

Preschool Children Perceived by Mothers as Irregular Eaters: Physical and Psychosocial Predictors from a Birth Cohort Study

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Keywords: child, mother, irregular eating

ABSTRACT

Objective: Parents often report their children display irregular eating patterns. Our aim is to describe the stability of maternal-perceived irregular eating of their offspring from 6 months to 2–4 years of age and to investigate factors that are associated with maternal perceived irregular eating of their 2–4 year old offspring.

Methods: A longitudinal mother-child linked analysis was carried out using 5 year follow-up data from a population-based prospective birth cohort of 5122 mothers who were participants in the Mater-University Study of Pregnancy, Brisbane. Measures included responses to standardized questionnaires, pediatrician review and standardized measures such as the Peabody Picture Vocabulary Test-Revised and the Child Behavior Checklist.

Results: 20.2% and 7.6% of mothers respectively stated their 2–4 year old was sometimes or often an irregular eater. Continuity of feeding difficulties from age 6 months was prominent: 48% of 6 month olds with a feeding problem were 'sometimes' or 'often' irregular eaters at age 2–4 years. From a multivariable analysis, both child-intrinsic factors (chronic physical morbidity, sleeplessness and anxiety-depressive symptoms) and factors that impinge upon the child (poor maternal health and maternal depression and anxiety) independently contributed to irregular eating status at age 2–4 years.

Conclusions: We conclude that approximately one third of mothers had some concern with their child's irregular eating, 7.6% of mothers were often concerned. Irregular eating children were usually physically well, more likely to have persisting feeding problems, sleeplessness, behavioral problems and lived with mothers with perceived poor physical and mental health. Intervention strategies should be family orientated and include child, mother and mother-child psychosocial approaches.

The community prevalence of mother-perceived feeding and eating difficulties in infants and children ranges from 21% to 33%.^{1,2} Common problems reported by parents of pre-school children include colic and food refusal³ and mealtime behavioral non-compliance.⁴ Infant and child feeding difficulties may also lead to malnutrition and have been associated with cognitive⁵ and psychopathological outcomes, including more demanding, unsociable⁶ and hyperactive behavior,⁷

crying on approach and displaying poorer eye contact.⁸ Reported temporal trends include both the risk of eating difficulties increasing across the preschool years² and stability of feeding difficulties over time with perceived feeding problems in the first year of life related to feeding problems at age 4 years⁷ and anorexia symptoms in adolescence were predicted by earlier digestive problems and picky eating.⁹

Advances have been hampered by lack of nosological clarity. Diagnoses and descriptive labels in the literature include “picky,” “choosy,” and “selective” eaters, food phobia, food refusal, food selectivity and failure to thrive.¹⁰ Etiological models of childhood eating and feeding difficulties have included physical, psychological and transactional factors, e.g. mother-child factors. Potential physical mechanisms for poor infant feeding include inefficient sucking^{1,11} and sensory abnormalities. Potential psychological factors include parent-report that picky eaters are more likely to have negative affect¹ and difficult (propensity to distress), irregular (increased routine variability) and sober (propensity to negatively emotionality) temperament.¹² There is also evidence that infants and children with feeding difficulties may be exposed to parenting deficits and more problematic parent-child relationships such as a coercive parenting pattern,⁴ and more frequent struggles over food and between spouse arguments about the child's eating.¹

A main effect of parent eating psychopathology on infant feeding problems has been hypothesized and appears likely for mothers with a diagnosis of anorexia nervosa.¹³ Stice and colleagues reported the emergence of overeating in 5 year olds if their mother experienced eating restraint and increased drive for thinness at the time of the child's birth.² On the contrary, no elevation in maternal eating attitudes was reported in the mothers of picky toddlers or children with infantile anorexia compared to healthy controls.¹²

Published research has consistently described the patterns of irregular eating and its subsequent consequences. Yet, surprisingly, very little is known about the predictors of irregular eating. It is imperative to identify the predictors to design interventions and further prevent irregular eating. The aims of this study are to report the stability of maternal perceived irregular eating of their offspring from six months to 2–4 years of age and to examine the early life factors that are associated with irregular eating.

METHODS

Sampling and Procedure

Full description of the MUSP has been given in Keeping and colleagues¹⁴ and Lawlor et al¹⁵ The original sample comes from Brisbane, the capital city of the state of Queensland, Australia, specifically the Mater Mothers Hospital obstetric unit which accounts for 50% of the births in Brisbane. The initial data collection and all subsequent follow-ups were subject to ethics committee review and approval, and informed, signed participant consent.

