Duration and determinants of interbirth interval: community-based survey of women in southern Jordan

R.M. Youssef [1]

مدة ومحدِّدات الفترات بين الأحمال: دراسة مجتمعية للنساء في جنوب الأردن

رنده محمود يوسف

الخلاصة: قامت الباحثة بدراسة الفترة الفاصلة بين حمل وآخر ومحدِّداتها في النسوة في سن الإنجاب في الكرك بالأردن في شهر تشرين الأول/أكتوبر 2003، وذلك باستخدام أسلوب الاعتيان المتعدِّد المراحل لانتقاء 1109 سيدة من المتزوِّجات اللاتي تراوحت أعمارهن بين 15 و49 عاماً وبلغ عدد الفواصل بين الأحمال لديهن 4349 فترة فاصلة. وقد جُمعت المعطيات باستكمال استبيان أثناء المقابلات، وتم تحليلها باستخدام جداول مجريات الحياة وتحليلات التحوُّف بحسب كوكس والبُقيا على قيد الحياة بحسب كابلان — مايير. وقد بَلَغ ناصف median الفترات الفاصلة بين الأحمال 27.40 شهراً. وأمكن التنبُّؤ بفواصل أطول بين الأحمال إذا دام الإرضاع من الثدي 12 شهراً أو أكثر، أو إذا استعملت موانع الحمل الحديثة، أو إذا لم يكتمل الحمل، أو زاد عدد الأطفال الباقين على قيد الحياة، أو وجد أطفال ذكور وحدهم أو مع الإناث، أو إذا تلقّت المرأة تعليماً عالياً، أو تقدَّم العمر بالزوجَيْن، أو طالت مدة الحياة الزوجية، أو طبِّقت المفاهيم المثالية للمباعدة بين الأحمال. وترى الباحثة ضرورة العمل على القيام بجهود منسَّقة لإطالة مدة الإرضاع من الثدي وتشجيع استخدام موانع الحمل الحديثة، وتشجيع فكرة العائلة الصغيرة، والتصدِّي لظاهرة تفضيل أحد الجنسَيْن، والتأكيد على الحد الأدنى لسنّ الزواج.

ABSTRACT The duration and determinants of interbirth intervals among women of reproductive age in Karak, Jordan were examined in October 2003. A multistage sampling technique was used to select 1109 ever-married women aged 15–49 years who contributed to 4349 interbirth intervals. Data were obtained by interview questionnaire and analysed with life table, Kaplan–Meier survival and Cox regression analyses. The median interbirth interval was 27.40 months. Longer interbirth interval was independently predicted by breastfeeding ≥ 12 months, modern contraceptive use and pregnancy wastage; by more surviving children, presence of boys only or both boys and girls at the interval onset; by woman's higher education, older age and longer marriage; and by ideal spacing conforming with family planning norms. Concerted efforts to encourage modern contraceptive use, extend breastfeeding, promote small family size, address gender preferences and reinforce the minimum age at marriage should be made.

Durée et déterminants de l'intervalle entre les naissances : enquête communautaire auprès de femmes dans le sud de la Jordanie

RÉSUMÉ La durée et les déterminants de l'intervalle entre les naissances chez des femmes en âge de procréer à Karak (Jordanie) ont été examinés en octobre 2003. Une technique d'échantillonnage à plusieurs degrés a été utilisée pour sélectionner 1109 femmes âgées de 15 à 49 ans ayant déjà été mariées avec 4349 intervalles entre les naissances. Des données ont été obtenues par questionnaire lors d'un entretien et analysées au moyen d'une table de mortalité, de l'analyse de survie de Kaplan-Meier et de l'analyse de régression de Cox. L'intervalle médian entre les naissances était de 27,40 mois. Un intervalle plus long entre les naissances était prédit indépendamment par une durée d'allaitement au sein de 12 mois ou plus, par l'utilisation d'un moyen de contraception moderne et par les grossesses improductives ; par un plus grand nombre d'enfants survivants, par la présence de garçons uniquement ou de garçons et de filles au début de l'intervalle ; par le niveau d'instruction plus élevé de la femme, son âge plus avancé et la durée plus longue du mariage ; et par un espacement idéal conforme aux normes de planification familiale. Des efforts concertés devraient être déployés pour encourager le recours aux moyens de contraception modernes, prolonger l'allaitement au sein, promouvoir une taille réduite de la famille, s'attaquer aux préférences fondées sur le sexe et faire respecter l'âge minimum au mariage.

[1]Department of Community Medicine, Faculty of Medicine, University, Mu'tah, Jordan (Correspondence to R.M. Youssef : randayoussef@link.net).

Introduction

Population growth is a major challenge in most developing countries, and Jordan is no exception to this. In Jordan, the rate of population growth is 4.3%, the third highest among countries of the Eastern Mediterranean Region after the United Arab Emirates (5.6%) and Qatar (5.4%) and the same as in Saudi Arabia (4.3%) [*1*]. This high rate of growth is the result of an imbalance between infant mortality and fertility. Development in public health has contributed to a rapid and continuous decline in infant mortality, which was halved in 1970 and then again in 1985 to reach 26 per 1000 live births in 1998 [*1,2*]. Fertility did not decline until 1970 when it was lowered to 7.8 births per woman. It has continued to decline and is currently 3.9 births per woman [*3*]. Although the fertility rate is still declining, population growth is likely to continue because of "population momentum" as the number of women reaching childbearing age constitutes a growing segment of the population [*2*].

