.5
TOTAL	**100**	**100**	**100**	**100**

6.5 Discussion

6.5.1 Main findings

Although the estimates generated from the PMM, AICM and ATPR differed considerably, they all suggested that the incidence of induced abortion is high in Central, Copperbelt and Lusaka provinces. This is concerning, and may reflect the high unmet need for family planning in Zambia (136).

The AICM rate of 48 per 1000 women is similar to AICM rates in Kenya which also found a rate of 48 in 2015(34), and Uganda's rate of 54 in 2005(178). However the lowest induced abortion rate of 30 per 1000 women estimated using the PMM data was higher than the Southern African regional rate of 15 per 1000 women(179), Malawi's rate of 23 (32),Rwanda's rate of 25(177), Ethiopia's rate of 23(31), and Burkina Faso's rate of 25(30).

6.5.2 Methodological challenges

Our application of each method has some biases. The community-based ATPR estimates an induced abortion rate (80 per 1000 women years) 1.7 times higher than the hospital-based AICM (48 per 1000). However, when private hospitals are assumed to have similar caseloads to public hospitals in the AICM the estimated induced abortion rate goes up to 68 per 1000 women and the 95% confidence interval (47-89) includes this relatively high ATPR rate. It is unlikely that women utilize private health centres for PAC at the same rate as public health centres so this estimate is most likely too high. Our results differ from that in the study by Sedgh and colleagues (2011) comparing the ATPR and AICM methods in Burkina Faso where the AICM abortion rate was higher.

Our study suggests that abortion caseload data collected using the AICM (HFS) tends to be greater than data collected via hospital registers (which should be the gold standard in countries with good records) using our modified PMM approach and may hence be overestimated. This difference is more pronounced in lower level hospitals than tertiary hospitals in our study. In Ethiopia and Malawi, the average of caseload estimates from the PMM and AICM have been used to derive estimates of post abortion patients treated in facilities (31,32). The studies in Ethiopia and Malawi implemented the standard PMM approach used by Rees et al 1997(87) and prospectively extracted data from the casefiles of all women admitted for abortion related-complications. This is unlike our study, which prospectively extracted data from casefiles of women meeting our narrower inclusion criteria and then counted all abortion-related admissions in hospital registers to get the PMM numbers.

Based on our Zambian experience, in tertiary hospitals where there is minimal variation between PMM and AICM, averages of the caseload may be close to the truth. Such adjustment may be necessary if the PMM is assumed to underreport caseload as observed in the first study utilizing the PMM by Rees et al in South Africa in 1994. They conducted a retrospective validation study after the original prospective study and concluded that 35% (range 17-51%) of cases had been missed using the prospective approach(87). Due to the challenges of health facility data quality in many low- and middle-income countries, and the under-reporting of abortion complications(180), we

acknowledge that health facility data on its own can sometimes underestimate the actual number of cases admitted and treated. However, in hospitals with widely divergent caseloads from the AICM and PMM, presenting averages will most likely bias the overall estimate of abortion incidence. We do not recommend that studies average HFS and PMM data. Rather a range of estimates for admissions for abortion-related complications should be reported and studies should attempt to explain the differences observed and discuss how this affects their final estimate of abortion incidence.

We were unable interview health workers in private health centres to provide caseload estimates for the HFS. Thus while our data is adjusted to account for all health centres, it is likely that the 53 public health centres were not representative of the 127 private health centres where women may have sought PAC. It is however more likely that women go to public health centres and hospitals to receive PAC than private health centres. Furthermore, most private health centres were in Lusaka many of which are associated with commercial companies or owned by private clinicians who are less likely to provide procedures like PAC, which would use up their staff time and resources than public health centres. Hence, our conservative estimate is probably more accurate than the sensitivity analysis where we have assumed the caseload in both public and private health centers are the same

