THE PATTERNS AND DETERMINANTS OF BIRTH INTERVALS IN MULTIPAROUS WOMEN IN BABOL, NORTHERN IRAN

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Abstract. The present study aimed to determine the patterns and factors associated with birth intervals in multiparous women in Babol, northern Iran. We conducted a cross-sectional study of 500 multiparous women at health centers and referred to the hospital for delivery in Babol, northern Iran in 2007. Data were collected using a questionnaire, including birth intervals, demographics, fertility variables, such as maternal education, maternal age at birth, gender of index child, history of still births, child status (infant mortality or still birth) of index child, parity, duration of breast feeding, residence area, contraception method used, and attendance at a family planning clinic. The data were analyzed using a logistic regression model. The mean (±SD) birth interval was 61±25.7 months. In 3.8% of women the birth interval was <2 years, in 41.7% it was 4-5 years and in 28% it was ≥6 years. The majority of women (76.8%) were age 20-34 years old at the time of pregnancy. About one-fourth (22.4%) of women were ≥35 years old at the time of pregnancy and 0.8% of women were <20 years old at pregnancy. Maternal age, duration of breast feeding, sex of index child, history of still births, history of infant mortality of the index child, type of contraception used, regular attendance at a family planning clinics and parity showed a significant correlation with birth interval (p<0.05).

INTRODUCTION

Birth spacing has become a main strategy of the health promotion program for mothers and children over the past 2 decades in the Islamic Republic of Iran. Published studies have shown short birth intervals increase maternal risk for toxemia, anemia, malnutrition, third trimester bleeding and maternal mortality (Conde-Agudelo and Belizan, 2000; Smith *et al*, 2003) and it has several serious adverse outcomes for neonates as well, such as prematurity, low birth weight, still birth, neonatal mortality and adverse effects on intellectual ability, physical growth and development(Greenspan, 1993; Zhu *et al*, 1999; Bella *et al*, 2005; Hsieh and Chen, 2005). However, a birth interval longer than 70 months is associated with increased risk for maternal death, third trimester bleeding, eclampsia and postpartum hemorrhage (Conde-Agudelo and Belizan, 2000). Evidence has consistently shown that a birth interval of 2 years improves the chance of infants and childhood survival compared with an interval <2 years (Boerma and Bicego, 1999). New research suggests a

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period of 3-5 years is the optimum birth interval and saves lives (Rasheed and Al-Dabal, 2007).

Studies regarding child spacing and a knowledge of biological and non-biological factors involved should help family planning programs become more successful with birth control, and the subsequent additional costs of adverse outcomes due to short birth intervals could be saved. For the past 2 decades the Islamic Republic of Iran has used a child spacing program as part of the national health promotion strategy for mothers and children. Birth interval is affected by demographics, socioeconomic and cultural factors that can be divided into 2 groups: 1) factors that have a direct effect on birth interval, such as fertility, frequency of sexual intercourse, breastfeeding and use contraceptive methods; 2) factors that have an indirect effect on birth interval, called intermediate factors, such as still births, infant mortality, availability of family planning clinics, maternal age, occupation, and level of education. Other factors, such as location of residence, gender of index child, birth order, and abortions also have an influence on birth interval (DaVanzo and Starbird, 1991; Bashchier and Hinde, 2000; Polo *et al*, 2000; Rasheed and Al-Dabal, 2007). In a study by Baschier and Hinde (2000) in Egypt, location residence and duration of breast-feeding were the determinants of birth interval (Baschier and Hinde, 2000). A study by Polo *et al* (2000) in Spain found that birth order and still births had an important influence on child spacing. In Saudi Arabia, Rasheed and Al-Dabal (2007) found maternal age, maternal education, and breast-feeding were determinants of birth interval. Birth interval can be affected by different cultural and socioeconomic factors. The present study was carried out to determine the patterns and factors associated with birth interval in multiparous women in Babol, northern Iran after 2 decades of a birth control program.