Excluded from the study were mothers transferred to other facilities and those not receiving care in the public hospital. During 1981–1983, 8556 consecutive public patients were approached at their first antenatal visit, 8458 agreed to complete the recruitment questionnaire and on average this occurred at 18.6 weeks of gestation. Some 7631 mothers gave birth to a live singleton baby at the study hospital, of whom 7223 constitute the overall birth cohort. The MUSP comprises two parallel cohorts: mothers and their offspring. Our current study is based on the cohort of 5-year-old children and their mothers who completed questionnaires 3–5 days after the birth and when the child was 6 months and 5 years.

Measures

Information was gathered by trained and supervised research officers who administered the research interview to all study participants. Collected data included physical measures recorded by obstetric staff at or soon after birth, maternal responses to questionnaires at birth, 6 months and five years and physical measures recorded by research officers at 6 months and 5 years. The interview was divided into maternal-report concerning the child and maternal-report concerning their own health and functioning. Child questions were grouped into domains: general health, physical symptoms and syndromes, sensory functioning, emotional and behavioral health and social development. At the year 5 interview the mother's perception that the child was an irregular eater was the major outcome variable of interest. Specifically mothers were asked to complete the statement, "as you remember your child's behavior between 2 and 4 years of age did he/she have an irregular eating habit," by giving 1 of 4 possible responses: "often," "sometimes," rarely," or "never." Potential associations with irregular eating were divided into factors intrinsic to the child and those that impinge upon the child. Child intrinsic variables included prematurity (gestational age <37 weeks), birthweight (<2500 gm was defined as "low birthweight"), the presence or absence of pediatrician-reported chronic physical morbidity at 5 years of age (e.g., chronic asthma), developmental delay at 5 years measured by the Denver Developmental Screening Test,¹⁶ maternal-report health questions from the Rand survey¹⁷ and the child's body mass index (kg/m² in all assessments, the average of two measures of the child's weight, lightly clothed with a scale accurate to 0.2 kg was used). A portable stadiometer was used to measure the height. Overweight or obesity was defined according to standard definitions derived from international surveys by Cole and colleagues.¹⁸ Child self-regulation (e.g. sleeping and feeding) difficulties at six months of age was measured from maternal report and at five years the child's verbal intelligence measured by the Peabody Picture Vocabulary Test - Revised (PPVT-R). The latter measure has concurrent validity as a test for children's intelligence.¹⁹ Child intrinsic variables also included maternal report of the child's internalizing and externalizing psychopathology at 5 years of age. Due to funding constraints, child psychopathology was measured with a shortened version of the Child Behavior Checklist (CBCL).²⁰ The modified CBCL has acceptable total and subscale score internal consistency (0.74–0.84) and correlated at 0.89 with the full version of the CBCL.²¹ For inclusion in a logistic regression analysis, scores in the top 10% for internalizing and externalizing problems at age 5 were considered a "case."

Factors that impinge upon the child were socio-economic, parent-child and parent-parent relationship variables. These included maternal report at the antenatal interview of: their marital status; married, single, de facto (non married couple living together), other (separated, divorced, widowed); educational attainment; gross family income around pregnancy and own health status (excellent, good, fair or poor). Quality of marital relationship was measured at 6 months and 5 years by maternal-report on the Dyadic Satisfaction items of the Spanier Dyadic Adjustment Scale.²² At each follow-up, the maternal score was dichotomized into good relationship versus moderate or poor relationship among women who reported they had a partner. Four mutually exclusive categories of relationship around pregnancy and 5-year follow-up were defined, e.g., good relationship around pregnancy and 5-year follow-up.

"Spends time teaching baby" was measured at the 6-month follow-up interview. The score was a dichotomous variable that summarized maternal report, choosing one of 5 response options, of their agreement with 4 statements: "Try to encourage baby to be interested in what is going on"; "My baby likes me talking to him/her"; "Spend a lot of time teaching baby to recognize things" and "Love to play with my baby." Scoring: items were reversed, summed averaged means of items were multiplied by 10 and the total score was categorized as always (score 10 to 39.9) and not always (score 40–50). Maternal views about the child were also measured at 6 month follow-up by mothers choosing one of 5 response options, to quantify their agreement with the statements: "Caring for my

