

# The Effect of Pregnancy Intention on Maternal Prenatal Behaviours and Parent and Child Health: Results of an Irish Cohort Study

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## Abstract

**Background:** Unintended pregnancy is associated with increased risk for adverse neonatal and early childhood outcomes spanning an array of indicators, but it remains unclear whether these risks hold independent of other biological, social and environmental risk factors.

**Methods:** This study uses data from the first wave of the 'Growing Up in Ireland Study', a large nationally representative cohort study of more than 11 000 infants, to examine the risk factors associated with unintended pregnancy. Adopting a staged approach to the analysis, the study investigates whether pregnancy intention influences maternal health behaviours during pregnancy independent of background characteristics, and whether pregnancy intention carries any additional risk for adverse infant and maternal health outcomes when we adjust for background characteristics and prenatal behaviours.

**Results:** The study confirmed that sociodemographic factors are strongly associated with unintended pregnancy and that unintended pregnancy is associated with a range of health compromising behaviours that are known to be harmful to the developing fetus. While there was little evidence to suggest that pregnancy intention was associated with adverse neonatal outcomes or developmental delay independent of other covariates, there was strong evidence that intention status had a bearing on the mother's psychosocial health. Unintended pregnancy was associated with increased risk of depression (risk ratio 1.36 [95% confidence interval 1.19, 1.54]), and higher parenting stress (risk ratio 1.27 [95% confidence interval 1.16, 1.38]).

**Conclusions:** Ascertaining the mother's pregnancy intention during the first antenatal visit may represent a means for monitoring those at greatest risk for adverse mother and child outcomes.

**Keywords:** pregnancy intention, neonatal health, child development, parental psychosocial health.

Although studies differ in their characterisation of pregnancy intention,<sup>1</sup> unintended pregnancy (UIP) is usually defined as a pregnancy that is mistimed (i.e. occurs earlier or later than was intended) or is unwanted.<sup>2</sup> UIPs are important from a public policy perspective because they are associated with increased risk for adverse neonatal outcomes, including preterm birth (PTB)<sup>3</sup> and low birthweight (LBW).<sup>4</sup>

Other studies have documented deficits extending into early childhood,<sup>5</sup> and adulthood,<sup>6</sup> although at present it is unclear whether these effects hold independent of other biological, social and environmental risk factors.<sup>1</sup>

Less well understood are the reasons why UIP leads to worse outcomes.<sup>7</sup> UIP may serve as a marker for other social disadvantages, which operate as independent risk factors for worse outcomes.<sup>7</sup> UIP may also influence maternal health behaviours during the prenatal period and these decisions can have important implications for fetal growth and development. Alternatively, it could be that women with a UIP may

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experience less prenatal care, or delay seeking prenatal care.<sup>8</sup> Finally, and less explored, are the psychosocial pathways through which UIP leads to adverse outcomes. For example, studies have documented poorer levels of psychological health among women with UIPs, including higher rates of depression, higher levels of perceived stress, and lower levels of partner and social support.<sup>9</sup>

### ***Pregnancy intention and pre-conceptual and prenatal behaviours***

A number of studies have examined the impact of UIP on maternal health behaviours during pregnancy, noting that those for whom the pregnancy was unintended are more likely to engage in health compromising behaviours, including smoking during pregnancy,<sup>10–13</sup> failing to adhere to recommendations regarding vitamin supplementation<sup>10,14,15</sup> and delaying the timing of the first antenatal booking appointment.<sup>8,10,12,13</sup> A recent study of maternal and neonatal consequences of UIP in rural India has also shown variations in the use of recommended prenatal care, with unwanted pregnancies over twice as likely as wanted pregnancies to receive inadequate prenatal care.<sup>16</sup> Other studies, however, have found that UIP does not carry any excess risk of smoking during pregnancy when background factors have been controlled for.<sup>17,18</sup>

