Interpregnancy intervals and women's knowledge of the ideal timing between birth and conception

Jenny M Yang ,[1] Kate Cheney,[1] Rebecca Taylor,[1] Kirsten Black[2]

[1]Women and Babies Department, Royal Prince Alfred Hospital, Camperdown, New South Wales, Australia
[2]University of Sydney, Sydney, New South Wales, Australia

Correspondence to
Dr Jenny M Yang, Women and Babies, Royal Prince Alfred Hospital, Camperdown, AU 2050, Australia; jennyyangklimis@gmail.com

Received 24 November 2018
Revised 5 August 2019
Accepted 30 August 2019
Published Online First 11 September 2019

To cite: Yang JM, Cheney K, Taylor R, *et al*. *BMJ Sex Reprod Health* 2019;**45**:249–254.

ABSTRACT

Background Short interpregnancy intervals (IPIs) are associated with adverse obstetric outcomes. However, few studies have explored women's understanding of ideal IPIs or investigated knowledge of the consequences of short IPIs.

Methods We performed a prospective questionnaire-based study at two hospitals in Sydney, Australia. We recruited women attending antenatal clinics and collected demographic data, actual IPI, ideal IPI, contraceptive use, and education provided on birth-spacing and contraception following a previous live birth. We explored associations between an IPI <12 months and a selection of demographic and health variables.

Results Data were collected from 467 women, of whom 344 were pregnant following a live birth. Overall, 72 (20.9%) women had an IPI <12 months only 7.5% of whom believed this was ideal, and the remaining stating their ideal IPI was over 12 months (52.3%) or they had no ideal IPI (40.3%). IPI <12 months following a live birth was significantly associated with younger age (p=0.043) but not with ethnicity, relationship status, education, religion, parity nor previous mode of delivery. IPI <12 months was associated with non-use of long-acting reversible contraception (LARC) (p<0.001), breastfeeding <12 months (p=0.041) and shorter ideal IPI (p=0.03). Less than half of the women (43.3%, n=149) reported having received advice about IPI and less than half about postnatal contraception (44.2%, n=147).

Conclusions Younger age and non-use of LARC are significantly associated with IPIs <12 months. A minority of women with a short IPI perceived it to be ideal. Prevention of short IPIs could be achieved with improved access to postnatal contraception.

Key messages

- Short interpregnancy interval (IPI) is associated with adverse obstetric outcomes.
- Younger age, lack of contraceptive use and preference for short IPI are all statistically associated with short IPI.
- Short IPI and its consequences could be prevented by increasing education on contraception and the adverse consequences of short IPIs.

INTRODUCTION

The interpregnancy interval (IPI) is defined as the time between the birth date of one pregnancy and the estimated conception date of the next pregnancy. A short IPI is known to be associated with adverse pregnancy outcomes for both mothers and their babies. A number of cross-sectional studies and meta-analyses previously reported that short IPIs (shorter than 12–18 months) are associated with an increased risk of adverse perinatal outcomes including preterm birth, low birth weight and small for gestational age.[1–5] Short IPIs have also been reported to increase the risk of neonatal, infant and child mortality.[6 7] Furthermore, among women with a previous caesarean section wanting a vaginal birth, an IPI <12 months confers an increased risk of uterine rupture.[8] These observations led to current clinical and public health recommendations advising a minimum IPI of 18 months.[9] More recent studies that have matched women as their own controls, to reduce confounding factors, have identified that an IPI <12 months confers greater risk for preterm birth and small for gestational age in high-resource settings, which supports the findings from the previous studies.[3 10 11]

Communication of these risks to women and their awareness of recommended IPIs has been little explored and, until recently,

