Methodological Advances in Survey-Based Abortion Incidence Estimation: Promising Findings from Nigeria, India, and Cote d'Ivoire

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Abstract

Monitoring abortion rates is highly relevant for demographic and public health considerations, yet its estimation is fraught with uncertainty due to lack of complete national health facility service statistics and reporting bias in survey data. In this study, we aim to estimate the one-year incidence of induced abortion in Nigeria, Rajasthan, India, and Cote d'Ivoire using a modified version of prior social network-based indirect abortion measurement methodologies. During survey interviews, respondents reported separately on their two closest confidantes' experience with pregnancy removal and menstrual period regulation (at a time when she was worried she was pregnant) in a population-based survey. Overall, confidante one-year incidence of pregnancy removal were higher than respondent incidences in all three countries and the inclusion of reported period regulation significantly increased the incidence estimates. Estimates decreased a non-statisticailly significant amount when adjusting for biases and exploring sensitivity analyses, with the exception of excluding confidante abortions that respondents reported with less certainty. Findings suggest the confidante approach, paired with asking about both pregnancy removal and period regulation, may present an opportunity to address some abortion related data deficiencies and underestimation challenges in low- and middle-income countries, particularly in contexts where abortion is legally and socially restricted.

Background

Regardless of legality, induced abortion is widespread throughout the world. The latest estimates suggest a global annual abortion incidence of 35 abortions per 1,000 women age 15 to 44, ranging from 17 in North America to 44 in Latin America (Sedgh et al., 2016). While monitoring abortion rates is highly relevant for demographic and public health considerations, its estimation is fraught with uncertainty due to lack of accurate or complete national service statistics and bias in self-reported survey data.

With regard to health facility service statistics, there are three primary challenges. In low-resource settings, providers often fail to accurately record and report postabortion care (PAC) and abortion services to national health registries. Although this data quality issue is not unique to abortion, it is exacerbated by the sensitive nature and legal status of pregnancy termination. Additionally, in all settings, self-induced abortion via misoprostol (with or without mifepristone) or other drugs, as well as abortions performed by providers outside the formal healthcare system, are not captured through service statistics if these women did not subsequently seek PAC in a health facility.

To address these limitations, researchers have long relied upon statistical techniques that adjust health facility service statistics or conducted community-based surveys of women in order to produce more accurate estimates of abortion in low- and middle-resource settings. The Guttmacher Institute developed the Abortion Incidence Complications Methodology (AICM) in the 1990s and has refined and adapted the method for different contexts (Singh, Remez, & Tartaglione, 2010). This methodology includes a health facility survey that generates a nationally representative estimate of the number of women receiving PAC, and if legal, abortion.

Investigators also survey key informants to produce a set of inflation factors, which they use with the facility service statistics to account for the abortions occurring outside of the formal health care system. With the increasing availability of medication abortion drugs, this standard AICM methodology is being challenged and researchers are making further modifications (Singh et al., 2018). Additionally, while this method allows for estimation of overall levels of abortion and abortion safety, assessing the distribution of abortion incidence and safety by women's characteristics is not possible.

Community-based surveys on abortion allow for collection of women's characteristics, however, there is significant concern regarding the validity of abortion reporting. Direct questioning in face-to-face surveys results in substantial underreporting of abortion (Clémentine Rossier, 2003). Even in settings where abortion is legal, direct questioning in face-to-face interviews results in underestimates, capturing only 47% of abortions in the United States to up to 73% in Estonia (Anderson, Katus, Puur, & Silver, 1994; Jones & Kost, 2007). Audio computer-assisted self inteview (ACASI) has the potential to increase reporting of sensitive behaviors like abortion by reducing the social desirability pressure of reporting to an interviewer in a face-to-face survey. Unfortunately, this interview methodology has not consistently outperformed direct questioning and improvements in data quality may be marginal (Lindberg & Scott, 2018; Phillips, Gomez, Boily, & Garnett, 2010; Scott, Bajos, Wellings, & Slaymaker, 2018); moreover, applying the method in low-literacy areas is challenging. In addition, there is differential underreporting of induced abortion according to women's sociodemographic characteristics, which prevents simple calibration of survey estimates to account for this downward bias (Jones & Kost, 2007; Udry, Gaughan, Schwingl, & Van Den Berg, 1996).

Researchers have developed several survey-based indirect approaches to the measurement of induced abortion but none have successfully addressed all of the obstacles to eliciting accurate reporting (Huntington, Mensch, & Miller, 1996; Clémentine Rossier, 2003; Singh et al., 2010). Asking about sensitive items indirectly can reduce the impact of social desirability. Specifically related to induced abortion, researchers have employed techniques such as the randomized response technique (RRT) and the list experiment to indirectly ask respondents about their own experience with abortion. These methods seek to elicit more truthful answers by asking respondents to report on sensitive behaviors without revealing their response directly to the interviewer. As such, individuals can know that their responses will be confidential, mitigating the social desirability pressures of direct questioning. Use of these methods enables researchers to produce estimates of lifetime prevalence of abortion overall and for subgroups that are typically more valid than direct reports (Coutts & Jann, 2011; Cowan, Wu, Makela, & England, 2016; Lara, Strickler, Olavarrieta, & Ellertson, 2004; Lensvelt-Mulders, Hox, Van der Heijden, & Maas, 2005; H. Moseson et al., 2015; Rosenfeld, Imai, & Shapiro, 2016). However, it is not possible to collect information on the details of the reported abortions and measuring abortion incidence rates remains challenging given the reduced precision associated with these indirect methods. Additionally, the performance of these methods in comparison to direct self-reports has been mixed (Bell & Bishai, 2019; Fuentes, 2017; Heidi Moseson et al., 2018; H. S. Moseson et al., 2017; Treleaven, Thuy, Pham, & Diamond-Smith, 2017).

Another category of indirect methodologies for measuring rare or sensitive behaviors relies on multiplicity sampling: asking respondents to report on the experiences of multiple people in their social network (Kalton & Anderson, 1986; Sirken, 1970). The “sisterhood method” (or more generally the sibling method) relies on this type of sampling to generate estimates of rare

outcomes like maternal mortality by using information the respondent provides about third parties (Boerma & Mati, 1989; Graham, Brass, & Snow, 1989; Koster-Oyekan, 1998). This method, and a similar approach commonly referred to as the network scale-up method (NSUM), has also been applied to measure sensitive or illicit behaviors such as injection drug use, men who have sex with men, sexual assault, and female sex work (Bernard et al., 2010; Feehan, Umubyeyi, Mahy, Hladik, & Salganik, 2016; Laumann, Gagnon, Michaels, Michael, & Coleman, 1989; Laumann, Gagnon, Michaels, Michael, & Schumm, 1993; Salganik et al., 2011).

The Anonymous Third-Party Reporting (ATPR) method is an adaptation of these social network-based approaches that investigators have used to measure abortion specifically (Elul, 2004; Clémentine Rossier, Guiella, Ouedraogo, & Thieba, 2006). Using the ATPR in Ouagadougou, Burkina Faso, investigators defined the relationship of interest as "a person who shared or could have shared intimate information with the respondent over the past year" (Clémentine Rossier et al., 2006). Interviewers asked respondents how many females of reproductive age met this definition. Slightly less than half (44%) of female respondents reported that at least one female confided in them in this manner. Interviewers then asked respondents about each confidante's experience with abortion in each of the five years prior to the survey. The resulting annual abortion incidence was 41 per 1,000 women aged 15 to 49 (Clémentine Rossier et al., 2006). Although no adjustments were made to account for significant differences observed between confidante and respondent characteristics, there was strong congruence between the confidante estimates and the contemporaneously collected facility-based data (Clémentine Rossier et al., 2006). Despite the promising performance of the ATPR method in Burkina Faso, implementation in Rajasthan, India did not result in more valid estimates (Elul, 2004). As such, results indicate the utility of this method may be context dependent, performing better in settings where it is

normative that people share details about the sensitive item with their network of close friends or relatives, perhaps as a means to facilitate accessing care and/or solicit support where abortion is illegal (Elul, 2004; Clémentine Rossier et al., 2006).