### ***Pregnancy intention and neonatal outcomes***

Most studies investigating this issue have focused on the immediate neonatal period but it has been argued that methodologically rigorous studies examining the relationship between pregnancy intention and neonatal outcomes are lacking.<sup>19</sup> The evidence from the stronger studies would seem to indicate that unwanted status does not carry any additional risk for adverse neonatal outcomes when maternal background characteristics and differences in prenatal behaviours are controlled for.<sup>4,18</sup> A systematic review<sup>4</sup> found that UIP was associated with significantly increased odds of PTB and LBW in the unadjusted analysis, but that the relationship with PTB no longer held in the multivariable adjusted model. When the unintended category was further disaggregated into unwanted and mistimed pregnancies, there was no higher risk for LBW in the adjusted models.

### ***Pregnancy intention and mother and child outcomes***

Fewer studies have examined the impact of pregnancy intention on children's outcomes beyond the immediate neonatal period, and among those that have, findings have been mixed. Analysis of data from the National Maternal and Infant Health Survey found that although unwanted pregnancy was associated with worse global health ratings, over-activity and lower scores on a composite developmental index, these effects were eroded when adjusted for maternal characteristics and social and biological risk factors.<sup>20</sup> A separate analysis of the same data set<sup>5</sup> found that across each of the assessed outcomes (less than excellent health, over-activity and the composite developmental score), UIP was associated with less favourable outcomes. Finally, Carson and collaborators did not note any significant differences in the cognitive scores of children resulting from unplanned vs. planned pregnancies at 3 or 5 years of age after adjusting for the marked socio-economic differences that existed between groups.<sup>21</sup>

### ***Pregnancy intention and parent psychosocial health***

While research on the impact of UIP on the mother's mental health and psychosocial outcomes is limited,<sup>1</sup> there is evidence that UIP may modify the psychosocial health of mothers, by impacting on the levels of stress, anxiety and depression she may experience.<sup>9</sup> One study found that mothers with UIPs were more likely to report higher levels of depression and lower levels of happiness than mothers with planned pregnancies, spent less leisure time with their children, and were more likely to use physical punishment with their children than other mothers.<sup>22</sup> Even after controlling for sociodemographic variables, research indicates that UIP predicts poorer psychosocial outcomes for mothers.<sup>23,24</sup>

Given the discrepant pattern of results that has emerged across studies, this study attempts to discern whether there are any significant effects of pregnancy intention on a variety of maternal prenatal behaviours, infant outcomes, and parental psychosocial variables independent of background factors using data from the first wave of the Growing Up in Ireland Study – a large nationally representative study of more than 11 000 infants who were first assessed at 9 months of

age. The objectives of this study were to (i) assess the relationship between pre-conceptual and post-partum behaviours;<sup>10</sup> and (ii) explore infant outcomes in relation to UIP beyond the immediate perinatal period.<sup>21</sup>

## Methods

### *Sample selection and recruitment*

Children who would have been 9 months of age at the time of interview (between September 2008 and April 2009) were selected from the Child Benefit Register (CBR) provided by the Department of Social and Family Affairs. The CBR was used as a sampling frame because child benefit is a universal welfare entitlement in Ireland and has practically complete coverage of all children born in the Republic of Ireland at the time of the study. The sample was selected on a systematic basis, pre-stratifying by marital status, county of residence, nationality and number of children (i.e. less than 16 years of age) in the household to ensure that households less likely to respond were oversampled, using a random start and constant sampling fraction. The total eligible CBR population was all births occurring during the period December 2007 to June 2008, which amounted to 41 185 children. A total of 17 264 families were approached to take part in the study, of which 64.5% ( $n = 11\,134$ ) families consented to participate.

The sample weights were constructed by adjusting the distribution of the sample to known population figures. The population distributions were derived from two sources. The first source was from tabulations, which were prepared by the Central Statistics Office on the number and characteristics of children (aged less than 1 year) and their families from the 2006 Census of Population. The second source was the CBR from which the sample was drawn. The 73 662 children registered on the CBR as being born in the calendar year 2008 were taken as the population to which the sample was statistically weighted and grossed in statistically re-adjusting the sample.

