BMJ Open

Estimating the visibility rate of abortion: a case study of Kerman, Iran

Maryam Zamanian,[1] Mohammad Reza Baneshi,[1] AliAkbar Haghdoost,[2] Farzaneh Zolala[2]

To cite: Zamanian M, Baneshi MR, Haghdoost AA, *et al*. Estimating the visibility rate of abortion: a case study of Kerman, Iran. *BMJ Open* 2016;**6**:e012761. doi:10.1136/bmjopen-2016-012761

▸ Prepublication history for this paper is available online. To view these files please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2016-012761).

Received 24 May 2016
Revised 18 August 2016
Accepted 14 September 2016

[1]Modeling in Health Research Center, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran
[2]HIV/STI Surveillance Research Center, and WHO Collaborating Center for HIV Surveillance, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran

Correspondence to
Dr Farzaneh Zolala;
zolalafarzaneh@gmail.com

ABSTRACT

Objectives: Abortion is a sensitive issue; many cultures disapprove of it, which leads to under-reporting. This study sought to estimate the rate of abortion visibility in the city of Kerman, Iran—that is, the percentage of acquaintances who knew about a particular abortion. For estimating the visibility rate, it is crucial to use the network scale-up method, which is a new, indirect method of estimating sensitive behaviours more accurately.

Materials and methods: This cross-sectional study was conducted in Kerman, Iran using various methods to ensure the cooperation of clinicians and women. A total of 222 women who had had an abortion within the previous year (74 elective, 74 medical and 74 spontaneous abortions) were recruited. Participants were asked how many of their acquaintances were aware of their abortion. Abortion visibility was estimated by abortion type. 95% CIs were calculated by a bootstrap procedure. A zero-inflated negative binomial regression analysis was conducted to assess the variables related to visibility.

Results: The visibility (95% CI) of elective, medical and spontaneous abortion was 8% (6% to 10%), 60% (54% to 66%) and 50% (43% to 57%), respectively. Women and consanguineal family were more likely to be aware of the abortion than men and affinal family. Non-family members had a low probability of knowing about the abortion, except in elective cases. Abortion type, marital status, sex of the acquaintance and closeness of the relationship were the most important determinants of abortion visibility in the final multifactorial model.

Conclusions: This study shows the visibility rate to be low, but it does differ among social network members and by the type of abortion in question. This difference might be explained through social and cultural norms as well as stigma surrounding abortion. The low visibility rate might explain the low estimates of abortion rates found in other studies.

Strengths and limitations of this study

- This is a rare study estimating abortion visibility in Iran—as well as in the rest of the world; the results could draw policy makers' attention to appropriate policies by providing a more realistic picture of abortion.
- The most important challenge faced in this study was low participation from women who had abortions and reproductive health providers because of stigma and severe legal restrictions. As a result, we tried to encourage their participation using different strategies.
- We were unable to assess other cases of abortion (eg, women who used traditional and herbal medicines, as well as cases performed by non-medical providers or the woman herself). The visibility of abortion in such cases may be different from the cases we considered.

INTRODUCTION

Self-reporting and direct methods of measuring health events are prone to high levels of under-reporting bias. This bias is much more common for behaviours that are sensitive or subject to social disapproval, occurring more often among women.[1 2] Abortion can be classified as a sensitive issue because of the high level of stigma related to it and legal restrictions in many communities.[3]

Abortion can be divided into two overarching categories, spontaneous and induced, with the latter further divided into two types, medical and elective.[4] Medical abortion is performed in cases of fetal anomaly or to safeguard the mother's health, whereas elective abortion is performed at the request of the mother for other than therapeutic reasons. Elective abortion, which has also been called intentional, criminal or illegal abortion, garners greater stigma in many societies.[3 5] Stigma causes women to hide their experience of abortion from acquaintances and healthcare providers.[6] Even in communities where abortion is legal, a comparison of medical records and self-reported abortion rates shows a high discrepancy of ~70%.[7] This rate may be much higher in societies where abortion is illegal, which results in under-reporting and unsafe abortions that can jeopardise the mother's life.[8]

Iran—a Middle Eastern country governed by the Islamic state—culturally, religiously

and legally prohibits elective abortion. Because of these conditions, many elective abortions are performed at home or under unsafe conditions,[9] which could lead to the mother's death or irreparable complications.[3] These abortions can never be registered if they are performed successfully, and, in cases of referral to a hospital for a critical complication endangering the mother's health, the mothers often report spontaneous abortion rather than elective.[9] In addition, a new population growth policy in Iran is encouraging families to have more children, as the Iranian population has declined in recent years.[10] This, in turn, could increase legal restrictions and ultimately lead to even more under-reporting of abortion. Last but not least, not all cases of spontaneous abortion are recorded in the registration system.[5]

While the data derived from direct survey methods and from the registration system represent just the tip of the iceberg, an accurate estimate of abortion is necessary to inspire more effective planning and policymaking to reduce unsafe abortion and to improve maternal health. Such an estimate is also needed for purposes such as accurate estimation of pregnancy rates, levels of unintended pregnancy (UP) (UP itself includes two main categories: unwanted pregnancy and mistimed pregnancy) and contraceptive failure rate.[11]

