

# Fathers make a difference: positive relationships with mother and baby in relation to infant colic

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## Summary

**Background** Maternal psychological factors like depression, anxiety and stress have been associated with infant fussiness or colic. However, little research exists on whether positive factors such as social support and the happiness of the mother–partner relationship are associated with lower rates of infant fussiness or colic.

**Objectives** We investigated the association between infant colic and three types of maternal support: general maternal social support (during pregnancy and post partum), the happiness of the mother–partner relationship (during pregnancy and post partum) and partner involvement in caring for the newborn.

**Methods** Participants were 3006 women in the First Baby Study, a prospective study of the effect of mode of first delivery on subsequent childbearing. Women were interviewed by telephone during pregnancy and 1 month after first childbirth and asked about social support and if their baby had a variety of problems since birth, including ‘Colic – crying or fussiness three or more hours a day’. Multivariable logistic regression models were used to model the association between maternal support and infant colic, controlling for confounders, including maternal race or ethnicity, insurance, marital status, smoking, mode of delivery, maternal post-partum depression, breastfeeding, other neonatal illnesses and newborn gestational age.

**Results** Infant colic was reported by 11.6% of new mothers. High general maternal social support (in comparison with low), measured during pregnancy, was associated with lower reported infant colic (adjusted odds ratio (AOR), 0.55, 95% confidence interval (CI), 0.40–0.75) and measured post partum (AOR, 0.51, 95% CI, 0.39–0.67); high relationship happiness (in comparison with low), measured during pregnancy (AOR, 0.71, 95% CI, 0.54–0.93), and measured post partum (AOR, 0.22, 95% CI, 0.12–0.40); and high partner involvement with newborn care (in comparison with low) (AOR, 0.60, 95% CI, 0.44–0.81).

**Conclusion** Higher levels of maternal social support during pregnancy and post partum are associated with lower rates of maternal reported infant colic.

## Keywords

fathers, infantile colic, maternal support, post partum, social support

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## Introduction

Fussiness or colic affects 5–19% of infants (Lucassen *et al.* 2001) and is a common reason for paediatrician visits in the early post-natal period (Barr 1998). Colic is more common among first-borns, most likely because first-time parents are more anxious than parents of subsequent children (Ståhlberg 1984). While biologic mechanisms may play a role in some cases of infantile colic (Szajewska *et al.* 2013), behavioural and psychosocial mechanisms also appear relevant (Wolke *et al.* 1994, Keefe *et al.* 2006, van Sleuwen *et al.* 2006, Blom *et al.* 2009, Howell *et al.* 2009, Newnham *et al.* 2009, Petzoldt *et al.* 2016). Many studies have focused on the association between psychosocial factors measured during pregnancy such as prenatal maternal depression, anxiety and low social support, as well as prenatal paternal depression and newborn colic or crying or fussiness (Rautava *et al.* 1993, Canivet *et al.* 2005, van den Berg *et al.* 2009, Petzoldt *et al.* 2014).

While it is important to understand associations between pregnancy-related factors and colic, we suggest that family dynamics in the post-partum period are also pertinent. Although the effect of post-partum maternal depression has been well studied (Mayberry & Affonso 1993, Miller *et al.* 1993, Akman *et al.* 2006, Howell *et al.* 2006, Vik *et al.* 2009), little research has focused on associations between other psychosocial factors measured in the post-partum period and infant colic. Very few studies have specifically concentrated on positive family dynamics, such as the happiness of the mother–partner relationship (Räihä *et al.* 2002). Our study aimed to investigate the extent to which positive social support and relationship factors in the lives of new parents during pregnancy and the post-partum period were associated with lower rates of maternal reported infant colic. We hypothesized that higher levels of maternal social support during pregnancy and post partum, a happier mother–partner relationship during pregnancy and post partum, and a father or partner who was more caring and helpful towards the new baby would be associated with lower levels of infant colic.

