Induced Abortion Incidence and Safety in Rajasthan, India: Evidence that Expansion of Services is Needed

Danish Ahmad, Mridula Shankar, Anoop Khanna, Caroline Moreau, and Suzanne Bell

Despite induced abortion being broadly legal in India, up-to-date information on its frequency and safety is not readily available. Using direct and indirect methodological approaches, this study measures the one-year incidence and safety of induced abortions among women in the state of Rajasthan. The analysis utilizes data from a population-based survey of 5,832 reproductive aged women who reported on the abortion experiences of their closest female confidante in addition to themselves. We separately assess correlates of having a recent and most unsafe abortion using multivariable regression models. The confidante approach produced a one-year abortion incidence estimate of 23 per 1,000 women, whereas the respondent estimate is 9.5 per 1,000 women. Based on the confidante estimate, approximately 441,000 abortions occurred in Rajasthan over a year. Overall, 25 and 29 percent of respondent and confidante reported abortions were classified as most unsafe. Results suggest that abortion remains an integral component of women's fertility regulation, and that a liberal law alone is insufficient to guarantee access to safe abortion services. Existing policies on abortion in India need updating to permit task sharing in line with current recommendations to expand service delivery so that demand is met through provision of safe and accessible services.

INTRODUCTION

In 1971, the Indian Parliament passed the Medical Termination of Pregnancy (MTP) Act as a legal measure to address the high rates of maternal mortality due to unsafe abortion. This law made induced abortion legal up to 20 weeks gestation under a broad set of circumstances, including endangerment of a woman's life, risks to her physical and mental health, fetal impairment, and pregnancies occurring as a result of contraceptive failure (*The Medical*

Danish Ahmad, Indian Institute of Health Management Research, 1 Prabhu Dayal Marg, Near Sanganer Airport, Jaipur, 302 029, India. E-mail: danish@iihmr.edu.in. Mridula Shankar, Department of Population, Family and Reproductive Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, 21205, USA. Anoop Khanna, Indian Institute of Health Management Research, Jaipur, India. Caroline Moreau, Department of Population, Family and Reproductive Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, 21205, USA. Suzanne Bell, Department of Population, Family and Reproductive Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, 21205, USA.

Termination of Pregnancy Act No. 34, 1971). A recent national study estimated that approximately 15.6 million induced abortions occurred throughout India in 2015 (Singh et al. 2018). This is equivalent to a national one-year incidence of 47 induced abortions per 1,000 women aged 15–49. This point estimate is higher than model-based estimates for developing countries overall, and regionally for south and central Asia, though still within the upper and lower bounds of these modeled estimates (Sedgh et al. 2016). Despite its legality, only 22 percent of these abortions took place in facilities, with a minority of these facility-based procedures provided through the public sector (Singh et al. 2018).

In India, an estimated 10 percent of maternal mortality is still attributable to unsafe abortion (Montgomery et al. 2014), demonstrating that a liberal law alone is insufficient to guarantee access to safe and legal services. Arduous certification requirements for private sector facilities, regulations preventing mid-level providers from legally offering the service, and poor public sector provision has resulted in inadequate availability of quality abortion and postabortion care (PAC), and women's continued reliance on untrained providers (Iyengar and Gemzell Danielsson 2017; Paul et al. 2015; Stillman et al. 2014).

In an attempt to address the shortage of quality affordable care, the Indian Parliament amended the MTP Act in 2002, allowing for the devolution of power to district-level committees to certify and regulate facilities providing abortion care, as a measure to accelerate registration of private facilities. The amendment also altered facility-based physical standards for abortion care, no longer requiring that they have the medical amenities to provide onsite emergency care for complications. Further, registered medical providers were permitted to prescribe the combination medication abortion drug regimen (mifepristone along with misoprostol) for pregnancy termination up to seven completed weeks of gestation (GoI 2002), and for pharmacies to dispense these drugs upon presentation of a prescription.

Demand for these drugs following passage of the amendment was striking, with distribution of misoprostol increasing 646 percent between 2002 and 2007 (Fernandez et al. 2009). The introduction of the medication option facilitated expansion of abortion services in the private and informal health care sectors, compensating for poor provision of surgical abortion services in public facilities, particularly at the primary-care level (Stillman et al. 2014). Findings from the recent national abortion study indicate that 81 percent of all terminations in 2015 were medication abortions, thus the market for these drugs has continued to increase in intervening years (Singh et al. 2018). However, 91 percent of these abortions occurred outside of a facility; this is a rate of 34 informal sector medication abortions per 1,000 women of reproductive age (Singh et al. 2018). Evidence suggests that much of this provision occurs through pharmacies without an accompanying prescription and involves inadequate counseling (Powell-Jackson et al. 2015; Srivastava et al. 2019). As such, the quality of care is generally low, although facility-based care does not necessarily imply higher quality (Singh et al. 2018). Beyond the extensive informal sector medication abortion, there are an additional two abortions per 1,000 women of reproductive age involving nonrecommended, unsafe methods obtained outside of facilities (Singh et al. 2018). These methods include anything other than a surgical procedure or medication abortion drugs. While self-managed medication abortion is associated with less risk and lower severity of negative sequelae compared to unsafe methods (Faúndes et al. 1996; Miller et al. 2005), the World Health Organization (WHO) considers all these nonfacility-based abortions as less safe (Ganatra et al. 2017) since their provision does

not involve trained providers. Attempts to expand the abortion provider base by including a provision for task sharing of abortion care with mid-level providers, in line with WHO guidance (WHO, 2015), and as part of a broader set of amendments to the MTP act have been unsuccessful. In March 2020, the Medical Termination of Pregnancy (Amendment) Bill 2020 was passed by the lower house of the Indian Parliament, allowing termination of pregnancies between 12 and 20 weeks gestation with the authorization of a single registered medical practitioner (previously required two), extending the gestational age limit to 24 weeks for specific categories of women, and removing any limit in the case of fetal abnormalities (The Medical Termination of Pregnancy (Amendment) Bill, 2020 | *PRSIndia*, n.d.).

In the changing landscape of abortion provision in India, individual, complete and up-to-date state-specific data on abortion incidence is available only for a limited number of states (Singh et al. 2018). This current analysis utilizes data from the state of Rajasthan, for which government data indicate an annual abortion incidence rate of two abortions per 1,000 reproductive-aged women (Ministry of Health and Family Welfare [MoHFW] 2013). This is a gross underestimate because it excludes private-sector abortions conducted in unregistered facilities or by unauthorized providers, and self-induced abortions occurring outside of the formal public health sector, all of which account for the majority of abortions in the state. Further, little is known about the experiences of an increasing share of women who undergo this procedure outside of the formal health care system and their associated risks of abortion-related morbidity and mortality. Understanding the demographics of women experiencing unintended pregnancies and subsequent abortion, particularly unsafe abortion, can inform family planning programs, policies, and services in order to better meet the reproductive health needs of these women moving forward.