How can better estimates for sensitive issues be obtained? An effective alternative method to self-reporting and direct techniques is the network scale-up (NSU) method, an indirect technique. In this method, a representative sample of the general population is questioned about the number of the target population in their active social network—it does not require direct questioning of the target population.[12] For example, the participants are asked, 'among your acquaintances, how many women have had abortion experiences?' This indirect and anonymous question could desensitise the respondents to the topic and increase response rates and accuracy for two reasons: first, the question is not directly about the respondents themselves but about other people; second, they are not required to name those acquaintances or their relation to them; they merely provide the number.[12 13] The NSU method is based on the idea that the proportion of individuals known by participants is linearly proportional to the real size of the same subpopulation in the society.[12] However, one of the basic NSU assumptions, perfect awareness of their acquaintances' behaviours, is often not met; hence, visibility bias remains a major source of bias in estimations of hard-to-count populations.[14]

Visibility bias describes respondents not being aware of all the behaviours among their active social network. This occurs more often for stigmatised or illegal behaviours. For example, respondents may not be aware of abortions that have happened in their network.[15] In the case of the NSU method, the obtained crude estimate should be adjusted accordingly. For example, if the visibility of a hidden behaviour was estimated at 50%, the NSU method's crude estimate should be doubled. Thus far, visibility rates have been estimated for hidden populations such as men who have sex with men (MSM), injection drug users (IDUs) and commercial sex workers (CSWs), as well as for certain types of cancer.[12 16–18] Only one study has estimated the visibility of abortion by asking gynaecologists and midwives to guess the visibility rate of abortion.[19] However, to the best of our knowledge, no study has used the standard method to estimate the abortion visibility (AV) rate. Therefore, in this study, we sought to estimate the visibility rate and its determinants for all types of abortion in an Iranian population to provide a more accurate estimate of abortion.

METHODS

Study setting and study population

This cross-sectional study was part of a larger ongoing study in Kerman, Iran in 2015, the primary aim of which was to estimate the frequency of abortion. Kerman is the capital of the largest province of Iran and is located in the southeastern part of the country. Eligible participants were female residents of Kerman over the past 5 years who had a history of abortion during the previous year. A total of 222 women who had an abortion of any type within the previous year (74 elective, 74 medical and 74 spontaneous) were recruited. To obtain the study sample, both private and public centres were approached, including referral hospitals, private offices of gynaecologists and midwives. The critical factor in this study was gaining the trust of the reproductive health providers, so that they felt comfortable cooperating with data collection for elective abortion cases. This was difficult owing to the severe legal restrictions on abortions in Iran. Therefore, we held several meetings to explain the study method and assure them that their confidentiality and anonymity were paramount. They were also provided with financial incentives. Subsequently, these providers introduced us to women who had had an abortion and consented to be interviewed. Most participants were interviewed in person, but 33 (~15%) were interviewed on the phone to further protect their privacy. After explaining the purpose of the study to the participants, reassuring them of their anonymity and the confidentiality of information, and obtaining verbal informed consent, we were permitted to collect data.

To obtain a sample of non-elective abortions—participants whose medical records listed a medical or spontaneous abortion within the previous year—we sought the help of gynaecologists and midwives in referral hospitals throughout the city. These participants were interviewed after they provided verbal consent. Written consent forms were not used owing to the cultural sensitivity of this topic and to help increase both participation and accuracy of responding.[20] All interviews were conducted in a private room at the same centre. Despite all these safeguards, the participation rates for elective,

medical and spontaneous abortions were 39%, 70% and 62%, respectively. We are cognisant that non-random sampling and the relatively low response rate for elective cases, which were almost unavoidable, could affect the generalisability of the results; therefore, the estimated AV rate cannot be generalised to the whole population of women living in Kerman. The data were collected using a structured interview instrument administered by a trained female interviewer. The study protocol was approved by the ethics committee of Kerman University of Medical Sciences (ir.kmu.rec.1394.223).

Data collection

The interview form included four sections. The first provided an overview of the study and its objectives. In the second, a table listed the participant's active social network relationships in the rows. In the NSU method, the standard definition of an active social network is 'people whom you know and who know you by name, with whom you can interact, if needed, and with whom you have had contact over the last two years personally, or by telephone or e-mail'.[12 13] For ease of recall and therefore increased accuracy, we divided the entire active social network into a list of comprehensive relationships and two main categories: family and non-family. The family group included consanguineal[1] and affinal[2] family. Both consanguineal and affinal family included two subgroups: immediate family (sometimes known as first-degree relatives, including parents, siblings and children) and extended family (including grandparents, aunts, uncles, cousins, nieces, nephews, etc). The non-family group included male and female friends from school, friends from university, friends from their neighbourhood, acquaintances from work, acquaintances from their husband's work, friends of their husband and other friends or acquaintances. The table included three columns (A, B and C). The first (column A) tallied the total number of persons from each relationship. The next column (B) indicated the number of adults (persons 18 years old and over) from each relationship, and the last (column C) indicated the number of adults who were aware of the abortion. (Participants were not asked about the awareness of those under 18 years old because any lack of knowledge on their part is more likely due to their age than to a low visibility rate.) Participants were prompted with questions such as 'How many cousins do you have? How many of them are adults? And how many of these adults are aware of your abortion?'.