Differentials in fertility levels are attributed to the length of the reproductive life of women and the interval between births [*4*]. The study of birth intervals in this context can provide insight into the mechanism underlying fertility changes. The variation in the fertility rate of a population is largely determined by its proximate determinants [*5*]. These determinants are the behavioural and biological mechanisms by which fertility is reduced below its biological maximum. Four proximate determinants have been identified: marriage, postpartum infecundability, contraception and induced abortion. Social factors such as women's education, employment opportunities and the number and the sex of surviving children also play a role in determining child spacing [*4,6–12*].

One factor unique to Jordan is the high frequency of closely spaced pregnancies [*8*]. An analysis of factors like this that influence birth interval among Jordanian women will provide planners and policymakers with useful information that could lead to reforms that encourage longer intervals between consecutive births. Such reforms may ultimately decrease the number of children each woman has with subsequent beneficial effects on population and on the health status of mother and child. This study, therefore, aimed to identify the duration and determinants of interbirth intervals among women of reproductive age in one region of Jordan.

Methods

A community-based study was conducted in October 2003, in the 7 districts of Al-Karak governorate, southern Jordan. This communication is part of a more extensive survey of the duration and determinants of interbirth interval and contraceptive use among women of reproductive age [*13*].

The target population was ever-married women of reproductive age. Eligibility criteria were being ever married only once and having at least 1 live birth. The inclusion of only women who contributed with at least 1 interval was inevitable since we focused on the interval between 2 consecutive live births. Those who were married more than once were excluded to avoid heterogeneity of interbirth intervals for the same woman.

Sample size was estimated based on the prevalence of contraception use reported by the Population and Family Health Survey for southern Jordan [*3,14*]. Among the population, the proportion of contraception users (p) was 0.48 and non-users (q) was 0.52. The chosen degree of precision (d) was 0.03 at the 95% confidence interval.

The sample size was calculated as: sample size (n) = $(z^2 \times p \times q)/(d^2)$.

The total sample size was 1109 women. Multistage sampling technique was used to enrol eligible women. All 7 districts in Al-Karak governate were surveyed to allow for the generalization of findings. The number of women to be selected from each district was determined by proportional allocation. Implicit in the procedure was that larger numbers of women were drawn from districts with larger populations. In each district, villages were ranked by population size. The first village surveyed was the largest, followed by the next largest. The procedure was repeated until the sample size was reached and a total of 15 villages in the 7 districts were surveyed. Refusals and non-respondents were not encountered.

Eligible women were interviewed using a pre-designed, pre-tested interview questionnaire. Sociodemographic data were gathered including birthdates of each woman and her husband, education, husband's occupation, woman's work status, family type and family income in Jordanian dinars. Marriage data included date of marriage, current marital status and, if applicable, date of divorce, separation or widowhood. Reproductive history included number of pregnancies, dates of pregnancy terminations, pregnancy outcomes including number, status and gender of children, breastfeeding practices and use of modern contraceptives. Family planning variables, including women's opinions of the ideal age for childbearing, ideal number of children per family and ideal child spacing, were surveyed. To ensure maximum accuracy and to eliminate the effect of recall bias, all dates including partner's birth date, marriage date and children's birth dates were obtained from the Family Registry Book.

Data processing and analysis was performed with *SPSS*, version 10. Two data files were created: one of women interviewed and another of "interbirth intervals". The interbirth interval, defined as the duration between 2 consecutive live births, was computed by transforming the dates of those 2 deliveries into a time variable. If a pregnancy ended in miscarriage or stillbirth, the interval extended to the next live birth. The "birth interval" was defined as the interval between the date of marriage and the first live birth. An interval was closed by birth, pregnancy or permanent absence of the husband as a result of death, divorce or separation, or loss of fertility following sterilization. Women's opinions of family planning ideals were recoded to represent family planning norms with an ideal age of conception between 25 and 35 years, ideal number of children of 3 or less and ideal spacing of 3 years or more [*15*]. Data were presented as the mean, the standard deviation (SD) and the corresponding 95% confidence interval (CI) of the mean. Mean duration of interbirth interval and its determinants were analysed with life table, Kaplan–Meier survival and Cox regression analyses suitable for censored observation. Significance of results was judged at the 5% level.

Results

This survey included 1109 ever-married women aged 18–49 years [mean age 32.22 (SD 7.101) years]. The mean age at marriage was 21.36 (SD 3.865) years with a median of 21 years, although 15.9% (n = 177) were married before 18 years of age. At the time of the survey, the majority of women (98.3%) were married and few were widowed (1.2%) or divorced or separated (0.5%).