In this study, we aim to address these data deficiencies in the state of Rajasthan using data from a population-based survey of reproductive age women. Our first objective is to measure the incidence of abortion overall and by women's characteristics, while our second objective is to measure abortion safety overall and by women's characteristics. Prior research has indicated that women in their peak reproductive years, urban residents, and more educated women tend to have more abortions, and we expect similar results in Rajasthan (Bell et al. 2020; International Institute for Population Sciences (IIPS) and ICF, 2017; Singh et al. 2017). In regard to safety, we hypothesize that the youngest women, less-educated women, and poorer women are most likely to have unsafe abortions.

METHODS

Sampling

This analysis uses population-level data from women of reproductive age in the Indian state of Rajasthan as part of the multicountry Performance Monitoring and Accountability 2020 (PMA2020) project. PMA2020 utilizes female resident interviewers and a mobile phone survey platform to field rapid and low-cost, cross-sectional, face-to-face surveys in 11 national/subnational geographies across sub-Saharan Africa and South and South East Asia (Zimmerman et al. 2017). In Rajasthan, the Indian Institute of Health Management Research implemented the survey with technical oversight from the Bill and Melinda Gates Institute

for Population and Reproductive Health at the Johns Hopkins Bloomberg School of Public Health.

The female sample in Rajasthan is the product of a two-stage sampling procedure. First, a sample of 147 geographical units called enumeration areas (EAs) whose boundaries enclose approximately 200 households was drawn using probability proportional to size sampling. Selected EAs were located across 32 districts, with 74.8 percent of sampled EAs located in rural areas. Next, a random sample of 35 households was selected within each EA. All women between the ages of 15 and 49 who were usual residents or had spent the previous night in the selected households were eligible to be interviewed after providing written consent. Data collection for round 4 of the female survey in Rajasthan occurred between April and June 2018, producing a final analytical sample of 5,832 women from 4,933 households, and a response rate of 98.6 percent. When weighted, the resulting data are representative at the state level. The Institutional Review Boards at the Indian Institute of Health Management Research and the Johns Hopkins Bloomberg School of Public Health provided ethical approval for the study.

Measures

The PMA2020 female questionnaire is designed to collect information on basic sociodemographic characteristics, fertility, contraception, and other reproductive health indicators. We added an abortion module in round 4 of the survey in Rajasthan to measure abortion incidence and collect information on the methods and sources of abortion care. In addition to asking about the respondent's own experience with abortion, we also employed the confidante methodology (Sedgh and Keogh 2019), an indirect social network-based methodology to collect data on the respondent's best friend's experiences with abortion. We describe this methodological approach to abortion measurement and the piloting experience elsewhere (Bell et al. forthcoming). Interviewers conducted surveys face-to-face using the Hindi translated questionnaire.

At the start of the abortion module, the interviewer asked the respondent about how many close female friends or relatives she had, defined as women between the ages of 15 and 49 living in Rajasthan, and with whom she mutually shares personal information. The interviewer subsequently obtained additional details on the respondent's closest confidante's age and highest level of schooling ever attended. The confidante's experience with abortion was determined through two questions: First, whether the confidante had ever done something to remove a pregnancy when pregnant or worried about being pregnant, and separately if the confidante had done anything to regulate her period when worried she was pregnant. We included the question on period regulation during piloting of the abortion module to capture the more colloquial form in which women may refer to early abortion experiences where they may not have confirmed the pregnancy. This phrasing may also be less stigmatizing and more successful in capturing experiences that women may not view as abortions (Sedgh & Keogh, 2019). In answering questions on their confidante's pregnancy removal and period regulation experiences, respondents had the option to choose a response that indicated that they were less certain ("Yes, I think so.") about the confidante's experience with these phenomena.

When a respondent reported her best friend's pregnancy removal or period regulation experience, the interviewer elicited additional details on the year it occurred, the method used,

and if the method involved surgery or pills, the associated source of care. In instances of multiple attempts to secure an abortion, we obtained information on the first and last methods and sources used. Subsequently, the interviewer asked the same series of questions about the respondent's own experiences with both phenomena. We will henceforth refer to the combination of reported pregnancy removal and period regulation experiences as "abortion."

We operationalized abortion safety along two dimensions using information on an abortion method and source. First, we categorized the abortion method as recommended (surgery or mifepristone and/or misoprostol) or nonrecommended (other pills, herbs, home remedies, inserting materials into the vagina) based on whether the method potentially exposed a woman to a high risk of abortion-related morbidity or mortality. Next, we categorized the responses on source as clinical (public and private health facilities) versus nonclinical (AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy) (clinical but not allowed to provide abortion)), community-based health workers, pharmacists/chemists, shop, friend/relative). Women who did multiple things in their abortion care pathway were categorized as using a nonrecommended method and/or nonclinical source if their first or last method and source fell into either of these categories as specified above. We operationalize abortion safety in this manner as the use of a nonrecommended method and/or source at any point in the abortion pathway is likely to increase risk of poor outcomes, and reliance on final method and source information alone provides an incomplete and inaccurate assessment of process measures of safety that would tend to underestimate the extent of unsafe abortion (Bell et al., 2019). We subsequently combined the information on method and source to determine the proportion of abortions conducted using (a) recommended method(s) and clinical source(s); (b) recommended method(s) and nonclinical source(s); (c) nonrecommended method(s) and clinical source(s); and (d) nonrecommended method(s) and nonclinical source(s) (evaluated as "most unsafe"). Specific details of this abortion safety measurement methodology are described elsewhere (Bell et al.forthcoming).

Analyses

First, we used descriptive statistics to assess and compare the sociodemographic characteristics of the sample of female respondents and their closest confidantes. Some respondents reported not having a confidante, leading to the potential for a biased confidante sample. As a strategy to impute the data for "missing" confidantes, we used a Poisson regression model with the outcome of whether or not a confidante had an abortion in the previous year modeled as a function of respondent sociodemographic characteristics. We combined the predicted likelihood estimates for the missing confidantes with the reported confidante abortion data to calculate the one-year "adjusted" confidante abortion incidence estimates. When analyzing confidante abortion rates by background characteristics, we used the respondent age and education data for their corresponding "missing" confidantes.

