—— Original Article ——

BURDEN OF ABORTION: INDUCED AND SPONTANEOUS

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Background: Abortion is a public health concern because of its impact on maternal morbidity and mortality. Each year, about 79 million unintended pregnancies, excluding miscarriage, occur worldwide. More than half of these unintended pregnancies end in abortion.

The purpose of this study was to determine the ever-event incidence of abortion (spontaneous and induced) and some related factors in a population-based sample of reproductive age women.

Methods: From July 2003 through January 2004, 2470 women were included in the study through multistage random sampling and were interviewed. Data were collected using a checklist with questions about demographics and specific items regarding abortion history. Information about age, literacy, gravidity, marriage age, abortion, type of abortion, family history of abortion, history of family marriage, smoking, drug use, alcohol use, coffee intake, and incidence of abortion during the previous year were recorded. Statistical analysis included Student's *t*-test, Chi-square, ANOVA, and logistic regression using SPSS software.

Results: Out of the 2,470 women in the study, 775 (45.7%), had at least one abortion in their lives. Of the women who had an abortion, 20.6% reported induced abortion and 74.2% reported spontaneous abortion. Forty-one point four percent of women aged 45 years and older had at least one abortion in their lifetime. Fifty-one (2.1%) women had a history of abortion during the previous year; the largest proportion was 5.4% for the age group 15 – 24 years. The most common method of induced abortion in the previous year was dilatation and curettage (42 to 67%). In multivariate analysis, household number, coffee consumption, gravidity, smoking, and history of abortion in the family were the most important factors related to abortion in the different age groups of women.

Conclusion: This study shows that the occurrence of at least one abortion in the life of women in our setting is high and varies by age group. There is a need for expanded comprehensive sexual and reproductive health services, and more education and accessibility of contraception methods.

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Introduction

Pregnancies are dated from the first day of the last normal menstrual period, even though fertilization does not occur until later. Abortion is the expulsion of the products of conception, before 20 weeks of pregnancy are completed.[1]

Every year, around 500,000 women are estimated to die from pregnancy-related causes, the majority in the developing world and many as a result of unsafe abortion. Around 25% of maternal deaths in Asia and 30 – 50% of maternal deaths in Africa and Latin America occur as a result of induced abortion.[2]

About 29% of South Australian women born around 1955 and exposed to legal abortion throughout their reproductive lifetimes experienced an induced abortion, as did at least 31% of those born in 1960.[3] Nearly, 20% of women reported having had an unwanted pregnancy in Nigeria.[4]

Each year, about 79 million unintended pregnancies, excluding miscarriage, occur worldwide. More than half of these unintended pregnancies end in abortion.[5]

The abortion rate worldwide was about 35 per 1,000 women aged 15 – 44 years in 1995. Of all

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pregnancies (excluding miscarriages and stillbirths), 26% were terminated by abortion. Approximately, 44% of abortions worldwide are performed illegally (of which, many, though not all, are unsafe). Reflecting the predominant laws in the regions, the proportion of abortions that are illegal ranges from almost none in Eastern Asia, Western Europe, and Northern America to almost all in Africa, Central America, and South America. The developing areas of the world account for 64% of legal and 95% of illegal abortions.[6]

The Program of Action of the 1994 International Conference on Population and Development urged governments and other relevant organizations "to deal with the health impact of unsafe abortion as a major public health concern and to reduce the recourse to abortion through expanded and improved family-planning services."

To implement this recommendation, policy-makers need information on the extent to which abortion negatively impacts women's health, the prevalence of abortion (the burden of the problem), and the determinants of intention to seek induced abortion. This study was conducted to determine the prevalence of abortion (ever-event incidence), previous year incidence, and some determinants of induced abortion in a population-based study in Tehran in 2003.

Patients and Methods

From 1st July 2003 through 26th January 2004, 2,470 women aged 15 to 55 years were

Table 1. Percentage distribution and means for selected characteristics of study women by age groups, Tehran, 2003.