The project was subject to ethical approval by a Research Ethics Committee convened by the Department of Health and Children. A letter of introduction was sent to the family a few days in advance of their first contact. Interviewers were instructed to make initial visits to households in person. Interviewers administered the main questionnaires on laptops, and

respondents completed a second, more sensitive questionnaire on a Computer Assisted Self-Interview (CASI) basis.

### *Assessment of pregnancy intention*

Information regarding pregnancy intention was obtained retrospectively when the child was 9 months of age by means of a survey question on the sensitive questionnaire administered on a CASI basis. This questionnaire was designed to capture other sensitive information relating to the respondent's marital status and life style related behaviours during pregnancy. Pregnancy intention was assessed by means of a question, which asked the mother whether she had intended to become pregnant before the study child was conceived. Responses were categorised into two categories: intended and unintended. The intended category included those who said that they had planned to become pregnant at that time ( $n = 6260$ ). The unintended category included both unwanted [no intention of ever becoming pregnant ( $n = 1054$ )], unsure ( $n = 779$ ) and mistimed pregnancies [either later ( $n = 1086$ ), much later ( $n = 711$ ) or earlier than intended ( $n = 677$ )]. It was assumed that all pregnancies in this category involved potentially adverse experiences for the mother, given the unwanted, uncertain or mistimed nature of the pregnancy.

The mother was asked two questions regarding folic acid use: (1) whether she had taken folic acid before pregnancy, and (2) whether she had taken folic acid during the first 3 months of her pregnancy. Dosage and type of preparation of folic acid were not specified. The mother also self-completed a sensitive CASI questionnaire, which asked whether she had smoked during the course of her pregnancy or drank alcohol during the course of her pregnancy.

Assessed neonatal outcomes included whether there were any complications during the child's birth (yes/no), whether the child was born LBW ( $<2500$  or  $\geq 2500$  g) and whether the child was delivered preterm (i.e. earlier than 37 weeks).

### *Children's developmental status at 9 months*

Developmental competencies at 9 months of age was assessed using the Ages and Stages Questionnaire (ASQ),<sup>25</sup> which is a parent-report instrument that produces subscale scores and a dichotomous pass/fail threshold for each of five skill areas: communication,

gross motor, fine motor, problem solving and personal-social development. Although Growing Up in Ireland asked a set of items that spanned multiple age ranges, this analysis uses the 10-month age interval score as the most appropriate single score for the 9-month-old infants. Other authors<sup>26</sup> have reported positively on the use of parent-report methods for detecting developmental delay and the ASQ's psychometric properties were described as 'excellent' in a review of such instruments by the American Academy of Pediatrics.<sup>27</sup>

### *Psychosocial outcomes*

#### Maternal depression

Maternal depression was indexed using the eight-item Centre for Epidemiological Studies Depression Scale (CESD-8), which is a short self-report screening instrument for depression in the general population.<sup>28</sup> Responses are indicated on a four-point rating scale: 'rarely or none of the time (less than 1 day)', 'some or a little of the time (1–2 days)', 'occasionally or a moderate amount of the time (3–4 days)' and 'most or all of the time (5–7 days)' with a reference period of the previous 7 days. A composite score is calculated by summing item responses (range 0–24). Scores can also be dichotomised with a score seven or greater suggesting a clinically significant level of psychological distress. The CESD has good internal consistency reliability ( $\alpha = 0.86$ ) and the concurrent validity of the scale has been established through its association with other depression measures such as the Beck Depression Inventory.<sup>28</sup>