The third section assessed the abortion type. In addition, participants were asked whether their pregnancy was intended (planned), why the pregnancy was unintended, the number of children they already have, any previous pregnancies, age, marriage age, marital status, career, husband's career, and their level of education.

The last section included more sensitive questions. This section included questions to be completed in cases of elective abortion (such as the reason for the abortion, whether the man involved in the pregnancy (MIP) was aware and consented to the abortion, and what their marital status was at the time of the abortion). A self-completion form and a ballot box were used for this section in order to maintain the participant's privacy and to improve the accuracy of the data. The form was piloted in two studies and revised accordingly to increase acceptability and comprehension.

Data analysis

We estimated AV using formula (1):

$$\mathrm{AV} = \frac{\text{the total number of adults who were aware of abortion}}{\text{the total number of adults in respondent's social network}} \quad (1)$$

AV and 95% CI were estimated for each type of abortion and by different subgroups divided by abortion type (table 1 and figure 1). The 95% CIs were computed by a bootstrapping procedure, drawing 1000 independent samples with replacement. The calculations for AV and 95% CI were performed separately for different demographic characteristics.

A zero-inflated negative binomial regression analysis was used to model the potential determinants of AV because so many acquaintances were not aware of the abortion, generating excess zero responses, and because of the large difference between the mean and variance of the data. To adjust for the correlation between each participant's responses about the members of her network, each participant was defined as a cluster layer, and cluster robust SE was used. Potential determinants of AV were tested in univariate analyses, and those with p values less than 0.2 were entered into a multifactorial model using backward elimination variable selection. We performed these analyses for each type of abortion separately; the results were similar in terms of effect sizes and levels of significance. Hence, we performed one regression for all of the data (including all types of abortion). The analyses were performed using Stata software (V.11.2) and Microsoft Excel (2007).

RESULTS

In this study, 222 women with a history of abortion in the previous year, including elective, medical and spontaneous abortions (74 cases of each type), were recruited. The mean (SD) age of elective, medical and spontaneous abortion cases was 31.4 (7.8), 29.0 (5.1) and 29.1 (6.5), respectively, and the respondents' mean years of education were 13.9, 12.6 and 11.8 years, respectively. The employment percentages were 31.1, 23.0 and 14.9 for respondents who had had elective, medical and spontaneous abortions, respectively. While

[1]Blood-related family.
[2]Marriage-related family, also called in-laws—that is, the husband's relatives.

Table 1 Abortion visibility by demographic characteristics

Variable	Category	Elective abortion		Medical abortion		Spontaneous abortion	
		n (%)	AV% (95% CI)	n (%)	AV% (95% CI)	n (%)	AV% (95% CI)
Age	18–35	51 (69)	9 (6 to 11)	67 (91)	61 (55 to 67)	61 (82)	48 (41 to 56)
	>35	23 (3)	7 (5 to 9)	7 (9)	45 (28 to 62)	13 (18)	58 (41 to 75)
Marital status	Married	61 (82)	8 (6 to 11)	74 (100)	60 (54 to 66)	74 (100)	50 (43 to 57)
	Single/divorced/ widowed	13 (18)	5 (2 to 7)	0 (0)	–	0 (0)	–
Job	Housewife	30 (41)	9 (6 to 13)	55 (74)	64 (54 to 68)	61 (82)	50 (43 to 57)
	Employee	15 (20)	9 (5 to 14)	10 (14)	53 (38 to 68)	7 (10)	53 (24 to 82)
	Student	21 (28)	5 (4 to 6)	2 (3)	46 (0 to 94)	2 (3)	44 (6 to 81)
	Self-employed	8 (11)	9 (2 to 17)	7 (9)	68 (58 to 79)	4 (5)	46 (4 to 88)
Husband's job	Employee	26 (43)	5 (4 to 7)	30 (40)	53 (45 to 62)	17 (23)	56 (40 to 71)
	Worker	2 (3)	17 (0 to 37)	3 (4)	94 (55 to 100)	7 (9)	55 (28 to 83)
	Self-employed	29 (47)	10 (6 to 14)	39 (53)	64 (55 to 72)	50 (68)	47 (39 to 55)
	Unemployed	4 (7)	9 (2 to 17)	2 (3)	64 (64 to 64)	0 (0)	
Education	≤9 years	11 (15)	10 (6 to 14)	18 (24)	61 (49 to 74)	22 (30)	54 (42 to 67)
	12–16 years	52 (705)	8 (6 to 11)	51 (69)	60 (53 to 68)	50 (67)	50 (42 to 59)
	≥18	11 (15)	5 (3 to 7)	5 (7)	53 (27 to 78)	2 (3)	24 (0 to 60)
Husband's education	≤9 years	14 (23)	10 (6 to 15)	22 (30)	67 (55 to 78)	27 (37)	46 (37 to 56)
	12–16 years	35 (57)	9 (5 to 12)	50 (67)	58 (52 to 65)	44 (59)	54 (45 to 63)
	≥18	12 (20)	6 (4 to 7)	2 (3)	28 (0 to 58)	3 (4)	35 (0 to 87)
Number of children	0	28 (38)	7 (4 to 11)	13 (18)	59 (45 to 72)	9 (12)	56 (34 to 77)
	≥1	46 (62)	8 (6 to 11)	61 (82)	60 (53 to 67)	65 (88)	50 (42 to 57)
Pregnancy type	Unintended	72 (97)	8 (6 to 10)	7 (9)	61 (50 to 72)	14 (19)	43 (25 to 60)
	Intended	2 (3)	8 (4 to 12)	67 (91)	60 (53 to 66)	60 (81)	52 (44 to 59)
Number of unintended pregnancies	0	9 (12)	6 (4 to 9)	58 (78)	63 (56 to 70)	49 (66)	53 (44 to 62)
	1	46 (62)	7 (5 to 10)	12 (16)	50 (39 to 61)	21 (28)	48 (35 to 60)
	≥2	19 (26)	10 (5 to 15)	4 (6)	48 (28 to 68)	4 (6)	31 (10 to 51)
Sex of acquaintances	Male	843 (48)	5 (4 to 7)	858 (51)	49 (42 to 56)	914 (51)	39 (32 to 46)
	Female	900 (52)	10 (8 to 13)	836 (49)	70 (64 to 76)	881 (49)	60 (53 to 68)
Closeness of relationship	Husband	63 (3)	90 (83 to 98)	74 (4)	100	74 (4)	100
	Immediate family*	364 (21)	23 (18 to 29)	295 (17)	95 (92 to 99)	361 (20)	92 (89 to 96)
	Extended family†	866 (50)	2 (1 to 4)	723 (43)	65 (57 to 73)	866 (46)	47 (39 to 55)
	Non-family	450 (26)	10 (7 to 13)	602 (36)	41 (34 to 48)	450 (30)	39 (29 to 49)