The women had on average 4.5 pregnancies [4.41 (SD 2.68)] and 4.00 deliveries [3.94 (SD 2.43)]. Median age at first

delivery was 22 years [2.74 (SD 3.85)]; however, some had their first baby as young as 14 years of age (maximum age 39 years). Nearly a quarter (24.26%) reported 436 pregnancy wastages including abortion and stillbirths. The number of children each woman had ranged from 1–13 with an average of 4 children per woman [3.92 (SD 2.398)].

On average women had their first child after 18 months of marriage [17.61 (SD 12.65) months]. Nearly three-quarters of women (73.9%) had their first child within a year of marriage and 15.8% gave birth during the second year. The remaining (10.4%) had their first child after the second year due to difficulties conceiving.

The 1109 enrolled women contributed to 4349 interbirth intervals. Nearly three-quarters of the women (76.5%) contributed to 1–5 interbirth intervals. A quarter (25.5%) of these intervals were first, 21.8% were second and 17.0% were third birth intervals, whereas 23.4% of the intervals were fifth or higher. Of the 4349 interbirth intervals, 78.2% were closed and 2.8% were open. The mean duration of interbirth interval was 40.36 (standard error 0.83) months (95% CI: 38.73–42.00 months) with a median of 27.40 (SE 0.30) months (95% CI: 26.82–27.98 months).

Table 1 shows that few intervals (13.9%) were for women who did not receive any formal education and that just less than half of the intervals were for women who had finished high school (21.0%) or had a university degree (23.2%). Among the latter, the interbirth intervals were significantly longer, at an average of 41 months (log rank test = 15.93, $P = 0.0031$). The risk of a subsequent live birth was 0.86 times lower among women who finished high school than among women without any formal education, and 0.83 times lower among women with university degrees. No significant difference was observed for the effect of the husband's education (log rank test = 7.65, $P = 0.1052$).

Women married to professionals or semi-professionals contributed to 28.2% of the intervals. These intervals were significantly longer (42.46 months) than for women married to men in other occupational categories (log rank test = 4.64, $P = 0.0313$). Also, intervals for women who were employed were 45.25 months compared with 39.14 months for women who were not employed (log rank test = 11.34, $P = 0.0008$). Employment at the beginning of the interval significantly reduced the risk of early termination of the interval by another live birth (hazard ratio = 0.86, 95% CI: 0.79–0.94) (Table 1).

Statistically significant differences were observed between the interbirth interval and the family type (log rank test = 8.07, $P = 0.0045$) as well as the per-capita monthly income (log rank test = 34.90, $P < 0.0001$). Interbirth interval was significantly shorter for women living in extended families (36.46 months) and for those whose per capita monthly income was less than 50 JD (38.85 months) (JD 1 = US$ 1.28 at the time of the study). The likelihood of a subsequent live birth was lower among women living with their nuclear families (hazard ratio = 0.84, 95% CI: 0.75–0.95) and those whose monthly per-capita family income was 50–100 JD (hazard ratio = 0.82, 95% CI: 0.73–0.90) or exceeded 100 JD (hazard ratio = 0.67, 95% CI: 0.56–0.79) (Table 1).

Table 2 shows that slightly more than half of the intervals (59.6%) were from the 10 years preceding our survey whereas only a few (8.1%) predated the survey by 20 years or more. The oldest intervals were remarkably short (mean 28.16 months). Intervals from the 10–20 years before our survey had a mean duration of 35.80 months, whereas the most recent intervals

Table 1 **Duration of interbirth interval in relation to sociodemographic characteristics of the women at the beginning of the interval**

Sociodemographic characteristic	No. (*n* = 4349)	%	Mean interbirth interval (months)	SE	95% CI	Hazard ratio (95% CI)
Woman's education						
No formal education[a]	604	13.9	39.99	2.40	35.28–44.70	1.00
6 years	676	15.6	37.55	1.57	34.47–40.63	0.97 (0.86–1.09)
9 years	1145	26.3	39.88	1.49	36.97–42.79	0.93 (0.82–1.02)
12 years	913	21.0	41.26	1.62	38.08–44.45	0.86 (0.76–0.96)
More than 12 years	1011	23.2	41.34	1.51	38.39–44.30	0.83 (0.74–0.93)
Husband's education						
No formal education[a]	334	7.7	43.77	3.48	36.94–50.59	1.00
6 years	707	16.3	36.01	1.48	33.11–38.91	1.02 (0.89–1.18)
9 years	1347	31.0	40.40	1.37	37.71–43.09	0.95 (0.83–1.08)
12 years	1198	27.5	40.72	1.46	37.85–43.59	0.91 (0.79–1.04)
More than 12 years	763	17.5	41.07	1.80	37.54–44.61	0.89 (0.77–1.02)
Husband's occupation						
Other[a,b]	3121	71.8	39.53	1.04	37.49–41.57	1.00
Professional or semiprofessional	1228	28.2	42.46	1.49	39.55–45.33	0.92 (0.85–0.99)
Woman's work status at the interval						
Not working[a]	3454	79.4	39.14	0.91	37.36–40.93	1.00
Working	895	20.6	45.25	1.92	41.49–49.01	0.86 (0.79–0.94)
Family type						
Extended[a]	395	9.1	36.46	2.19	32.17–40.75	1.00
Nuclear	3954	90.9	40.84	0.90	39.07–42.60	0.84 (0.75–0.95)
Monthly per capita income (JD)						
< 50[a]	3465	79.7	38.85	0.95	36.99–40.70	1.00
50–100	693	15.9	44.61	2.91	40.31–48.92	0.82 (0.73–0.90)
> 100	191	4.4	59.40	5.58	48.46–70.33	0.67 (0.56–0.79)