The best friend method, a version of the ATPR that only asks about one best friend's experience with the sensitive item, may more consistently outperform direct questioning by producing higher (and presumably more valid) estimates (Grossman et al., 2015; Yeatman & Trinitapoli, 2011). In a Malawi study where researchers prompted respondents to "think about your best female friend in [area]," findings indicated that only 0.4% of respondents reported ever having had an abortion while 8% reported that they were certain their best friend had had an abortion and an additional 0.5% suspected as much (Yeatman & Trinitapoli, 2011). In Texas in the United States, results were mixed. Although 12% (95% CI 9-15%) of respondents reported their own prior abortion compared to 8% (95% CI 6-10%) for best friends, self-reported self-induction of abortion was lower (2%; 95% CI 1-3%) than for best friends (4%; 95% CI 2-7%) (Grossman et al., 2015).

Following from these social network-based abortion measurement studies, researchers at the Guttmacher Institute have suggested collecting information on a small, fixed number of respondents' closest confidantes (three) and their experiences with abortion (Sedgh & Keogh, forthcoming). This adaptation, referred to as the confidante methodology, incorporates the relationship description from the ATPR, which emphasizes sharing of sensitive information, and the fixed number of friends from the best friend methodology. The multiplicity sampling includes up to three of the respondent's closest confidantes, which increases the sample of confidantes.

These methods have a number of similarities and differences. Structurally, they all start with a network generating question that defines the relationship of interest, then ask the respondent to provide additional information about these third parties. However, the relationship description in the network generating question, the number of individuals about which the interviewer is asking, and the analytic approach varies across methodologies. At the center of these social network-based methodologies are multiple sociological assumptions. In particular, when researchers apply these methods to the measurement of sensitive behaviors, the assumptions include: 1) that respondents know about the sensitive behaviors of friends or relatives in their network; 2) that respondents are able to provide accurate answers to survey questions about their social networks; and 3) that social desirability pressure is reduced when reporting on the stigmatized behaviors of one's friends or relatives as opposed to oneself (Feehan & Salganik, 2016; Fisher, 1993; Shelley, Bernard, Killworth, Johnsen, & McCarty, 1995). Violations of assumption one result in transmission error while violations of assumption two results in recall error (Feehan & Salganik, 2016). Additionally, for most of these methodologies, there is an assumption of homophily amongst one's close social network, indicating that people choose friends who are similar with regard to socioeconomic and other characteristics (McPherson, Smith-Lovin, & Cook, 2001). This is a necessary assumption given the overarching objective of these methodologies is to create a surrogate sample that is representative of the population of interest. This is in contrast to an assumption of the NSUM that requires social ties be formed at random, violations of which result in barrier bias (Feehan & Salganik, 2016).

Contrary to many other survey-based indirect methodologies, social network-based methods allow researchers to collect sociodemographic characteristics and abortion experience details of respondents' confidante(s). This information could include the year of and pathways to

termination, as well as details on whether the woman experienced complications and sought postabortion treatment in a health facility. One of our primary interests in calculating abortion incidences was to estimate abortion safety and identify inequities in utilization of safe abortion care. Thus, we chose a social network-based methodology, following Guttmacher's proposed hybrid ATPR-best friend methodology, by including questions about up to two of the respondents' closest confidantes (instead of three). In using this approach, we sought to mitigate the potential for underestimation that may occur when collecting information on abortion for all the respondents' confidantes as in the ATPR. The choice of two confidantes (rather than one), increased the potential number of reported events to more precisely characterize pathways to abortion care, while keeping the number of questions limited (two confidantes rather than three) to enable replication of our module for monitoring purposes.

Regardless of methodology, the phrasing of abortion questions in a manner that maximizes comprehension and captures the breadth of abortion experiences is a non-trivial matter. Complicating measurement is the range of different terminologies and phrases women use to refer to abortion and the different meanings of the word "abortion". For instance in Tanzania, women may use traditional medicines to "move a pregnancy to the back", thus suspending it indefinitely until a time when she wishes to continue the pregnancy (Plummer et al., 2008). There is also evidence to suggest that some women may conceive of medical abortion as a miscarriage even though they took medicine to stop the pregnancy (Kanstrup, Mäkelä, & Hauskov Graungaard, 2017; Simonds, Ellertson, Springer, & Winikoff, 1998). And in some contexts, women take pills or have a procedure to "bring back their period" (or "wash") without confirming whether they are pregnant, referred to as "menstrual regulation" rather than "abortion" (Rahman, DaVanzo, & Razzaque, 2014). The lack of pregnancy confirmation makes it unclear to the

researcher how to categorize this event, although it is generally believed that women correctly presume they are pregnant (Rahman et al., 2014).

In this study, we draw on the prior successes of social network-based indirect methodologies and the Guttmacher Institute's proposed adaptations to test the confidante methodology (Clémentine Rossier et al., 2006; Sedgh & Keogh, forthcoming; Yeatman & Trinitapoli, 2011). We rely on data regarding the respondents' two closest confidantes to estimate one-year incidence of induced abortion in Nigeria, Rajasthan, India, and Cote d'Ivoire. We also assess the utility of using two complementary terminologies – "pregnancy removal" and "period regulation when worried you were pregnant" – to identify abortion experiences. The overall objective is to determine a parsimonious way to collect abortion data using a social network-based approach that produces the most valid abortion incidences for monitoring unsafe abortion and unintended pregnancy.

Methods

Data

Data for this study come from population-based surveys of reproductive age women (15 to 49 years old) conducted by Performance Monitoring and Accountability 2020 (PMA2020) in Nigeria, Rajasthan, India, and Cote d'Ivoire. The PMA2020 female survey gathers data on a range of reproductive health indicators through annual data collection cycles in 11 countries in sub-Saharan Africa and Asia (Zimmerman 2017). We employed a multi-stage cluster sampling design using probability proportional to size sampling to produce nationally representative household and female samples in Nigeria and Cote d'Ivoire, and a state representative sample in Rajasthan. The sampling methodology is described in greater detail elsewhere (Performance

Monitoring and Accountability 2020 (PMA2020), 2019; Zimmerman, Olson, Tsui, & Radloff, 2017).

Trained female resident interviewers conducted face-to-face interviews with all consenting women aged 15 to 49 residing in sampled households. In the most recent survey rounds in each location (Round 5 in Nigeria, Round 4 in Rajasthan, and Round 2 in Cote d'Ivoire), researchers added a final questionnaire section on abortion to the core female questionnaire. Data collection occurred in Nigeria from April through May 2018, in Rajasthan from April through June 2018, and in Cote d'Ivoire from July through August 2018. Local ethics committees in each location and at the Johns Hopkins Bloomberg School of Public Health provided ethical approval for this study.

Measurement

The newly added module collected abortion data using two data collection techniques to generate new and updated estimates of abortion incidence at the national and/or state levels. Prior to any mention of abortion, interviewers obtained information on up to two of the respondent's closest confidantes. We defined confidantes as female friends or relatives age 15 to 49 living in the country "whom you share very personal information with and who also share their very personal information with you." This definition is similar to that used by researchers in prior applications of the ATPR (Clémentine Rossier et al., 2006). We did not define "personal information" beyond the aforementioned question language so there was some subjectivity in how respondents interpreted the relationship. However, we made clear during the training that resident interviewers were not to provide "abortion" as an example of such personal information if the respondent asked. We discussed this relationship definition with resident interviewers during a

focus group at the outset of the pilot training and they agreed that this description, including "personal information" as they translated it into local languages, was clear and would capture the type of close friendships we sought to identify. We also added a face validity question after this question in the pilot survey, asking respondents to articulate their understanding of the relationship we described. Based on resident interviewers' interpretation of respondents' answers, 91%, 96%, and 85% of pilot survey respondents in Nigeria, Rajasthan, and Cote d'Ivoire, respectively, interpreted the relationship as we intended without further explanation.