Table 1 Interpregnancy interval questionnaire

Question	Answer
1. What is the due date of this pregnancy?	
2. In terms of the timing of this pregnancy would you say it happened:	At the right time✓ At an OK time but not quite right✓ At the wrong time✓
3. In total how many children have you had?	
4. In total how many children do you want?	
5. Have you ever had a miscarriage or stillbirth?	Number of miscarriages✓ Number of stillbirths✓
6. What was your last pregnancy?	A miscarriage✓ A stillbirth✓ A termination✓ A live birth✓
7. When was this last pregnancy?	Day/month/year:
8. If you have had a previous birth how was your last baby born?	Normal vaginal delivery✓ Forceps/vacuum delivery✓ Caesarean (emergency)✓ Caesarean (elective)✓
9. How many weeks at birth was that baby?	
10. Did you breastfeed the baby?	Yes, fully for _____ months Yes, partly for _____ months Not at all
11. What do you think is the ideal space between a birth and getting pregnant again?	<6 months✓ 6 months to 1 year✓ 1–2 years✓ 2–3 years✓ Over 3 years✓ Don't know✓
12. Did you use any contraception between the pregnancies?	Yes✓ Which one: No✓
13. Have you ever used any contraceptive methods in the past? If yes, please tick	Pills✓ Condoms✓ Withdrawal✓ Intrauterine devices✓ Implants✓ Injection✓ Other✓
14. If not, what was the reason for this?	Never used contraception before✓ Don't understand contraception✓ Worried about side effects✓ No reason✓ Did not think I could get pregnant with breastfeeding✓ Other, please state:
15. Did the hospital or genearl practitioner (GP) give you any advice about the timing of the next pregnancy?	Yes✓ No✓
16. If yes, what did the doctor recommend?	
17. How old are you?	16–17✓ 18–24✓ 25–34✓ 35–39✓ >40✓
18. What is your current relationship status?	Single and never married✓ Married✓ Living with a man/woman as a couple✓ Widowed✓ Divorced or separated✓
19. What is your current employment situation?	Working full-time✓ Working part-time✓ Working and studying✓ Studying full-time✓ Studying part-time✓ Unemployed✓ On a disability pension✓
20. What is the highest qualification you have attained?	Tertiary✓ Secondary school✓ Primary school✓ Other (please specify)✓
21. What is your cultural background?	Please state
22. What religion do you belong to?	Please state
23. What is your post code?	Please state

minimal attention has been given to the issue of IPIs in Australian maternity care. Among multigravida women, we sought to document their IPIs and explore their knowledge of the recommended timing between pregnancies, including whether or not they recalled being given any information to guide them.

METHODS

We undertook a prospective questionnaire-based study at The Royal Prince Alfred Hospital and The Canterbury Hospital in Sydney, Australia. These hospitals have a combined birth rate of approximately 8000 births per year. Participants were recruited by an experienced midwife researcher during an antenatal clinic visit and were given a brief questionnaire to complete privately. All women attending for antenatal care at either hospital attend at least one obstetrician visit, according to the protocol at both hospitals, and therefore we aimed to recruit women when attending these visits. While recruitment was performed opportunistically, according to the availability of researchers, all clinic types were attended to ensure patients from specialised clinics (such as the diabetes clinic) were represented. The only inclusion criteria were being older than 16 years and having had a previous pregnancy. The only women excluded were those who could not understand the English or translated questionnaires or for whom an interpreter was not available.

The questionnaire collected demographic data, previous obstetric history, IPI, contraceptive use, and perspectives on timing of the current pregnancy and ideal birth spacing (table 1). Recollection of advice previously given regarding birth spacing and contraception was also collected (table 1). The questionnaire was translated into Korean, Bangla, Arabic and Chinese, the most common languages used other than English at the participating hospitals.

A short IPI was defined as <12 months between resolution of the most recent pregnancy and conception of the current pregnancy, and the responses were coded into Microsoft Excel. Sample size was calculated based

on data from one of the hospitals which recorded an IPI <12 months for 20% of the women. Assuming this proportion in a population of 8000, we would need 239 multigravida women to report the 95% CI with a margin of error of 5%. We estimated that in at least 25% of the sample the previous pregnancy was an outcome other than a live birth (eg, a miscarriage, termination or stillbirth) and for this reason we inflated the sample size. Descriptive statistics were performed using IBM SPSS Statistics 24 using univariate analyses with the Chi squared test, with a p value of <0.05 considered to be significant. Responses for several variables were merged into new subgroups for ease of statistical analysis: age group, relationship status, parity, mode of last birth, and breastfeeding after last birth.