#### Maternal perception of the child's temperament

The six-item fussy-difficult subscale of the Infant Characteristics Questionnaire was used to index difficult infant temperament.<sup>29</sup> Respondents rate the perceived ease or difficulty of their infant's temperament on a seven-point rating scale with scores at the higher end of the spectrum representing a more difficult disposition. The scale has good internal consistency with an  $\alpha$  of 0.79 and test-retest reliability of 0.70 over a 30-day interval. Convergence between parent and independent observer ratings of 0.61 has been reported for the fussy-difficult scale.<sup>29</sup>

#### Parenting stress

The parental stress scale is an 18-item self-report instrument, which was designed to assess parenting stress.<sup>30</sup> Respondents indicate their level of agreement to a series of statements regarding the parenting role on a five-point Likert-scale with responses ranging from strongly agree to strongly disagree. The instrument produces scores for each of four subscales: Parental rewards, Parental stressors, Lack of control and Parental satisfaction. A total stress score is calculated by summing across the four subscales, with scores ranging between 18 and 90 (higher scores being indicative of higher parenting stress).

#### Statistical analysis

Non-biological mothers were not asked the question relating to pregnancy intention ( $n = 181$ ) and a further 386 mothers declined to answer the question resulting in an analytic sample of 10 567. With the exception of income, which was missing for 7.4% of the sample, the degree of missing data was relatively small. We created a dummy variable for cases missing on income to bring them back into the analysis. We first describe the sociodemographic characteristics of the sample by pregnancy intention status and report the independent association of each of these factors with intention status by fitting log-Poisson regression models expressing the risk ratio (RR) and associated 95% confidence intervals (CI) estimated using a Poisson model with robust variance estimator. We then estimate the unadjusted and multivariable adjusted RRs of engaging in health compromising prenatal behaviours adjusting for demographic characteristics. Finally, we present the unadjusted and multivariable adjusted RRs for adverse infant and maternal health outcomes adjusting for the set of demographic and prenatal life style-related behaviours. All analyses were undertaken using STATA (version 12.0).

### **Results**

Overall, 40.7% of the sample reported that they had a UIP. Table 1 describes the sociodemographic characteristics of the sample by pregnancy intention status. Lower social class, income and education were all associated with increased risk for a UIP, as was unmarried status. Coming from a white non-Irish or a

**Table 1.** Independent association of maternal background characteristics with pregnancy intention status

Variable		Intended ( <i>n</i> = 6260)		Unintended ( <i>n</i> = 4307)		
		<i>n</i>	Weighted %	<i>n</i>	Weighted %	RR [95% CI]
Marital status	Married and living with spouse/partner	5094	70.3	2154	29.7	1.00 [Reference]
	Married and separated from spouse/partner	79	39.7	120	60.3	2.03 [1.80, 2.28]
	Divorced/widowed	59	48.4	63	51.6	1.74 [1.46, 2.07]
	Never married	1028	34.3	1970	65.7	2.21 [2.12, 2.31]
Ethnicity	Irish	5084	60.2	3361	39.8	1.00
	Any other white background	806	56.9	609	43.1	1.08 [1.01, 1.15]
	Black	160	47.2	179	52.8	1.33 [1.20, 1.47]
	Asian	168	51.0	113	49.0	1.01 [0.87, 1.16]
Household social class	Professional/managerial	3542	67.8	1682	32.2	1.00
	Other non-manual/skilled manual	1826	57.4	1358	42.6	1.32 [1.25, 1.40]
	Semi-skilled/unskilled	534	55.3	432	44.7	1.39 [1.28, 1.50]
	Never worked – no class assigned	331	29.0	810	71.0	2.20 [2.09, 2.33]
Maternal education	Lower secondary	547	45.9	645	54.1	1.63 [1.52, 1.74]
	Upper secondary	1851	53.9	1584	46.1	1.39 [1.31, 1.47]
	Post-secondary	1273	61.8	787	38.2	1.15 [1.07, 1.23]
	Degree	2586	66.7	1290	33.3	1.00
Household income quintile	Lowest	881	43.2	1158	56.8	1.96 [1.81, 2.12]
	2nd	992	54.4	832	45.6	1.57 [1.44, 1.71]
	3rd	1152	61.4	724	38.6	1.33 [1.21, 1.46]
	4th	1439	68.0	676	32.0	1.10 [1.00, 1.21]
	Highest	1355	71.0	554	29.0	1.00
	Missing on income	441	54.9	363	45.2	1.56 [1.40, 1.72]
		Mean [95% CI]		Mean [95% CI]		
	Mother's age (years)		32.6 [32.5–32.7]		30.4 [30.2–32.7]	
		Median (range)		Median (range)		
	No. of previous livebirths		2.0 (5.0)		2.0 (5.0)	