We collected basic confidante characteristics prior to introducing the abortion module to minimize respondents preferentially selecting confidantes who had previously undergone abortions, which could bias the confidante abortion incidence upwards. Interviewers first asked respondents for the number of female friends or relatives between the ages of 15 and 49 living in the country whom they considered "confidantes" using the aforementioned definition. If the respondent reported more than one confidante, the interviewer asked her to picture her *closest* female friend or relative first. For confidante two, the interviewer asked the respondent to picture her *next closest* female friend or relative. For each confidante, we had the respondent provide a fake name in order to easily refer to the woman in later questions and collected information on the confidante's age and level of education.

Next, for each of the two confidantes, interviewers asked separate questions on their experiences with pregnancy removal followed by questions about period regulation at a time when they were worried they were pregnant. We decided on this approach based on existing literature and early experiences while piloting the questionnaire in Nigeria. Results from face validity questions about respondents' interpretation of the phrases "pregnancy removal" and "period regulation at a

time when you were worried you were pregnant" indicated generally very high levels of correct interpretation: 89%, 100%, and 100% of pilot survey respondents in Nigeria, Rajasthan, and Cote d'Ivoire, respectively, interpreted "pregnancy removal" correctly while 97% and 100% of pilot survey respondents in Rajasthan and Cote d'Ivoire, respectively, interpreted the "period regulation" phrase correctly. We did not ask the period regulation and associated face validity question in this way during the pilot in Nigeria so we do not have a comparable estimate for this context.

For each reported pregnancy removal and period regulation, we obtained information on the year it last occurred. Details on the last pregnancy removal were further collected, including the first and last or only method(s) used, provider(s) or source of these method(s), and whether the confidante visited a health facility for treatment of (perceived) complications in the process of terminating the pregnancy. The same information was collected for the last period regulation if they reported no pregnancy removal or if the last period regulation was the most recent experience; we always collected details on the last reported pregnancy removal. Subsequently, we asked similar questions on the respondent's own experiences with pregnancy removal and period regulation when worried she was pregnant.

Analyses

We first investigated respondent's socioeconomic characteristics overall and by number of reported confidantes (zero, one or more, and two or more) to determine whether and by which characteristics these subgroups differed. We then examined the selected socioeconomic characteristics for the confidantes in comparison to respondent characteristics. Next, we calculated one-year incidences of abortion based on pregnancy removal data alone, and one-year

incidence of "likely abortion" combining pregnancy removal and period regulation data. We computed these figures for each sample separately – respondents, confidante ones, and confidante twos – by first calculating the number of reported abortions in 2017 and in 2018 up to the date of the interview divided by the number of women in each sample (respondents, confidante ones, and confidante twos). We only collected year of reported abortion because PMA2020 survey analytics and interviewer feedback indicate that collecting month data is time consuming, requiring significant probing, and is prone to uncertainty. To convert the proportion into a one-year incidence rate, we divided the estimate by the total number of years covered from January 1, 2017 through the date of the interview. We then multiplied the value by 1,000 to generate the one-year estimate of pregnancy removal or "likely abortion" (pregnancy removal and period regulation combined) per 1,000 women age 15 to 49. We scaled the standard errors in the same manner. We weighted the incidence estimates and adjusted variances for all respondent and confidante estimates to account for the complex survey sampling design.

For respondents who reported "don't know" with regard to whether a confidante had ever had a pregnancy removal (or period regulation), we conservatively assumed that her confidante had not had one in the year prior to the survey for the purpose of incidence estimation. If a respondent reported a confidante had a prior pregnancy removal or period regulation but was not completely certain, we included these cases in the incidence estimation. Separately, we also calculated respondent's likely abortion incidences (pregnancy removal and period regulation combined) by whether the respondent reported zero confidantes, one or more confidantes, or two or more confidantes to evaluate potential selection bias in the confidante sample estimates. We also explored likely abortion incidences for confidantes one and two by whether or not respondents shared their own abortion experience with each of their confidantes.

Adjusting for Biases

Althogh the study attempts to collect information on two confidants, some repondents reported no confidante or one confidante only. For respondents with zero confidantes, or for those with only one in the context of the confidante two estimates, their corresponding confidante one and two abortion data are essentially "missing". There was a concern that this may introduce bias. Additionally, due to concerns of transmission bias, we sought to account for incomplete sharing of respondent likely abortions. To address these biases, we ran separate Poisson models for each confidante sample using the respondent socioeconomic variables and whether the respondent had and shared their own abortion experience with that confidante as the predictors, and the indicator variable for whether the confidante had an abortion in the year prior as the outcome. We then predicted the outcome variable, confidante probability of having a likely abortion in the prior year, for all observations. This included predicting confidante probability of having an abortion in the year prior for respondents with no confidantes; these are the "missing" observations in the surrogate confidante samples. We used this information to create a new variable that combined respondent reported confidante abortion data for those with confidantes, and the predicted probability of abortion in the prior year for the confidantes who were not in the sample because they had no close friends who we could have captured in the respondent sample. Using the same calculation described above, we estimated the one-year incidence of induced abortion. This modeling approach is similar to mortality rate estimation work using survey data (Gakidou & King, 2006).

Finally, we conducted a number of sensitivity analyses. We first examined how confidante incidence estimates would change if we excluded confidante pregnancy removals and period

regulations that respondents reported to have occurred with some uncertainty as opposed to those where the respondent was certain. To account for respondent uncertainty in another way, we only excluded less certain pregnancy removals and period regulations if the respondent did not report the method the confidante used. We also investigated the extent to which incidence estimates changed after excluding incidence data for which the method used was only emergency contraception with no reported complications for which care was subsequently sought at a health facility. Lastly, we explored the impact of our assumption that confidantes did not have a pregnancy removal or period regulation in the year prior to the survey if the respondent replied "don't know" to these questions. The percentage "don't know" for the pregnancy removal and period regulation questions ranged from 7 to 10% in Nigeria, 1 to 3% in Rajasthan, and 1 to 4% in Cote d'Ivoire, and some socioeconomic characteristics of respondents were significantly different by whether or not they answered "don't know" to these confidante questions (particularly in Nigeria). By predicting the probability of a recent abortion using the Poisson models for these "don't know" responses, we determined the extent to which our results may be sensitive to this assumption.

Results

Sociodemographic characteristics of respondents and confidantes

Interviewers completed surveys with 11,106 women in Nigeria, 5,832 women in Rajasthan, and 2,718 women in Cote d'Ivoire (Tables 1a-1c). Response rates were approximately 98% in all three countries (data not shown). Respondents reported on average 0.8 close confidantes in Nigeria, and provided demographic and abortion experience details for a total of 7,836 confidantes; the corresponding numbers were 1.1 and 6,030 in Rajasthan and 0.8 and 2,010 in Cote d'Ivoire. Forty-three percent of Nigeria respondents reported having zero close confidantes

while 15% and 35% of respondents reported having no close confidantes in Rajasthan and Cote d'Ivoire. Respondents in each country who reported having zero confidantes tended to be older, less educated, and currently married or cohabiting compared to those with one or more confidantes (Tables 1a-1c). There were additional differences in respondent characteristics among those with different numbers of reported confidantes by wealth in some countries and by country specific variables like religion, caste, ethnicity, and state (Tables 1a-1c). Compared to the respondents, confidante one was on average more educated, and confidante two was even more so (Table 2). In Rajasthan specifically, confidante one and two were younger than respondents (Table 2).