baby is very satisfying”; “Feel so angry that sometimes I could smack my baby”; “My baby makes me too tired”; “My baby is so good I hardly know he/she is there”; “Sometimes feel like hitting my baby” and “Feel fed up looking after my baby all day.” Items 1 and 4 were reversed, summed averaged means of items were multiplied by 10 and the total score was categorized as not always (score 10–29.9), mostly (30–42) and always (score 42.1–50) (see Brennan and colleagues 23 for more details). Parenting and discipline practices relating to control were measured at 5-year follow-up interview, in this case by mothers choosing one of 4 response options to the statements “I supervise my child very carefully”; “Expect child to do as he/she is told without explanation; “Watch everything my child does”; “Child should do as he/she is told immediately” and “Strict discipline is good for my child's later development.” Responses were reversed, summed averaged means of items were multiplied by 10 and operationalized as having a low (10–30), moderate (30.1–42.9), or high (43–50) control-parenting style. Smoking status was assessed at the first antenatal clinical visit; on average at 18-weeks of gestation. At that time mothers were asked to record whether they smoked (yes or no). If they responded yes, they were further asked to report the frequency and quantity of tobacco use in the previous week. Duration of breastfeeding was collected at a 6-month follow-up of the mothers. Mothers were asked to respond to the following options: never, 2-weeks or less, 3–6 weeks, 7 weeks–3 months, 4–6 months, still. We did not use any information related to maternal drug use during pregnancy. Maternal depression and anxiety were measured 3–5 days after birth, at 6 months and 5 years by maternal report on the depression and anxiety subscales of the Delusional Symptom Status Inventory,²⁴ a measure of psychopathology in community subjects that has acceptable internal consistency in this sample.²⁵ This instrument was chosen because items could not be confounded with pregnancy or birth symptoms and the instrument is comparable with other well known depression screening measures. A depression or anxiety case was defined as experiencing symptoms “all the time,” “most of the time” or “some of the time” on four of seven symptoms. A mother who reported depressive symptoms at least one time at prenatal, 3–5 days post delivery or 6-month post delivery follow-ups was defined as depressed around pregnancy. Maternal anxiety was similarly defined.

Statistical Analyses

Logistic regression was used to assess the age-adjusted association of exposures and other covariates with the maternal report on children having irregular eating habit between 2 and 4 years of age. A series of multiple logistic regressions was used to further assess the association of maternal report on children having irregular eating between 2 and 4 years of age. In the first and second models, the variables included are those defined as intrinsic to the child and impinging upon the child respectively. In the third model, all listed variables in model 1 and model 2 were incorporated. All analyses were undertaken using Stata version 8.0.²⁶

RESULTS

Examination of study and non-study groups showed that mothers lost to follow-up were of lower educational level and age, were more likely to be unmarried and poorer, to have smoked more in pregnancy and were depressed during pregnancy (Table 1). In order to further assess whether those lost to follow-up produced bias in our results, we attached inverse probability weighting to subjects included in the analyses to restore the representation of those lost to follow-up. We followed the method suggested by Hogan and colleagues and used robust standard errors estimates applied to the model.²⁷ We found no difference between the weighted and unweighted results, which suggests that attrition is unlikely to have substantively biased our findings.

Table 1 Comparison of Study and Non-Study Groups

	Non-Study (n = 2255) % (n)	Study (n = 4915) % (n)	p-Value
Maternal education			<0.001
Incomplete high school	21.69 (489)	16.60 (816)	
Complete high	63.81 (1439)	64.50 (3170)	
Post high	14.50 (327)	18.90 (929)	
Racial origin			<0.001
White	83.48 (1749)	91.76 (4510)	
Asian	5.92 (124)	3.72 (183)	
Aboriginal-Islander	10.60 (222)	4.52 (222)	
Family income at first clinic visit			<0.001
Low	37.91 (875)	29.16 (1433)	
Medium	43.63 (1007)	54.97 (2702)	
High	7.97 (184)	11.15 (548)	
Missing	10.49 (242)	4.72 (232)	
Marital status			<0.001
Married	64.59 (1450)	80.08 (3936)	
Single	14.34 (322)	8.42 (414)	
<i>De facto</i>	16.61 (373)	9.58 (471)	
Other	4.45 (100)	1.91 (94)	
Maternal cigarettes (last trimester of pregnancy)			<0.001
Nil	53.99 (1210)	65.35 (3212)	
1–9	33.38 (748)	27.85 (1369)	
10 or more	12.63 (283)	6.80 (334)	
Maternal depression			<0.001
Non-depressed	91.61 (1988)	95.32 (4685)	
Depressed	8.39 (182)	4.68 (230)	
Child sex			0.996
Male	51.94 (294)	51.93 (1679)	
Female	48.06 (272)	48.07 (1554)	
Birthweight			0.147
Normal	95.19 (2196)	95.93 (4715)	
Low birthweight	4.81 (111)	4.07 (200)	