[a]Reference category.
[b]Other occupational categories includes skilled, semiskilled and manual labourers.
SE = standard error.
CI = confidence interval.
JD = Jordanian dinar (JD 1 = US$ 1.28).

had the longest mean duration at 40.60 months (log rank test = 150.16, $P < 0.0001$).

The majority of intervals (83.3%) were for women aged 20–35 years and almost half (49.3%) were for those married less than 5 years. The length of the interbirth interval was significantly affected by the woman's age (log rank test = 457.16, $P = 0.0000$) and the duration of her marriage (log rank test = 505.03, $P < 0.0001$) at the beginning of the interval. The shortest inter-

Table 2 **Duration of interbirth interval in relation to age, duration of marriage at interval onset and years preceding the survey**

Characteristic at interval onset	No. (*n* = 4349)	%	Mean inter-birth interval (months)	SE	95% CI	Hazard ratio (95% CI)
Maternal age (years)						
15–[a]	346	8.0	26.58	0.98	24.65–28.50	1.00
20–	1313	30.2	29.64	0.71	28.25–31.03	0.84 (0.74–0.95)
25–	1495	34.4	35.93	0.90	34.17–37.70	0.63 (0.56–0.71)
30–	814	18.7	56.08	3.19	49.82–62.33	0.41 (0.36–0.47)
35–	314	7.2	81.32	5.01	71.49–91.15	0.25 (0.21–0.31)
40–49	67	1.5	83.08	6.62	70.11–96.06	0.14 (0.09–0.22)
Duration of marriage (years)						
1–[a]	2141	49.3	28.61	0.52	27.60–29.62	1.00
5–	1279	29.4	43.87	1.43	41.07–46.66	0.57 (0.53–0.62)
10–	610	14.0	56.21	3.45	49.46–62.97	0.45 (0.40–0.50)
15–	227	5.2	69.96	5.33	59.51–80.40	0.32 (0.26–0.38)
20–31	92	2.1	99.85	8.54	83.10–116.59	0.18 (0.13–0.26)
Years preceding the survey						
1–	2594	59.6	40.60	0.72	39.19–42.00	0.55 (0.49–0.62)
10–	1405	32.3	35.80	0.99	33.86–37.74	0.77 (0.68–0.87)
20+ [a]	350	8.1	28.16	1.14	25.93–30.39	1.00

[a]Reference category.
SE = standard error.
CI = confidence interval.

vals were those starting with the woman's age between 15 and 20 years (26.58 months) and in which the woman was married for less than 5 years (28.61 months). The likelihood of a new live birth was significantly lower for intervals that began between the ages of 35 and 40 years (hazard ratio 0.25, 95% CI: 0.21–0.31) and for those that began between the ages of 40 and 49 years (hazard ratio 0.14, 95% CI: 0.09–0.22). Similarly, the likelihood of a new live birth was significantly lower for intervals that started after 20 years of marriage (hazard ratio 0.18, 95% CI 0.13–0.26) (Table 2).

Table 3 shows a significant increase in the interbirth interval with the increase in the number of surviving children (log rank test = 621.94, $P < 0.0001$). Intervals starting with 1 surviving child were the shortest (24.82 months). The risk of termination of the interval by a subsequent live birth significantly decreased with the presence of 3 surviving children (hazard ratio 0.46, 95% CI: 0.41–0.51) or 4 surviving children (hazard ratio 0.39, 95% CI: 0.34–0.43). It was 0.32 in the presence of 5 or more surviving children (hazard ratio 0.32, 95% CI: 0.29–0.36). The interbirth interval was also influenced by the sex of surviving children (log

Table 3 **Duration of interbirth interval in relation to children's variables at the interval**

Characteristics of the offspring	No. (*n* = 4349)	%	Mean inter-birth interval (months)	SE	95% CI	Hazard ratio (95% CI)
Number of children						
1[a]	1110	25.6	24.82	0.61	23.62–26.01	1.00
2	952	21.9	33.52	0.92	31.72–35.32	0.58 (0.53–0.63)
3	737	16.9	41.59	1.71	38.24–44.94	0.46 (0.41–0.51)
4	549	12.6	51.51	3.36	44.92–58.10	0.39 (0.34–0.43)
5 or more	1001	23.0	57.45	2.11	53.32–61.58	0.32 (0.29–0.36)
Sex of living children						
Only girls	878	20.2	27.34	0.87	25.62–29.05	2.15 (1.98–2.35)
Only boys	995	22.9	31.45	1.06	29.37–33.53	1.69 (1.56–1.84)
Both boys and girls[a]	2476	56.9	49.45	1.58	46.36–52.54	1.00
Child death						
No[a]	4296	98.8	40.47	0.85	38.81–42.13	1.00
Yes	53	1.2	35.13	4.97	25.39–44.86	1.22 (0.92–1.64)