## Materials and methods

### Human subjects protection

This study was approved by the Penn State College of Medicine Institutional Review Board, as well as the Institutional Review Boards of the primary participating hospitals. All participants provided informed, signed consent.

### Participants and procedure

The data for this study was collected as part of a longitudinal study of women at first childbirth called the First Baby Study. The purpose of the First Baby Study was to investigate the association between mode of delivery and subsequent child-bearing. Women were recruited from various settings throughout Pennsylvania, such as childbirth education classes, hospital tours, low-income clinics in both rural and urban settings, obstetrician's offices, targeted mailings, health fairs and recruitment posters placed in ultrasound clinics, grocery stores, libraries and other venues.

Participants were women expecting their first child, with a singleton pregnancy, 34 weeks gestation and above, and aged 18–35 years at the time of the baseline interview. Exclusion criteria included not English or Spanish speaking, having a prior pregnancy with gestation of 20 weeks or longer, planning to have a tubal ligation, planning to have the child adopted or surrogate pregnancy. Participants delivered at 78 hospitals located throughout Pennsylvania between January 2009 and April 2011. Study design and sample representativeness are described in more detail elsewhere (Kjerulff *et al.* 2013).

The baseline interview occurred when women were in their third trimester. In addition, participants were interviewed 1 month after childbirth, as well as 6, 12, 18, 24, 30 and 36 months post partum. We used data from the baseline and 1 month interviews for this study.

A total of 15 mother–newborn pairs were excluded from this study because of missing data on the colic question ( $n = 8$ ) or because the baby was still in the hospital at the time of the 1 month interview and/or had abstinence syndrome ( $n = 7$ ). This reduced the sample size to 2991.

### Measures

The hospital discharge data for the mother and newborn and the birth certificate data were obtained. Insurance coverage information was procured from the hospital discharge data. Gestational age, newborn birthweight and gender were elicited from the birth certificate data. Mode of delivery was ascertained by self-report and verified from the birth certificate and hospital discharge data. Maternal age, race, education, marital or relationship status, smoking during pregnancy and breastfeeding were provided by maternal self-report. To enquire about their relationship status, the participants were asked if their husband or partner was the father of their baby. We did not ask about the gender of the mother's partner.

In the 1-month post-partum interview, mothers were asked a variety of questions about the health of their newborn, as follows: 'Next is a list of illnesses babies may have. Please tell me if your baby has had any of the following problems during the past 4 weeks.' A variety of illnesses were mentioned, including 'colic – crying or fussiness three or more hours a day.' We also asked about 'cough or cold', 'respiratory infection (respiratory flu, bronchitis, respiratory distress syndrome)', 'jaundice requiring light therapy or a biliblanket', 'fever of 100.4°F or more for 24 hours or more', 'thrush', and 'poor weight gain'. Mothers answered 'yes' or 'no' to each of these items. The number of days per week or instances of such symptoms was not quantified. An overall measure was created such that if the mother reported the presence of any of the aforementioned illnesses (except for colic), the newborn was categorized as having an 'Other neonatal illness'.

Maternal post-partum depression was measured using the Edinburgh Postnatal Depression Scale (Cox *et al.* 1987). We modified two items in the Edinburgh Postnatal Depression Scale – 'Things have been getting on top of me' was altered to 'I have had trouble coping' and 'The thought of harming myself has occurred to me' was changed to 'The thought of harming myself or others has occurred to me'.

### General social support

We used five items from the Medical Outcome Study Social Support Survey (Sherbourne & Stewart 1991) to measure four types of social support: emotional, tangible, affectionate and positive social interaction. This scale (General Social Support) was administered in the baseline interview during the third trimester of pregnancy. Respondents could answer 'None of the time', 'A little of the time', 'Some of the time', 'Most of the time' or 'All of the time'. Items were scored as 1 through 5 for the aforementioned answers, and total scores were calculated, summing across the five items such that a higher score indicated stronger social support.