Many mothers stated their child was “sometimes” (n = 1054; 20.2%) or “often” (n = 398; 7.6%) an irregular eater at 2–4 years of age. There was no significant increased odds of irregular eating by gender (95% CI: 0.86–1.10), or between low, medium and high income groups. (95% CI range 0.67–1.49). Table 2 summarizes variables significantly associated with an increased likelihood of irregular eating status and includes the presence of chronic medical morbidity, sleeplessness, assessment that the child was developmentally delayed and the child's internalizing and externalizing psychopathology. Children in the obese range on body mass index (BMI) assessment had a decreased likelihood of irregular eating status. There was no significant relationship with the child's

verbal intelligence. Feeding difficulties at 6 months and between 2 and 4 years of age were correlated with unadjusted odds ratios rising from reports at six months of age of feeding difficulties a ‘few times a month’ (OR: 1.36; 95% CI: 1.18,1.57) to feeding problems “almost every day” (OR: 3.12; 2.49,3.91). Of 6-month-old infants described as “never” experiencing a feeding problem only 6% “often” had a problem between 2 and 4 years of age (Figure 1.). Conversely if “often” a problem at 6 months, 49% “sometimes” or “often” had a problem between 2 and 4 years.

Table 2 Children Having Irregular Eating Habit (%) Between 2–4 Years of Age by Medical, Non-Medical and Other Causes

	Number	% of Children Having Irregular Eating Habit (Sometimes or Often)	p-Value	Unadjusted Odds Ratio (CI)
Mothers age			0.067	
13–19	603	26.2		1.00
20–34	4353	27.7		1.08 (0.89,1.31)
35+	264	33.7		1.43 (1.05,1.96)
Maternal education			0.009	
Incomplete high school	888	31.2		1.00
Completed high	3334	26.5		0.80 (0.68,0.93)
Post-high	964	29.6		0.93 (0.76,1.13)
Chronic child morbidity at 5 years			<0.001	
No morbidity	4893	27.2		1.00
Some morbidity	114	45.6		2.24 (1.54,3.26)
BMI at age 5			0.004	
Normal	3267	29.4		1.00
Overweight/obese	677	23.9		0.76 (0.62,0.92)
Delayed development			0.014	
No delay	3851	28.2		1.00
Delay	90	40.0		1.70 (1.11,2.61)
Feeding problems at 6-m FU			<0.001	
Rarely/never	2796	23.5		1.00
Few times a month	1504	29.5		1.36 (1.18,1.57)
Few times a week	315	35.6		1.80 (1.41,2.30)
Almost everyday	360	48.9		3.12 (2.49,3.91)
Sleeplessness			<0.001	
Rarely/never	1368	22.3		1.00
Few times a month	2128	26.6		1.25 (1.07,1.48)
Few times a week	576	34.2		1.81 (1.46,2.24)
Almost everyday	892	35.8		1.94 (1.61,2.34)
Internalizing problem at age 5			<0.001	
Normal	4596	25.6		1.00
Case	606	44.2		2.30 (1.93,2.73)
Externalizing problem at age 5			<0.001	
Normal	4659	26.1		1.00
Case	556	41.7		2.03 (1.69,2.43)
Relationship with partner			<0.001	
+time 1 and time 2	2943	25.35		1.00
+time 1 and –time 2	534	31.46		1.35 (1.11,1.65)
–time 1 and +time 2	716	28.21		1.16 (0.96,1.39)
–time 1 and –time 2	764	34.55		1.55 (1.31,1.84)
Health of mother			<0.001	
Excellent	1215	21.9		1.00
Good	2985	27.4		1.35 (1.15,1.58)
Fair/poor	823	37.0		2.10 (1.73,2.56)
Maternal depression ¹			<0.001	
–time 1 and time 2	4205	26.4		1.00
–time 1, +time 2	206	37.9		1.70 (1.27,2.27)
+time 1, –time 2	393	30.3		1.21 (0.97,1.52)
+time 1 and time 2	105	51.4		2.95 (2.00,4.36)

(Table continues)

Table 2 Continued

	Number	% of Children Having Irregular Eating Habit (Sometimes or Often)	p-Value	Unadjusted Odds Ratio (CI)
Maternal anxiety ¹				
-time 1 and time 2	3470	24.4		1.00
-time 1, +time 2	359	38.7		1.96 (1.57,2.46)
+time 1, -time 2	684	30.0		1.33 (1.11,1.59)
+time 1 and time 2	446	44.4	<0.001	2.48 (2.03,3.04)
Positive about caring for baby				
Always	2002	24.6		1.00
Mostly	2765	28.9		1.25 (1.09,1.42)
Not always	284	40.1	<0.001	2.06 (1.59,2.66)
Degree of control-parenting style				
Low control	705	27.0		1.00
Moderate control	3876	28.8		1.10 (0.92,1.32)
High control	564	22.3	0.005	0.78 (0.60,1.00)
Spends time teaching baby				
Always	4330	27.5		1.00
Not always	725	29.5	0.263	1.10 (0.93,1.31)
Duration of breastfeeding				
Never	997	29.0		1.00
Less than 4-month	1902	29.7		1.03 (0.87,1.22)
4-month and more	2137	25.6	0.012	0.84 (0.71,1.00)
Small for gestational age				
No	5012	27.6		1.00
Yes	208	33.7	0.06	1.33 (0.99,1.79)