[a]Reference category.
SE = standard error.
CI = confidence interval.

rank test = 373.31, $P < 0.0001$). Intervals starting with girls only were the shortest (27.34 months) and increased to 31.45 months for those starting with boys only, while those starting with both boys and girls were the longest (49.45 months). The risk of a subsequent live birth was 1.69 times higher for intervals starting with boys only and increased to 2.15 times for intervals starting with girls only. Intervals in which women experienced the loss of a child were shortened by 5 months; this difference was not statistically significant (log rank test = 1.93, $P = 0.1651$).

A significantly longer interbirth interval (40.54 months) was associated with breastfeeding of an infant born in the previous interval (log rank test = 6.11, $P = 0.0135$) and much longer (45.15 months) when breastfeeding was practised for 1 year or longer (log rank test = 146.03, $P < 0.0001$). The risk of termination of the interval by a subsequent live birth was 0.85 times lower with breastfeeding practice and 0.66 times lower with the breastfeeding for 1 year or longer (Table 4).

Intervals in which women experienced pregnancy wastage extended for 57.65 months compared with 39.25 months for intervals in which women did not experience an abortion or a stillbirth (log rank test = 58.15, $P < 0.0001$). Pregnancy wastage reduced the risk of a subsequent live birth by 0.57 times. Also, intervals in which women opted for modern contraceptives (52.28 months) were significantly longer than intervals (34.69 months) in which modern contraceptives were not used (log rank test = 313.76, $P < 0.0001$). The use of modern contraceptives increased the interbirth interval and had lower risk of a subsequent live birth (hazard ratio 0.51, 95% CI: 0.47–0.55) (Table 4).

Table 5 shows the interbirth interval in relation to family planning norms based on the recoding of the women's opinions. The

Table 4 **Duration of interbirth interval in relation to the proximate determinants of fertility at the beginning of the interval**

Proximate determinant	No. (*n* = 4349)	%	Mean inter-birth interval (months)	SE	95% CI	Hazard ratio (95% CI)
Breastfeeding						
No[a]	308	7.1	36.69	2.52	31.75–41.63	1.00
Yes	4041	92.9	40.54	0.86	38.86–42.23	0.85 (0.75–0.97)
Duration of breastfeeding						
No or less than 12 months[a]	2070	47.6	34.87	1.03	32.85–36.89	1.00
12 months or more	2279	52.4	45.15	1.36	42.48–47.82	0.66 (0.62–0.71)
Pregnancy wastage[b]						
No[a]	4119	94.7	39.25	0.85	37.58–40.92	1.00
Yes	230	5.3	57.65	3.44	50.91–64.38	0.57 (0.49–0.66)
Use of modern contraceptive						
No[a]	2951	67.9	34.69	0.86	33.00–36.38	1.00
Yes	1398	32.1	52.28	1.61	49.14–55.43	0.51 (0.47–0.55)

[a]Reference category.
[b]Pregnancy wastage includes miscarriage and stillbirth.
SE = standard error.
CI = confidence interval.

interbirth interval was significantly longer (48.31 months) among women who reported an ideal number of children of 3 or less than among those who reported an ideal of 4 or more children (39.53 months). The interbirth interval was on average 40

Table 5 **Duration of interbirth interval in relation to family planning norms**

Family planning norm	No. (*n* = 4349)	%	Mean inter-birth interval (months)	SE	95% CI	Hazard ratio (95% CI)
Age for child bearing (years)						
25–35[a]	403	9.3	40.93	2.52	36.05–45.91	1.00
> 35	3946	90.7	40.57	0.96	38.70–42.45	1.01 (0.90–1.14)
Child spacing						
3 years or more[a]	2150	49.4	40.60	1.00	38.63–42.56	1.00
Less than 3 years	2199	50.6	40.44	1.35	37.80–43.09	1.44 (1.06–1.22)
Number of children						
3 or less[a]	407	9.4	48.31	3.07	42.29–54.33	1.00
4 or more	3942	90.6	39.53	0.87	37.83–41.22	1.22 (1.08–1.37)

[a]Reference category.
SE = standard error.
CI = confidence interval.

months for women who reported an ideal spacing of 3 or more years and those who reported an ideal spacing of less than 3 years. However, the median duration of interbirth interval for those who reported an ideal spacing of 3 years or more was 29.27 (SE 0.51) months (95% CI: 28.27–30.26 months) compared with 26.10 (SE 1.35) months (95% CI: 37.80–43. 09 months) for those who reported an ideal spacing of less than 3 years. This difference was statistically significant (log rank test = 14.22, P = 0.0002). The interbirth intervals were nearly equal for women who reported an ideal childbearing age of 25–35 years and those who reported an ideal childbearing age beyond this range.