To measure social support at 1-month post partum, we added four items (that we developed) to the five-item measure described earlier, to measure general social support pertinent to new motherhood. These four new items were 'Someone to teach you what you need to know about taking care of a new baby', 'Someone to give you advice about breastfeeding if you needed it', 'Someone to help you take care of the baby' and 'Someone to give you a break taking care of the baby so you can get some rest'. Respondents could answer 'None of the time', 'A little of the time', 'Some of the time', 'Most of the time' or 'All of the time'. Items were scored as 1 through 5 for

the aforementioned answers, and total scores were calculated, summing across the nine items such that a higher score indicates stronger support for the mother. This survey we called General Social Support for New Mothers.

### Partner–baby support scale

We developed an instrument to measure support from the mother's partner around taking care of the baby. This instrument asked 'In terms of your husband or partner and the new baby, how much of the time...': 'does your partner take care of the baby?', 'Is your partner helpful to you?', 'Is your partner nervous with the baby?', 'Does your partner avoid the baby?', 'Is your partner warm, loving and affectionate toward the baby?', 'Is your partner interested in the baby?' and 'Is your partner happy that you had the baby?' Respondents could answer 'None of the time', 'A little of the time', 'Some of the time', 'Most of the time' or 'All of the time'. Items were scored as 1–5 for the aforementioned answers, and total scores were calculated such that a higher score indicated stronger support from the partner or father.

### Relationship happiness

We used a one-item measure of relationship happiness from the Couples Satisfaction Index (Funk & Rogge 2007). This item was 'Please indicate the degree of happiness, all things considered, of your relationship with your partner'. The response options were read out loud by the interviewer and were 'Extremely unhappy', 'Fairly unhappy', 'A little unhappy', 'Happy', 'Very happy', 'Extremely happy' and 'Perfect'. Responses to the relationship happiness item were categorized into three groups: those who rated their relationship as 'extremely unhappy', 'fairly unhappy' or 'a little unhappy' were in the 'Unhappy' group; those who described their relationship as 'happy' or 'very happy' were in the 'Happy or Very happy' group; and those who described their relationship as 'extremely happy' or 'perfect' were in the 'Extremely happy or perfect' group.

The women who reported that they did not have a partner or significant other were not asked the questions about partner or baby support or relationship happiness.

### Statistical analyses

The associations between the predictors (maternal and newborn characteristics and overall score categories on the measures of social support) and the dependent variable of infant colic were examined using chi-square tests. The