*Immediate family of consanguineal and affinal family.
†Extended family of consanguineal and affinal family.
AV, abortion visibility.

all of the women with medical and spontaneous abortions were married, the corresponding figure was 82.4% for elective abortions; 9.5% of these participants were single, and 8.1% were divorced or widowed. While pregnancies ending in spontaneous and medical abortions were mainly intended (90.5% and 81.1%, respectively), most pregnancies terminated by elective abortion were unintended, with some of those being unwanted (31.1%) and mistimed (27.1%) pregnancies (table 2). Elective abortions were conducted mainly with the agreement of both parents (66.2%). However, 31.1% were undertaken based only on the mother's wishes, and, in one-third of these cases, the MIP was not informed about the abortion. The remainder of the abortions were performed based only on the wish of the MIP (2.7%).

The number of family members in the participants' social networks totalled 25 974, consisting of 60% adults. Of the adults, 20% were immediate family members and 80% were extended family members. The corresponding figure for non-family adults was 6609. The average percentage of each subgroup in a participant's active social network was husband 1%, consanguineal family 42%, affinal family 27%, and non-family members 30%. The sex ratio of the participants' active social network was 48% male to 52% female (table 1).

The visibility (95% CI) of elective, medical and spontaneous abortion was 8% (6% to 10%), 60% (54% to 66%) and 50% (43% to 57%), respectively (figure 1A). All abortion types were much more visible to husbands than to other members of the active social network (in the case of elective abortion, the difference between husbands and other members of the network was much higher than for the other two types of abortion) (figure 1B). The visibility of all abortion types was lower for non-family than for family, except for elective abortions,