Age groups (yr)	15 – 24 n = 312	25 – 34 n = 983	35 – 44 n = 796	+45 n =379	Sig*
Variables	No. (%)	No. (%)	No. (%)	No. (%)	
Categorical variables					
Literacy					0.000[†]
Illiterate	—	—	8(1.0)	29 (7.7)	
Up to high school	38 (12.2)	152 (15.5)	187 (23.5)	161 (42.5)	
Diploma	247 (79.2)	613 (62.4)	464 (58.3)	152 (40.1)	
Academic	27 (8.7)	218 (22.2)	137 (17.2)	37 (9.8)	
Occupation					0.000[†]
Housewife	260 (83.3)	702 (71.4)	609 (76.6)	330 (87.1)	
Occupied	52 (16.7)	281 (28.6)	186 (23.4)	49 (12.9)	
History of family marriage					0.91
Yes	33 (10.6)	104 (10.6)	88 (11.1)	45 (11.9)	
No	279 (89.4)	879 (89.4)	708 (88.9)	334 (88.1)	
Smoking					0.007[†]
Yes	35 (11.2)	81 (8.2)	69 (8.7)	16 (4.2)	
No	277 (88.8)	902 (91.8)	727 (91.3)	363 (95.8)	
History of abortion in family **					0.000[†]
Yes	9 (13.6)	35 (14.5)	54 (27.0)	30 (37.5)	
No	57 (86.4)	206 (21.0)	146 (73.0)	50 (62.5)	
Alcohol and drug abuse					0.86
Yes	8 (2.6)	26 (2.6)	20 (2.5)	7 (1.8)	
No	304 (97.4)	957 (97.4)	776 (97.5)	372 (98.2)	
History of coffee drinking					0.70
Yes	73 (23.4)	238 (24.2)	192 (24.1)	82 (21.6)	
No	239 (76.6)	754 (75.8)	604 (75.9)	297 (78.4)	
Abortion (ever)					0.000[†]
Yes	80 (25.6)	290 (29.5)	248 (31.2)	157 (41.4)	
No	232 (74.4)	693 (70.5)	548 (68.8)	222 (58.6)	
Abortion in previous year					0.000[†]
Yes	16 (5.1)	23 (2.3)	8 (1.0)	4 (1.1)	
No	296 (94.9)	960 (97.7)	788 (99.0)	375 (98.9)	
Continuous variables {mean, (SD)}					
Coffee cup per day (in consumer)	2.6 (2.1)	2.7 (2.3)	2.4 (2.0)	2.5 (2.7)	0.52
Marriage age	19.1 (1.7)	20.2 (3.10)	20.0 (3.9)	18.3 (3.8)	0.000[†]
Household number ***	35.1 (16.7)	27.5 (14.0)	23.3 (13.3)	23.4 (19.2)	0.000[†]
Gravidity	1.1 (0.9)	2.0 (1.1)	2.9 (1.3)	4.2 (1.9)	0.000[†]
Pack year cigarette	0.16 (0.87)	0.19 (1.1)	0.36 (2.30)	0.30 (2.9)	0.21

* = P value; ** = only was filled for 587 women; *** = m^2/family size; † = significant.

Table 2. Percentage distribution and means for selected characteristics of study women aged 15 – 24 years (n = 312) by occurrence of abortion, Tehran, 2003.

| Variables | Abortion occurrence | | Bivariate | Multivariate |
| | Yes (n = 232) | No (n = 80) | Sig | Sig* |
	No. (%)	No. (%)		
Categorical variables				
Literacy			0.48	0.21
Under-diploma	8 (7.5)	30 (13.0)		
Diploma and above	72 (92.5)	202 (87.0)		
Occupation			0.64	0.90
Housewife	68 (85.0)	192 (82.8)		
Occupied	12 (15.0)	40 (17.2)		
History of family marriage			0.02	0.88
Yes	14 (17.5)	19 (8.1)		
No	66 (82.5)	213 (91.9)		
History of abortion in family **			0.005	0.99
Yes	8 (26.7)	1 (2.80)		
No	22 (73.3)	35 (97.2)		
Alcohol and drug abuse			0.01	0.90
Yes	5 (6.3)	3 (1.2)		
No	75 (93.8)	229 (98.9)		
Smoking			0.00	0.30
Yes	21 (26.2)	14 (6.0)		
No	59 (73.8)	218 (93.9)		
Continuous variables {mean, (SD)}				
Coffee cup per day (in consumer)	3.4 ± 2.4	2.0 ± 1.5	0.00	0.16
Marriage age	19.1 ± 1.6	19.0 ± 1.7	0.67	0.09
Household number ***	41.2 ± 17.7	33.0 ± 15.8	0.00	0.00
Gravidity†	1.8 ± 1.0	0.85 ± 0.7	0.00	0.00
Pack year cigarette	0.45 ± 1.3	0.06 ± 0.5	0.00	0.59

* = $P < 0.05$ is significant; ** = only filled for 66 women; *** = m²/family size, was significant for induced abortion only; † = was significant for spontaneous abortion.

interviewed in Tehran. Eligibility criteria included history of at least one marriage, residency in Tehran, and Iranian nationality. The study employed a cross-sectional design. We collected data through multistage random sampling. Initially, we divided the city of Tehran into 5 regions, and then selected 2 areas from each region. From each area, based on its population, we selected a relevant sample. Data were collected through house-to-house visits, in a standardized, 30-minute interview conducted by trained, medical student interviewers. A checklist was designed that included general questions about demographic characteristics (age, literacy, job, age of marriage, family marriage, gravidity, etc.) and specific questions about abortion, type of abortion, alcohol, cigarette, and coffee consumption, family history of abortion, method of most recent induced abortion, and household number. The checklist was modified after being piloted with 30 women. The question regarding family history of abortion was obtained for only 587 women, as this question was added to the checklist midway during data collection.