One important determinant of the ATPR's accuracy, and the most challenging part of the methodology, is the denominator used - the number of confidants who would tell the respondent if they had an abortion. If the respondent restricts the denominator to only confidants, who they know have induced abortions, then there may be over-estimation and vice versa. Two previous studies in Burkina Faso(30,119) suggest that when the word abortion was explicitly used in the network-generating question, the size of the denominator reduced, as women tended to report those confidants who they know had an abortion. Hence, the authors recommended respondents be asked broadly about people who confide in them. Based on our pilot study, we limited our network-generating question to ask about reproductive health secrets. It is however possible that our denominator was overly restrictive, leading us to overestimate the abortion rate. Adapting the ATPR by asking respondents to report on abortions for a fixed number of pre-defined confidants such as has been done in the best friend approach(181) may limit

the bias associated with the respondent accurately listing all the possible confidants who would share secrets with her. It is however difficult to ascertain what reproductive health behaviour friends confide in each other and how they choose what they tell each friend. The ATPR network may be validated by introducing questions about known population parameters e.g. reproductive health questions such as use of contraceptives, HIV testing where data on the population prevalence is available for comparison as has been done in Malawi within the best friend approach(182). This method has also been successfully applied in the network scale-up approach which asks questions on known information about the population to respondents as an internal validation of the average network size in the population (133).

The average number of confidants in our study (2.4) compares with the average number of confidants when the ATPR methodology was applied in Burkina Faso in 2006 (2.7)(119). It is however greater than when the ATPR was applied in Burkina Faso in 2011 (1.9)(30). The ATPR is a useful method for estimating the incidence of abortion and can provide valuable information about the increased use of medical abortion from the perspective of women. However, there is need for rigorous qualitative research to understand the social meaning of confidences to precede its implementation in any context. It would also be useful to conduct studies comparing estimates using different network-generating questions within the same context.

Women (via the ATPR) and health professionals (via the HPS) provided different responses to the questions used to calculate the multiplier. The ATPR (2.4) multiplier suggests that a greater proportion of women sought health facility care for abortion-related complications than the AICM (4.4), unlike the aforementioned study in Burkina Faso. This may be as due to differences in the legal status of abortion in both countries. Abortion in Burkina Faso is legal only to save the life and protect the health of a pregnant woman, and in cases of rape, incest or severe foetal impairment(119). Hence, women are more likely to need help from their confidants with finding an abortion provider and may speak to their confidantes about abortions that eventually become complicated even when they do not eventually seek hospital care for those complications. Thus the ATPR's multiplier which was higher is hypothesized to be more accurate than the AICM's(30). Contrarily, in Zambia, which has a less restrictive legal context, it may be that

women were less likely to know about their confidant's successful and uncomplicated abortions, assuming access to termination of pregnancy was available and women did not require their networks to find these services, as they would in more restrictive contexts.

Another element that may account for the substantial difference is the increased use of medical abortion. Health professionals in the HPS may have less information on how women access it, and how this is affecting admission and complication patterns because it is used clandestinely. Additionally, respondents to the ATPR were unable to report on the circumstances surrounding 50% of the induced abortions and this missing data may increase or decrease our estimate of the multiplier. However, we are unable to ascertain the factors associated with missing information direction of any possible bias. Incorporating interviews with women in the community into the HPS may be valuable to understand patterns of care seeking for abortion-related complications and provide more information relevant to the multiplier. Furthermore, to improve objectivity of information from HPS interviews the method can be refined to use Delphi techniques(183,184).

These methods have other important methodological limitations which have been acknowledged(34,42). One is how the AICM estimates the proportion of women admitted for complications of miscarriages. It typically uses a biological estimate of the proportion of all births resulting in late miscarriages and what proportion of women HPS respondents thought would seek facility care for a late miscarriage. These assumptions were estimated from clinical trials conducted in 1980 in developed countries and may not reflect current trends or patterns in a developing country's context (34). A 2012 systematic review of four studies with women recruited in the USA reported that the remaining probability of miscarriage at 13 weeks was approximately 3%(185) which is similar to the AICM rate. On the other hand, a recent cohort study in Kenya reported that the remaining probability of miscarriage at 13 weeks was 5.7% (186). This suggests that the proportion of late miscarriages used for the AICM assumptions may be low for countries in Sub-Saharan Africa. If this is the case, then the number of induced abortions estimated from health facility data is inflated.