To calculate the one-year incidence of abortion for the respondent and confidante samples, we combined information from the pregnancy removal and period regulation questions. Reported abortions occurring in the years 2017 and 2018 were divided by the total number of person-years contributed by women in each sample (respondents, confidantes) from January 1, 2017 to the date of interview in 2018. For the confidante estimate, we included

abortions that were reported by respondents with less certainty if respondents also reported the method(s) utilized by the confidante. We present the one-year abortion incidence rate overall and by background characteristics per 1,000 women aged 15–49 for respondents and confidantes separately. We then used separate bivariate and multivariable logistic regression models for respondent and confidante data to determine background characteristics associated with having an abortion in the previous year.

For the data on abortion safety, we calculated the proportion of all respondent and confidante abortions that fall into each of the four safety categories previously described. Separately, we present the proportion of respondent and confidante abortions that were most unsafe overall and by select background characteristics. We used bivariate and multivariable logistic regression models to examine characteristics associated with having a most unsafe abortion among respondents and their confidantes. We subsequently calculated the one-year incidence of most unsafe abortions in Rajasthan and estimated the total number of most unsafe abortions that occurred in the state in 2017. Finally, as a sensitivity analysis, and to consider the possibility that many women may be unable to distinguish mifepristone and misoprostol from other pills, we recategorized "other pills" as a recommended method to determine the extent to which safety estimates change if we take this less conservative approach to estimation.

To account for the complex sampling design and to adjust the standard errors for clustering, we applied survey weights and used the Taylor series linearization method. To ensure the confidante sample characteristics were representative of the population of reproductive age women in Rajasthan, we constructed poststratification weights using the respondent distribution. We conducted all analyses in Stata version 15.1 (StataCorp. 2017).

RESULTS

Table 1 contains the sociodemographic characteristics of the female respondents and confidantes. In total 5,832 respondents completed the survey and reported an average of 1.1 confidantes each, with 4,911 (84.2 percent) reporting at least one close female confidante. On average, respondents were aged 29.1 years and confidantes were similarly aged (27.7). Education levels were low, with 36.8 percent of respondents reporting no formal schooling; confidante education estimates skewed slightly higher, but adjusted estimates accounting for missing confidantes were closer to the respondent distribution. More than three-quarters of respondents were currently married or cohabiting, 85.9 percent were Hindu, and 46.7 percent belonged to the "other backward class" as defined by the Government of India. A minority had one or two children (36.2 percent) and just under two-thirds lived in a rural area (65.4 percent).

We present the annual incidence of abortions among respondents and their closest confidantes in Table 2. Overall, respondents reported a one-year abortion rate of 9.5 per 1,000 (95 percent confidence interval (CI): 6.4–12.5) reproductive age women while the adjusted confidante estimate was 23.2 per 1,000 (95% CI: 8.2–38.1). The abortion incidence was highest for respondents and confidantes aged 25–29 (18.6 and 48.1, respectively), followed closely by those aged 20–24 (18.0 and 36.0) (Figure 1). The incidence was lowest for women at the

TABLE 1 Characteristics of female respondents aged 15–49 and their closest female confidantes aged 15–49 in Rajasthan[a]

	Respondent		Unadjusted confidante		Adjusted confidante[b]	
	N	%	N	%	N	%
Mean age	5,832	29.1	4,911	27.7	5,832	28.3
Age						
15–19	1,116	18.5	1,035	20.0	1,186	19.1
20–24	1,153	19.6	1,071	22.3	1,216	21.1
25–29	986	16.7	870	17.6	1,004	17.2
30–34	786	13.6	700	14.0	823	13.6
35–39	738	12.8	523	11.3	655	12.4
40–44	592	10.9	413	8.6	539	9.5
45–49	461	7.8	299	6.2	409	7.2
Education						
Never	2,187	36.8	1,626	32.3	2,065	34.8
Primary	1,400	24.0	1,064	21.4	1,275	22.7
Secondary	938	16.5	888	17.9	1,031	16.8
Higher	1,307	22.7	1,334	28.4	1,461	25.7
Marital status						
Currently married/cohabiting	4,421	76.4	–	–	–	–
Divorced or separated/widowed	153	2.6	–	–	–	–
Never married	1,240	21.0	–	–	–	–
Religion of household						
Hindu	5,020	85.9	–	–	–	–
Muslim	735	12.7	–	–	–	–
Other	76	1.4	–	–	–	–
Caste of household						
Scheduled caste	1,283	22.7	–	–	–	–
Scheduled tribe	828	11.7	–	–	–	–
Other backward caste	2,653	46.7				
General	1,068	18.9	–	–	–	–
Parity						
0	1,804	30.6	–	–	–	–
1–2	2,087	36.2	–	–	–	–
3–4	1,478	25.8	–	–	–	–
5+	461	7.4	–	–	–	–
Residence						
Rural	4,366	65.4	–	–	–	–
Urban	1,466	34.6	–	–	–	–
Mean number of confidantes	5,766	1.1	–	–	–	–
Total	5,832	100.0	4,912	100.0	5,832	100.0

[a] Ns within categories that do not sum to total is due to missingness.
[b] Including respondent characteristics for "missing" confidantes.

TABLE 2 One-year pregnancy removal and combined (including period regulation) abortion incidences (per 1,000) of female respondents and their closest female confidantes in Rajasthan

	Respondent		Unadjusted confidante		Adjusted confidante[a]	
	Estimate	SE	Estimate	SE	Estimate	SE
Pregnancy removal	7.0	1.24	15.6	4.80	15.2	4.68
Combined (+ period regulation)	9.5	1.57	23.6	7.62	23.2	7.63

[a] Including respondent characteristics for "missing" confidantes.

end of their reproductive years, aged 45–49 (0.3 and 0.0). Abortion rates of respondents and confidantes with any education were markedly higher than among those who never attended school, while respondents living in urban areas had a higher incidence (13.3) than those in rural areas (7.4). The abortion incidence reporting ratio between respondents and confidantes was 2.4 overall, ranging from 1.9 among women with primary education to 5.1 among women 40–44 years of age. Bivariate logistic regression findings (Table 3) suggested that the odds

FIGURE 1 One-year induced abortion incidence (per 1,000 women aged 15–49) among respondents and their closest female confidants by background characteristics, Rajasthan, India