**Table 1.** Maternal and newborn characteristics overall and by infant colic

	Overall ( <i>n</i> = 2991)	Infant colic N (%)		<i>P</i>
		Yes 348 (11.6)	No 2643 (88.4)	
Age (years)				0.82
18–24	806 (26.9)	90 (11.2)	716 (88.8)	
25–29	1186 (39.7)	137 (11.6)	1049 (88.4)	
30–36	999 (33.4)	121 (12.1)	878 (87.9)	
Race or ethnicity				0.13
White	2490 (83.3)	285 (11.4)	2205 (88.6)	
Black	221 (7.4)	20 (9.0)	201 (91.0)	
Hispanic	163 (5.5)	24 (14.7)	139 (85.3)	
Other	116 (3.9)	19 (16.4)	97 (83.6)	
Maternal education				0.29
HS degree or less	494 (16.5)	52 (10.5)	442 (89.5)	
Some college or technical school	801 (26.8)	105 (13.1)	695 (86.9)	
College grad or higher	1696 (56.7)	191 (11.3)	1505 (88.7)	
Insurance at birth				0.012
Private	2301 (76.9)	248 (10.8)	2053 (89.2)	
Public	682 (22.8)	97 (14.2)	585 (85.8)	
Marital status				0.10
Married	2130 (71.2)	240 (11.3)	1890 (88.7)	
Living with partner (not married)	524 (17.5)	76 (14.5)	448 (85.5)	
Not living with partner	172 (5.8)	18 (10.5)	154 (89.5)	
Unattached	165 (5.5)	14 (8.5)	151 (91.5)	
Smoked in pregnancy				0.015
Every day	110 (3.7)	21 (19.1)	89 (80.9)	
Some days	199 (6.7)	29 (14.6)	170 (85.4)	
Not at all	2682 (89.7)	298 (11.1)	2384 (88.9)	
Mode of delivery				0.08
Spontaneous vaginal	1872 (62.6)	200 (10.7)	1672 (89.3)	
Instrumental vaginal	260 (8.7)	30 (11.5)	230 (88.5)	
Planned caesarean	155 (5.2)	17 (11.0)	138 (89.0)	
Unplanned caesarean	704 (23.5)	101 (14.3)	603 (85.7)	
Breastfeeding 1 month				0.016
Yes	2094 (69.7)	348 (11.6)	2643 (88.4)	
No	912 (30.3)	125 (13.8)	780 (86.2)	
Gestational age (weeks)				0.126
34 to <37	121 (4.0)	7 (5.8)	114 (94.2)	
37 to <39	571 (19.1)	71 (12.4)	500 (87.6)	
39 to <41	1839 (61.5)	223 (12.1)	1616 (87.9)	
41+	460 (15.4)	47 (10.2)	413 (89.8)	
Birthweight (gramme)				0.636
Low <2500	93 (3.1)	13 (14.0)	80 (86.0)	
Normal 2500–4000	2560 (86.3)	298 (11.6)	2262 (88.4)	
High >4000	315 (10.6)	33 (10.5)	282 (89.5)	
Gender				0.483
Male	1514 (50.6)	170 (11.2)	1344 (88.8)	
Female	1477 (49.4)	178 (12.1)	1299 (87.9)	
Maternal EDPS Score				<0.0001
<13	2897 (96.3)	323 (11.2)	2556 (88.8)	
13+	110 (3.7)	25 (22.7)	85 (77.3)	
Other neonatal illnesses				0.027
Yes	1066 (35.6)	143 (13.4)	923 (86.6)	
No	1925 (64.4)	205 (10.6)	1720 (89.4)	
Baby was in NICU				0.515
Yes	151 (5.0)	20 (13.2)	131 (86.8)	
No	2840 (95.0)	328 (11.5)	2512 (88.5)	

associations between each of the items in the post-partum maternal social support measures and infant colic were also examined using chi-square tests.

Multivariable logistic regression models were used to measure the association between each of the measures of social support and infant colic, controlling for the maternal and newborn characteristics that were associated with infant colic (if  $P < 0.20$ ). Separate regression analyses were conducted, one for each measure of social support, because the measures of social support were collinear. Women without partners were not included in the regression analyses for the 'partner–baby support' and 'relationship happiness' because they were not asked those questions.

We calculated Cronbach's alphas to measure the internal reliability of the summated scales, the 'corrected item-total correlation' and the 'Cronbach's alpha if item deleted' for each item in these scales in order to make sure each item was contributing appropriately to its summated score. Items with poor 'corrected item-total correlations' and 'Cronbach's alphas if item deleted' were not included in the calculations of the summated scores for these scales. With the distribution of total scores on these two scales, participants were categorized into tertiles reflecting low, medium or high levels of support. The

psychometric properties of the scaled instruments are shown in Appendix 1. Initial analyses were conducted using IBM SPSS Statistics, version 23 (IBM Corp, Released 2015, Armonk, NY, USA), and verified using SAS, version 9.4 (SAS Institute Inc, Cary, NC, USA).

## Results

### Maternal and newborn characteristics overall and by infant colic

The overall rate of infant colic in this study was 11.6%. Women with public insurance were more likely to report infant colic (Table 1), and degree of smoking during pregnancy was associated with those who smoked every day during pregnancy, reporting the highest rate of infant colic. Mothers who were breastfeeding reported lower rates of infant colic than those not breastfeeding. Maternal post-partum depression was strongly associated with reported infant colic – women who scored as depressed had more than twice the rate of infant colic in comparison with those not depressed.