Secondly, the assumption that women are unlikely to seek care for first trimester miscarriages is not readily backed up by empirical research. Whilst women may not readily recognize very early miscarriages e.g. less than 7 weeks if they do not calculate their cycles or it appears as a late period, it is possible that pregnancies beyond that gestational age may be recognized and healthcare accessed if a miscarriage occurs. Their behaviour may also vary by context and sociodemographic characteristics. Furthermore, if HPS respondents overestimated the proportion of women seeking facility care for a late miscarriage, then our overall estimated rate of induced abortion would be lower and vice versa. Additionally, health professionals interviewed for the HPS in Latin America were observed to overestimate the proportion of all induced abortions leading to complications managed in hospital, which would underestimate the rate of induced abortion (42,187). However, although majority of the respondents to our HPS were health professionals the multiplier generated is higher than the ATPR's which was conducted with women.

Whilst the AICM has recently published method of generating confidence intervals for the estimates of women treated for post abortion care, confidence intervals have not been estimated for the multiplier and have not been calculated for estimates published using the ATPR. Without boundaries of uncertainty to examine, it is challenging to compare point estimates, which are generated from data of variable quality and assumptions that may introduce a high margin of error.

6.5.3 Strengths of the study

This study is the first to estimate the incidence of induced abortion in Zambia, and the second to compare the estimates from hospital and community-based methodologies in Sub-Saharan Africa (30). We improved the methods used to measure incidence by: (i) adapting the data collection tool for the AICM to reflect the increasing and important use of medical abortion; (ii) comparing caseload data collected using the PMM and AICM and; (iii) exploring the use of different network-generating questions within the community-based methodology. The ATPR was conducted within a population-representative survey and the hospital-based methodologies covered a substantial proportion of district to tertiary health facilities. Although information on the circumstances of abortions was

missing for many abortions reported, the willingness of women to report on their confidants' abortions, and the number of abortions reported suggests that this method could be applied successfully in this context.

6.5.4 Interpretation

Previous studies postulate that the important biases of both methods most likely underestimate the incidence of induced abortion (30,42). However, because our network-generating question may have been restrictive and data on the circumstances of abortion was missing for half of the respondents we suspect that the ATPR estimate for Zambia may be too high. Although we cannot say with certainty which of our estimates is closest to the truth, the confidence interval around the conservative AICM estimate (48 per 1000 women, 95% CI 27-68) suggests that the incidence of induced abortion is high in Central, Copperbelt and Lusaka provinces. This is consistent with data from previous hospital studies showing a substantial number of admissions for abortion-related complications(19,145). The high abortion rate in Zambia indicates the high unmet need for family planning (21%). Amongst the three provinces unmet need is highest in Central province (25.7), but lowest in Lusaka province (16.7), which has the lowest percentage in the country(136). Although the government has endorsed policies to increase access to safe abortion, and anecdotally the use of medical abortion is increasing, it is possible that majority of the induced abortions occurring are not conducted safely. Data from the ATPR suggest about half of women self-induced their abortions using unsafe methods such as traditional plants and herbs, or overdoses of over-the-counter medications as has been reported in other qualitative studies in Zambia (141,143).

6.6 Conclusion

The incidence of induced abortion appears to be comparatively high in Zambia. However, there is substantial uncertainty around abortion estimates generated. As long as abortion remains a sensitive issue, it is likely that estimates will be based on substantial assumptions applied to facility and survey data such as those we have fielded. It is essential that more research be conducted into describing the reporting biases and measurement errors associated with these methods and their likely impact on estimates,

quantifying these biases, and calculating robust confidence intervals for estimates generated.

Finally, from a programmatic perspective, our results suggest that the incidence of induced abortions is high in Zambia and a high number of women seek care for unsafe abortion-related complications. The 2009 Ministry of Health standards and guidelines clearly outline a national strategy to reduce maternal mortality and morbidity from unsafe abortions. It is important that changes be implemented within the health system and the community to facilitate family planning access and uptake, and access to comprehensive abortion services within the full remit of the law and in accordance with these guidelines. This is necessary to achieve the goals already set by Zambia's policy makers to end preventable maternal morbidity and mortality.