Abortion is defined as the expulsion of the products of conception, before 20 weeks of pregnancy are completed. The women in the study were divided into two groups: those who had spontaneous abortions and those who had induced abortions.

Spontaneous abortion is defined as anyone who had a spontaneous abortion before 20 weeks gestation, including inevitable abortions, incomplete abortions, missed abortions, and complete abortions.

Induced abortion is defined as any action towards the successful termination of pregnancy before 20 weeks gestation.

Sample size was calculated by estimation of 15% ever-event incidence of abortion, type one error 5%, and precision of estimation 0.018.

The women in the study were divided into four groups by age in years: 15 to 24, 25 to 34, 35 to 44, and 45 and above. The group was stratified to produce homogenous age groups of women for analyzing age-specific determinants for abortion.

In bivariate analysis, the differences between women with and without a history of at least one abortion were analyzed with Student's *t*-test and ANOVA for continuous variables, and the Chi-

Table 3. Percentage distribution and means for selected characteristics of study women aged 25 – 34 years (n = 983) by occurrence of abortion, Tehran, 2003.

| Variables | Abortion occurrence | | Bivariate | Multivariate |
| | Yes (*n* = 290) | No (*n* = 693) | Sig | Sig* |
	No. (%)	No. (%)		
Categorical variables				
Literacy			0.25	0.79
Under-diploma	39 (13.5)	113 (16.4)		
Diploma and above	251 (86.5)	580 (83.6)		
Occupation			0.16	0.99
Housewife	216 (74.5)	486 (70.2)		
Occupied	74 (25.5)	207 (29.8)		
History of family marriage			0.76	0.40
Yes	32 (11.0)	72 (10.3)		
No	258 (89.0)	621 (80.7)		
History of abortion in family **			0.00	0.06
Yes	20 (25.3)	15 (9.2)		
No	59 (74.7)	147 (90.8)		
Alcohol and drug abuse			0.00	0.82
Yes	15 (5.1)	11 (1.5)		
No	275 (94.9)	682 (98.5)		
Smoking†			0.00	0.00
Yes	48 (16.5)	33 (4.7)		
No	242 (83.5)	660 (95.3)		
Continuous variables {mean, (SD)}				
Coffee cup per day† (in consumer)	3.6 ± 3.0	2.2 ± 1.6	0.00	0.02
Marriage age	20.2 ± 3.0	20.2 ± 3.2	0.75	0.74
Household number ***	29.2 ± 15.6	26.4 ± 13.2	0.00	0.00
Gravidity†	2.7 ± 1.0	1.8 ± 1.0	0.00	0.00
Pack year cigarette	0.53 ± 1.9	0.05 ± 0.3	0.00	0.55

* = $P < 0.05$ is significant; ** = only filled for 241 women; *** = m²/family size, was significant for induced abortion only; † = was significant for spontaneous abortion.

square test for categorical variables in separate age groups. All variables, identified on the basis of biologic plausibility as possible confounders in preliminary analyses, were included in the logistic-regression model. Multivariate adjusted odds ratios were reported. The occurrence of abortion as a dependent variable, and some determinant factors were selected as covariates for the model in separate age groups. All covariates were selected for inclusion in the model as independent variables, without considering their significant association in bivariate analyses. Continuous variables were included in the model as numeric variables, and categorical variables were divided into binary variables with dummy codes of 0 and 1.

The level used to determine significance was $P < 0.05$.

Results

Descriptive data are provided in Table 1 by age groups for the complete sample of 2,470 women.

Women aged 15 – 24, 25 – 34, 35 – 44, and +45 years composed 12.6%, 39.7%, 32.2%, and 15.3% of all participants, respectively. Most women who were enrolled in this study had no more than diploma education (high school graduates); this was the case in all age groups, ranging from 40 to 79.2% of women with a diploma education.

Women who did not work outside of the home were dominant in this study (ranged from 71.4 to 87.1% between age groups). Literacy, job, smoking habit, abortion in the family, abortion in the previous year, marriage age, household number, and gravidity were differed significantly by age group ($P < 0.05$).