Among the study participants who reported having a partner, 98.6% reported that their partner was the father of

**Table 2.** General social support (during pregnancy and post partum) relationship happiness (during pregnancy and post partum), partner–baby support, overall and by infant colic

	Overall	Infant colic N (%)		P	Adjusted OR (95% CI) <sup>‡</sup>
		Yes	No		
General social support during pregnancy					
Low	506 (16.9)	87 (17.2)	419 (82.8)	<0.0001	—
Medium	1225 (41.0)	142 (11.6)	1083 (88.4)		0.81 (0.62–1.05)
High	1257 (42.1)	119 (9.5)	1138 (90.5)		0.55 (0.40–0.75)
General social support for new mothers				<0.0001	
Low	928 (31.1)	154 (16.6)	774 (83.4)		—
Medium	925 (31.0)	91 (9.8)	834 (90.2)		0.58 (0.44–0.77)
High	1135 (38.0)	102 (9.0)	1033 (91.0)		0.51 (0.39–0.67)
Partner–baby support <sup>†</sup>				0.0030	
Low	657 (22.0)	102 (15.5)	555 (84.5)		—
Medium	1088 (36.4)	125 (11.5)	963 (88.5)		0.72 (0.54–0.96)
High	1077 (36.0)	107 (9.9)	970 (90.1)		0.60 (0.44–0.81)
Relationship happiness during pregnancy <sup>†</sup>				0.002	
Unhappy	56 (2.0)	9 (16.1)	47 (83.9)		—
Happy or very happy	637 (22.5)	98 (15.4)	539 (84.6)		0.59 (0.27–1.28)
Extremely happy or perfect	2140 (75.5)	226 (10.6)	1914 (89.4)		0.71 (0.54–0.93)
Relationship happiness post partum <sup>†</sup>				<0.0001	
Unhappy	65 (2.3)	21 (32.3)	44 (67.6)		—
Happy or very happy	886 (31.4)	133 (15.0)	753 (85.0)		0.36 (0.20–0.65)
Extremely happy or perfect	1875 (66.3)	180 (9.6)	1695 (90.4)		0.22 (0.12–0.40)

<sup>†</sup> Women without partners not included in this analysis.

<sup>‡</sup> All logistic regression equations adjusted for maternal race, insurance, marital status, smoking, mode of delivery, breastfeeding, maternal post-partum depression, other neonatal illnesses and newborn gestational age.

their baby. There were 38 mother–baby pairs in which the mother reported that her partner was not the father of the baby and one in which the mother reported that she did not know if her partner was the father of the baby.

### General social support, partner–baby support and relationship happiness by infant colic

In the multivariable logistic regression models (Table 2), we adjusted for maternal race, insurance, marital status, maternal smoking, mode of delivery, breastfeeding, post-partum maternal depression, other neonatal illnesses and newborn gestational age. The logistic regressions results seen in Table 2 indicated that high social support during pregnancy in comparison with low was protective for colic, and an ‘extremely happy or perfect’ relationship during pregnancy was also protective, in compar-

ison with ‘unhappy’. For the post-partum measures of social support, both high and medium levels of social support were significantly protective for colic in comparison with low, and having a relationship seen as ‘extremely happy or perfect’ and ‘happy or very happy’ was protective for colic in comparison with ‘unhappy’. For the Partner–Baby Support Scale, both high and medium levels of support were protective for colic in comparison with low. The social support factor that was most strongly protective against colic was the post-partum maternal rating of the happiness of her relationship with her partner.

The baseline (during pregnancy) measure of General Social Support and the General Social Support for New Mothers Scale was strongly correlated ( $r = 0.55$ ,  $P < .0001$ ). In addition, the baseline measure of relationship happiness and the 1-month post partum measure of relationship happiness was strongly correlated ( $r = 0.52$ ,  $P < .0001$ ).