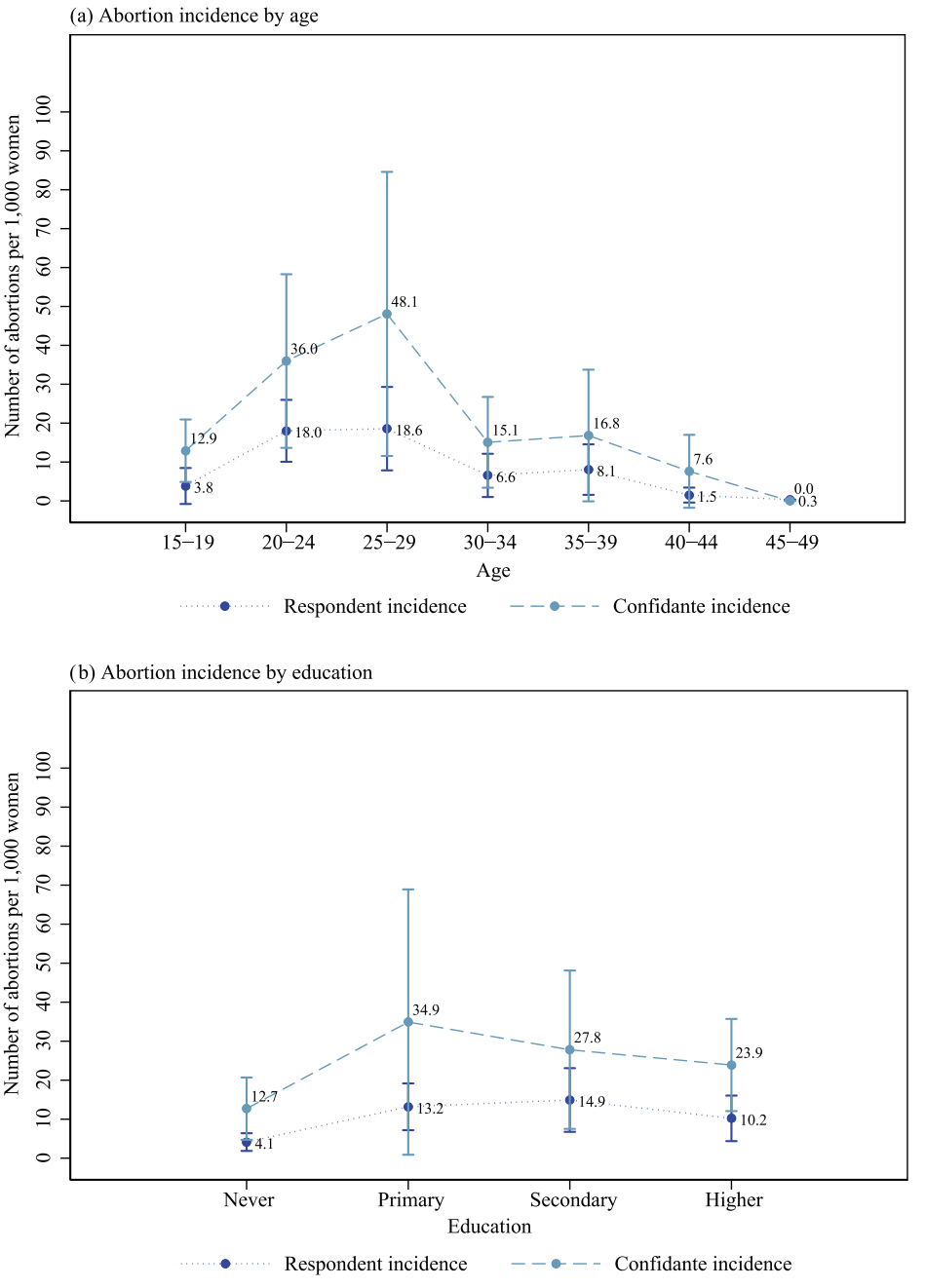


TABLE 3 Bivariate and multivariate regressions of characteristics associated with experiencing an abortion in the year prior to the survey among Rajasthan's respondents and confidantes aged 15–49[a]

	Respondent (n = 5,829)						Confidante[b] (n = 4,613)					
	OR	95% CI		aOR	95% CI		OR	95% CI		aOR	95% CI	
Age												
15-19	1.00	–	–	1.00	–	–	1.00	–	–	1.00	–	–
20-24	**4.78**	**1.24**	**18.38**	**5.37**	**1.41**	**20.47**	**2.90**	**1.68**	**5.00**	**2.86**	**1.61**	**5.10**
25-29	**4.93**	**1.71**	**14.26**	**5.56**	**1.94**	**15.94**	**3.27**	**1.54**	**6.92**	**3.17**	**1.33**	**7.55**
30-34	1.71	0.37	8.00	2.11	0.44	10.17	0.83	0.35	1.94	0.81	0.30	2.19
35-39	2.11	0.47	9.50	2.89	0.62	13.42	0.65	0.20	2.18	0.65	0.18	2.32
40-44	0.39	0.06	2.40	0.55	0.09	3.22	0.80	0.19	3.31	0.80	0.14	4.51
45-49	**0.09**	**0.02**	**0.29**	**0.14**	**0.04**	**0.51**	1.00	–	–	1.00	–	–
Education												
Never	1.00	–	–	1.00	–	–	1.00	–	–	1.00	–	–
Primary	**3.23**	**1.57**	**6.63**	2.31	1.16	4.58	1.94	1.00	3.74	1.26	0.61	2.60
Secondary	**3.66**	**1.82**	**7.36**	**2.94**	**1.46**	**5.90**	1.40	0.64	3.09	0.95	0.36	2.48
Higher	**2.49**	**1.15**	**5.37**	**1.63**	**0.67**	**3.93**	1.77	0.92	3.42	1.01	0.43	2.40
Residence												
Rural	1.00	–	–	1.00	–	–	–	–	–	–	–	–
Urban	1.81	0.94	3.50	1.73	0.89	3.36	–	–	–	–	–	–
Wealth quintile												
Poorest	1.00	–	–	1.00	–	–	–	–	–	–	–	–
Second poorest	1.11	0.42	2.90	1.07	0.42	2.74	–	–	–	–	–	–
Middle	0.68	0.26	1.77	0.55	0.19	1.55	–	–	–	–	–	–
Second wealthiest	1.19	0.43	3.29	0.76	0.32	1.84	–	–	–	–	–	–
Wealthiest	1.39	0.57	3.41	0.82	0.27	2.43	–	–	–	–	–	–

[a] Values in bold indicates statistical significance at the $P < 0.05$ level.
[b] Adjusted for missing confidantes using the Poisson prediction model.