Ethics approval was obtained via the Sydney Local Health District Ethics office for both sites (protocol X16-0135).

Patient and public involvement

The research question was informed and developed by clinical experience of the researchers who observed that there appeared to be little understanding of the adverse effects of short IPIs, particularly in those women who had had short IPIs. We also observed poor rates of postpartum contraceptive use and wanted to investigate the reasons for this further, so that we could create a targeted strategy to address this. Women were not involved in the design of the study. They were recruited voluntarily as described above. Results will be disseminated to study participants via incorporation into antenatal education sessions.

RESULTS

Data were collected from 5 September 2016 until 17 May 2018. There were 474 women approached of whom 467 women agreed to participate. Three hundred and forty-four women were pregnant following a live birth, 74 following a miscarriage or ectopic pregnancy, 43 following a termination of a pregnancy and six following a stillbirth (figure 1). This represents approximately 7% of births to both primiparous and multiparous women over the study period.

IPI in women whose last pregnancy was a live birth

Overall, 72 (20.9%) women had an IPI <12 months, 110 had an IPI of 12–24 months (32%) and 162 women had an IPI >24 months (47.1%). The demographic characteristics of respondents according to IPI are demonstrated in table 2. Data on 10 or fewer participants were missing for the variables of education

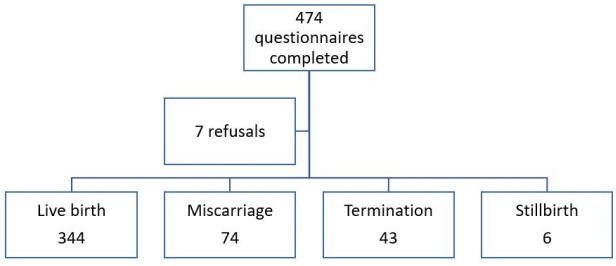

Figure 1 Flow chart of recruitment.

Table 2 Association between demographics and interpregnancy interval following a live birth

Demographic characteristic	IPI <12 months (%)	IPI ≥12 months (%)	Total	X^2
Age (years)				
<25*	13 (18.1)	25 (9.2)	38	p=0.043
25–34	45 (62.5)	166 (61)	211	
>34†	14 (19.4)	81 (29.8)	95	
Total	72 (100.0)	272 (100.0)	344	
Ethnicity				
Australian	3 (4.2)	15 (5.5)	18	p=0.075
Indian Subcontinent	18 (25.0)	79 (29.0)	97	
Asian	16 (22.2)	72 (26.5)	88	
African/Middle Eastern	14 (19.4)	19 (7.0)	33	
European	7 (9.7)	25 (9.2)	32	
ATSI	1 (1.4)	6 (2.2)	7	
Other	7 (9.7)	17 (6.3)	24	
Unknown	6 (8.3)	39 (14.3)	45	
Total	72 (100.0)	272 (100.0)	344	
Relationship status‡				
Single§	2 (2.9)	18 (6.6)	20	p=0.194
Partnered¶	67 (97.1)	256 (93.4)	323	
Total	69 (100.0)	274 (100.0)	343	
Education‡				
Tertiary	36 (50.7)	144 (53.7)	180	p=0.525
High school/TAFE	32 (45.1)	105 (39.2)	137	
Primary	3 (4.2)	19 (7.1)	22	
Total	71 (100.0)	268 (100.0)	339	
Religion				
None	18 (25.0)	100 (36.8)	118	p=0.150
Christian	22 (30.6)	63 (23.2)	85	
Muslim	26 (36.1)	77 (28.3)	103	
Other	6 (8.3)	32 (11.8)	38	
Total	72 (100.0)	272 (100.0)	344	
Parity‡				
1 child	40 (55.6)	160 (60.2)	200	p=0.482
2+ children	32 (44.4)	106 (39.8)	138	
Total	72 (100.0)	266 (100.0)	338	
Mode of last birth				
Vaginal**	55 (76.4)	196 (72.1)	251	p=0.462
Caesarean section††	17 (23.6)	76 (27.9)	93	
Total	72 (100.0)	272 (100.0)	344	