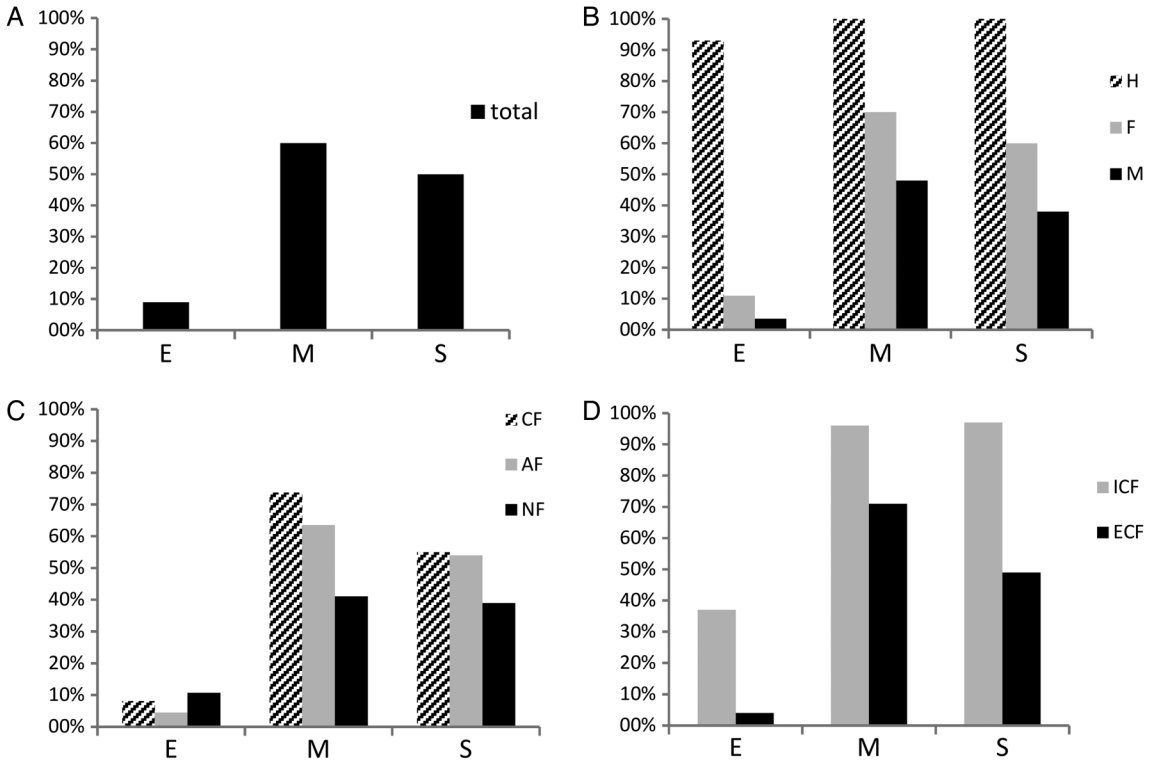

Figure 1 Abortion visibility in the city of Kerman, in 2015, divided by abortion type. (A) Abortion visibility, divided by abortion type. (B) Comparison of abortion visibility among women's husbands and female and male members of their social network, divided by abortion type. (C) Comparison of abortion visibility among women's consanguineal family, affinal family and non-family, divided by abortion type. (D) Comparison of abortion visibility among women's immediate and extended consanguineal family, divided by abortion type. The y axis shows abortion visibility as a percentage, which is calculated by dividing the number of adults who were aware of the abortion by the total number of adults listed in any given category. E, elective; M, medical; S, spontaneous; H, husband; F, females; M, males; CF, consanguineal family; AF, affinal family; NF, non-family; ICF, immediate consanguineal family; ECF, extended consanguineal family.

Table 2 Elective abortion visibility divided by the reason for abortion

Reason for abortion	n (%)	AV% (95% CI)
Mistimed*	20 (27.1)	8 (5 to 11)
Unwanted*	23 (31.1)	8 (6 to 10)
Illegitimate pregnancy*†	13 (17.6)	5 (3 to 7)
'Aghd' period pregnancy*‡	12 (16.2)	8 (1 to 15)
Sex-selective abortion§	2 (2.7)	¶
Financial problems*	1 (1.3)	¶
Husband addiction*	3 (4.0)	¶

*Unintended pregnancy.
†Pregnancy outside of marriage.
‡Pregnancy in girls whose marriages are legally recorded but they do not yet share accommodation with their husbands.
§Intended pregnancy.
¶Not calculated because of small sample size.

which were more visible to non-family than to family (figure 1C). The visibility of all types of abortion was higher for consanguineal family than for affinal family (although this difference was smaller for spontaneous abortion) (figure 1C); among consanguineal family members, all abortion types were more visible to immediate family than to extended family (but in elective cases, this difference was much higher than for the other two types) (figure 1D). With the exception of the husband, abortion was always more visible to women than to men in participants' networks (figure 1B). The difference in visibility between women and men who were immediate consanguineal family was not sizable for medical and spontaneous abortions, but the difference was high for elective abortion (55% for women vs 13% for men), meaning mothers and sisters were more likely to know about elective abortions than fathers and brothers.

In the univariate analysis, the visibility of abortion was not significantly (at the 0.2 level) associated with the participant's age and education or with the husband's occupation and education (results not shown). Therefore, these variables were not included in the multifactorial analysis. The number of children did not remain significant after adjustment for other variables in the multifactorial analysis.

The final multivariate model—after being adjusted for potential factors and backward elimination—showed that non-elective abortions were approximately twice as visible as elective ones (medical abortion was 98% (95%

Table 3 Determinants of abortion visibility

Determinant	Crude		Adjusted after backward elimination		
	RR	95% CI	RR	95% CI	p Value
Abortion type (Ref: elective)					
Medical	2.05		1.98		<0.0001
Spontaneous	2.04	1.66 to 2.50	1.96	1.56 to 2.46	<0.0001
Marriage status (Ref: married)					
Unmarried	0.22	0.15 to 0.32	0.34	0.22 to 0.52	<0.0001
Number of children (Ref: 0)					
≥1	1.09	0.97 to 1.23			
Job (Ref: housewife)					
Employee	0.97	0.85 to 1.12	1.02	0.90 to 1.15	0.733
Student	0.72	0.54 to 0.96	0.83	0.67 to 1.02	0.083
Self-employed	1.07	0.95 to 1.19	1.14	1.03 to 1.27	0.012
Sex of acquaintances (Ref: male)					
Female	1.09	1.04 to 1.14	1.19	1.13 to 1.26	<0.0001
Closeness of relationship (Ref: non-family)					
Husband	1.59	1.44 to 1.75	1.91	1.69 to 2.18	<0.0001
Immediate family*	1.46	1.33 to 1.60	1.47	1.34 to 1.62	<0.0001
Extended family†	1.22	1.11 to 1.34	1.13	1.03 to 1.24	0.007
Number of unintended pregnancies (Ref: 0)					
1	0.87	0.78 to 0.97	0.83	0.72 to 0.95	0.006
≥2	0.72	0.59 to 0.89	0.7	0.57 to 0.88	0.002
Pregnancy type (Ref: unintended)					
Intended	1.26	1.10 to 1.46	0.83	0.70 to 0.98	0.025