TABLE 4 Safety of most recent reported likely abortion among female respondents aged 15–49 and their closest female confidantes aged 15–49 in Rajasthan

	Respondent		Confidante	
	Estimate	N	Estimate	N
Recommended, clinical provider	42.1	181	37.6	315
Recommended, nonclinical provider	28.7	147	29.3	250
Nonrecommended, clinical provider	4.4	18	3.7	29
Non-recommended, nonclinical provider	24.9	109	29.4	250
Total	100.0	457	100.0	844

of a recent abortion were over four times higher among respondents aged 20–29 compared to adolescents, while these odds were 90 percent lower among women 45–49 years; multivariable results were similar. Confidante bivariate and multivariable findings also indicated that women aged 20–29 were significantly more likely to have had a recent abortion; there were no confidantes in the age range of 45–49 for whom respondents reported an abortion in the previous year. In bivariate and multivariate respondent analyses, women with any education had significantly increased odds of a recent abortion. Neither residence nor wealth was significantly associated with the occurrence of a recent abortion among respondents.

Safety of the most recent abortion among respondents and their closest confidante is presented in Table 4. Just over four in ten (42.1 percent) respondent abortions were performed using only recommended methods and clinical providers while 37.6 percent of confidante abortions met these criteria. Over one-quarter of respondents (28.7 percent) and confidantes (29.3 percent) used a recommended method (namely medication abortion pills) from a nonclinical source. Use of nonrecommended method(s) from only clinical provider(s) was the

least common among respondents and their confidantes (4.4 and 3.7 percent, respectively). Approximately one-fourth (24.9 percent) of respondent abortions were performed by a nonclinical provider using nonrecommended methods, whereas this percentage was higher (29.4 percent) among confidantes. Recategorizing "other pills" as a recommended method resulted in a 9.1 (24.9-15.8 percent) and 7.7 (29.4–21.7 percent) percentage point reduction in the most unsafe category and a 9.0 (28.7–37.7 percent) and 7.7 (29.3–37.0 percent) percentage point increase in recommended methods by nonclinical providers for respondents and confidantes, respectively (data not shown).

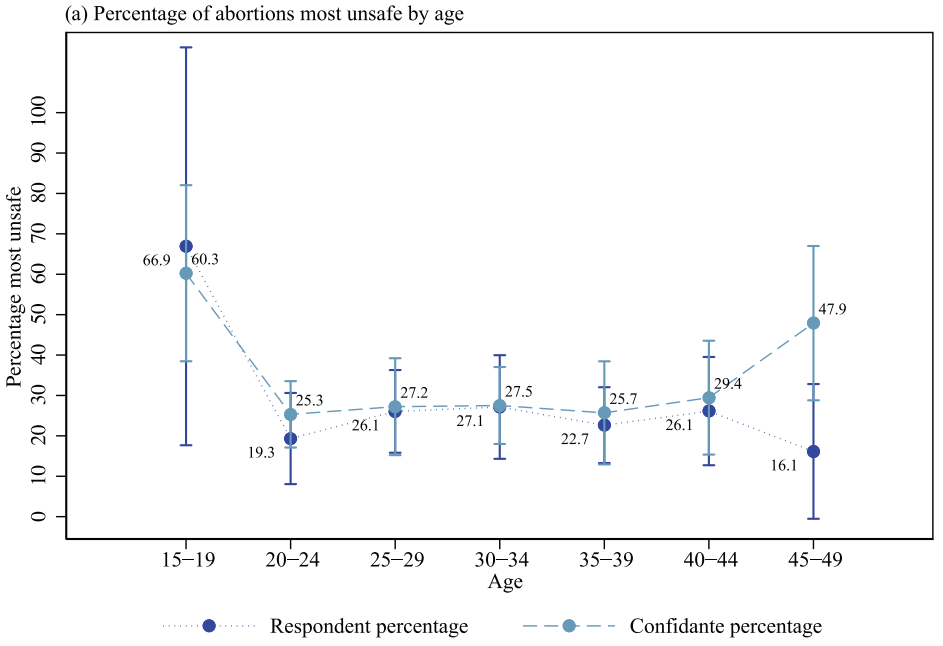
We present the percentage of abortions among respondents and their closest confidante that were most unsafe by background characteristics in Figure 2. Respondents and confidantes aged 15–19 had the highest levels of most unsafe abortion at 66.9 and 60.3 percent, respectively. Among respondents, those who had at least some primary or secondary schooling had the highest levels of most unsafe abortions at 28.9 and 29.3 percent, respectively, while confidantes with no education were most likely to have a most unsafe abortion (35.8 percent). Respondents residing in urban areas (30.4 percent) appeared more likely to have an unsafe abortion compared to those in rural areas (19.9 percent). Respondent data on wealth indicated that levels of most unsafe abortion were generally similar across categories but highest for those in the second poorest quintile (28.9 percent). None of these differences rose to the level of statistical significance. While increasing age was associated with decreased likelihood of having a most unsafe abortion among respondents and confidantes, the bivariate and multivariable odds ratios were only statistically significant among confidantes (Table 5). There was no clear pattern with regard to abortion safety by education, residence, and wealth among respondent abortions, however confidantes with higher education had a 63 percent lower odds of having a most unsafe abortion compared to women with no education (OR = 0.37, 95 percent CI 0.19–0.73).

DISCUSSION

To our knowledge, this is the first study to provide population-based estimates of induced abortion incidence and safety, including by background characteristics, among reproductive aged women in the Indian state of Rajasthan. Using an indirect, confidante-based approach to measuring abortion incidence, we estimate the abortion rate for 2017 is at least 23.2 per 1,000 women aged 15–49 years. The proclivity for survey respondents to underreport their own abortion experience is evidenced in these data; the confidante estimate was over twice as high overall as the respondent estimate of 9.5 per 1,000, and the reporting ratio by women's characteristics ranged widely from 1.8–4.6, indicative of differential underreporting across subgroups. These results suggest that the confidante method is more accurate in capturing the incidence of induced abortion, given the social desirability bias that causes substantial underreporting of abortion data obtained through self-report.