MATERIALS AND METHODS

This cross-sectional study was conducted on 500 multiparous women who attended health care centers and were referred to hospitals for delivery in Babol, northern Iran from 1 March to 30 September, 2007. Study population was multiparous women referred for delivery to four hospitals in Babol (public and private hospitals) and also multiparous women with children under 6 years old who attended health centers for child health care or family planning. Of total 20 primary health centers in Babol, 5 were selected randomly from 5 different areas (south, north, east, west and central Babol) from different socio-economic classes. All multiparous women were recruited to participate in the study. Women with 3 or more abortions, in whom their pregnancy occurred one year after discontinuing a contraceptive or in whom fertility or ovulution stimulation methods were used were excluded from the study. The delivery prior to the most recent birth was considered as the index child (either still or live birth) and the birth interval was defined as the duration between the birth of the index child and the most recent delivery, *ie* the time period between the 2 most recent consecutive births. With a sample size of 500 subjects we were able to estimate the mean birth interval with a margina of error of 2.2 months by 95% confidence level. The study proposal was approved by the research committee of Babol University of Medical Sciences and an informed consent was obtained from all women prior to participation in the study.

The data was collected using a specially designed and pre-tested questionnaire; the information was obtained from the women by trained interviewers in hospital and health centers. The data included birth in-

tervals, demographic and fertility variables, such as maternal education, maternal age at birth of index child, sex of index child, history of still births, child status of index child (died/alive), parity, duration of breast feeding, location of residence (rural/urban), contraception method used prior to pregnancy with last delivery, attendance at a family planning clinic, frequency of sexual intercourse per week prior to the last pregnancy, and history and number of abortions and pregnancies. Reliability of collected data regarding birth intervals was assessed by repeated measurements of the same subjects using an intra class correlation coefficient of >0.95 and internal consistency of data obtained was assessed by Cronbach's alpha coefficient of >0.90 in a pilot study.

Statistical analysis

For statistical analysis we used SPSS software; a chi-square test was used for bivariate data analysis and logistic regression analysis was used to estimate the crude and adjusted odds ratio (OR) of the risk for a birth interval less than 3 years for demographic and social and fertility related factors. The predictors for <3 year birth interval were determined using the logistic regression model. First, each variable was entered into the model one at a time and the crude estimate of the odds ratio for the different levels within that variable were calculated. For categorical variables, the indicator variables were defined with a specific reference group. We then used stepwise multiple regression analysis and the adjusted odds ratio was estimated. We also estimated the 95% confidence interval for the OR. A *p*-value > 0.05 was considered as statistically significant.

RESULTS

The results show the mean (±SD) birth interval was 61.02 ± 25.7 months. Only 3.8% had a birth interval <2 years, and 28% had a birth interval ≥6 years. The mean age (±SD) at delivery for the women in this study was 30 ± 3.5 years (range 18 to 40 years). Fifty-seven percent of women in this study were married before age 19 years. Nearly half the women (48.6%) in this study completed high school and 3.8% had a university level of education; most lived in an urban area (Table 1). The majority of women (71.4%) had 2 parities and just over half (56.8%) had breast fed their children for at least 2 years. Four point seven percent of women had a still birth with their last pregnancy and 2.2% of mothers experienced infant mortality before the index child.

The mean birth interval was 36.2 ± 27.4 months in mothers <20 years old, this figure was 70.3 ± 28.4 months in those >35 years old (Table 1). With increasing maternal age at birth, the birth interval increased significantly ($p<0.05$). With increasing maternal education level the birth interval significantly increased ($p<0.05$). The mean birth interval was higher when the index child was a male compared with a female ($p<0.05$). The mean birth intervals were 34.2 and 64.9 months for mothers who breastfed their index child <6 months and ≥24 months, respectively. By increasing the duration of breastfeeding, the mean birth interval increased significantly ($p<0.05$). The mean birth interval in mothers who experienced infant mortality in the index child was 51.5 months and the figure for mothers who did not have infant mortality was 61.1± 25.7 months.

Table 2 shows the relationship between birth interval and age. Fifty percent of women <20 years old and 0.9% of women ≥35 years old had a birth interval of <2 years, but in 42.9% of mothers aged ≥35 years old, the birth interval was ≥6 years, which increased with increasing maternal age, while the birth interval of <2 years decreased with

Table 1
Birth intervals and their relationship to variables in study subjects.