*Immediate family of consanguineal and affinal family.
†Extended family of consanguineal and affinal family.
AV, abortion visibility; RR, rate ratio; Unmarried, single/divorced/widowed.

CI 1.58 to 2.48) and spontaneous abortion 96% (95% CI 1.56 to 2.46) more visible than elective abortion). In addition, the abortions of unmarried women were 66% (95% CI 0.22 to 0.52) less visible than those of married women. The abortions of self-employed women were 14% (95% CI 1.03 to 1.27) more visible than those of housewives. Abortions of intended pregnancies were 17% (95% CI 0.70 to 0.98) less visible than those of UPs, yet increasing the number of UPs decreased visibility (1 UP vs 0 UPs was 17% (95% CI 0.72 to 0.95) less visible and two or more UPs vs 0 UPs was 30% (95% CI 0.57 to 0.88) less visible).

Among acquaintances, compared with men, women were 19% (95% CI 1.13 to 1.26) more informed about abortions. Compared with non-family members in active social networks, the husband, immediate family members and extended family members were 91% (95% CI 1.69 to 2.18), 47% (95% CI 1.34 to 1.62) and 13% (95% CI 1.03 to 1.24) more informed about abortions (table 3).

DISCUSSION

This study found that the visibility of abortion, particularly elective abortion, was very low in Kerman in 2015. Of all members of the participants' active social networks, their husbands had a very high probability of being informed about the abortion. In addition, women and consanguineal family were more likely to be informed of the abortion than men and affinal family. Non-family members had a low probability of being informed, yet non-family had the highest possibility of being informed of elective abortions. Other factors affecting visibility were marital and employment status, as well as the type of pregnancy and frequency of UPs.

To the best of our knowledge, only one study in the world has estimated the visibility of abortion, but it used a different method: Rastegari and coworkers[19] used gynaecologists' and midwives' guesses to calculate the visibility rate of abortion in Iran. Their study estimated visibility at 20–34% for elective abortion (termed abortions without medical indications), which was higher than our estimate, and 43–75% for other types of abortion (termed abortions with medical indications), which was similar to our estimate but had wide variability and did not differentiate between spontaneous and medical abortions. Although that study was the first attempt to estimate AV, it is reasonable to suppose that this issue is best sourced not from clinicians but by the woman herself, as she knows far more about her own pattern of disclosure. Another study in Iran used a method similar to that used in this study to estimate the visibility of cancer, finding a cancer visibility rate of 86%.[18] Other studies have estimated visibilities of 1.4 for MSM in Japan, 76 for IDUs in Brazil, and 24, 57 and 34 for MSM, IDUs and CSWs, respectively, in Ukraine.[12 16 17] The observed differences in these visibility rates indicate variation in the stigma of each behaviour in different cultures. The visibility rate of abortion in this study was similar to, or even lower than, those of other

stigmatised behaviours, which highlights that abortion is highly stigmatised in the study setting.

The rest of the literature has mainly compared self-reporting and medical record data, and they have also concluded that abortions are under-reported.[21 22] These studies have shown that most women who have a history of abortion (listed in their medical records) did not self-report the abortion. This is the case even in countries where there are no legal restrictions for abortion.[7] Abortion under-reporting, which could be an indicator of low AV, in addition to the sensitive nature of sexual matters such as abortion, is also due to social, cultural, religious and legal factors that are more pertinent in traditional, religious countries such as Iran. In Iran, sexual relationships outside marriage are highly stigmatised, particularly for women.[9] Hence, the stigma related to abortion differs by marital status. Married women are stigmatised for elective abortion because it is against religious law.[9] However, women who experience non-elective abortions could be labelled infertile or could be blamed by others.[23 24] In Iran, the expression 'ojagh koor' (which has a negative meaning and is pejorative) is applied to both men and women who are unable to have children. 'This metaphoric expression is according to popular belief in Iran that an infertile couple will never have a house with a 'warm kitchen' (ojaghe koor)'.[23] As a result, many women hide their abortions from acquaintances. This might also explain the low visibility of intended pregnancies leading to abortion compared with UPs. On the other hand, a higher number of previous UPs decreased the level of visibility. Recently, Iranian families have tended to consider fewer children as a sign of higher social class;[10] therefore, informing others about repeated UPs could decrease their social standing and lead to humiliation for violating childbearing norms.