Cox regression analysis indicated that longer interbirth interval was independently predicted by woman's higher education, higher per capita family income, longer duration of marriage, more surviving children, presence of boys only or both sexes, breastfeeding for 12 months or more, miscarriage or stillbirth, use of modern contraception and opinion of the ideal number of children and child spacing that conform with family planning norms. Shorter interbirth interval was independently predicted by younger women's age at the beginning of the interval (Table 6).

Discussion

This study determined the duration of the interval between births and the factors that favoured longer spacing. The study considered 4349 closed and open intervals contributed by 1109 women. The duration between 2 consecutive live births was of a median duration of 27 months, which was shorter than the national figure of 30 months reported in 2002 in the Jordan Population and Family Health Survey [*3*]. Among the developing countries, Jordan has a relatively high income and has the largest proportion of women giving birth at intervals of less than 3 years. Between 1998 and 2001, 74% of women had their next child within less than 3 years [*8*].

Health policy has emphasized birth spacing. In 1996, the government of Jordan ratified the National Health Programme for Birth Spacing, a component of the National Population Strategy [*16*]. Since then, health education messages have focused not only on small family size but also on longer spacing between births [*3,8*]. Certainly these messages have brought favourable changes in women's attitudes that have been reflected in their behaviour. In the current survey, women whose ideals conformed to these family planning norms had fewer children and longer child spacing intervals. The 18% increase in the birth interval between 1997 and 2002 has been attributed to the National Health Programme for Birth Spacing [*3*]. Among the population, the birth interval lengthened remarkably; this change may eventually result in a continuous decline in fertility as has been accomplished in Bangladesh [*11*].

Expanding education and employment opportunities for women is a motive for child spacing. In Jordan, women's literacy reached 80% in 1998, one of the highest rates in the Eastern Mediterranean Region [*1*]. The present study and others have demonstrated the positive impact of women's education, particularly higher education, on birth interval [*4,6–8,11*]. In fact, it is women's educational attainment rather than that of their husbands that has a significant impact on birth intervals. Higher educational attainment improves woman's status and opens the door for employment with subsequent increases in the space between births [*6–9*]. The relatively longer intervals observed in relation to women's employment may be a reflection of their

Table 6 **Independent predictors of the duration of the interbirth interval**

Independent predictor	Coefficient	Hazard ratio	95% CI	*P*-value
Woman's education				
No formal education[a]				
6 years	–0.0946	0.91	0.81–1.03	0.1254
9 years	–0.1962	0.82	0.73–0.92	0.0006
12 years	–0.2910	0.75	0.66–0.84	< 0.0001
More than 12 years	–0.2104	0.81	0.71–0.92	0.0014
Woman's age at interval onset (years)				
15–	0.9703	2.64	1.58–4.40	0.0002
20–	1.1634	3.20	1.95–5.26	< 0.0001
25–	1.1122	3.04	1.86–4.97	< 0.00010
30–	0.8827	2.42	1.48–3.94	0.0004
35–	0.5627	1.76	1.07–2.86	0.0237
40–49[a]				
Years married at interval onset				
1–[a]				
5–	–0.2455	0.78	0.69–0.88	0.0001
10–	–0.4475	0.64	0.53–0.77	< 0.0001
15–	–0.6670	0.51	0.39–0.67	< 0.0001
20–31	–0.9075	0.40	0.27–0.61	< 0.0001
Monthly per capita income (JD)				
< 50[a]				
50–100	–0.3464	0.71	0.64–0.79	< 0.0001
> 100	–0.5458	0.58	0.48–0.70	< 0.0001
Number of surviving children				
1[a]				
2	–0.4074	0.66	0.59–0.74	< 0.0001
3	–0.4311	0.65	0.56–0.76	< 0.0001
4	–0.4579	0.63	0.52–0.77	< 0.0001
5 or more	–0.3606	0.69	0.56–0.86	0.0008
Sex of surviving children				
Only girls[a]				
Only boys	–0.1172	0.89	0.81–0.98	0.0213
Both boys and girls	–0.1849	0.83	0.74–0.93	0.0016
Pregnancy wastage				
No[a]				
Yes	–0.6242	0.53	0.46–0.62	< 0.0001
Duration of breastfeeding				
Less than 12 months[a]				
12 months or more	–0.4444	0.64	0.60–0.69	< 0.0001
Use of contraception				
No[a]				
Yes	–0.5861	0.56	0.51–0.60	< 0.0001

Table 6 **Independent predictors of the duration of the interbirth interval *(concluded)***

Independent predictor	Coefficient	Hazard ratio	95% CI	*P*-value
Ideal spacing				
Less than 3 years[a]				
3 years or more	–0.1073	0.90	0.84–0.96	0.0023
Ideal number of children				
4 or more[a]				
3 or less	–0.2616	0.77	0.68–0.87	< 0.0001

[a]Reference category.
CI = confidence interval.
JD = Jordanian dinar (JD 1 = US$ 1.28).

need to care for their children while simultaneously realizing themselves outside the home and remaining gainfully employed. Women's attainment of higher education influences spacing indirectly by leading to delays in age at marriage, changes in reproductive norms and behaviours as well as the practice and efficacy of contraception [*4,17–19*]. It seems then that social, economic and environmental factors influence fertility through its proximate determinants.