1. Where time 1 = "around pregnancy"; time 2 = "at 5 years."

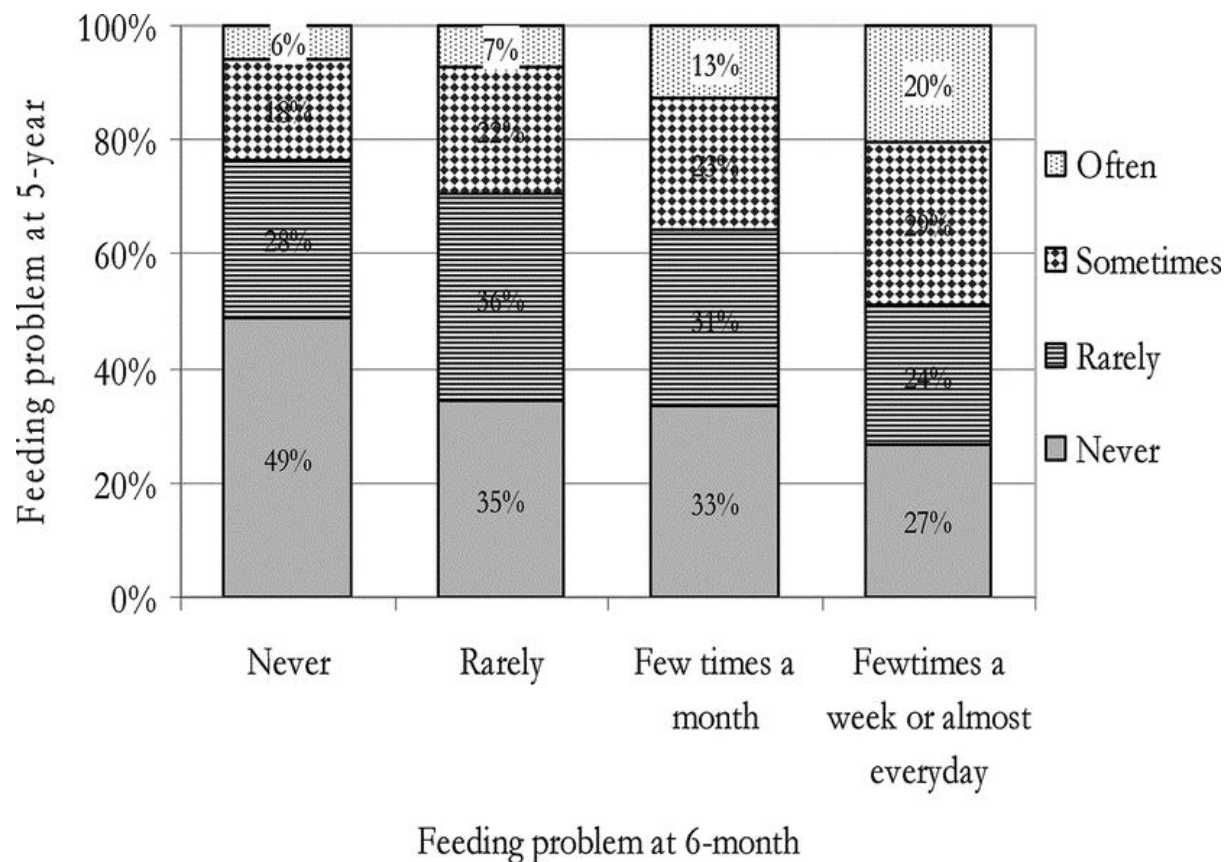


Figure 1: Continuity of irregular eating from age 6-month to 2-4 years.

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Factors that indirectly impinge upon the child that were significantly related to the child's irregular eating status included maternal health perception, marital partner relationship, persistent depression or anxiety over the preceding five years and not always holding positive views about the child. There was a weak relationship between irregular eating status and breast-feeding for longer than four months. High control parenting style was related to less irregular eating. There were no significant relationships with antenatal factors such as maternal smoking or alcohol consumption, maternal feelings when discovered she was pregnant, maternal satisfaction or relationship with partner. Similarly, factors at birth with no significant relationship included birth-weight, relationship with partner, relationship with baby or time spent with the child.