Reference category for the categorical dependent variable: Intended pregnancy.

RR, risk ratio; CI, confidence interval.

black ethnic/racial background was also associated with increased risk for a UIP.

Table 2 shows the relationship between pregnancy intention and maternal prenatal behaviours controlling for the set of maternal background characteristics shown in Table 1. Having a UIP was associated with higher risk of smoking and drinking during pregnancy, and attending later on average for the first prenatal booking appointment. UIP was also associated with a significantly lower probability that the mother would take periconceptional folic acid or folic acid during the first 3 months of pregnancy.

Table 3 provides the unadjusted (model 1) and multivariable adjusted RR controlling for maternal background characteristics and maternal prenatal health behaviours (model 2). Of the three assessed neonatal outcomes, only one was associated with pregnancy intention status with a UIP being associated with

increased risk for birthing complications in the final model (RR 1.08 [95% CI 1.02, 1.14]). Although a UIP was associated with significantly increased risk of failing to meet the developmental milestone typical of children of this age on the gross motor component of the ASQ, this association was fully eroded in the multivariable analysis.

Unintended pregnancy was associated with increased risk of scoring above the 80th percentile on the Parental Stress Scale, and the effect remained after adjustment for confounding variables. Compared with those for whom the pregnancy was intended, the RR of scoring above the 80th percentile on the parental stress scale was 1.27 [95% CI 1.16, 1.38] among those who characterised their pregnancy as unintended. A UIP was also associated with significantly higher risk of obtaining a clinically significant depression score on the CESD (RR 1.36 [95% CI 1.19, 1.54]).

**Table 2.** Relationship between pregnancy intent and prenatal behaviours in the unadjusted and multivariable adjusted model (adjusted for maternal background characteristics)

	Pregnancy intended		Pregnancy unintended			
	<i>n</i>	Weighted %	<i>n</i>	Weighted %	Model 1	Model 2
					RR [95% CI]	RR [95% CI]
Took periconceptional folic acid	4846/6116	79.2	1732/4198	41.3	0.52 [0.50, 0.54]	0.62 [0.60, 0.65]
Took folic acid in first 3 months of pregnancy	5888/6115	96.3	3734/4197	89.0	0.92 [0.91, 0.93]	0.96 [0.95, 0.97]
Smoked during pregnancy	730/6220	11.7	1026/4263	24.1	2.05 [1.88, 2.24]	1.24 [1.13, 1.36]
Drank alcohol during pregnancy	1275/6220	20.5	876/4263	20.6	1.00 [0.93, 1.08]	1.15 [1.06, 1.24]
First antenatal booking appointment later than 16 weeks	206/6041	3.4	316/4134	7.6	2.24 [1.89, 2.66]	1.66 [1.39, 1.98]

Reference category for the categorical dependent variable: Intended pregnancy.

Model 1: Unadjusted model.

Model 2: Adjusted for marital status, maternal age, ethnicity, household social class, maternal education, household income and parity. RR, risk ratio; CI, confidence interval.