In Jordan, almost all women marry before the end of their childbearing period [*3*]. The legal age of marriage is 18 years although exceptions do occur especially in remote areas [*3*]. Since childbearing has biological limits, delay in the age of marriage is associated with fewer children per woman [*20,21*]. The median age of marriage of 21 years among the surveyed population means that the period during which women were likely to bear children was reduced [*18*]. In addition, birth intervals were modulated by women's age in the current study and in others as intervals that started with the woman's age older than 30 years were significantly longer [*4,8,10,12,21*]. This has been attributed to the decline in fecundity with age as a result of ovarian and hormonal malfunctioning [*10,21,22*].

Within a year of marriage, the majority of women had given birth to their first child. Because of the social pressure women may face, especially in traditional societies, other children tend to come in quick succession resulting in significantly shorter birth intervals within the first 5 or 10 years of marriage [*8*]. The birth interval between the first and second child was on average 24 months and increased steadily with the increase in the number of surviving children at the beginning of the interval. Similar observations have been reported that emphasize the short birth intervals among women of low parity [*3,4,8,12*].

The sex of children is also an influential factor on birth spacing, especially in societies where preference for sons dominates [*3,4,8,10,11,15,23,24*]. In Jordan, women expressed a preference for sons; the negative impact of this preference on the birth interval has been previously reported [*3*]. A lack of sons reduced the birth interval by an average of 4 months. Previous studies indicated that son preference put an upward pressure on fertility as couples continued to have children until they reached their desired number of sons [*14,24*]. Birth intervals became considerably longer once

women reached the desired balance of sons and daughters.

Contraception use increases the birth interval by increasing the time until the next conception with a subsequent decline in fertility [*18*]. In Zimbabwe and Addis Ababa, the widespread use of contraception reduced fertility to below replacement levels [*20,25*]. In this study, modern contraceptives were used in only a third of the intervals and their use increased the birth interval by an average of 10 months. Moreover, independent of other determinants, modern contraceptives increased the birth interval 1.80 times. Among enrolled women, the prevalence of modern contraceptives was still low and those who persisted with modern contraceptive use were women above the age of 35 years and women with many surviving children [*13*]. It was more likely that women opted for contraception to end childbearing than to maintain longer spacing between births.

In societies where contraception prevalence is low, fertility control could be achieved through breastfeeding. The significant fertility-inhibiting effect of breastfeeding has been documented and its superiority over contraception has been proven in societies where the practice predominates [*8,10,18,26–29*]. In this study in almost all intervals breastfeeding was practised and in half of these intervals it continued for 1 year or more. Breastfeeding increased the birth interval by an average of 4 months. Independent of other proximate determinants of fertility, breastfeeding for 12 months reduced fertility by more than half by increasing the period of postpartum non-susceptibility [*8,10,18,26*]. This was probably the reason why a relatively short birth interval was observed in association with the loss of a child and it may be attributed to the biological effect of interrupting breastfeeding with a subsequent increase in the effective fertile period [*3,4,7,10,12,23*]. It has also been attributed to the "replacement effect" that reflects a need to substitute for the lost child [*4,12*].

The birth interval among the study population was relatively long but was still far from the target of 3-years spacing. The effect of breastfeeding and contraception use on child spacing needs highlighting. The duration of postpartum non-susceptibility associated with breastfeeding varies from one woman to another. Under the best circumstances, this period is 12 months and is associated with a birth interval of 27 months [*18*]. As breastfeeding benefits both the baby and the mother, women should be encouraged to nurse their newborns for more than 12 months. Concomitantly, modern contraceptives should be promoted as their universal use will extend the waiting time for conception to 30 months, resulting in a birth interval of 41 months [*18*].

The effective use of modern contraceptives also prevents unintended pregnancy and obviates the need for abortion. The role of abortion in lengthening the birth interval was not investigated in this study since abortion is not legal in Jordan or in other Muslim countries. Instead, enquiry was made into pregnancy wastage and abortion could not be recommended as a means of lengthening the birth interval.

More effort is needed to improve the status of women. As the rate of female literacy is high in Jordan, attempts should be made to increase educational attainment and expand women's employment opportunities, especially since only 16% of women in the southern region of Jordan were employed [*3*]. The median age of marriage in the southern region was lower than the national median of 23.5 years; improving the status of women might also bring about an

increase in the median age of marriage. More importantly, reinforcement is needed to prevent marriage before the legal age for women. Exerting control over the age at marriage and increasing the spacing between births are effective strategies for fertility control.

Acknowledgement

The author wishes to acknowledge Mu'tah University and the Deanship of Scientific Research for supporting the research objective and for the generous funding that made possible the realization of this study.