This finding differs from previous experiences using indirect social network-based methodologies to improve abortion reporting in Rajasthan (Bell & Bishai, 2019; Elul, 2004). Specifically, Elul and colleagues found that the use of the anonymous third-party reporting method (ATPR), which is similar to the confidante method used in this study, performed

FIGURE 2 Percentage of all reported induced abortions that were most unsafe among respondents and their closest female confidants by background characteristics, Rajasthan, India



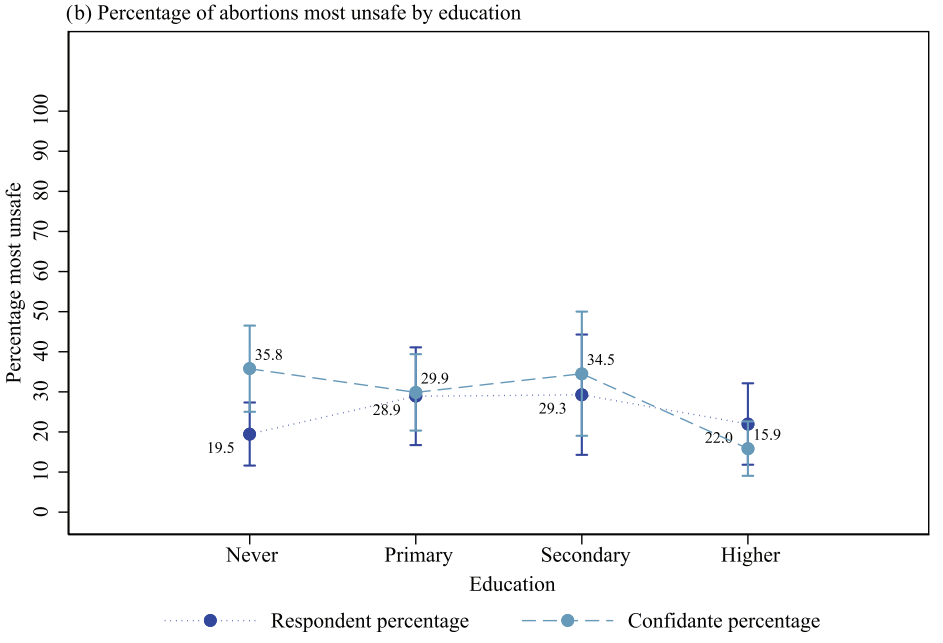


TABLE 5 Multivariate regression of characteristics associated with experiencing a most unsafe abortion among Rajasthan's respondents and confidantes aged 15–49[a]

	Respondent (n = 455)						Confidante (n = 844)					
	OR	95% CI		aOR	95% CI		OR	95% CI		aOR	95% CI	
Age												
15–19	1.00	–	–	1.00	–	–	1.00	–	–	1.00	–	–
20–24	0.12	0.01	1.20	0.12	0.01	1.27	**0.22**	**0.09**	**0.56**	**0.26**	**0.11**	**0.64**
25–29	0.17	0.02	1.82	0.18	0.02	1.71	**0.25**	**0.10**	**0.61**	**0.28**	**0.11**	**0.70**
30–34	0.18	0.02	2.01	0.20	0.02	2.15	**0.25**	**0.11**	**0.59**	**0.26**	**0.11**	**0.61**
35–39	0.14	0.01	1.75	0.14	0.01	1.59	**0.23**	**0.09**	**0.60**	**0.23**	**0.09**	**0.59**
40–44	0.17	0.02	1.91	0.19	0.02	2.14	**0.28**	**0.09**	**0.84**	**0.27**	**0.09**	**0.77**
45–49	0.10	0.01	1.31	0.10	0.01	1.28	0.61	0.19	1.91	0.53	0.18	1.61
Education												
Never	1.00	–	–	1.00	–	–	1.00	–	–	1.00	–	–
Primary	1.68	0.88	3.20	1.72	0.83	3.54	0.76	0.43	1.35	0.82	0.47	1.41
Secondary	1.71	0.69	4.26	1.35	0.45	4.06	0.95	0.48	1.86	0.98	0.52	1.87
Higher	1.16	0.56	2.44	1.24	0.50	3.09	**0.34**	**0.18**	**0.64**	**0.37**	**0.19**	**0.73**
Residence												
Rural	1.00	–	–	1.00	–	–	–	–	–	–	–	–
Urban	1.76	0.88	3.50	2.05	0.90	4.63	–	–	–	–	–	–
Wealth quintile												
Poorest	1.00			1.00			–	–	–	–	–	–
Second poorest	1.70	0.67	4.31	1.50	0.54	4.15	–	–	–	–	–	–
Middle	1.20	0.45	3.22	0.79	0.27	2.33	–	–	–	–	–	–
Second wealthiest	1.48	0.55	4.02	0.73	0.26	2.04	–	–	–	–	–	–
Wealthiest	1.52	0.64	3.61	0.74	0.25	2.14	–	–	–	–	–	–

[a] Values in bold indicates statistical significance at the $P < 0.05$ level.

worse than self-report. We highlight four possible reasons that could account for the difference in findings: First, in Elul et al.'s application of the ATPR method, respondents were asked to report on the abortion experiences of up to five reproductive aged women with whom "they share the most with." Depending on the composition of this network, many respondents will (a) likely not know this information for confidantes further away in network "closeness," yet incorrectly report that these confidantes have not had an abortion, or (b) be considering multiple female members within the family and thus be more reluctant to report, with both scenarios resulting in an undercount in the numerator. To the extent that women have knowledge of and more accurately report about their closest confidante's experience, the use of a single confidante to estimate abortion incidence will perform better than the ATPR method in this setting. Second, in our confidante incidence calculations, we included confidante abortions that respondents reported with less certainty, if respondents also reported the method(s) used. To our knowledge, Elul and colleagues only incorporated positive responses in the numerator. Third, the definitions used to identify individuals within the social network were slightly different: Whereas, we asked women to think about other reproductive aged women whom they reciprocally share personal information with, Elul et al. ask about women whom respondents share the most with. The reciprocity of sharing is less clear in the latter definition. Finally, in our incidence estimates, period regulations accounted for a slightly higher percentage of confidante abortions compared to self-reported abortions (34 percent vs. 26 percent), indicating that the additional framing of abortion questions in this manner may have increased confidante reports to a greater extent than self-report.

Assuming that the confidante rate is closer to the true one-year incidence, our estimates translate to approximately 441,000 abortions occurring over a 12-month period in Rajasthan. Unsurprisingly, the respondent and confidante incidence estimates are substantially higher

than the 2012 state government estimate of 2.0 per 1,000 women (MoHFW 2013), for reasons identified earlier. The confidante abortion rate of 23.2 per 1,000 women is significantly lower than the 2015 estimates of 47.6 and 57.3 per 1,000 women generated by the Guttmacher Institute in the neighboring states of Gujarat and Madhya Pradesh, albeit using different sources of information, including facility-based data and sales of medication abortion drugs (Singh et al. 2018).