## Comment

This study has confirmed that sociodemographic and socio-economic factors are associated with UIP, and that UIP is a risk factor for a range of prenatal behav-

ours that are deleterious to fetal health. There was little evidence to suggest that pregnancy intention has any impact on early infant health outcomes when we control for maternal background characteristics and maternal health behaviours during pregnancy. Indeed,

**Table 3.** Relationship between pregnancy intent and child outcomes at birth and 9 months of age in the unadjusted and multivariable adjusted model (adjusted for maternal background characteristics and prenatal behaviours)

	Pregnancy intended		Pregnancy unintended			
	<i>n</i>	Weighted %	<i>n</i>	Weighted %	Model 1	Model 2
					RR [95% CI]	RR [95% CI]
<b>Neonatal outcomes</b>						
Birthing complications	2210/6040	36.6	1653/4132	40.0	1.09 [1.04, 1.15]	1.08 [1.02, 1.14]
Infant born low birthweight	313/5981	5.2	237/4085	5.8	1.11 [0.94, 1.31]	1.01 [0.83, 1.22]
Born earlier than 36 weeks	239/6033	4.0	183/4122	4.4	1.12 [0.93, 1.35]	1.06 [0.85, 1.33]
<b>Infant outcomes</b>						
Fail communication	416/6006	6.9	283/4109	6.9	1.00 [0.99, 1.01]	0.99 [0.98, 1.00]
Fail gross motor	977/6020	16.2	581/4119	14.1	1.03 [1.01, 1.04]	1.01 [0.99, 1.03]
Fail fine motor	557/5858	9.5	418/4026	10.4	0.99 [0.98, 1.00]	1.01 [0.99, 1.02]
Fail problem solving	811/5703	14.2	588/3904	15.1	0.99 [0.97, 1.01]	0.99 [0.97, 1.01]
Fail personal-social	1061/5970	17.8	749/4088	18.3	0.99 [0.97, 1.01]	0.99 [0.97, 1.01]
<b>Mental health and relationship quality</b>						
Maternal depression	464/6022	7.7	603/4118	14.6	1.90 [1.70, 2.13]	1.36 [1.19, 1.54]
Parenting stress score >80th percentile	1002/6011	16.7	1032/4109	25.1	1.51 [1.39, 1.63]	1.27 [1.16, 1.38]
Fussy-difficult score >80th percentile	1190/6026	19.8	968/4124	23.5	1.19 [1.10, 1.28]	1.04 [0.96, 1.13]

Reference category for the categorical dependent variable: Intended pregnancy.

Model 1: Unadjusted model.

Model 2: Adjusted for marital status, maternal age, ethnicity, household social class, maternal education, household income, parity, folic acid use, smoking during pregnancy, drinking during pregnancy and timing of the first antenatal booking appointment.

RR, risk ratio; CI, confidence interval.

pregnancy intention was associated with only one of the three neonatal outcomes. UIP was associated with only one of the five ASQ components and the excess risk of gross motor delay was fully attenuated in the final model.

There was, however, strong evidence that UIP has a bearing on the mother's psychosocial health as evidenced by higher rates of depression and higher rates of parenting stress among those for whom the pregnancy was unintended. These findings are suggestive of a parent-child relationship that is under strain and may provide a potential mediating pathway through which pregnancy intention can come to influence later outcomes.<sup>5,6</sup> Indeed, a common finding in the literature is that children who are exposed to a caregiving environment in which the mother is suffering from major depressive illness are at increased risk for a range of adverse health outcomes, including emotional and behavioural maladjustment.<sup>31</sup>

This study has several limitations. First, the time horizon for assessing the consequences of UIP is small as it spans only the first 9 months of the infant's life. Second, some investigators<sup>32,33</sup> have questioned the validity of using retrospective reports of pregnancy intention because of response biases resulting from *ex post* rationalisation of pregnancy intention. It should be acknowledged however that the effects may be under or overestimated<sup>1</sup> and that analysis of data from the National Longitudinal Survey of Youth cohort revealed that the association between UIPs and children's outcomes did not differ appreciably when intention was assessed prospectively compared with retrospectively.<sup>18</sup> Third, although higher rates of maternal depression among those with unwanted and mistimed pregnancies were documented, a baseline measure for maternal depression was not available so it is difficult to establish in a cross-sectional study whether the relationship is causal. Finally, it could be argued that the sample is highly selective as the sample was selected from the CBR at 9 months of age and hence excludes women who aborted their pregnancies. This group may differ in a number of important ways from those who went on to deliver an unwanted pregnancy. However, given that abortion is not legal in Ireland, except in very strict circumstances, this may not present a large challenge to the validity of the results.