**Table 3.** General social support for new mothers items overall and by infant colic<sup>†</sup>

Social support items	Infant colic N (%)			$\chi^2$	P
	Overall	Yes	No		
1. Someone to confide in or talk to about your problems				30.96	<0.0001
None or a little of the time	68 (2.3)	19 (28.8)	47 (71.2)		
Some or most of the time	788 (26.2)	114 (14.5)	670 (85.5)		
All of the time	2148 (71.5)	214 (10.0)	1926 (90.0)		
2. Someone to get together with for relaxation				38.34	<0.0001
None or a little of the time	257 (8.6)	58 (22.8)	196 (77.2)		
Some or most of the time	1463 (48.7)	172 (11.8)	1283 (88.2)		
All of the time	1284 (42.7)	118 (9.2)	1163 (90.8)		
3. Someone to help you with daily chores if you are sick				19.89	<0.0001
None or a little of the time	244 (8.1)	45 (18.7)	196 (81.3)		
Some or most of the time	1427 (47.5)	179 (12.6)	1240 (87.4)		
All of the time	1334 (44.4)	124 (9.3)	1207 (90.7)		
4. Someone to turn to for suggestions about how to handle a personal problem				42.87	<0.0001
None or a little of the time	63 (2.1)	21 (35.0)	39 (65.0)		
Some or most of the time	901 (30.0)	126 (14.0)	772 (86.0)		
All of the time	2040 (67.9)	201 (9.9)	1831 (90.1)		
5. Someone to love and make you feel wanted				17.99	<0.0001
None or a little of the time	34 (1.1)	9 (27.3)	24 (72.7)		
Some or most of the time	495 (16.5)	77 (15.7)	415 (84.3)		
All of the time	2475 (82.4)	262 (10.6)	2203 (89.4)		
6. Someone to teach you what you need to know about taking care of a new baby				31.54	<0.0001
None or a little of the time	60 (2.0)	17 (29.8)	40 (70.2)		
Some or most of the time	1152 (38.3)	160 (13.9)	989 (86.1)		
All of the time	1793 (59.7)	171 (9.6)	1614 (90.4)		
7. Someone to help you take care of the baby				14.09	0.001
None or a little of the time	108 (3.6)	20 (18.9)	86 (81.1)		
Some or most of the time	1337 (44.5)	176 (13.3)	1152 (86.7)		
All of the time	1560 (51.9)	152 (9.8)	1405 (90.2)		
8. Someone to give you a break taking care of the baby so you can get some rest				7.85	0.020
None or a little of the time	202 (6.7)	33 (16.5)	167 (83.5)		
Some or most of the time	1691 (56.3)	204 (12.1)	1478 (87.9)		
All of the time	1112 (37.0)	111 (10.0)	998 (90.0)		

<sup>†</sup> One of the items was dropped because of a low corrected item-total correlation (Appendix 1).

### Analysis of specific items in the general social support for new mothers scale and the partner–baby support scale by infant colic

Among the individual items in the General Social Support for New Mothers Scale (Table 3), the items most strongly protective for colic were ‘Someone to turn to for suggestions about how to handle a personal problem’, ‘Someone to get together with for relaxation’ and ‘Someone to teach you what you need to know about taking care of a new baby’, as can be seen by the chi-square statistic values. Among the items in the Partner–Baby Support Scale (Table 4), the items most strongly protective for colic were ‘How much of the time is your partner warm, loving and affectionate toward the baby?’ and ‘How much of the time is your partner helpful to you?’

### Discussion

The post-partum maternal-rated happiness of her relationship with her partner (in most cases the father of the baby) was the factor that was most protective for infant colic, even more protective than partner support with caring for the new baby and general social support for new mothers. This association remained strong even after controlling for the study covariates, including post-partum maternal depression and other neonatal illnesses. This suggests that a happy mother–partner relationship can be a powerfully protective factor, even if the mother is experiencing post-partum depression.