*Merged groups '16–17 years' and '18–24 years'.
†Merged groups '35-39 years' and '≥40 years'.
‡Variable with less than 10 values missing.
§Merged groups 'single and never married', 'widowed' and 'divorced or separated'.
¶Merged groups 'married' and 'living with a man/woman as a couple'.
**Merged groups 'normal vaginal delivery' and 'forceps/vacuum delivery'.
††Merged groups 'caesarean (emergency)' and 'caesarean (elective)'.
ATSI, Aboriginal or Torres Strait Islander background; IPI, interpregnancy interval; TAFE, technical and further education.

level, relationship status, and parity, and there were 69 values for ethnicity which were not able to be classified or were unknown. Younger women were more likely to have an IPI <12 months compared with older women (34.2% of women aged <25 years compared with 14.0% of women aged >34 years; p=0.043). There were no other associations between an IPI <12 months and ethnicity, marital status, education, religion, parity, or mode of last birth (table 2). Only 5% of the sample stated their ethnicity as 'Australian', although many of the unclassified values were 'Caucasian'. Over two-thirds of the young women aged <25 years were of Asian or Subcontinent origin (26/38, 68%).

Perspectives and advice on IPI

The majority of women who were pregnant following a live birth stated that the ideal IPI is either 1–2 years or 2–3 years (29% and 26.4%, respectively). Only 2.4% believed 6–12 months was the ideal IPI and 32.6% did not know. Of the women who conceived within 12 months following a live birth, only 40.8% said it was the 'right time'. One hundred and eighty-nine (54.9%) of all women following a live birth stated that they had never received advice about ideal IPI following a live birth (table 3). Women whose last birth was via caesarean section were significantly more likely to have received advice about ideal IPI (65.6% vs 35.1%; p<0.001); however, they were equally likely to have an IPI of <12 months as those who had a vaginal birth in their last pregnancy.

Factors associated with an IPI <12 months following a live birth

There was a statistically significant association between use of long-acting reversible contraception (LARC) and IPI >12 months (p value =<0.001). Women who breastfed for more than 12 months were less likely to have an IPI <12 months compared with no breastfeeding or feeding for a shorter period of time (table 3).

Women's ideal IPI was related to their actual IPI, with a greater proportion of women with a short interval believing 6–12 months was the right spacing between pregnancies, compared with those without a short IPI (table 3).

Contraceptive advice and use between pregnancies

One hundred and eighty women (54.2%) used contraception between a live birth and their current pregnancy, of which 17.2% specified as using a LARC. The self-reported frequency of contraceptive advice given to these women after their previous pregnancy was 44.2% (n=147). Of the whole cohort, including women who did not have a live birth as their last pregnancy outcome, 219 women (46.9%) did not use contraception following their last pregnancy. Twelve women (5.5%) stated this was because they were afraid of side effects, 12 (5.5%) due to a deficient understanding of contraception, seven (3.2%) due to lack of previous experience with contraception, and six (2.7%) due to believing breastfeeding would be sufficient to prevent pregnancy. One hundred and forty-eight respondents (67.6%) did not provide an answer and 35 women (16%) stated that they did not have a specific reason for not using contraception. Nine women (4.1%) had 'other' reasons for not using contraception, with notable reasons including infertility, being in a same-sex relationship, religious objection to contraception, and partner objection to contraception.