Among the major strengths of the study is the large and representative nature of the sample, which amounts to approximately one-sixth of all livebirths in

Ireland during this period, which allows for the estimation of robust main effects. In addition, we were able to examine the impact of pregnancy intention across a wide range of prenatal, neonatal and child outcomes in the first 9 months of life, as well as the effect of intention status on the parent-child dynamic which has been identified as a major shortcoming in the literature.<sup>19</sup> The finding that UIP is associated with health compromising behaviours during pregnancy and adverse maternal psychosocial health has clear policy implications. Ascertaining the mother's pregnancy intention during the first antenatal visit may represent an opportunity to monitor those at greatest risk for adverse psychosocial outcomes, and allow for the development of interventions that may mitigate the risk among those with unintended pregnancies.

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### References

- 1 Gipson JD, Koenig MA, Hindin MJ. The effects of unintended pregnancy on infant, child, and parental health: a review of the literature. *Studies in Family Planning* 2008; 39:18-38.
- 2 Santelli J, Rochat R, Hatfield-Timajchy K, Gilbert GC, Curtis K, Cabral R, *et al.* and other members of the Unintended Pregnancy Working Group. The measurement and meaning of unintended pregnancy. *Perspectives on Sexual and Reproductive Health* 2003; 35:94-101.
- 3 Orr ST, Miller CA, James SA, Babones S. Unintended pregnancy and preterm birth. *Paediatric and Perinatal Epidemiology* 2000; 14:309-313.
- 4 Shah PS, Balkhair T, Ohlsson A, Beyene J, Scott F, Frick C. Intention to become pregnant and low birth weight and preterm birth: a systematic review. *Maternal and Child Health Journal* 2011; 15:205-216.
- 5 Crissey SR. Effect of pregnancy intention on child well-being and development: combining retrospective