Unmarried women (single, divorced and widowed) tell a very different story; having sexual relationships outside marriage is the main reason for the stigma attached to abortions, regardless of the type. This stigma can be very devastating and can disrupt a person's life. For example, a pregnant single woman may lose the chance to be married and have a normal social life. This could even disgrace her family name. She is very likely to be blamed, rejected and subjected to physical or mental punishment by acquaintances.[9] The social stigma of abortion for unmarried women is much heavier than for married women, which explains the lower visibility in these women. Severe social stigma exists even for girls whose marriages are legally recorded but who do not yet share accommodation with their husbands and during which they still live with their parents (the 'Aghd' period). In this period, there is no legal restriction against having a sexual relationship with her husband and getting pregnant; however, from a traditional point of view, they should abstain from sexual activity until they share accommodation.[9] These norms could explain the low visibility observed for this group. Furthermore, current Iranian rules based on Islamic laws prohibit elective abortion, and there are legal penalties for reproductive health providers who perform abortions.[3 9] A new Iranian population growth policy[10] could enforce such restrictions, which could ultimately decrease AV further.

The visibility of abortion was significantly higher among self-employed women, those with no affiliation with the government. As abortion is unlawful, women who have government jobs might perceive it as a threat to their job, which would lead them not to disclose it and be more conservative than self-employed women. Moreover, in self-employed professions, such as hair styling, women might have more opportunities to speak with other women and to talk about personal issues[25] than do women in government jobs.

The highest AV was observed for husbands. This is due to his special position as the MIP and the provider of support for the woman in such a situation.[9] However, ~10% of elective abortions were performed without informing the MIP. This could be explained by the father's religious prejudice or by different levels of involvement in the tasks of childbearing: in many societies, such as Iran, women are more often thought to be solely responsible for this task.[9] Other studies conducted in Iran have also found that men were less satisfied with their wives' terminating UPs and that women who had failed to gain their husband's consent were likely to obtain an abortion without.[9] With the exception of their husband, the women in this study were more likely to disclose their abortion to women than men. Other studies report that, in general, female-to-female disclosure is higher than female-to-male disclosure.[26] Moreover, the shame of disclosing sexual and reproductive issues to members of the opposite gender contributes to different levels of disclosure between men and women. Furthermore, the women disclosed their abortions to more consanguineal family members than affinal family members, which might be due to women being more likely to be blamed by affinal families than by consanguineal families.[24 27] However, in the case of elective abortions, the participants were more likely to disclose their abortion to non-family members than to family members, even consanguineal family members (which are the closest family members). This difference may be because women trust their peers and very close friends enough to disclose sensitive personal issues;[28 29] in addition, family members might be more likely than non-family members to want to prevent women from obtaining an elective abortion.

Strengths and limitations

We acknowledge that our study has several limitations; the most important challenge in this study was the low participation rates of women who had had abortions and reproductive health providers. Reproductive health providers were often unwilling to cooperate because of the severe legal restrictions on abortion in Iran. As a

result, we tried to encourage their participation using different strategies, such as holding meetings to explain the study method, assuring them of confidentiality and anonymity protection, and providing financial incentives. We also had difficulty obtaining women's consent to participate, particularly in cases of elective abortion and for unmarried women. Sometimes women who had been introduced by the midwife or gynaecologist as a patient who had obtained an elective abortion denied the intentionality of the abortion; the midwife or gynaecologist had to reassure them of the confidentiality of the study.

Furthermore, it is very common in Iranian society to use herbal medicines that do not require prescriptions. We have not assessed these traditional methods of abortion, nor have we considered abortions performed by non-medical providers or by the woman herself. The visibility of abortion in such cases might differ from that of other cases, perhaps affected by factors such as low socioeconomic status because of the high costs of elective abortion services.

We also note two points for consideration, although they do not affect the level of visibility. The first is the possibility of recording elective abortions as non-elective (if the physician and patient agree to do so).[9] However, this did not affect our results for visibility because these women pretended their abortion was medical, and their disclosing behaviour is similar to that of women who had had a medical abortion. The second point is that some married women who became pregnant outside of marriage and thus obtained an elective abortion may have reported it as an unwanted or mistimed pregnancy. This could affect the classification of the reasons for abortion but not the visibility.

Despite these limitations, this is one of the rare studies estimating AV in Iran, or even the world. It can be considered a first step in highlighting the extent of the problem in a developing and traditional society, and even beyond such societies; the results could direct policymakers to appropriate policies by providing a more realistic picture of abortion.

CONCLUSION

In this study, AV was low, but differed among social network members and by the type of abortion. This difference might be explained by social and cultural norms and the stigma surrounding abortion. The low visibility rate that we observe might explain the low estimates of abortion rates found in other studies, and this issue should be considered by policymakers when planning women's healthcare services.

Contributors MZ collected the data. MZ, MRB and AAH analysed the data. MZ and FZ wrote the manuscript. All the authors approved the final version of the manuscript.

Competing interests None declared.