Table 3 summarizes the results of a multivariable logistic regression analysis of irregular eating status between 2 and 4 years of age. In model 1, independent contributors were child chronic medical morbidity, sleeplessness and both internalizing and externalizing mental health symptoms. Child obese status was negatively correlated with irregular eating. Model 2, independent contributions included persistent maternal anxiety and maternal depression and not always positive about carrying baby. Model 3, the final model inclusive of all variables, independent contributors included chronic physical morbidity, child internalizing symptoms, sleeplessness, obese status, poor maternal general health and persisting maternal depression and anxiety.

Of children identified as sometimes or often irregular eaters, 52 (3.8%) also had a chronic physical condition. When Model 3 was repeated after excluding children with chronic illness there was no change in the point estimate of any variable reported in the final model (model 3).

DISCUSSION

This study, using data from a large birth cohort, found 7.6% of mothers reported their children were irregular eaters at 2 to 4 years of age. Very few of these identified children had a chronic physical morbidity that may have caused irregular eating. On multivariable analysis both biological and psychological factors intrinsic to and operating on the child provided unique contributions to irregular eating between 2 and 4 years of age. Physical factors included the presence of chronic physical morbidity. Psychosocial factors included anxiety/depressive symptoms of the child, the child experiencing sleeplessness, poor maternal general health and persistent maternal depression and anxiety.

Stability of irregular eating status was noted from 6 months to 2–4 years of age. This is consistent with the findings of Marchi and Cohen who reported the stability of 'pickiness' eating behavior in children assessed from 1 to 10 years and reassessed when 9 to 18 years and the 9 year follow-up reported by Dahl and colleagues who reported infants (average age 7.8 months) with refusal to eat were significantly more likely than controls to have eating problems at home and school.⁷

Past research has reported conflicting findings on the relationship between maternal depression and the child's eating difficulties. In a case controlled study of community identified infants with failure to thrive O'Brien and colleagues²⁸ reported significantly elevated maternal depression measured by either the Hospital Anxiety and Depression Scale or the Edinburgh Postnatal Depression Scale. In a prospective case controlled study of young children, mean age 2 to 14 months, Ramsay and colleagues found maternal depression when measured at 1 week, 2, 6 and 14 months post delivery was not significantly related to the infant's failure to thrive status or feeding ability.¹¹ Direct comparison between these findings and our results is difficult given our older sample and the focus of this study on perceived irregular eating rather than objective failure to thrive. Nevertheless, in our study maternal depression was an independent contributor to the child's picky eating status. Our

results also report a new factor, persistent maternal anxiety, as another independent contributor to the child's irregular eating status.

Table 3 Multivariable Associations of Children Having Irregular Eating Habit Between 2–4 Years of Age by Medical, Non-Medical, and Other Causes (for All Analyses N=3371)

	Model-1 Odds Ratio (95% CI)	Model-2 Odds Ratio (95% CI)	Model-3 Odds Ratio (95% CI)
Chronic morbidity			
No morbidity	1.00		1.00
Some morbidity	1.81 (1.11,2.95)		1.73 (1.05,2.84)
BMI at age 5			
Normal	1.00		1.00
Overweight/obese	0.75 (0.61,0.93)		0.76 (0.61,0.94)
Delayed development			
No delay	1.00		1.00
Delay	1.56 (0.96,2.52)		1.59 (0.97,2.60)
Sleeplessness			
Rarely/never	1.00		1.00
Few times a month	1.35 (1.11,1.64)		1.29 (1.06,1.58)
Few times a week	1.74 (1.34,2.27)		1.59 (1.21,2.10)
Almost everyday	1.82 (1.44,2.30)		1.60 (1.25,2.04)
Internalizing problem at age 5			
Normal	1.00		1.00
Case	1.95 (1.54,2.47)		1.76 (1.38,2.24)
Externalizing problem at age 5			
Normal	1.00		1.00
Case	1.37 (1.07,1.76)		1.20 (0.93,1.56)
Maternal education			
Incomplete high school		1.00	1.00
Completed high		0.87 (0.70,1.08)	0.91 (0.73,1.13)
Post high		1.06 (0.82,1.37)	1.12 (0.86,1.46)
Health of mother			
Excellent		1.00	1.00
Good		1.12 (0.92,1.36)	1.10 (0.91,1.34)
Fair/poor		1.61 (1.25,2.07)	1.54 (1.20,1.99)
Relationship with partner			
Good relationship around pregnancy and 5-y FU			
+time 1 and time 2		1.00	1.00
+time 1 and -time 2		1.21 (0.94,1.57)	1.19 (0.91,1.54)
-time 1 and +time 2		1.15 (0.91,1.45)	1.16 (0.91,1.46)
-time 1 and -time 2		1.05 (0.83,1.34)	1.04 (0.81,1.32)
Maternal depression¹			
-time 1 and time 2		1.00	1.00
-time 1 and +time 2		0.80 (0.52,1.24)	0.77 (0.50,1.20)
+time 1 and -time 2		0.78 (0.56,1.07)	0.79 (0.57,1.09)
+time 1 and time 2		2.05 (1.12,3.78)	1.95 (1.05,3.61)
Maternal anxiety¹			
-time 1 and time 2		1.00	1.00
-time 1, +time 2		1.62 (1.20,2.19)	1.49 (1.10,2.03)
+time 1, -time 2		1.25 (0.98,1.61)	1.17 (0.91,1.51)
+time 1 and time 2		1.87 (1.36,2.55)	1.61 (1.17,2.21)