Previous research has reported that being married or having a common-law partner was associated with reduced likelihood

of infant colic (Clifford *et al.* 2002), whereas in our study we found a more complex association – the unmarried women who were living with their partner had the highest rate of reported infant colic (14.5%), while the women who were unattached had the lowest rate (8.5%). However, the overall association between marital status and infant colic in this study was not significant ( $P = 0.10$ ).

In our study, investigation of the associations between infant colic and the specific items in the scaled instruments indicated the importance of several factors measured in the ‘General Social Support for New Mothers Scale’, including having someone to turn to for suggestions about how to handle personal problems, someone to get together with for relaxation and someone to teach them what they need to know about taking care of a new baby. The important items in the ‘partner–baby support’ instrument addressed the extent to which the father or partner was warm, loving and affectionate towards the new baby and helpful to the new mother. These results suggest that mothers and their newborns need multiple sources of love and support – from friends, family and, most importantly, the father or partner. Furthermore, the importance of the happiness of the relationship between the new mother and her partner underscores the value of having a happy mother–father or partner relationship in terms of the well-being of the child.

The main strengths of our study include adequacy of the sample size with minimal missing data, as well as standardization of the mothers with first-born infants (most studies on infant colic have not controlled for birth order), thereby

**Table 4.** Partner–baby support items overall and by infant colic<sup>†,‡</sup>

Partner Baby Support Items	Overall	Infant colic		$\chi^2$	P
		Yes	No		
1. How much of the time does your partner take care of the baby?				1.06	0.304
None, a little or some of the time	2216 (78.1)	268 (12.2)	1937 (87.8)		
Most or all of the time	623 (20.7)	66 (10.6)	554 (89.4)		
2. How much of the time is your partner helpful to you?				8.34	0.004
None, a little or some of the time	595 (21.0)	90 (15.2)	501 (84.8)		
Most or all of the time	2245 (79.0)	244 (10.9)	1991 (89.1)		
4. How much of the time is your partner warm, loving and affectionate towards the baby?				12.76	<0.0001
None, a little or some of the time	47 (1.7)	13 (28.9)	32 (71.1)		
Most or all of the time	2790 (98.3)	321 (11.6)	2457 (88.4)		
5. How much of the time is your partner interested in the baby?				5.62	0.018
None, a little or some of the time	86 (3.0)	17 (20.0)	68 (80.0)		
Most or all of the time	2753 (97.0)	317 (11.6)	2423 (88.4)		
6. How much of the time is your partner happy that you had the baby?				4.26	0.039
None, a little or some of the time	30 (1.1)	7 (24.1)	22 (75.9)		
Most or all of the time	2809(98.9)	327 (11.7)	2469 (88.3)		

<sup>†</sup> One of the items was dropped because of a low corrected item-total correlation (Appendix 1).

<sup>‡</sup> Women without a partner not included in these analyses.

excluding the confounding effects of prior experience with infant's older siblings. New mothers are more vulnerable because of inexperience and, hence, are more likely to report infant colic as compared with mothers with other children (Canivet *et al.* 2004, Howell *et al.* 2009). Most previous studies did not control for minor illnesses like respiratory infections, which were related to colic or infant crying for more than 3 h a day in our study ( $P = 0.027$ ).

A limitation of this study is that we measured our primary independent variables (post-partum social support) and our dependent variable (infant colic) at the same time point, 1 month after first childbirth. Our goal was to focus on the family dynamics and maternal support in the post-partum period after first childbirth. Maternal support and relationship happiness measured during pregnancy also were protective for infant colic, although not as strongly when measured during the post-partum period. In addition, general social support measured during pregnancy was strongly associated with general social support measured at 1-month post partum, and relationship happiness showed a similar association.