A methodological consideration that may negatively affect the performance of the confidante method and partially explain our lower incidence in comparison to the Guttmacher results is the type of respondent-confidante relationship that the respondent is referring to, particularly if it is familial in nature. In Rajasthan, the structure of gender norms and social relations may be such that women (particularly earlier in marriage and their reproductive lifecourse) lack the agency to freely engage with other women in the community outside of the immediate marital and extended familial unit. As such, personal networks within which sensitive information is shared may be restricted to female relatives, and women may be less inclined to report on a relative's abortion experience vis-a-vis a friend's experience. Additionally, this estimation method appears to provide higher estimates of incidence in legally restrictive settings where women tend to rely more heavily on their social networks for information on abortion sources (Rossier et al. 2006). In Rajasthan, there may be less discussion of abortion overall due to better accessibility of abortion services. Furthermore, in this context confidante abortions that have complications may be more visible than clandestine uncomplicated self-managed medication abortions. Despite the reduced visibility of abortion, our findings provide promising evidence of superior performance of the confidante method compared to self-report in the context of a community-based survey.

The state of Rajasthan has also implemented aggressive regulatory measures such as sting operations on abortion providers and raids of pharmacies by local authorities (Chandrasekhar 2019) as a strategy to address worsening trends in imbalanced child sex ratios indicated by data from the 2001 and 2011 censuses (Census 2011). These actions have limited the availability of abortion services altogether, including the stocking and dispensing of medication abortion drugs in pharmacies. Thus, while our confidante abortion rate is likely still an underestimate, this situation surrounding abortion service provision in Rajasthan is suggestive of a lower abortion rate as compared to other states.

The incidence of abortion was particularly high among women aged 20–29. State data from PMA2020 in 2018 indicate that just over one quarter (26 percent) of women aged 18–24 were married by aged 18, and 7 percent had already had a first birth by this age (PMA2020 2018). In India overall, the median age at sterilization among married women 15–49 years is 26 (IIPS and ICF 2017), and in Rajasthan just over two-thirds (67 percent) of married female contraceptive users reported female sterilization as their method of contraception (PMA2020 2018). Given the preponderance of early marriage and childbearing followed by sterilization, this finding is in line with the time in the reproductive lifecourse when we expect women to be at highest risk of an unintended pregnancy. A previous study among women who reported abortions in the state found that approximately 1 in 5 had terminated their pregnancies due to inadequate spacing (Elul 2004). These findings underscore the need for the state government to prioritize investments for the expansion of contraceptive services that pivot away from a longstanding focus on female sterilization alone to the provision of

short- and long-acting reversible contraceptive methods to women and couples who are inclined to delay or adequately space their pregnancies.

In multivariate analyses, we see inconsistent results between respondents and confidantes. Compared to women with no education, having any education among respondents was associated with increased odds of reporting a recent abortion. A similar association was not observed in the adjusted model of confidante-reported recent abortions. This discrepancy may indicate that the trend seen in the respondent data is an artifact of differential underreporting by educational status. On the other hand, women with no education may have less information on or access to abortion services, and hence have a greater propensity for having unintended births. Separately, education may also influence desire for and greater motivation to have fewer children. While respondent abortion incidence was higher among urban versus rural residents, this relationship did not reach statistical significance in the multivariate models. Existing policy prescriptions allow for abortion provision in primary health centers, which are geographically and financially most accessible to women, especially those residing in rural areas; however inadequate staffing of certified abortion providers in these facilities remains a key barrier to implementation, a problem that is likely to disproportionally affect access to facility-based care for rural residents.

Our findings on the safety of reported abortions for both respondents and confidantes indicate that a large minority (42 and 38 percent) were provided by a clinical provider using a recommended method, and over one quarter (28 percent) was obtained through a nonclinical source using medication abortion drugs. In the current context of poor facility-based care, women are increasingly accessing medication abortion drugs from pharmacies and chemist shops (primarily without prescriptions) and self-managing their pregnancy terminations. While more research is needed to understand women's experiences using these drugs and the quality of care associated with their informal provision in this context, in the absence of easy avenues to care in the formal health sector, women's informal access to these drugs has likely improved safety, as has been documented in other settings (Costa 1998; Miller et al. 2005).

A large minority of abortions (25 and 29 percent, respectively of respondent and confidantes) were in the most unsafe category, despite a liberal abortion law being in place since 1971, with adolescents aged 15–19 at significantly higher risk of a most unsafe abortion compared to other age groups, based on confidante data. These results are in line with the literature that highlights the general inadequacy of abortion service provision within the public sector in India for all women (Duggal & Ramachandran, 2004; Jejeebhoy et al. 2011; Stillman et al. 2014) and especially for adolescents (Sivakami and Rai 2019) given the taboo around their reproductive and sexual health needs, including in the context of early marriage (Santhya et al. 2010).

Our estimates of most unsafe abortions are significantly higher than the 2015 national estimate indicating that only 5 percent of abortions occurring outside health facilities were conducted using methods other than medication abortion drugs. A unique feature of our data is the individual-level information on the methods and sources women utilized to undergo an abortion throughout the process. In operationalizing abortion safety using these process-based measures, we integrate information on multiple methods use rather than relying only on the final method and source. Singh and colleagues employed a different estimation

approach altogether, not accounting for use of multiple methods, and using mifepristone distribution data to estimate the extent of medication abortions performed outside formal health care institutions. Separately, since our assessment of abortion safety is not restricted to a specific time period, our safety estimates include data on abortions that may have occurred prior to the expanded availability of medication abortion drugs in the retail health market. Finally, we cannot rule out bias due to misclassification. For women who reported using pills to terminate, we only categorized the use of mifepristone and misoprostol as recommended. However, some women who used medication abortion drugs may have been unable to specifically distinguish them as such, resulting in the misclassification of such abortions as most unsafe. Recategorizing "other pills" as recommended reduced the most unsafe category by nine and eight percentage points for respondents and confidantes, respectively, resulting in an equivalent increase in the recommended method/nonclinical source category. These lower estimates of most unsafe abortions (15.8 and 21.7) are still concerningly high for a country where abortion has been broadly legal since 1971. Separately, the categorization of most safe abortions was made on the basis of two assumptions: first that procedures conducted in public and private facilities were carried out by certified abortion clinical providers, and second that surgical procedures were compliant with current WHO-recommended methods (i.e., vacuum aspiration or dilatation and evacuation). Both these assumptions can contribute to misclassification resulting in an *over*estimation of most safe abortions, given our inability to assess—based on women's self-report—if an individual facility was certified or provider trained, and if surgery involved a recommended or outdated method (e.g., dilatation and curettage).

Among confidantes, having some higher education was associated with significantly reduced odds of experiencing a most unsafe abortion, compared to women with no education. More education may be linked to greater exposure to health information, better linkages with safer abortion sources, and more resources to obtain safer care. Similar trends were not seen among respondent reported abortions, which could be due to the smaller number of respondent self-reported abortions and consequently lower power, and/or differential underreporting by educational levels.