(Table continues)

Table 3 Continued

	Model-1 Odds Ratio (95% CI)	Model-2 Odds Ratio (95% CI)	Model-3 Odds Ratio (95% CI)
Positive about carrying baby			
Always		1.00	1.00
Mostly		1.18 (1.00,1.39)	1.06 (0.89,1.25)
Not always		1.59 (1.14,2.23)	1.26 (0.89,1.80)
Degree of control-parenting style			
Low control		1.00	1.00
Moderate control		1.02 (0.82,1.28)	1.02 (0.82,1.28)
High control		0.74 (0.53,1.03)	0.74 (0.53,1.03)
Duration of breastfeeding			
Never		1.00	1.00
Less than 4-month		1.10 (0.89,1.37)	1.11 (0.89,1.38)
4-month and more		1.03 (0.83,1.28)	1.04 (0.83,1.30)

1. Where time 1 = "around pregnancy," time 2 = "at 5 years." Model -1: variables included in this model are intrinsic to the child. Model -2: variables included in this model are impinging upon the child. Model -3: all listed variables in model 1 and 2.

Children with significant internalizing psychopathology, a summary scale of predominantly anxiety and depressive symptoms, remained significant in the final model and suggest that irregular eating status may be related to dysregulation or failure to obtain mastery of other functions such as mood. Other possibilities include irregular eating and internalizing symptoms in the child share relationships to proximal variables such as poor maternal health or persistent maternal anxiety. Internalizing symptoms at age 5 may also be related to temperament characteristics, such as a propensity to negative emotionality noted in infants with eating disorders.¹² Bi-directional effects include depressed or anxious mothers could be biased in their perception of their child's feeding and mental health state. Against a misclassification of the child's feeding status is the significant correlation between maternal report of picky eating and pediatrician assessed lower child body mass index.

Study limitations are those inherent to longitudinal studies. Maternal perception of child irregular eating was determined by maternal-report to one multiple response question. Again, the inverse relationship between maternal reported irregular eating and body mass index provides some objective concurrent validity to the parent's perception. Further, attrition of study subjects is typical. The participants who did not attend were more likely to be from poorer backgrounds and mothers were likely to have had low education and to be non-white.

In summary, results from this large birth cohort found that mother's reported that they perceived nearly one in three 2- to 4-year-old children as irregular eaters. Irregular eating was a behavioral phenotype with significant stability in the first years of life. Irregular eating status was not related to maternal smoking or alcohol consumption during pregnancy, duration of breast feeding, time spent with the child, parenting style, the child's verbal IQ or whether the child was developmentally delayed. The main independent contributors of irregular eating were chronic physical morbidity, children with persisting feeding problems from 6 months of age, children who experienced anxiety or depressive symptoms at age 5 and whose mother at 5 year follow-up described her health as fair to poor and who experienced persisting depression and anxiety symptoms. Interventions guided by this profile would include a family-centered approach that may include behavioral change around eating behaviors as well as mother, child and mother-child interventions for depression and anxiety. Subsequent studies will report the trajectory of children with irregular eating into adolescence and adulthood.

ACKNOWLEDGMENTS

This work was supported by funding for the Mater-University of Queensland Study of Pregnancy from the National Health and Medical Research Council (Australia) grant (to authors A.A.M., J.M.N., G.M.W., M.J.O'C., W.B.