Respondent and confidante pregnancy removal and likely abortion incidence estimates

Comparing the unadjusted estimates, respondent one-year incidence rate of pregnancy removal was 52% lower than confidante one incidence in Nigeria, 55% lower in Rajasthan, and 42% lower in Cote d'Ivoire; these differences were all statistically significant (Figure 1). Confidante two pregnancy removal incidence rates were even higher in comparison to respondent incidences, with the exception of Nigeria, where the confidante two incidence rate was higher than the respondent but lower than confidante one (Figure 1). Including period regulation increased the incidence estimates for respondents by 111% in Nigeria, 35% in Rajasthan, and 97% in Cote d'Ivoire. The corresponding inreases for confidante one incidence rates were 62% in Nigeria, 52% in Rajasthan, and 59% in Cote d'Ivoire. Confidante one likely abortion incidence rates in Nigeria and Rajasthan were statistically significantly higher than those of the respondents. Confidante two rates similarly increased in each country when including period regulation, but the percentage increase was smaller, ranging from 24% to 59% (Figure 1).

Investigating respondent one-year incidence rate of "likely abortion" (pregnancy removal and period regulation combined) by number of reported confidantes reveals marked differences in rates in Nigeria, ranging from 30.3 among respondents who had 0 close confidantes to 51.4 among respondents who had at least one confidante; this difference was statistically significant (Table 3). We see similar results in Cote d'Ivoire, with one-year incidence rate estimates ranging from 27.9 among respondents who had 0 close confidantes to 50.0 among respondents who had at least two confidantes (Table 3). Conversely, estimates in Rajasthan remained consistent regardless of number of confidantes (Table 3). Differences in respondent likely abortion rates by number of reported confidantes in Cote d'Ivoire and Rajasthan were not statistically significantly different.

Exploring the role of disclosure, one-year confidante likely abortion incidence rates were significantly different if respondents had disclosed their own abortion to that friend compared to those who had not disclosed or had not reported a prior likely abortion (Table 4). Patterns across confidantes one and two varied but the confidante likely abortion incidences were generally highest if their respondent reported sharing their own likely abortion with that confidante, significantly lower if the respondent did not share her likely abortion with that confidante, and even lower if the respondent did not report a likely abortion (Table 4). Cote d'Ivoire was an exception with regard to differences in confidante two rates between the respondents who did and did not share their own likely abortion, but the confidante two likely abortion rates were still lowest among those whose respondents did not self-report a likely abortion (Table 4).

Confidante incidence estimates adjusting for biases

Using the predicted confidante incidence rates of likely abortion from the Poisson regression models, we found that both confidante estimates declined compared to the unadjusted estimates, with the exception of Rajasthan and Cote d'Ivoire confidante two. Poisson predicted incidence estimates were 2% to 10% lower for confidante one, 14% lower for Nigeria confidante two, and 9% and less than 1% higher for confidante two in Rajasthan and Cote d'Ivoire, respectively, however these differences were not statistically significant (Table 5). The Poisson models had high goodness-of-fit, with the chi-squared p-values greater than 0.96 for all models except Rajasthan confidante two, although it was still insignificant (p=0.06).

Sensitivity analyses

When excluding the confidante pregnancy removals and period regulations that respondents reported with less certainty, adjusted estimates declined by 35% for confidante one and 13% for confidante two in Nigeria, by 41% for confidante one and 51% for confidante two in Rajasthan, and by 44% for confidante one and 26% for confidante two in Cote d'Ivoire (Figure 2). However, when excluding only the less certain confidante abortions for which respondents were unable to describe the method used resulted in estimates that were only 5% and 3% lower in Nigeria, 1% and 0% lower in Rajasthan, and 3% and 2% lower in Cote d'Ivoire for confidantes one and two, respectively (Figure 2). Examining the impact of excluding pregnancy removal and period regulations that only involved use of emergency contraception with no subsequent postabortion care, the likely abortion incidences decreased by 3 to 6% in Nigeria across the respondent, confidante one, and confidante two estimates, 0 to 4% in Rajasthan, and 7 to 13% in Cote d'Ivoire (Figure 3). Additionally, in using the Poisson model to predict the probability of abortion for the confidantes where respondents answered "don't know" to the questions on pregnancy removal or period regulation, likely abortion incidences for confidantes one and two decreased by

approximately 8 to 14% in Nigeria, and increased by 2 to 3% in Rajasthan, and 1 to 2% in Cote d'Ivoire (results not shown). Incorporating results from these sensitivity analyses, we produced final pregnancy removal and likely abortion incidence estimates that exclude less certain confidante terminations for which the method was unknown, and any terminations for respondents or confidnates for which emergency contraception was the only method used and no postabortion care was sought. We present these final estimates in Figure 4. Compared to the original Poisson estimates for confidantes, these final adjustments reduced the confidante pregnancy removal and likely abortion incidences by 6 to 9% in Nigeria, 0 to 1% in Rajasthan, and 7 to 18% in Cote d'Ivoire.

Discussion

Results from this study provide important insights into the performance of the confidante methodology in Nigeria, Rajasthan, and Cote d'Ivoire (Sedgh & Keogh, forthcoming). Findings suggest that this hybrid version of the ATPR and best friend approaches performed well in these contexts, providing valuable data on the frequency of abortion. Incidence rates for confidantes were typically significantly higher than those of respondents, suggesting this indirect methodology is effective in reducing social desirability bias associated with direct measures. However, this methodology does not eliminate concerns of bias. Even after applying our adjustments to account for potential biases, large differences remained between respondent and confidante one or two abortion incidence estimates in Nigeria and Cote d'Ivoire.

Comparing our results to available one-year abortion incidence estimates in these countries provides an external means of assessing the method's performance. In Nigeria, researchers previously used health facility postabortion care data to conduct an AICM study (Bankole et al.,

2015). Results indicated the 2012 national annual incidence of abortion was 33 per 1,000 women age 15 to 49 (Bankole et al., 2015). Our Poisson estimate of likely abortion incidence for confidante one was higher at 58. We also reported much higher annual incidence rates in Rajasthan than the 2 abortions per 1,000 women of reproductive age based on official government statistics from 2012. This is expected as government statistics do not include self-sourced abortions and those conducted outside of facilities registered with the government to provide abortion (Ministry of Health and Family Welfare, 2013). While no other studies report on Rajasthan specific abortion rates, a recent national study in India, which relied on several sources of data to account for abortions occurring outside the formal healthcare sector, estimated the annual abortion incidence to be 47 abortions per 1,000 women of reproductive age (Singh et al., 2018). This estimate is higher than our estimated incidence of 24 for confidante one, which may be partially explained by Rajasthan's higher contraceptive prevalence rate (and higher use of sterilization, specifically) compared to national estimates (International Institute for Population Sciences (IIPS) & ICF, 2017). Additionally, mifepristone drug distribution data suggest much lower levels of use in Rajasthan compared to other states (IMS Health, 2015). There are unfortunately no national estimates of one-year induced abortion incidence for comparison in Cote d'Ivoire. However, given the low contraceptive use, high total fertility rate, and legally restrictive context, we might expect a high rate, similar to that of Nigeria, where conditions are similar. Our Poisson confidante one rates for these countries are both high at 49 and 58 likely abortions per 1,000 women of reproductive age in Cote d'Ivoire and Nigeria, respectively.

Beyond the incidence estimates, findings suggest that women may view their abortion experience in one of two ways – either as a distinct termination where a pregnancy was removed, or as a way to bring back their period at a time when they suspected they were pregnant. The latter approach

to phrasing questions on abortion may enable researchers to better capture very early terminations, when women may take pills to terminate. However, this approach may also introduce measurement error by capturing instances of emergency contraception use. We explored this hypothesis in a sensitivity analysis by removing period regulations (and pregnancy removals) using emergency contraception alone and found that the estimates of likely abortion incidence did not substantially change. This approach may also be more likely to capture suspected but not actual pregnancies following exposure to unprotected sex, or pregnancies that would have resolved on their own. Further research is needed to understand this phenomenon.