The Indian scenario surrounding abortion is also complicated by the practice of sex selective abortions on account of son preference (Jha et al. 2011). Fetal sex determination using diagnostic technology was made illegal under the Pre-Conception and Pre-Natal Diagnostic Techniques (PCPNDT) Act in 1994. In the ensuing period, media and public information campaigns have focused on drawing public attention to the illegality of sex determination to the exclusion of providing information on a woman's legal right to access safe abortion services (Nidadavolu and Bracken 2006). The lack of nuance in public messaging has contributed to poor understanding of the legality of abortion in India, and likely plays a role in influencing where women seek abortion care. With the targeting of abortion services in general (Potdar et al. 2015) and ongoing regulatory actions restricting availability of medication abortion drugs in the retail market (Chandrashekar et al. 2019), women in the state will likely be compelled to turn to unsafe methods, with serious implications on their health.

This study has a number of strengths. A key strength of this analysis is its use of data from a large, representative sample of reproductive aged women and their confidantes to capture population-level estimates of abortion incidence and safety in Rajasthan. While prior attempts to measure abortion incidence using indirect approaches in Rajasthan were not

successful (Elul 2004; Bell and Bishai 2019), our testing of the confidante approach resulted in higher estimates than those obtained through direct measurement, suggesting value in the use of a dual approach in this context. This analysis also incorporated appropriate analytical techniques to adjust for missing information and selection bias in the confidante data. The inclusion of a question on period regulation (at a time the woman was worried she was pregnant) in addition to one on pregnancy removal, as recommended in recent methodological guidance on abortion measurement (Sedgh and Keogh 2019), increased abortion reporting. Women may view these postcoital actions to regulate fertility as distinct and separate from abortion, perhaps because there is more ambiguity and less stigma associated with actions taken to regulate a period versus have an abortion (Bell and Fissell 2020). While there is potential for the period regulation question to capture nonabortions (for instance, emergency contraceptive use), we phrased both questions within the context of actions that women may take when they become pregnant at a time when they cannot or do not want to be pregnant, in order to minimize misreporting. Additionally, among respondents, current or previous use of emergency contraception was very low (0.05 percent) (Larson et al. 2020). With women's attention to menstrual regularity in the context of marital relationships, the widespread diffusion of medication abortion drugs, and growing access to pregnancy testing kits through community health workers, primary health centers, and pharmacies, we expect that we are capturing intentional actions taken to end a suspected or confirmed pregnancy, but this is an area where further investigation is warranted. In future surveys, the addition of a question on pregnancy testing, duration since last period, and inclusion of emergency contraception as an explicit option for the type of medication used can help establish validity of such alternative phrasing. We were also able to use individual-level process measures on method(s) and source(s) of abortion to construct safety estimates, providing insight into women's abortion-related experiences and the potential health risks attached.

This study is not without limitations. Although the confidante abortion incidence rates are significantly higher—and we believe closer to the true incidence—than those obtained via self-report, they likely remain underestimated. Differential underreporting or sharing of the abortion experience with respondents by background characteristics could result in associations and correlates of abortion and abortion safety being misrepresented. However, the similar patterns among respondents and confidantes suggests our conclusions may ultimately be correct even if exact levels are not since the confidante data may not suffer from the same differential underreporting concerns as the self-reported data. The confidante method assumes that the surrogate confidante sample is representative of reproductive-aged women. However, approximately 16 percent of respondents reported not having a confidante, and the confidante sample was, on average, more educated and marginally younger in age. We employed statistical approaches, described in detail elsewhere (Bell et al. forthcoming), which included reweighting the confidante sample using available data on sociodemographic characteristics to be representative of the distribution of respondents; however, we cannot rule out residual bias in the confidante sample due to unmeasured factors. Sample sizes of respondents and confidantes had low power to detect significant differences across socioeconomic groups among those who had an abortion. This study also collected limited details on the characteristics of confidantes, which restricts analyses by individual characteristics other than age and education. Separate from the issue of misclassification discussed earlier, the safety

distribution of the confidante data may be artificially skewed towards unsafe abortions if such abortions are disproportionately more visible (due to complications) than clandestine safer ones. Thus, while respondent self-reported data are prone to greater underreporting overall, the safety profile of these self-reported abortions may be more accurate than that of the confidantes. Finally, the efficacy (and hence safety) of the medication abortion regimen is affected by gestational age. In operationalizing abortion safety using process measures, we were unable to account for gestational age at abortion as this information was not collected in the survey.

This study provides support for a number of programmatic and research recommendations that have been put forth previously. Given the current regulatory framework, to better meet the future abortion care needs of women in the state, a key priority should be to improve the capacity of the public health sector to provide abortion services, particularly in primary-level facilities. Achieving population-level coverage of this essential reproductive health service will require expansion of existing training programs to increase the number of certified public providers, with accompanying measures to gradually build facility-level capacity to have adequate stocks of medication abortion drugs and necessary equipment for vacuum aspiration. For these technical improvements to be most effective, they will need to be accompanied by complementary strategies that combat misinformation and promote accurate knowledge of a woman's right to abortion services, up to the gestational age limit(s) specified by the newly amended MTP Act. Specifically, while raising awareness about the illegality of sex determination is important, the messaging of public campaigns and related actions need to be scrutinized to prevent miscommunication regarding the right to receive and provide abortion services. Additionally, proactive public health information on locations where women can access safe, and preferably free or subsidized health services can increase uptake of legal abortion care. Finally, the Indian context presents a unique setting to study pharmacy-based medication abortion provision and the mechanisms through which quality of care at the point of sale can be improved. The presence of pharmacies and chemist shops in both urban and rural areas, and the large role that their staff play in enabling access to medication abortion drugs, can be leveraged to test interventions to improve effective use of these drugs for self-managed abortions.

CONCLUSION

This study found the confidante approach yielded a significantly higher induced abortion incidence estimate than that obtained via self-report in a survey among reproductive age women in the Indian state of Rajasthan. This result lends credence to the assumption that many women know about their friends' abortion experiences and would be more willing to report on them than their own. However, the resulting estimates likely remain underestimates. Using process-related information on abortion method(s) and source(s), we found that a significant proportion of abortions used nonrecommended methods from nonclinical sources despite the legality of abortion in this context. Our findings provide further evidence that a liberal law, while necessary, is not sufficient to ensure the safety of induced abortions. We recommend programmatic actions to improve public provision of abortion services, specifically at the level of primary care, and suggest research opportunities for studying

and improving informal pharmacy-based distribution of medication abortion drugs for self-management.

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