Variables	No. (%)	Birth interval, mean ± SD (month)	*p*-value
Age of mother (years)			
<20	4 (0.8)	36.25 ± 27.43	<0.001
20-34	384 (76.8)	58.55 ± 34.17	
≥35	112 (22.4)	70.38 ± 28.43	
Maternal education level			
Illiterate	5 (1.0)	82.0 ± 58.01	
Primary level	98 (19.6)	61.5 ± 29.44	0.012
Secondary level	243 (48.6)	57.8 ± 23.49	
College	135 (27.0)	64.18 ± 24.68	
University level	19 (3.8)	71.62 ± 22.51	
Infant mortality			
No	489 (98.8)	61.1 ± 25.7	
Yes	11 (2.2)	51.5 ± 23.3	
Duration of breastfeeding (months)			
<6	29 (5.8)	34.24 ± 21.19	
6-11	33 (6.6)	56.64 ± 28.42	<0.001
12-17	75 (15.0)	55.61 ± 29.08	
18-23	79 (15.8)	62.57 ± 28.75	
≥24	284 (56.8)	64.99 ± 21.94	
Location of residence			0.62
Urban	376 (75.2)	60.7 ± 25.81	
Rural	124 (24.8)	62.02 ± 25.56	
Marriage age (years)			
<19	285 (75.0)	62.88 ± 27.05	
20-29	208 (25.6)	58.71 ± 22.76	0.08
≥30	7 (1.4)	48.29 ± 15.22	
Gender of index child			
Male	282 (56.4)	63.17 ± 27.01	0.03
Female	218 (53.6)	58.25 ± 23.74	

increasing maternal age ($p<0.05$). A short birth interval was more common among women whose educational level was primary to high school level. A longer birth interval was more common in women with a university level education but this association did not reach statistical significance. In terms of the husband's education level, a birth interval of <2 years significantly more common in women with a husband with an education level of high school or lower ($p=0.003$). In women who breastfed their children <6 month 11(37.9%) had a short birth interval. In women who breastfed their children ≥18 months, none had short birth interval ($p<0.001$). On bivariate analysis, the association between birth interval and contraceptive method used, the number of times

Table 2
Birth intervals in relation to variables in studied subjects.

Variables No. (%)	Birth interval (months) <24 No. (%)	24-47 No. (%)	48-71 No. (%)	≥72 No. (%)	*p*-value
Age group (years)					<0.001
<20	2 (50)	- (-)	2 (50)	- (-)	
20-34	16 (4.2)	106 (27.7)	169 (44.1)	93 (24.0)	
≥35	1 (0.9)	27 (23.2)	37 (33.0)	47 (42.9)	
Maternal education level					
Illiterate	- (-)	2 (40.0)	1 (20)	2 (40)	
Primary school	6 (6.2)	28 (27.7)	38 (39.2)	26 (26.8)	NS
Secondary school	11 (4.5)	67 (27.6)	108 (44.4)	57 (23.5)	
College	2 (1.5)	32 (23.7)	57 (42.2)	44 (32.6)	
University level	- (-)	4 (21.1)	4 (21.1)	11 (57.8)	
Paternal education level					
Illiterate	- (-)	- (-)	5 (50)	5 (50)	0.003
Primary school	4 (6.6)	16 (26.2)	21 (34.4)	20 (32.8)	
Secondary school	11 (4.5)	71 (28.9)	101 (41.8)	60 (24.8)	
College	4 (2.7)	41 (27.5)	68 (45.6)	36 (24.2)	
University level	- (-)	59 (13.5)	139 (35.1)	199 (51.4)	
Breast-breastfeeding (months)					
<6	11 (37.9)	13 (44.8)	2 (6.9)	3 (10.4)	<0.001
6-11	4 (12.1)	10 (30.3)	8 (24.3)	11 (33.3)	
12-17	4 (5.3)	28 (37.3)	27 (36.0)	16 (21.4)	
18-24	- (-)	27 (34.2)	27 (34.2)	25 (31.6)	
≥24	- (-)	54 (19.1)	144 (50.9)	86 (30.0)	