The period regulation results also suggest a potential interest among women for methods analogous to menstrual regulation in some Asian countries (Rahman et al., 2014). Even if the women experiencing period regulations at a time when they were worried they were pregnant were not in fact pregnant, we have identified a nontrivial group of women who had reason to believe they were pregnant and took action to end the suspected pregnancy. Like women who have abortions to terminate a confirmed pregnancy, these women are likely in need of contraceptives to avoid subsequent actual or perceived unintended pregnancies. Alternatively, these findings might suggest a preference among some women to control their fertility post-coitally instead of prophylactically. It may require a different approach to meet these women's reproductive health needs.

This study has a number of strengths. Samples are large and diverse and contexts vary with regard to abortion legality. Investigators collected data contemporaneously and employed the same piloting, training, and data collection methodologies, providing a robust assessment of the performance of this methodology. Asking general abortion questions and about the confidantes'

experiences with abortion prior to asking the respondents about their own experience may have improved self-reported data. This is also the first time that a population-based survey has been used to quantitatively assess the extent of period regulation for the purpose of fertility control. Additionally, the analytic approach adjusts for potential biases in the confidante abortion incidence estimates.

This study also has a number of limitations. We cannot rule out the possibility of transmission bias as a result of confidantes not sharing their abortion experience with respondents, leading to underestimation of confidante abortions. We have tried to address this in the Poisson prediction approach but adjustment for respondent sharing behaviors in this model may not fully account for potential underreporting and biases associated with unmeasured characteristics. We also did not ask when the respondent last communicated with the confidante and made the assumption that confidantes would have shared a recent abortion with the respondents. To the extent that this is not true, it would also contribute to transmission bias. However, this bias, along with recall bias, may be offset by the fact that we included confidante abortions that the respondent reported with less certainty. Also, while we tested and adjusted for departures from the assumption of homophily using age and educational information from respondent and confidante samples in sensitivity analyses (which did not significantly change the incidence estimates), there could have been additional unobserved differences in characteristics contributing to biased surrogate samples of confidantes.

Additionally, defining confidantes as only those with whom the respondent reciprocally shared personal information may have also biased the estimates upwards. The fact that a significant proportion of women reported no such relation in Nigeria and Cote d'Ivoire suggests the narrow

definition may have been problematic and introduced bias; researchers had similar concerns with regard to the ATPR's implementation in Burkina Faso (Clémentine Rossier et al., 2006). Specifically concerning the period regulation data, there is a possibility that some women reported period regulations done for reasons other than suspected pregnancy; this may be especially true for respondent reported confidante data and would similarly bias the estimates upward. There is also a possibility of more than one respondent reporting the same woman as their closest or second closest confidante. Given we were selecting 35 to 40 households from each EA of 200 or more households and that confidantes do not have to reside in respondent's community, we think the likelihood of double counting confidantes is unlikely. However, double counting would not bias our results since any double counting would apply to both the numerator and the denominator (Singh et al., 2010). Lastly, although we sought to ensure the question wording made clear we were interested in pregnancy removals that the woman intentionally induced, some women may have mistakenly reported spontaneous abortions.

Future studies can address some of this study's limitations and work to improve upon other aspects of the method. Specifically, additional research is needed to determine the optimal relationship definition for producing the most valid estimates of abortion. This may involve respondents reporting their closest friends without the explicit criteria regarding reciprocal sharing of personal information, or it may require asking about another type of relationship altogether; women share their abortions with different people and it is not always their closest female friend (Clementine Rossier, Feehan, Olowabi, Marchin, & Kim, 2018). With regard to transmission bias, our means of assessing the visibility of abortions in these communities was to ascertain whether respondents who reported their own abortion "told" specific individuals, including each of her confidantes. However, in asking about the confidantes' abortions, we did

not ask only for those about which the confidante had "told" the respondent. Future work may better capture the visibility of abortions between friends by simply asking respondents if it is likely that a confidante *knows* about her abortion.

More broadly, research is still needed to determine in which contexts social network-based methods, like the confidante methodology, perform best. As previously mentioned, the ATPR performed well in Burkina Faso and poorly in India, and the best friend method's performance in Malawi was good but equivocal in the United States. In our study, the confidante methodology produced the seemingly most valid estimates of likely abortion in Nigeria and Cote d'Ivoire compared to estimates in Rajasthan. The ability of these social network-based methods to produce valid estimates appears to be associated with the legal context of abortion but may also depend on women's ability to access care independently. To the extent that women can self-source medication abortion drugs (India) or facility-based care (United States) with relative ease, women may be less likely to interact with women in their social network to facilitate accessing care or to receive emotional support (Clémentine Rossier et al., 2006).

A recent review of the literature on how women access abortion care and to whom they disclose in the process identified two dimensions that are associated with the extent of disclosure (Clementine Rossier et al., 2018). The dimensions were stigma and ability to access abortion services anonymously, which intersect to form four possible contexts. Based on this paradigm, social network-based measurement methodologies would work best for women in settings with moderate stigma (as opposed to hyper stigma) and where it is difficult or impossible to access care without reliance on contacts. Future work should refine this framework and identify countries that best meet these criteria.

Many countries currently have limited knowledge about the extent of induced abortion locally, the demography of women who terminate a pregnancy, and risk-factors for abortion-related morbidity and mortality. Current results suggest that the confidante approach, paired with asking about both pregnancy removal and period regulation, may present an opportunity to address some abortion related data deficiencies. Depending on the research objectives, collecting data on respondents' single closest confidante may be sufficient and may result in less biased data than that of a second or higher order confidante. Future studies using this approach could benefit from collecting additional information on the confidante(s), which could help to generate weights and models that better account for confidante selection bias. Additionally, subsequent work can explore alternative weighting approaches to account for the observed sources of bias to produce a singular estimate of abortion for a given context.

Table 1a. Characteristics of female respondents age 15 to 49 overall and by number of female confidantes in Nigeria*

	All respondents	0 Confidantes	≥ 1 Confidante	≥ 2 Confidantes
N	11,106	4,788	5,883	1,953
Age				
15-19	18.9	17.5	**19.8**	18.8
20-24	16.2	14.9	**17.5**	16.5
25-29	18.8	17.2	**20.1**	19.0
30-34	15.0	15.0	**15.0**	15.5
35-39	13.9	15.5	**12.7**	14.0
40-44	10.5	11.7	**9.2**	10.0
45-49	6.8	8.2	**5.7**	6.2
Education				
Never	17.5	19.0	**14.8**	**15.9**
Primary	15.2	16.5	**14.2**	**12.1**
Secondary	46.9	46.9	**48.1**	**44.6**
Higher	20.3	17.6	**22.8**	**27.3**
Marital status				
Currently married/cohabiting	63.7	66.4	**61.1**	**62.6**
Divorced or separated/widowed	4.8	5.5	**4.3**	**4.1**
Never married	31.5	28.1	**34.6**	**33.3**
Religion of household				
Catholic	14.7	13.1	**15.8**	**17.6**
Other Christiam	44.0	44.1	**45.4**	**44.7**
Muslim	39.2	41.2	**36.4**	**35.6**
Other	2.1	1.7	**2.4**	**2.0**
Ethnicity				
Hausa	21.0	22.8	**19.0**	**19.6**
Igbo	22.5	21.0	**23.6**	**24.6**
Other	56.5	56.2	**57.4**	**55.9**
Wealth				
Poorest	23.2	23.1	**22.2**	**20.2**
Second poorest	20.2	20.3	**20.2**	**20.3**
Middle	17.6	19.5	**16.4**	**15.4**
Second wealthiest	18.6	18.1	**19.4**	**19.3**
Wealthiest	20.5	19.1	**21.8**	**24.8**
Residence				
Rural	42.9	39.3	**44.7**	**46.0**
Urban	57.1	60.7	**55.3**	**54.0**
State				
Anambra	12.8	10.3	**14.4**	**15.4**
Kaduna	9.5	10.0	**8.9**	**7.9**
Kano	13.1	14.5	**11.2**	**12.5**
Lagos	21.4	22.4	**21.4**	**22.2**