Another limitation to our study was that our measure of infant colic did not strictly fulfil the Wessel or Rome III criteria (WESSEL *et al.* 1954, Hyman *et al.* 2006), although several studies have used modified definitions (Reijneveld *et al.* 2001). Therefore, some normal infants may have been categorized as having infant colic. On the other hand, the rate of infant colic observed in our study (11.6%) was quite similar to rates reported in previous studies, which used the Wessel or Rome III criteria (Barr *et al.* 1992, Canivet *et al.* 2004, Petzoldt *et al.* 2014). Additionally, because we interviewed the new mothers regarding infant colic only at 1-month post partum, we missed the infants with colic presenting after 4 weeks of age.

## Conclusion

In conclusion, this study provides evidence of the importance of the mother–partner relationship and partner or paternal support during the post-partum period. In contrast to earlier eras, fathers are increasingly expected to take part in caring for their newborns and nurturing their relationship with the baby and their partner or wife (Garfield & Chung 2006, Salzmänn-Erikson & Eriksson 2013, Yogman *et al.* 2016). In this study, the new mothers reported 1 month after first childbirth that for the most part the new fathers or partners were ‘warm, loving and affectionate toward the baby’ and that their relationship with the father or partner was in the range of ‘happy’ to ‘perfect’. While the results of this study suggest that these positive family dynamics may be protective for the health

of the newborn, further research is needed to determine if this is a causal relationship and, if so, how this information could be used to help families with colicky newborns.

## Key messages

- The happier a woman rated her relationship with the father of her baby (or in some cases her partner who was not the father), during pregnancy and post partum, the lower the risk of colic or excessive crying or fussiness in infants of first-time mothers.
- The stronger a woman rated the support provided by the father or partner in relation to caring for the baby, particularly in terms of being warm, loving and affectionate towards the baby and helpful to the mother, the lower the risk of colic or excessive crying or fussiness in infants of first-time mothers.
- The stronger a woman rated her general social support during pregnancy and post partum, particularly in terms of having someone she can turn to for suggestions about how to handle a personal problem and someone to confide in or talk to about her problems, the lower the risk of colic or excessive crying or fussiness in infants of first-time mothers.

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## Appendix 1

### Instrument psychometric properties

#### *General social support (during pregnancy)*

The overall Cronbach's alpha for this five-item scale was 0.81. The corrected item-total correlations ranged from 0.54 to 0.68. Total scores ranged from 5 to 25, the mean was 22.2, the median was 23.0 and the mode was 25.0. Total scores on the General Social Support Scale were categorized into tertiles: 5–19 (low), 20–23 (medium) and 24–25 (high).

#### *General social support for new mothers scale*

One of the nine items in the General Social Support for New Mothers instrument generated considerable missing data – this item was 'Someone to give you advice about breastfeeding'. Women who were not breastfeeding tended to answer 'don't know' in response to that question. Therefore, that item was not included in calculation of the total score. Total scores ranged from 8 to 40, the mean was 34.7, the median was 36.0

and the mode was 40.0. The 'corrected item-total correlations' ranged from 0.53 to 0.71, the Cronbach's alphas if item deleted ranged from 0.86 to 0.88 and the overall Cronbach's alpha was 0.88. Total scores on the Social Support for New Mothers Scale were categorized into tertiles: 8–32 (low), 33–37 (medium) and 38–40 (high).

#### *Partner–baby support scale*

One of the seven items in the partner–baby support instrument did not exhibit an acceptable 'corrected item-total correlation' and 'Cronbach's alpha if item deleted'. This item was 'How much of the time is your partner nervous with the baby?'. Therefore, that item was not included in calculation of the total score. Total scores ranged from 6 to 30, the mean was 26.54, the median was 27.0 and the mode was 28.0. The 'corrected item total correlations' ranged from 0.39 to 0.55, the 'Cronbach's alphas if item deleted' ranged from 0.62 to 0.68 and the overall Cronbach's alpha was 0.70. Total scores on the Partner–Baby Support Scale were categorized into tertiles: 6–25 (low), 26–27 (medium) and 28–30 (high).