Ethics approval Ethics committee of Kerman University of Medical Sciences.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

REFERENCES

1. Glynn JR, Kayuni N, Banda E, *et al*. Assessing the validity of sexual behaviour reports in a whole population survey in rural Malawi. *PLoS ONE* 2011;6:e22840.
2. Moseson H, Massaquoi M, Dehlendorf C, *et al*. Reducing under-reporting of stigmatized health events using the List Experiment: results from a randomized, population-based study of abortion in Liberia. *Int J Epidemiol* 2015;44:1951–8.
3. Erfani A, McQuillan K. Rates of induced abortion in Iran: the roles of contraceptive use and religiosity. *Stud Fam Plann* 2008;39:111–22.
4. Veisi F, Zanganeh M. The causes of illegal abortions and their methods in outpatient clinics of Kermanshah University of Medical Sciences. *Sci J Forensic Med* 2012;18:47–52.
5. Abbasi M, Gooshki ES, Allahbedashti N. Abortion in Iranian legal system: a review. *Iran J Allergy Asthma Immunol* 2013;13:71–84.
6. Moore AM, Jagwe-Wadda G, Bankole A. Men's attitudes about abortion in Uganda. *J Biosoc Sci* 2011;43:31–45.
7. Jagannathan R. Relying on surveys to understand abortion behavior: some cautionary evidence. *Am J Public Health* 2001;91:1825–31.
8. Grimes DA, Benson J, Singh S, *et al*. Unsafe abortion: the preventable pandemic. *Lancet* 2006;368:1908–19.
9. Shahbazi SH, Fathizadeh N, Taleghani F. The process of illegal abortion: a qualitative study. *Payesh* 2011;10:183–95.
10. Mohammadi E, Nourizadeh R, Simbar M. Understanding reasons why women facing unintended pregnancy seeking for abortion: a qualitative study. *Payesh: Journal of Iranian Institute for Health Sciences Research* 2014;13:413–24.
11. Reporting of induced and spontaneous abortion in the 2002 National Survey of Family Growth. Bethesda, MD: National Center for Health Statistics National Survey of Family Growth Research Conference, 2006.
12. Paniotto V, Petrenko T, Kupriyanov O, *et al*. *Estimating the size of populations with high risk for HIV using the network scale-up method*. Ukraine: Kiev International Institute of Sociology, 2009.
13. Killworth PD, Johnsen EC, McCarty C, *et al*. A social network approach to estimating seroprevalence in the United States. *Soc Netw* 1998;20:23–50.
14. Jackson D, Kirkland J, Jackson B, *et al*. Social network analysis and estimating the size of hard-to-count subpopulations1. *Connections* 2005;26:49–60.
15. Rwanda Biomedical Center/Institute of HIV/AIDS DPaCDRI, School of Public Health (SPH), UNAIDS, and ICF International. *Estimating the Size of Populations through a Household Survey*. Calverton, Maryland, USA: RBC/IHDPC, SPF, UNAIDS, and ICF International, 2012.
16. Salganik MJ, Mello MB, Abdo AH, *et al*. The game of contacts: estimating the social visibility of groups. *Soc Networks* 2011;33:70–8.
17. Ezoe S, Morooka T, Noda T, *et al*. Population size estimation of men who have sex with men through the network scale-up method in Japan. *PLoS ONE* 2012;7:e31184.
18. Molavi Vardanjani H, Baneshi MR, Haghdoost A. Cancer visibility among Iranian familial networks: to what extent can we rely on family history reports? *PLoS ONE* 2015;10:e0136038.
19. Rastegari A, Baneshi MR, Haji-maghsoudi S, *et al*. Estimating the annual incidence of abortions in Iran applying a network scale-up approach. *Iran Red Crescent Med J* 2014;16:e15765.
20. Zolala F. Exploring routine data collection systems in Iran, focussing on maternal mortality and using the city of Bam as a case study. The University of Edinburgh, 2011.
21. Anderson BA, Katus K, Puur A, *et al*. The validity of survey responses on abortion: evidence from Estonia. *Demography* 1994;31:115–32.
22. Jones EF, Forrest JD. Use of supplementary survey of abortion patients to correct contraceptive failure rates for underreporting of abortion. New York: United Nations. Department of International Economic and Social Affairs, Measuring the Dynamics of Contraceptive Use,1991:139–52.

23. Mojtaba Shahnooshi ZK. The social consequences of infertility on family in Isfahan. *Soc Sci* 2011;4:171–98.
24. Behboodi-Moghadam Z, Salsali M, Eftekhar-Ardabily H, *et al*. Experiences of infertility through the lens of Iranian infertile women: a qualitative study. *Jpn J Nurs Sci* 2013;10:41–6.
25. Flaherty DG. Telling our stories: a phenomenological study of the leader's gendered experience of self-disclosing. Antioch University, 2006.
26. Derlaga VJ, Berg JH. *Self-disclosure: Theory, research, and therapy*. Springer Science & Business Media, 2013.
27. Choi WMA, Chan KL, Brownridge DA. Unraveling in-law conflict & its association with intimate partner violence in Chinese culture: Narrative accounts of Chinese battered women. *Womens Health Urban Life* 2010;9:72–92.
28. Draper M. Self-Disclosure and Friendship Closeness Michael Draper, Rachel Pittard, and Michael Sterling Hanover College 18 April 2008.
29. Christensen K. "You're the only person I can talk to". The role of self-disclosure in the social construction of friendship. *UW-L J Undergraduate Res* 2011;XIV:1–15.