Nasarawa	13.4	12.5	**14.3**	**12.8**
Rivers	17.0	17.8	**17.1**	**18.3**
Taraba	12.7	12.4	**12.6**	**10.9**
Total	100.0	100.0	100.0	100.0

*Estimates weighted; bold indicates p-value for design-based F test (reference group 0 confidantes) less than 0.05

Table 1b. Characteristics of female respondents age 15 to 49 overall and by number of female confidantes in Rajasthan, India*

	All respondents	0 Confidantes	≥ 1 Confidante	≥ 2 Confidantes
N	5,832	854	4,912	1,118
Age				
15-19	18.5	16.6	**18.9**	**20.9**
20-24	19.6	15.7	**20.5**	**23.6**
25-29	16.7	14.0	**17.2**	**17.3**
30-34	13.6	13.7	**13.6**	**14.1**
35-39	12.8	13.9	**12.5**	**11.3**
40-44	10.9	14.2	**10.2**	**8.2**
45-49	7.8	11.9	**7.0**	**4.7**
Education				
Never	36.8	47.9	**34.5**	**31.0**
Primary	24.0	22.9	**24.3**	**26.5**
Secondary	16.5	16.0	**16.6**	**14.5**
Higher	22.7	13.3	**24.6**	**28.0**
Marital status				
Currently married/cohabiting	76.4	80.5	**75.5**	**72.6**
Divorced or separated/widowed	2.6	3.4	**2.4**	**2.2**
Never married	21.0	16.1	**22.1**	**25.2**
Religion of household				
Hindu	85.9	79.9	**87.1**	80.6
Muslim	12.7	18.9	**11.5**	18.4
Other	1.4	1.3	**1.4**	1.0
Caste of household				
Scheduled caste	22.7	26.4	**21.8**	**29.1**
Scheduled tribe	11.7	8.6	**12.3**	**11.5**
Other backward caste	46.7	45.0	**47.1**	**44.7**
General	18.9	20.0	**18.7**	**14.8**
Wealth				
Poorest	16.0	24.2	**14.3**	**11.4**
Second poorest	17.8	16.1	**18.2**	**17.1**
Middle	20.1	15.3	**21.0**	**24.5**
Second wealthiest	22.8	25.1	**22.5**	**25.1**
Wealthiest	23.3	19.3	**24.0**	**21.9**
Residence				
Rural	65.4	62.9	65.8	**72.6**
Urban	34.6	37.1	34.2	**27.4**
Total	100.0	100.0	100.0	100.0

*Estimates weighted; bold indicates p-value for design-based F test (reference group 0 confidantes) less than 0.05

Table 1c. Characteristics of female respondents age 15 to 49 overall and by number of female confidantes in Cote d'Ivoire*

	All respondents	0 Confidantes	≥ 1 Confidante	≥ 2 Confidantes
N	2,738	959	1,761	263
Age				
15-19	20.1	18.0	**21.1**	**21.5**
20-24	18.1	16.6	**19.0**	**23.5**
25-29	17.9	17.8	**17.8**	**14.9**
30-34	16.3	16.9	**16.0**	**14.2**
35-39	12.8	12.0	**13.3**	**19.3**
40-44	9.4	11.0	**8.5**	**4.5**
45-49	5.5	7.8	**4.3**	**2.1**
Education				
Never	45.2	50.3	**42.2**	40.1
Primary	25.9	26.2	**25.7**	28.0
Secondary	23.0	18.9	**25.2**	25.3
Higher	6.0	4.6	**6.8**	6.6
Marital status				
Currently married/cohabiting	64.8	68.8	**62.6**	**58.6**
Divorced or separated/widowed	4.4	4.4	**4.4**	**3.4**
Never married	30.8	26.8	**33.0**	**38.0**
Religion of household				
Muslim	39.5	38.8	39.8	35.5
Catholic	20.3	17.7	21.8	21.0
Evangelical	15.4	14.0	16.2	19.3
Other	13.7	14.8	13.1	15.8
No religion	11.1	14.7	9.0	8.4
Ethnicity				
Akan	34.6	36.8	33.5	36.2
Mande (nord and sud)	20.8	23.8	19.1	20.0
Gur	14.4	9.1	17.2	17.0
Other Ivoirian	9.3	8.7	9.7	10.9
Other non-Ivoirian	21.0	21.6	20.6	16.0
Wealth				
Poorest	20.1	22.4	18.7	19.9
Second poorest	20.0	19.3	20.5	23.5
Middle	17.1	17.5	16.9	14.1
Second wealthiest	19.7	22.0	18.3	18.8
Wealthiest	23.1	18.8	25.6	23.8
Residence				
Rural	38.5	40.3	37.7	40.2
Urban	61.5	59.7	62.3	59.8
Total	100.0	100.0	100.0	100.0

*Estimates weighted; bold indicates p-value for design-based F test (reference group 0 confidantes) less than 0.05

Table 2. Characteristics of female respondents age 15 to 49 and their two closest female confidantes age 15 to 49 in Nigeria, Rajasthan, India and Cote d'Ivoire*

	Nigeria						Rajasthan						Cote d'Ivoire					
	Respondent		Confidante 1		Confidante 2		Respondent		Confidante 1		Confidante 2		Respondent		Confidante 1		Confidante 2	
	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Mean age	29.1	11,106	28.4	5,772	28.5	1,923	29.1	5,832	27.7	4,911	26.5	1,118	28.5	2,738	29.0	1,756	27.5	262
Age																		
15-19	18.9	2,257	**19.0**	1,163	**18.1**	382	18.5	1,116	**20.0**	1,035	**22.7**	276	20.1	542	17.9	305	22.4	56
20-24	16.2	1,870	**19.6**	1,132	**18.7**	352	19.6	1,153	**22.3**	1,071	**23.8**	264	18.1	500	17.9	307	20.9	52
25-29	18.8	2,040	**18.0**	1,073	**18.7**	381	16.7	986	**17.6**	870	**20.0**	212	17.9	495	16.0	298	16.4	45
30-34	15.0	1,629	**15.3**	878	**17.4**	323	13.6	786	**14.0**	700	**14.3**	158	16.3	436	18.3	306	14.4	36
35-39	13.9	1,473	**13.1**	694	**12.7**	230	12.8	738	**11.3**	523	**9.2**	107	12.8	351	13.6	255	14.0	41
40-44	10.5	1,102	**9.3**	509	**9.6**	158	10.9	592	**8.6**	413	**4.9**	51	9.4	262	9.4	166	7.9	22
45-49	6.8	735	**5.7**	323	**4.9**	97	7.8	461	**6.2**	299	**5.2**	50	5.5	152	6.9	119	4.0	10
Education																		
Never	17.5	2355	**15.9**	1,049	**16.1**	342	36.8	2,187	**32.3**	1,626	**28.1**	291	45.2	1,254	**42.8**	773	**39.3**	110
Primary	15.2	1,906	**11.3**	789	**8.2**	202	24.0	1400	**21.4**	1,064	**20.8**	226	25.9	714	**20.7**	366	**19.6**	49
Secondary	46.9	4934	**46.4**	2,687	**46.3**	894	16.5	938	**17.9**	888	**18.9**	223	23.0	615	**28.2**	484	**31.4**	80
Higher	20.3	1911	**26.3**	1,345	**29.4**	508	22.7	1307	**28.4**	1,334	**32.2**	378	6.0	152	**8.3**	134	**9.7**	23
Number of confidantes																		
0	45.1	4,788	--	--	--	--	17.1	854	--	--	--	--	35.8	959	--	--	--	--
1	35.8	3,930	--	--	--	--	65.2	3,794	--	--	--	--	54.3	1,498	--	--	--	--
2+	19.1	1,953	--	--	--	--	17.7	1,118	--	--	--	--	9.9	263	--	--	--	--
Total	100.0	11,106	100.0	5,883	100.0	1,953	100.0	5,832	100.0	4,912	100.0	1,118	100.0	2,738	100.0	1,761	100.0	263