The occurrence of at least one lifetime abortion in the total sample of women was 45.7%. Out of all women with an abortion history, 20.6% had induced abortion, and 74.2% had a lifetime history of at least one spontaneous abortion. The occurrence of induced and spontaneous abortion were 9.4% and 33.9%, respectively. Fifty-one women (2.1%) had a history of abortion during the previous year; of these 5.4% were 15 to 24 years of age. Induced abortion was more common among 25 – 34 years old women than in the other age groups (22% vs. about 17 – 20%). The most common cause of induced abortion in all age groups was "personal reasons" (ranging between

Table 4. Percentage distribution and means for selected characteristics of study women aged 35 – 44 years (n = 796) by occurrence of abortion, Tehran, 2003.

Variables	Abortion occurrence		Bivariate	Multivariate
	Yes (*n* = 248)	No (*n* = 548)	Sig	Sig*
	No. (%)	No. (%)		
Categorical variables				
Literacy			0.68	0.87
Under-diploma	63 (25.5)	132 (24.1)		
Diploma and above	185 (74.5)	416 (75.9)		
Occupation			0.27	0.14
Housewife	183 (73.4)	426 (77.9)		
Occupied	65 (26.6)	121 (22.1)		
History of family marriage			0.03	0.55
Yes	36 (14.5)	52 (11.0)		
No	212 (85.5)	496 (89.0)		
History of abortion in family **			0.00	0.00
Yes	29 (46.7)	25 (18.1)		
No	33 (53.3)	113 (81.9)		
Alcohol and drug abuse			0.06	0.75
Yes	10 (4.0)	10 (1.8)		
No	238 (96.0)	538 (98.2)		
Smoking†			0.00	0.00
Yes	42 (16.9)	27 (4.9)		
No	206 (83.1)	521 (95.1)		
Continuous variables {mean, (SD)}				
Coffee cup per day† (in consumer)	3.6 ± 2.5	2.0 ± 1.5	0.00	0.08
Marriage age	20.2 ± 4.4	19.9 ± 3.7	0.33	0.00
Household number ***	25.4 ± 14.0	22.4 ± 12.8	0.00	0.02
Gravidity†	3.5 ± 1.2	2.6 ± 1.2	0.00	0.00
Pack year cigarette	0.82 ± 3.3	0.16 ± 1.6	0.00	0.18

* = *P* < 0.05 is significant; ** = only filled for 200 women, was significant for spontaneous abortion; *** = m²/family size, was significant for induced abortion only; † = was significant for spontaneous abortion.

age group from 40 to 84%). Dilatation and curettage in an office was the most common method of induced abortion (ranging between age gro roups was "personal reasons" (ranging between age group from 40 to 84%). Dilatation and curettage in an office was the most common ups from 42 to 67%). More than 90% of abortions were performed illegally.

Tables 2 to 5, show the participants' characteristics by occurrence of abortion history and age group.

In bivariate analysis, except women aged 25 – 34 years old, family marriage was associated significantly (*P* < 0.05) with abortion occurrence.

In all age groups, abortion in the family, smoking habit, coffee consumption, household number, and gravidity were significantly associated with ever-abortion incidence.

Through multivariate analysis we can see that only gravidity had a significant relationship with ever-abortion in all age groups of women. Smoking habit, coffee consumption, household number, and abortion in the family were the most significant factors in relation to occurrence of abortion in different age groups.

We estimated a 2.7 abortion rate per hundred women-years at risk (or 0.027 per women-years at risk). Given the constant age-specific abortion rate, an average of 0.68 abortion per woman in reproductive age is estimated (total abortion rate).

Discussion

Our results suggest that the occurrence of abortion (spontaneous or induced) is 45.7%. These rates were 9.4% and 33.9% for induced and spontaneous abortions, respectively. In the Jos and Ire local government of Nigeria, nearly 20% of women aged 15 – 45 years reported having had an unwanted pregnancy. Of these, 58% reported that they had successfully terminated the pregnancy, and 9% stated that they had attempted termination but failed.[4]

At least 41.4% of women aged 45 years and older had at least one abortion during their lifetime; this can estimate the lifetime prevalence of abortion. However, we have to consider the low sample size of this age group in the present study, which can affect the representativity of this group. In rural upper Egypt, the lifetime prevalence of abortion is reported to be 40.6%.[7] Research by the Alan Guttmacher Institute shows that more than

Table 5. Percentage distribution and means for selected characteristics of study women aged +45 years (n = 379) by occurrence of abortion, Tehran, 2003.