Table 3 Associations between ideal interpregnancy interval (IPI), breastfeeding, contraception use, and IPI education with IPI following a live birth

Parameter	IPI <12 months (%)	IPI ≥12 months (%)	Total	X^2
Ideal IPI				
<6 months	0	0	0	p=0.030
6–12 months	5 (7.5)	3 (1.1)	8	
1–2 years	20 (29.9)	81 (30.0)	101	
2–3 years	11 (16.4)	78 (28.9)	89	
>3 years	4 (6.0)	25 (9.3)	29	
Don't know	27 (40.3)	83 (30.7)	110	
Total	67 (100.0)	270 (100.0)	337	
Breastfeeding*				
No feeding	13 (18.3)	44 (16.1)	57	p=0.041
<6 months	23 (32.4)	74 (27.1)	97	
6–12 months	22 (31.0)	58 (21.2)	80	
12+ months	13 (18.3)	97 (35.5)	110	
Total	71 (100.0)	273 (100.0)	344	
Use of contraception†				
None	49 (71.0)	103 (39.2)	152	p<0.001
Short-acting reversible methods	18 (26.1)	131 (49.8)	149	
Long-acting reversible methods	2 (2.9)	29 (11.0)	31	
Total	69 (100.0)	263 (100.0)	332	
Received advice about IPI				
No	36 (50.7)	153 (56)	189	p=0.580
Yes	33 (46.5)	116 (42.5)	149	
Don't know	2 (2.8)	4 (1.5)	6	
Total	71 (100.0)	273 (100.0)	344	

*Both partial and exclusive breastfeeding.
†Missing data not included (n=12).
IPI, interpregnancy interval.

DISCUSSION

In this study of an urban antenatal population, one-fifth of women had an IPI <12 months and less than half of these pregnancies were considered to be well timed. Neither mode of previous birth nor sociodemographic characteristics were significantly associated with an IPI <12 months with the exception of maternal age.

The other factors associated significantly with IPI <12 months were breastfeeding less than 12 months, not using contraception, and belief that a short IPI of 6–12 months was ideal. Counselling about IPI by hospital staff or general practitioners occurred significantly more commonly for women who had a caesarean section but this did not impact on the actual IPI.

Other studies have reported a similar rate of short IPI.[12] These studies identified an association between short IPI and decreased education level, extremes of age, relationship status, minority race, depression, smoking, increased paternal age, low socioeconomic status, and low income.[13–18] Our study found a similar association between short IPI and maternal age, although we found contradictory results with regard to education level, relationship status and cultural background. We also included factors that had not been investigated in other studies such as breastfeeding, contraceptive use, beliefs of ideal IPI, and recollection of advice regarding ideal IPI and contraception. One explanation for the discordant findings may be that our sample represents a more heterogenous population than previously published research, most of which concentrates on high-risk populations such as adolescents and minority groups. The only other Australian studies in this area investigated short IPI in a rural Indigenous population and adolescents, who are both high-risk populations.[19 20]

Of note, there are two major groups described in the literature at high risk of short IPIs: those with unintentional pregnancies, who comprise a large proportion of these women; and also well-educated (53% with tertiary education) and older women (28% over 34 years old) who may deliberately delay childbearing, thereby having to balance the risks of short IPI with their declining fertility.[14] The latter group represented a significant proportion of our study participants compared with other studies in this area, therefore the association between young age and short IPI may be even more pronounced than what we found.

In addition to contributing to the limited body of literature that assesses short IPI in a low-risk Western population, a strength of this study is the fact that the questionnaires were translated and distributed to women at two different sites. Although only 7% of women who delivered during the recruitment period were represented by this study, the effort to translate and widely distribute the questionnaires enabled representation of a wide range of demographics and particularly high-risk women who may have been excluded from other studies due to language barriers. At the study sites, women of Asian and Subcontinent background comprised most of the young women, and based on other studies this group may also be less likely to access contraception.[21] Furthermore, most existing studies are predominantly database-based. Ours is one of few studies with a qualitative component with regard to contraception recall. This strength provides contemporary insight into women's perspectives on previous postpartum contraception, and identifies deficiencies in contraceptive knowledge that can be targeted to increase contraceptive rates.