References

1. Shawky S. Infant mortality in Arab countries: sociodemographic, perinatal and economic factors. ***Eastern Mediterranean health journal***, 2001, 7(6):956–65.
2. Bloom DE et al. ***Demographic transition and economic opportunity: The case of Jordan***. Bethesda, Maryland, United States of America, Partners for Health Reformplus Project, Abt Associates Inc., 2001 (http://www.riverpath.com/library/pdf/jordan.PDF, accessed 13 June 2005).
3. ***Jordan population and family health survey 2002***. Amman, Jordan, Department of Statistics and Calverton, Maryland, USA, ORC Macro, 2003.
4. Chakraborty N, Sharmin S, Islam MA. Differential pattern of birth interval in Bangladesh. ***Asia-Pacific population journal***, 1996, 11(4):73–86.
5. Bongaarts J. A framework for analyzing the proximate determinants of fertility. ***Population and development review,*** 1978, 4(1):105–32.
6. Sufian AJ. Socioeconomic factors and fertility in the Eastern Province of Saudi Arabia. ***Biology and society***, 1990, 7(4): 186–93.
7. Oheneba-Sakyi Y, Heaton TB. Effects of sociodemographic variables on birth intervals in Ghana. ***Journal of comparative family studies***, 1993, 24(1):113–24.
8. Setty-Venugopal V, Upadhyay UD. Birth spacing: three to five saves lives. ***Population reports***, Series L, No. 13. Baltimore, Maryland, USA, Johns Hopkins Bloomberg School of Public Health, Population Information Program, 2002.
9. Miller CF, Xiao JJ. Effects of birth spacing and timing on mothers' labor force participation. ***Atlantic economic journal***, 1999, 27(4):410–22.
10. Mturi AJ. The determinants of birth interval among non-contracepting Tanzanian women. ***African population studies***, 1997, 12(2)(http://www.uaps.org/journal/journal12v2/The%20Determinants%20of%20Birth%20Intervals%20Among.htm, accessed 13 June 2005).
11. Van Ginneken J, Razzaque A. Supply and demand factors in the fertility decline in Matlab, Bangladesh in 1997–1999. ***European journal of population***, 2003, 19:29–45.
12. Polo V, Luna F, Fuster V. Determinants of birth interval in a rural Mediterranean population (La Alpujurra, Spain). ***Human biology***, 2000, 72(5):877–90.
13. Youssef RM. Contraception use and probability of continuation: community-based survey of women in southern Jordan. ***Eastern Mediterranean health journal***, 2005, 11(4):545–58.
14. Lwanga SK, Lemeshow S. ***Sample size determination in health studies: A practical manual***. Geneva, World Health Organization, 1991.

15. Zidar VM et al. New survey findings: the reproductive revolution continues. ***Population reports***, Series M, No. 17. Baltimore, Maryland, USA, Johns Hopkins Bloomberg School of Public Health, The INFO Project, 2003.

16. National Population Commission. ***The updated national population strategy: concepts, foundation, and goals, 2000–2020***. Amman, Jordan, National Population Commission, 2000 (http://www.policyproject.com/pubs/countryreports/Jordan_NPS.pdf, accessed 13 June 2005).

17. Vavrus F, Larsen U. Girls' education and fertility transition: analysis of recent trends in Tanzania and Uganda. ***Economic development and cultural change***, 2003, 51(4):945–55.

18. Centers for Disease Control and Prevention (CDC). ***Family planning methods and practice: Africa***, 2nd ed. Atlanta, Georgia, USA, Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Reproductive Health, 2000.

19. Bollen KA, Glnaville JL, Stecklov G. Socioeconomic status and class in studies of fertility and health in developing countries. Au:***Annual review of sociology***, 2001, 27:153–86.

20. Sibanda A et al. The proximate determinants of the decline to below replacement fertility in Addis Ababa, Ethiopia. ***Studies in family planning***, 2003, 34(1): 1–7.

21. Bhattcharya B, Singh KK, Singh U. Proximate determinants of fertility in Eastern Uttar Pradesh. ***Human biology***, 1995, 67(6):867–86.

22. Weinstien M, Wood J, Greenfield DD. How does variation in fetal loss affect the distribution of waiting time to contraception? ***Social biology***, 1993, 40(1–2): 108–30.

23. Hoa HT et al. Child spacing and two child policy in practice in rural Vietnam: cross sectional survey. ***British medical journal***, 1996, 313(7065):1113–6.

24. Alakkam A. Factors affecting birth spacing among agarian families in a North Jordanian village. ***Journal of comparative family studies***, 2002, 33(1):117–25.

25. Sibanda A. Reproductive change in Zimbabwe and Kenya: The role of the proximate determinants of fertility. ***Social biology***, 1999, 46(1–2):82–99.

26. Philippine's Legislators' Committee on Population and Development Foundation. Breast is best. ***Population count***, 1993, 3(2):1–4.

27. Da Vanzo J, Starbird EH. Correlates of short interbirth intervals in Peninsular Malaysia: their pathways of influence through breastfeeding and contraception use. ***Studies in family planning***, 1991, 22(4):241–54.

28. Islam MM, Al Mamun A, Bairagi R. Fertility and its proximate determinants in Bangladesh. Evidence from the 1993/94 demographic and health survey. ***Asia-Pacific population journal***, 1998, 13(3): 3–22.

29. Letamo G. Contributions of proximate determinants to fertility change in Botswana. ***Journal of biosocial science***, 1996, 28(3):325–38.