*Estimates weighted, Ns unweighted; bold indicates p-value for design-based F test (reference respondents) less than 0.05

Table 3. One-year likely abortion incidence (per 1,000) of respondents age 15 to 49 by country and whether the respondent had any close confidantes*

	Reported 0 confidantes		Reported at least one confidante		Reported at least two confidantes	
	Estimate	SD	Estimate	SD	Estimate	SD
Nigeria	30.32	3.99	**51.37**	5.74	39.40	6.25
Rajasthan, India	9.15	2.70	9.20	1.56	10.45	2.83
Cote d'Ivoire	27.94	7.22	41.86	7.51	50.01	15.37

*Estimates weighted to account for survey design; bold indicates design-based F test p-value less than 0.05 (reference respondents with 0 friends)

Table 4. One-year likely abortion incidence (per 1,000) of female confidantes age 15 to 49 by country and whether the respondent reported and shared her own likely abortion*

	Told confidantes about likely abortion				Did not tell confidantes about likely abortion				Did not report likely abortion			
	Confidante 1		Confidante 2		Confidante 1		Confidante 2		Confidante 1		Confidante 2	
	Estimate	SD	Estimate	SD	Estimate	SD	Estimate	SD	Estimate	SD	Estimate	SD
Nigeria	**154.43**	25.25	**166.24**	42.80	**96.87**	14.14	**108.60**	27.21	46.76	4.43	45.08	6.42
Rajasthan, India	**47.33**	21.77	62.70	47.30	**40.45**	16.80	15.67	10.27	21.15	6.97	11.48	3.10
Cote d'Ivoire	**110.20**	19.14	**97.59**	62.48	**87.02**	20.59	**97.76**	50.84	37.79	6.39	56.64	19.63

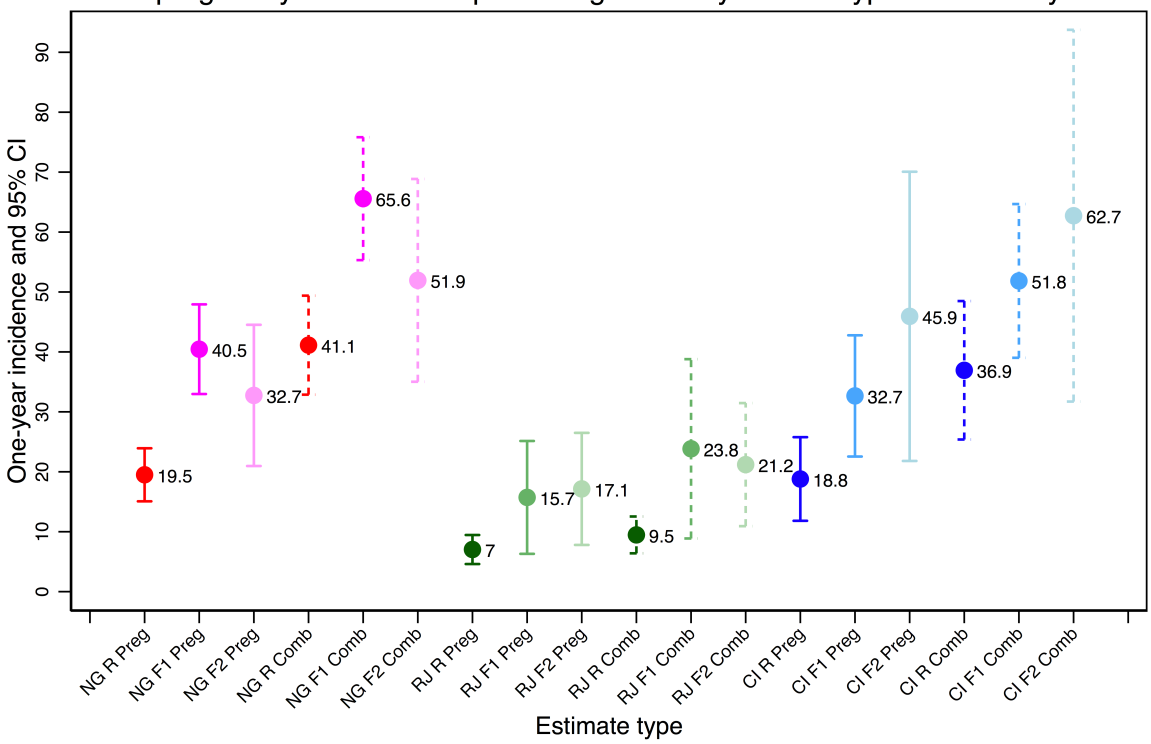
*Estimates weighted to account for survey design; bold indicates design-based F test p-value less than 0.05 (reference respondents who reported no likely abortion)

Table 5. One-year likely abortion incidence (per 1,000) of female respondents age 15 to 49 and their closest female confidantes age 15 to 49 by country and whether adjust for biases using Poisson model

	Respondent		Confidante 1*		Confidante 2*	
	Estimate	SE	Estimate	SE	Estimate	SE
Nigeria	n=	11,106	n=	5,883	n=	1,953
Unadjusted	41.13	4.21	65.57	5.23	51.94	8.63
Poisson model	--	--	59.27	3.00	44.71	2.32
Rajasthan	n=	5,832	n=	4,912	n=	1,118
Unadjusted	9.47	1.57	23.83	7.63	21.19	5.24
Poisson model	--	--	23.32	6.32	23.17	1.65
Cote d'Ivoire	n=	2,738	n=	1,761	n=	263
Unadjusted	36.93	5.89	51.85	6.54	62.73	15.82
Poisson model	--	--	49.95	4.12	62.82	4.96

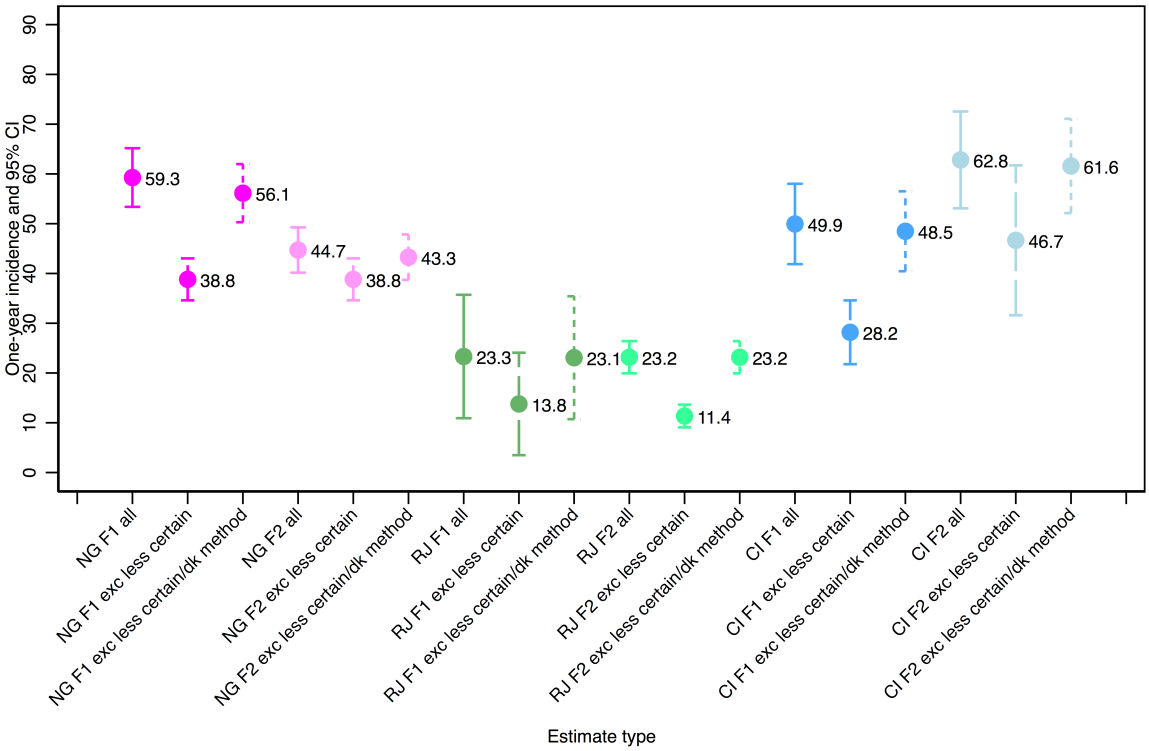
*Poisson modeled confidante estimates' sample sizes are equivalent to the corresponding respondent sample size for that country