The literature has identified that many misconceptions persist regarding contraception, such as having to avoid contraception because of breastfeeding.[22] It is therefore no surprise that up to 70% of pregnancies within 12 months of birth are unintended,[23] and that conversely, unintended pregnancy is a major risk factor of short IPI.[14 17 24 25] Early provision of LARC decreases the rate of short IPI,[26] with one study finding a US$4.5 million economic cost saving at 3 years from immediate postpartum Implanon (etonogestrel subcutaneous implant) in American adolescents.[27] Bocanegra[26] found that the number needed to treat with immediate postpartum contraception to avoid one short IPI is 6.38. Another study found that while 12.8% of women planned on using a LARC postpartum, this increased to 47.8% if it was immediately available.[28] Our study has identified that women recall that they received only limited information with regard to postpartum contraception and risks of short IPI, as the women in our study report low rates of receiving both contraceptive advice and the IPI recommendations. This study has therefore identified an area that could be targeted by a public health initiative aimed at preventing women from having short IPIs. This could be achieved by providing education on contraception and the adverse outcomes related to short IPIs, as well as access to contraception prior to discharge following birth. Future research after implementing such strategies can be conducted to assess their effectiveness in preventing both short IPIs and the associated adverse outcomes.

CONCLUSIONS

Short IPIs are associated with an increased risk of preterm birth and several other adverse perinatal outcomes. In an Australian population, one-fifth of women had an IPI <12 months following a live birth of whom less than one-tenth felt this was the ideal interval. Only half of the women recalled receiving education about pregnancy spacing and less than half recalled provision of information on postpartum contraception. Educating women about the adverse outcomes related to short IPIs and providing education and access to postnatal contraception, particularly LARC methods, could reduce the number of pregnancies conceived within a year of a previous birth.

Contributors KB designed the research question and study approach. JY, KC and RT also contributed to the concept and design of the study and data collection instruments. KC made substantial contributions to the acquisition of data for the work. JY and RT also contributed to acquisition of the data for the work. KB and JY performed analysis and interpretation of the data for the work. JY drafted the original manuscript. KB, KC and RT critically revised the work for intellectual content.

JY, KB, KC and RT all gave approval of the final manuscript for submission and accept responsibility for the paper as published.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