REFERENCES

1. Jacobi C, Agras WS, Bryson S. et al. Behavioral validation, Precursors and Concomitants of picky Eating in Childhood. *J Am Acad Child Adolesc Psychiatry*. 2003;42:76–84.
2. Stice E, Agras WS, Hammer LD. Risk factors for the Emergence of Childhood Eating Disturbances: A Five-Year Prospective Study. *Int J Eat Disord*. 1999;25:375–387.
3. Lindberb L, Bohlin G, Hagekull B. Early feeding problems in a normal population. *Int J Eat Disord*. 1991;10:395–405.
4. Sanders MR, Patel RK, Le Grice B et al. Children with persistent feeding difficulties: An observational analysis of the feeding interactions of problem and non-problem eaters. *Health Psychol*. 1993;12:64–73.
5. Chatoor I, Surlles J, Ganiban J et al. Failure to thrive and cognitive development in toddlers with infantile anorexia. *Pediatrics* 2004;113:440–447.
6. Wolke D, Skuse D, Mathisen B. Behavioral style in failure to thrive infants: A preliminary communication. *J Pediatr Psychol*. 1990;15:237–254.
7. Dahl M, Sundelin C. Feeding problems in an affluent society. Follow-up at four years of age in children with early refusal to eat. *Acta Paediatr*. 1992;81:575–579
8. Powers FF, Low J. Behavior in non-organic failure to thrive. *J Dev Behav Pediatr*. 1983;4:26–33.
9. Marchi M, Cohen P. Early childhood eating behaviors and adolescent eating disorders. *J Am Acad Child Adolesc Psychiatry*. 1990;29:112–7.
10. Chatoor I. Feeding disorders in infants and toddlers: diagnosis and treatment. *Child Adolesc Psychiatr Clin North Am*. 2002;11:163–83.
11. Ramsay M, Gisel GG, McCusker J et al. Infant sucking ability, non-organic failure to thrive, maternal characteristics, and feeding practices: a prospective cohort study. *Dev Med Child Neurol*. 2002;44:405–414.
12. Chatoor I, Ganiban J, Hirsch R et al. Maternal characteristics and toddler temperament in infantile anorexia. *J Am Acad Child Adolesc Psychiatry* 2000;39:743–751.
13. Russell GFM, Treasure J, Eisler I. Mothers with anorexia nervosa who underfeed their children: their recognition and management. *Psychol Med*. 1998;28:93–108.

14. Keeping JD, Najman JM, Morrison J et al. A prospective longitudinal study of social, psychological and obstetric factors in pregnancy: Response rates and demographic characteristics of the 8556 respondents. *Br J Obstet Gynaecol.* 1989;96:289–297.
15. Lawlor D, Najman JM, Sterne J et al. Associations of parental, birth and early life characteristics with systolic blood pressure at age 5: findings from the Mater-University study of pregnancy and its outcomes. *Circulation* 2004;110:2417–2423.
16. Frankenburg WK, Dodds JB. The Denver developmental screening test. *J Pediatr.* 1967;71:181–191.
17. Eisen M, Donald CA, Ware JE, Brook RH. Conceptualisation and measurement of Health for Children in the Health Insurance Study, Rand, Santa Monica, CA, 1980.
18. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* 2000;320 (7244):1240–3.
19. Childers JS, Durham TW, Wilson S. Relation of performance on the Kaufman Brief Intelligence Tests with the Peabody Picture Vocabulary Test-Revised among pre-school children. *Percept Mot Skills* 1994;73:1195–1199.
20. Achenbach TM. Manual for the Child Behaviour Checklist and 1991 Profile. Burlington, Vermont: University of Vermont Department of Psychiatry; 1991.
21. Bor W, Najman JM, Andersen MJ et al. The relationship between low family income and physiological disturbance in young children: An Australian longitudinal study. *Aust N Z J Psychiatry.* 1997;37:644–675.
22. Spanier GB. Measuring Dyadic Adjustment – new scales for assessing quality of marriage and similar dyads. *J Marriage Fam.* 1976;38:15–28.
23. Brennan PA, Hall J, Bor W et al. Integrating biological processes in relation to early-onset persistent aggression in boys and girls. *Dev Psychol.* 2003;39:309–323.
24. Bedford A, Foulds GA. Validation of the Delusional-Symptoms-States Inventory. *Br J Med Psychol.* 1977:163–171.
25. Spence SH, Najman JM, Bor W et al. Maternal anxiety and depression, poverty and marital relationship factors during early childhood as predictors of anxiety and depressive symptoms in adolescence. *J Child Psychol Psychiatry.* 2002;43:457–469.
26. Stata version 8.0. Stata Inc., Texas.
27. Hogan JW, Roy J, Korkontzelou C. Handling drop-out in longitudinal studies. *Stat Med.* 2004;23:1455–97.
28. O'Brien LM, Heycock EG, Hanna M et al. Postnatal Depression and Faltering Growth: A Community Study. *Pediatrics* 2004;113:1242–1247.

Index terms: child; mother; irregular eating