having sexual intercourse per week, sex of index child and a history of still births was statistically significant ($p<0.05$). The associations with location of residence, maternal occupation and marriage age were not significant. Table 3 shows the results of the logistic regression model for the odds ratio for a risk of birth interval <3 years with different levels of factors compared with the reference level when each variable was entered into the model alone. The odds ratio for women <20 years old was 7.9 times (95%CI 1.08-57.5) higher than women 20-34 years old. With increasing number of parities to odds ratio tended to be lower, but the difference was not significant. By increasing the duration of breast feeding, the odds ratio significantly decreased. Among mothers who experienced a still birth or infant mortality with the index child, the odds increased 14.9 or 5.76 times, respectively, compared with women who did not experience these problems. On multiple logistic regression analysis with the stepwise method, the adjusted odds ratio for having a birth interval <3 years, decreased significantly with increasing parity, duration breastfeeding, and contraceptive method used, but increased significantly in those with a history of infant mortality or still birth of the index child.

Table 3
Odds ratios for a birth interval <3 years in studied subjects using logistic regression.

Characteristics	OR (95% CI)	*p*-value
Age of mothers at birth (years)		
20-34	1.0 (-)	
<20	7.9 (1.08 - 57.5)	0.04
≥35	0.45 (0.18 - 1.08)	0.07
Parity		
2	1.0 (-)	
3	0.98 (0.5 - 1.09)	0.9
4	0.78 (0.09 - 6.2)	0.82
5	0.02 (0.00 - 1.46)	0.75
Maternal education		
Higher than high school (*vs* high school or lower)	0.58 (0.29 - 1.17)	0.13
Duration of breast feeding (months)		
<6	1.0 (-)	
6-11	0.3 (0.1 - 0.87)	0.03
12-17	0.18 (0.07 - 0.47)	0.001
18-23	0.08 (0.03 - 0.23)	0.0001
≥24	0.01 (0.004 - 0.046)	0.0001
Contraceptive method used		
None	1.0 (-)	
Natural method	0.06 (90.02 - 0.22)	0.00001
Modern methods	0.03 (0.008 - 0.11)	0.00001
Still birth (yes *vs* no)	14.9 (6.1 - 36.4)	0.00001
Infant mortality (yes *vs* no)	5.76 (1.04 - 32.02)	0.04

DISCUSSION

The mean±SD birth interval in this study was 61± 25.7 month. Only 3.8% of women had a birth interval <2 years and 28% had a birth interval ≥ 6 years. Mohammadi-Baghmalaie *et al* (2005) found a birth interval of 3.5± 1.08 years in southern Iran. Abebe and Yohannis (1993) found a birth interval of 22.1 months in Ethiopia. Rasheed and Al-Dabal (2007) and Al-Almaie (2005) found birth intervals < 2 years in 28% and 5.2%, respectively, of women in Saudi Arabia. The differences between the results of the above studies and ours may be due to differences in geographic, cultural and socioeconomic factors. The various studies were conducted in different years and thus the coverage rates of family planning varied. In the present study, the birth interval in the majority of mothers was in the recommended range (3-5 years) set by the Ministry of Health for Iran, which shows acceptable coverage of family planning in the study area. Although the percentage of mothers with short birth interval (<2 years) was low, the concern is the increasing birth interval of ≥6 years in 28% of women. This can result in high risk pregnancies in women over 35 years increasing the odds of adverse pregnancy outcomes, such as pre-eclampsia, diabetes, fetal choromosomal disorders and abortions. Recent evidence shows children are healthier when the birth interval is 3-5 years and are more likely to survive (Rasheed and Al-Dabal, 2007). In our region, birth intervals

beyond 6 years are more unfavorable than those reported by Rasheed and AL-Dabal (2007) in Saudi Arabian women. Women in northern Iran need to be informed of the health advantages related to a birth interval of 3-5 years. It is therefore essential that health programs convey this information to parents and future parents.

In regard to the relationship between birth interval and maternal age, our results show the mean birth interval was 36.2 months in women less than 35 years old and 70.3 months in women over age 35 years. This association has been reported by Polo *et al* (2000) in Spain and in a study by Al-Almaie (2005) in Saudi Arabia. Increasing birth intervals, with increasing maternal age, is probably due to an increase in experience and knowledge of mothers with age or due to different physiological characteristics of different age groups and decreasing fertility with aging. However, women must be educated that long birth intervals (>6 years) are problematic when it causes the women to be over age 35 years at the time of pregnancy since it is associated with adverse pregnancy outcomes.