ORCID iD
Jenny M Yang http://orcid.org/0000-0002-2943-1088

REFERENCES

1. Wendt A, Gibbs CM, Peters S, *et al*. Impact of increasing inter-pregnancy interval on maternal and infant health. *Paediatr Perinat Epidemiol* 2012;26:239–58.
2. Shachar BZ, Mayo JA, Lyell DJ, *et al*. Interpregnancy interval after live birth or pregnancy termination and estimated risk of preterm birth: a retrospective cohort study. *BJOG* 2016;123:2009–17.
3. Hanley GE, Hutcheon JA, Kinniburgh BA, *et al*. Interpregnancy interval and adverse pregnancy outcomes: an analysis of successive pregnancies. *Obstet Gynecol* 2017;129:408–15.
4. Conde-Agudelo A, Rosas-Bermúdez A, Kafury-Goeta AC. Birth spacing and risk of adverse perinatal outcomes: a meta-analysis. *JAMA* 2006;295:1809–23.
5. Chen I, Jhangri GS, Lacasse M, *et al*. Relationship between interpregnancy interval and adverse perinatal and neonatal outcomes in northern Alberta. *J Obstet Gynaecol Can* 2015;37:598–605.
6. Perin J, Walker N. Potential confounding in the association between short birth intervals and increased neonatal, infant, and child mortality. *Glob Health Action* 2015;8:29724.
7. Kozuki N, Lee ACC, Silveira MF, *et al*. The associations of birth intervals with small-for-gestational-age, preterm, and neonatal and infant mortality: a meta-analysis. *BMC Public Health* 2013;13:S3.
8. Knight M, Acosta C, Brocklehurst P, *et al*. Beyond maternal death: improving the quality of maternal care through national studies of 'near-miss' maternal morbidity. In: *Programme Grants for Applied Research*. Southampton, UK: NIHR Journals Library, 2016: 4.9. 1–180.
9. American College of Obstetricians and Gynecologists. ACOG Committee Opinion No. 736: optimizing postpartum care. *Obstet Gynecol* 2018;131:e140–50.
10. Schummers L, Hutcheon JA, Hernandez-Diaz S, *et al*. Association of short interpregnancy interval with pregnancy outcomes according to maternal age. *JAMA Intern Med* 2018;178:1661.
11. Ball SJ, Pereira G, Jacoby P, *et al*. Re-evaluation of link between interpregnancy interval and adverse birth outcomes: retrospective cohort study matching two intervals per mother. *BMJ* 2014;349:g4333.
12. Mignini LE, Carroli G, Betran AP, *et al*. Interpregnancy interval and perinatal outcomes across Latin America from 1990 to 2009: a large multi-country study. *BJOG* 2016;123:730–7.
13. Zhang L, Shen S, He J, *et al*. Effect of Interpregnancy interval on adverse perinatal outcomes in southern China: a retrospective cohort study, 2000-2015. *Paediatr Perinat Epidemiol* 2018;32:131–40.
14. Gemmill A, Lindberg LD. Short interpregnancy intervals in the United States. *Obstet Gynecol* 2013;122:64–71.
15. Patchen L, Caruso D, Lanzi RG. Poor maternal mental health and trauma as risk factors for a short interpregnancy interval among adolescent mothers. *J Psychiatr Ment Health Nurs* 2009;16:401–3.
16. Centers for Disease Control and Prevention (CDC). Risk factors for short interpregnancy interval - Utah, June 1996-June 1997. *MMWR Morb Mortal Wkly Rep* 1998;47:930–4.
17. Kaharuza FM, Sabroe S, Basso O. Choice and chance: determinants of short interpregnancy intervals in Denmark. *Acta Obstet Gynecol Scand* 2001;80:532–8.
18. Thoma M, Copen C, Kirmeyer S. Short interpregnancy intervals in 2014: differences by maternal demographic characteristics. *NCHS Data Brief* 2016:1–8.
19. Rousham EK, Gracey M. Factors affecting birthweight of rural Australian aborigines. *Ann Hum Biol* 2002;29:363–72.
20. Lewis LN, Doherty DA, Hickey M, *et al*. Predictors of sexual intercourse and rapid-repeat pregnancy among teenage mothers: an Australian prospective longitudinal study. *Med J Aust* 2010;193:338–42.
21. Richters J, Fitzadam S, Yeung A, *et al*. Contraceptive practices among women: the second Australian study of health and relationships. *Contraception* 2016;94:548–55.
22. Cleland J, Shah IH, Benova L. A fresh look at the level of unmet need for family planning in the postpartum period, its causes and program implications. *Int Perspect Sex Reprod Health* 2015;41:155–62.
23. White K, Teal SB, Potter JE. Contraception after delivery and short interpregnancy intervals among women in the United States. *Obstet Gynecol* 2015;125:1471–7.
24. Masinter LM, Dina B, Kjerulff K, *et al*. Short interpregnancy intervals: results from the first baby study. *Womens Health Issues* 2017;27:426–33.
25. Cha S, Chapman DA, Wan W, *et al*. Discordant pregnancy intentions in couples and rapid repeat pregnancy. *Am J Obstet Gynecol* 2016;214:494.e1–494.e12.
26. Thiel de Bocanegra H, Chang R, Menz M, *et al*. Postpartum contraception in publicly-funded programs and interpregnancy intervals. *Obstet Gynecol* 2013;122:296–303.
27. Han L, Teal SB, Sheeder J, *et al*. Preventing repeat pregnancy in adolescents: is immediate postpartum insertion of the contraceptive implant cost effective? *Am J Obstet Gynecol* 2014;211:24.e1–7.
28. Heller R, Cameron S, Briggs R, *et al*. Postpartum contraception: a missed opportunity to prevent unintended pregnancy and short inter-pregnancy intervals. *J Fam Plann Reprod Health Care* 2016;42:93–8.