- reports of attitude and contraceptive use. *Population Research and Policy Review* 2005; 24:593–615.
- 6 Henry D. Born unwanted, 35 years later: the Prague study. *Reproductive Health Matters* 2006; 14:181–190.
  - 7 Baydar N. Consequences for children of their birth planning status. *Family Planning Perspectives* 1995; 27:228–234.
  - 8 McComb Hulsey T. Association between early prenatal care and mother's intention of and desire for the pregnancy. *Journal of Obstetric, Gynecologic and Neonatal Nursing* 2001; 30:275–282.
  - 9 Maxson P, Miranda ML. Pregnancy intention, demographic differences, and psychosocial health. *Journal of Women's Health* 2011; 20:1–9.
  - 10 Cheng D, Schwarz EB, Douglas E, Horon I. Unintended pregnancy and associated maternal preconception, prenatal and postpartum behaviors. *Contraception* 2009; 79:194–198.
  - 11 Hellerstedt WL, Pirie PL, Lando HA, Curry SJ, McBride CM, Grothaus LC, et al. Differences in preconceptional and prenatal behaviors in women with intended and unintended pregnancies. *American Journal of Public Health* 1998; 88:663–666.
  - 12 Korenman S, Kaestner R, Joyce T. Consequences for infants of parental disagreement in pregnancy intention. *Perspectives on Sexual and Reproductive Health* 2002; 34:198–205.
  - 13 Kost K, Landry DJ, Darroch JE. Predicting maternal behaviors during pregnancy: does intention status matter? *Family Planning Perspectives* 1998; 30:79–88.
  - 14 Green-Raleigh K, Lawrence JM, Chen H, Devine O, Prue C. Pregnancy planning status and health behaviors among non-pregnant women in a California managed health care organization. *Perspectives on Sexual and Reproductive Health* 2005; 37:179–183.
  - 15 Timmermans S, Jaddoe VW, Hofman A, Steegers-Theunissen RP, Steegers EA. Periconceptional folic acid supplementation, fetal growth and the risks of low birth weight and preterm birth: the Generation R Study. *British Journal of Nutrition* 2009; 102:777–785.
  - 16 Singh S, Chalasani S, Koenig MA, Mahapatra B. The consequences of unintended births for maternal and child health in India. *Population Studies: A Journal of Demography* 2012; 66(3):223–239.
  - 17 Chuang CH, Hillemeier MM, Dyer A, Weisman CS. The relationship between pregnancy intention and preconception health behaviors. *Preventive Medicine* 2011; 53:85–88.
  - 18 Joyce T, Kaestner R, Korenman S. On the validity of retrospective assessments of pregnancy intention. *Demography* 2002; 39:199–213.
  - 19 Tsui AO, McDonald-Mosley R, Burke AE. Family planning and the burden of unintended pregnancies. *Epidemiologic Reviews* 2010; 32:152–174.
  - 20 Hummer RA, Hack KA, Raley RK. Retrospective reports of pregnancy wantedness and child well-being in the United States. *Journal of Family Issues* 2004; 25:404–428.
  - 21 Carson C, Kelly Y, Kurinczuk JJ, Sacker A, Redshaw W, Quigley WA. Effect of pregnancy planning and fertility treatment on cognitive outcomes in children at ages 3 and 5: longitudinal cohort study. *BMJ* 2011; 343.
  - 22 Barber JS, Axinn WG, Thornton A. Unwanted childbearing, health, and mother-child relationships. *Journal of Health and Social Behavior* 1999; 40:231–257.
  - 23 Najman JM, Morrison J, Williams G, Andersen M, Keeping JD. The mental health of women 6 months after they give birth to an unwanted baby: a longitudinal study. *Social Science and Medicine* 1991; 32:241–247.
  - 24 Hardee K, Eggleston E, Wong EL, Irwanto HTH. Unintended pregnancy and women's psychological well-being in Indonesia. *Journal of Biosocial Science* 2004; 36:617–626.
  - 25 Squires J, Potter L, Bricker D. *The ASQ User's Guide*, 2nd edn. New York: Paul H Brookes Publishing, 1999.
  - 26 Brothers KB, Glascoe FP, Robertshaw NS. PEDS: developmental milestones – an accurate brief tool for surveillance and screening. *Clinical Pediatrics* 2008; 47:271–279.
  - 27 American Academy of Pediatrics, Committee on Children with Disabilities. Developmental surveillance and screening of infants and young children. *Pediatrics* 2001; 108:192–196.
  - 28 Melchior LA, Huba GJ, Brown VB, Reback CJ. A short depression index for women. *Educational and Psychological Measurement* 1993; 53:1117–1125.
  - 29 Bates JE, Freeland C, Lounsbury ML. Measurement of infant difficulty. *Child Development* 1979; 50:794–803.
  - 30 Berry JO, Jones WK. The parental stress scale: psychometric evidence. *Journal of Social and Personal Relationships* 1995; 12:463–472.
  - 31 Goodman SH, Tully EC. Depression in women who are mothers: an integrative model of risk for the development of psychopathology in their sons and daughters. In: *Women and Depression: A Handbook for the Social, Behavioral and Biomedical Sciences*. Editors: Keyes CLM, Goodman SH. New York: Cambridge University Press, 2006; pp. 241–282.
  - 32 Rosenzweig MR, Wolpin KI. Maternal expectations and ex post realizations. *Journal of Human Resources* 1993; 28:205–227.
  - 33 Westoff C, Ryder N. The predictive validity of reproductive intentions. *Demography* 1977; 14:431–453.