In the present study, there was no significant association between birth interval and marriage age similar to that reported by Ram and Rahim (1994) in Canada. However, Mohammadi-Baghmalaie *et al* (2005) in southern Iran reported with increasing marriage age, birth interval decreased. This may be because with increasing maternal age and concern of infertility and the occurrence of congenital diseases, the couples decided to have their children soon after marriage.

In our study, multiparous women with an education higher than high school level, the risk for birth interval of less than 3 years was 50% lower than in mothers with an education level of high school or less, but this difference was not statistically significant. This may be due to small sample size in mothers with an education level higher than high school. In studies by Baschier and Hinde (2000) in Egypt and Al-Nahedh (1999) in rural Saudi Arabia. a higher level of maternal education was associated with a decreasing the birth interval. Increasing maternal education levels may be associated with increased maternal knowledge regarding adverse pregnancy outcomes of short birth intervals.

In our study there was no significant association between birth interval and location of residence. Baschier *et al* (2000) in Egypt and Fallahzadeh (1996) in central Iran reported that child interval were longer in urban areas than in rural areas. The sample size from rural areas in our study was small and lacked differences in birth intervals between rural and urban areas. This may be due to the similar geography, culture and knowledge between the two areas. The role of health care givers in family planning among the various populations studied is an important factor in explaning this similarity.

In the present study, the duration of breastfeeding of the index child and the method of contraceptive used were factors significantly associated with child intervals. These results are similar to those reported by Baschier and Hinde (2000) in Egypt, Rasheed and Al-Dabal (2007) in Saudi Arabia and Falahian *et al* (1993) in Iran. The longer birth interval is associated with a longer duration of breastfeeding. Breastfeeding leads to secretion of prolactin hormone from the hypophysis and lower FSH and LH levels in the blood. Subsequently, ovulation is delayed and the amonorrhea period prolongs reducing the risk of fertility decreases (Bushra and Manan, 1995; Al-Nahedh, 1999). The impact of breastfeeding on fertility is potentially great in populations that have high rates of long periods of exclusive breast feeding. Using a suitable contraceptive method prevents unintended pregnancies

and short birth intervals.

The relationship between sex, still birth and infant mortality in the index child with decreasing duration of child interval in our study was statistically significant; consistent with the findings of Mace and Sear (1997) and Baschier and Hinde (2000). The association between birth interval and gender of the index child is related to the attitudes regarding having a male child in the Eastern culture. The association between birth interval and still birth and infant mortality may be due to the need of the parents to replace the lost child in a short time (Bushra and Manan, 1995; Rasheed and Al-Dabal, 2007). Still births and infant mortality result in no breast feeding and a return to ovulation sooner causing a shorter birth interval (Audrey and Rosner 1990; Bushra and Manan, 1995).

In our study, another factor associated with birth interval was regular attendance at a family planning clinic which can increase the knowledge and attitudes of mothers regarding family planning and the practice of contraception resulting in a longer birth interval. The similar results were also reported by Abebe and Yohannis (1996) in Ethiopia. Another factor associated with birth interval was the frequency of sexual intercourse per week preceding pregnancy with the index child. Increased frequency resulted in decreased birth interval. Similar findings were also reported by Fallahzadeh (1996) in central Iran and Swenson and Thang (1993) in Vietnam.

The findings of the present study cannot be generalized to all Iranian women since the study was not community based, but conducted among users of primary health centers in an urban area. However, our hospital based data (both public and private hospitals) included multiparous women from both rural and urban areas.

In conclusion, maternal age, parity, duration of breastfeeding, history of still births, infant mortality, regular attendance at a family planning clinic and using contraception were significantly associated with birth interval. Although child spacing in the majority of multiparous women was optimal as recommended by the Ministry of Health of Iran (3-5 years), more than a quarter of women had a prolonged birth interval (≥6 years) which increased the risk for a pregnancy in women age >35 years old. We recommend an educational program to prevent birth intervals beyond the optimal range (≥6 years) which increases the risk during pregnancy.

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