Figure 1. One-year incidence of pregnancy removal and the combination of pregnancy removal and period regulation by woman type and country



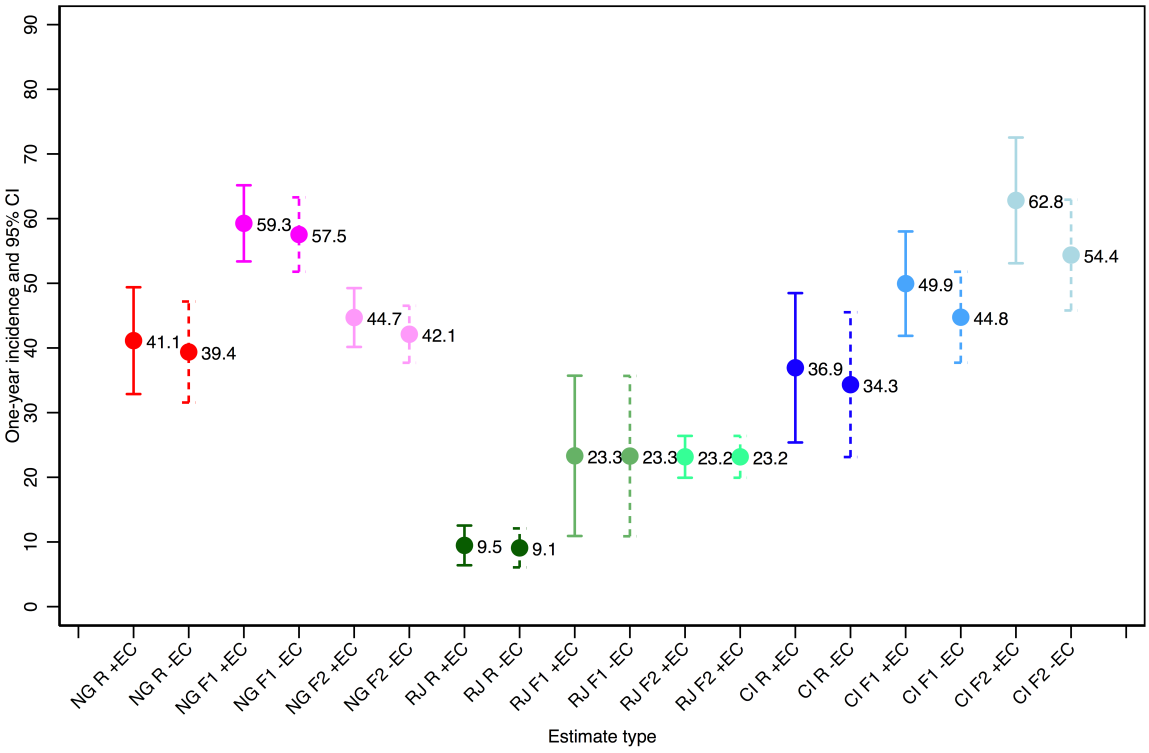
*NG = Nigeria; RJ = Rajasthan; CI = Cote d'Ivoire; R = respondent; F1 = confidante 1; F2 = confidante 2; Preg = pregnancy removal only; Comb = "likely abortion", combing pregnancy removal and period regulation

Figure 2. One-year incidence of likely abortion (pregnancy removal and period regulation) by woman type, country and whether respondent report was certain, less certain, or less certain but knew method



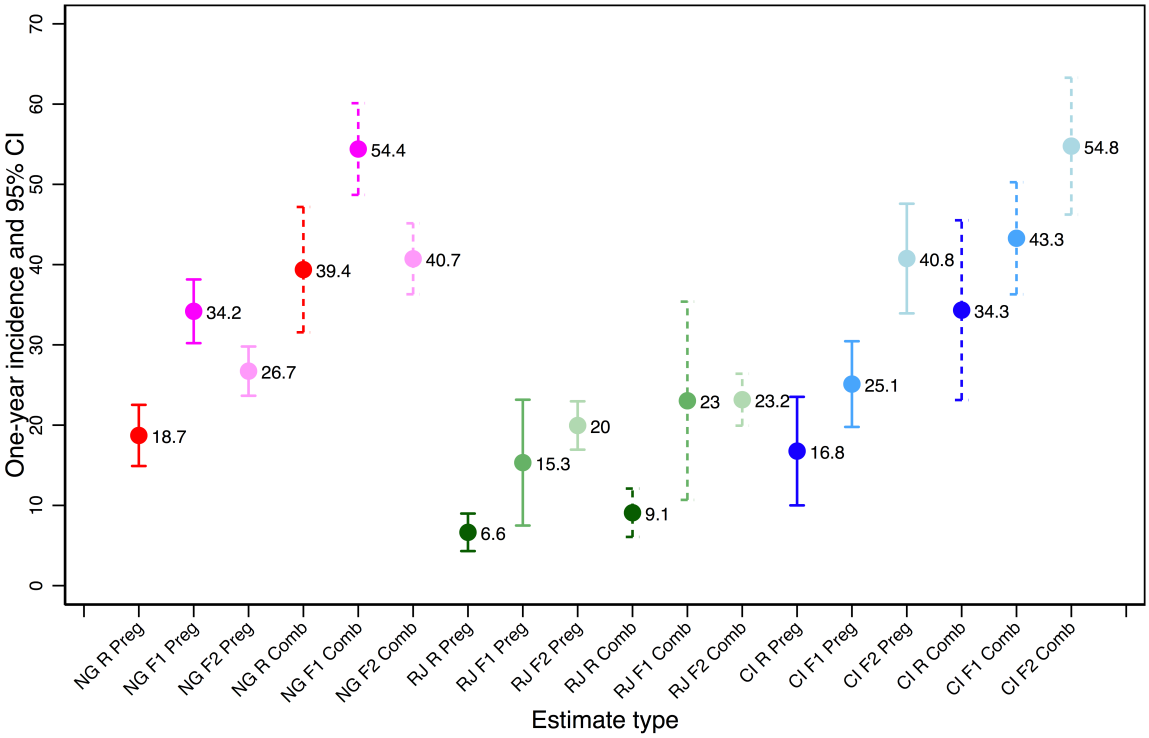
*NG = Nigeria; RJ = Rajasthan; CI = Cote d'Ivoire; F1 = confidante 1; F2 = confidante 2; all = includes all confidante likely abortions regardless of certainty with which respondent reported it; exc less certain = excludes confidante likely abortions that respondents reported with less certainty; exc less certain/dk method = only excludes confidante likely abortions that respondents reported with less certainty *and* could not provide details on the method used

Figure 3. One-year incidence of likely abortion (pregnancy removal and period regulation) by woman type, country and whether include emergency contraception only use



*NG = Nigeria; RJ = Rajasthan; CI = Cote d'Ivoire; R = respondent; F1 = confidante 1; F2 = confidante 2; +EC = includes likely abortions for which only EC was used and no postabortion care was sought; -EC = excludes likely abortions for which only EC was used and no postabortion care was sought

Figure 4. Final one-year incidence of pregnancy removal and the combination of pregnancy removal and period regulation by woman type and country



*NG = Nigeria; RJ = Rajasthan; CI = Cote d'Ivoire; R = respondent; F1 = confidante 1; F2 = confidante 2; Preg = pregnancy removal only; Comb = "likely abortion", combing pregnancy removal and period regulation

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