Variables	Abortion occurrence		Bivariate	Multivariate
	Yes (*n* = 157)	No (*n* = 222)	Sig	Sig*
	No. (%)	No.(%)		
Categorical variables				
Literacy			0.05	0.53
Under-diploma	88 (56.1)	102 (46.0)		
Diploma and above	69 (43.9)	120 (54.0)		
Occupation			0.40	0.99
Housewife	134 (85.4)	196 (88.3)		
Occupied	23 (14.6)	26 (11.7)		
History of family marriage			0.04	0.79
Yes	25 (15.9)	20 (9.0)		
No	132 (84.1)	202 (91.0)		
History of abortion in family **			0.00	0.27
Yes	22 (62.8)	8 (17.7)		
No	13 (37.2)	37 (82.3)		
Alcohol and drug abuse			0.39	0.99
Yes	4 (2.5)	3 (1.3)		
No	153 (97.5)	219 (98.7)		
Smoking			0.02	0.99
Yes	11 (7.0)	5 (2.2)		
No	146 (93.0)	217 (97.8)		
Continuous variables {mean, (SD)}				
Coffee cup per day (in consumer)	3.5 ± 4.0	1.8 ± 1.0	0.00	0.08
Marriage age	18.0 ± 4.2	18.6 ± 3.5	0.14	0.46
Household number***	24.8 ± 20.2	22.4 ± 18.4	0.22	0.09
Gravidity†	5.2 ± 2.2	3.4 ± 1.3	0.00	0.04
Pack year cigarette	0.66 ± 4.5	0.05 ± 0.54	0.09	0.99

* = $P < 0.05$ is significant; ** = only filled for 80 women; *** = m^2/family size; † = was significant for spontaneous abortion.

one-third of women in the US will have an abortion by the age of forty-five; of these, 52% will be under the age of twenty-five.[8] Although it may seem counterintuitive, the rate of abortion has not always declined as contraceptive use has increased around the world. This paradox occurs because many factors influence the rate of abortion. In Korea, for example, the abortion rate rose from around 0.5 abortion per woman in 1960 to nearly 3.0 abortions per woman in the late 1970s, as the desired family size shrank too rapidly for the increase in contraceptive use to keep pace.[5]

On the basis of rates in 2003, a woman in Iran will have an average of 2.3 pregnancies during her lifetime, of which 0.68 will result in an abortion. This abortion rate in England, where the Total Fertility Rate is 2.16 (in 1995), is 0.44.[9]

The risk of abortion was increased in women who consumed high levels of coffee. This rate was increased 1.2-fold per one cup of coffee. In a study on caffeine intake and risk of spontaneous abortion, there was 2-fold risk of spontaneous abortion in women who consumed high levels of caffeine.[11] However, because of the controversy about this relationship in the literature, evidence for a causal link between caffeine and abortion remains inconclusive.[12]

Our results demonstrate that cigarette smoking is independently associated with a higher risk of abortion in most age groups of women. The absence of a dose-response relationship (in a logistic model), suggests that any level of exposure to cigarette smoking, rather than a high level of exposure, is associated with abortion. This relationship confirmed in some other studies.[13–18]

Household number as an indicator of socioeconomic status had an independent positive association with occurrence of induced abortion in all age groups (except women older than 45 years). It has been shown that women in the highest income bracket have a higher abortion rate.[10] This is possibly because these women have more access to physicians and methods of abortion.

Our study shows increasing risk of abortion with increasing age in women. This result has been observed by several authors.[19–20] The observed association could be a result of age-related changes such as increased conceptions that are chromosomally abnormal or decreasing uterine and hormonal function.

Our study has several strengths. First, by enrolling a population-based sample and

conducting the study through house-to-house interviews rather than at a prenatal care setting, we provided a representative sample. Second, we recruited women aged 15 to 55 years, to reduce the possibility of recall bias. Finally, because of the sampling method, the rates of recruitment, retention, and acquisition of complete data were high.

The study also had some limitations. Asking these questions by interview, especially in house-to-house surveys, may have an effect on the valid estimation of induced abortion rates. Although the recruitment of reproductive age women lessens the chance of recall bias, this is still an important factor to validly estimate the occurrence of abortion.

This study shows that abortions, particularly induced abortions, are common practice in our setting. A substantial proportion of induced abortions were performed illegally (data not shown here), and are likely to be unsafe, with the risk of associated complications. To combat this, there is a need for expanded reproductive health services. Globally, abortions are an important cause of morbidity and mortality among women of reproductive age, particularly in developing countries. Women in all societies need access to safe contraception and more effective education services. This will also reduce the costs of abortion and improve sexual health.

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