

## ORIGINAL ARTICLE

## Infants in a neonatal intensive care unit: parental response

J D Carter, R T Mulder, A F Bartram, B A Darlow

*Arch Dis Child Fetal Neonatal Ed* 2005;**90**:F109–F113. doi: 10.1136/adc.2003.031641

See end of article for authors' affiliations

Correspondence to:  
Dr Carter, Department of Psychological Medicine, Christchurch School of Medicine and Health Sciences, PO Box 4345, Christchurch, New Zealand; [janet.carter@chmeds.ac.nz](mailto:janet.carter@chmeds.ac.nz)

Accepted 28 January 2004

**Objective:** To compare the psychosocial functioning of the parents (mother and father) of infants admitted to a neonatal intensive care unit (NICU) with the parents of infants born at term and not admitted to the NICU.

**Design:** Random sample of NICU parents and term non-NICU parents were assessed across a variety of psychiatric and psychosocial measures shortly after the birth of their infant.

**Setting:** Christchurch Women's Hospital, New Zealand. Labour ward and level III NICU.

**Participants:** A total of 447 parents (242 mothers; 205 fathers) with an infant admitted to a regional NICU during a 12 month period; 189 parents (100 mothers; 89 fathers) with infants born at term and not requiring NICU admission.

**Main outcome measures:** Depression and anxiety symptoms, psychosocial functioning.

**Results:** Overall, levels of anxiety and depression were low in both parent groups. Compared with control parents, a higher percentage of NICU parents had clinically relevant anxiety and were more likely to have had a previous NICU admission and be in a lower family income bracket. Infant prematurity was associated with higher levels of symptomatology in both NICU mothers and fathers.

**Conclusions:** Specific interventions are not needed for most parents who have an infant admitted to the NICU as they appear to adapt relatively successfully. Infant prematurity impacts negatively on the father as well as the mother. Consequently these parents may benefit from increased clinical attention.

Parents of infants admitted to a neonatal intensive care unit (NICU) are believed to experience heightened distress, including increased anxiety, depression, and trauma symptoms, compared with parents of healthy infants. This distress has been associated with multiple factors including adapting to having a sick infant, the stress of the NICU environment, the physical and emotional isolation from the baby, as well as the normal stresses of parenthood.<sup>1–4</sup>

Research to date has focused on parents of specific high risk groups—for example, very premature, low birthweight, or critically ill infants. Most studies report that mothers of very preterm infants (<33 weeks) experience higher rates of depression and anxiety than mothers of full term infants,<sup>5–7</sup> but others have failed to find significant differences.<sup>8–9</sup> Compared with families of healthy infants, families of premature and sick infants may be at increased risk of divorce,<sup>10</sup> and suffer more severe family stress and financial problems.<sup>11–12</sup>

Four main methodological problems are evident in the research to date. Firstly, samples of convenience have often been used, and secondly, a restricted range of potential adverse effects has been examined. Thirdly, control groups are seldom included, so we know very little about how the experience of parents of NICU infants compares with the experience of non-NICU infants. There are no adequate studies on the experience of parents of preterm infants of 33–35 weeks gestation or infants admitted to a NICU for reasons other than prematurity. Finally, despite research indicating that fathers of critically ill newborn infants assume a central role in maintaining family stability during the crisis period,<sup>13</sup> few studies have focused on the experience of fathers in the NICU.

We compared the mother and father of infants admitted to a NICU with the mother and father of infants not admitted to a NICU across psychiatric symptoms and history, pregnancy related factors, couple relationship, and social supports. We also examined the impact of infant prematurity on the parents' functioning.

## METHODS

## Participants and setting

The participants in this study are parents residing in the central Canterbury province who had an infant in the Christchurch Women's Hospital labour ward or the NICU. The Christchurch Women's Hospital NICU is the only level III centre in a geographical region that has 7000 births annually, and consequently all sick newborns are admitted to this unit. Criteria for NICU admission are birth weight <1800 g, gestation <34 weeks, or any illness in the infant such as respiratory distress. Families were not eligible if it was known that the infant would go straight into foster care or be adopted (12 families). The only exclusion criterion was lack of written informed consent. A table of random numbers was generated to select 300 families from the sequential admission register for the NICU in one calendar year (February 2001 to February 2002). Owing to a higher than expected proportion of admissions to the unit coming from outside the region during the enrolment period, recruitment was falling below the target number so in the last four months of the target year all eligible admissions were approached to participate in the study. The obtained sample is thus representative of the births resulting in admissions to the NICU in the target year. Total admissions to the NICU in the target year were 578 infants. In all, 296 families were approached to participate in this study. Of these, 242 (82%) gave written informed consent (242 mothers; 205 fathers).

The control group for this study was recruited as part of a larger companion study. A representative sample of families who were usually resident in central Canterbury province and whose infant had not been admitted to the NICU were selected from the sequential register of births held in the delivery ward of the Christchurch Women's Hospital by sampling every eighth birth not admitted to the NICU.

**Abbreviations:** DAS, dyadic adjustment scale; EPDS, Edinburgh postnatal depression scale; HADS, hospital anxiety and depression rating scale; NICU, neonatal intensive care unit; SAS, social adjustment scale

**Table 1** Comparison of basic details across neonatal intensive care unit (NICU) mothers with control mothers and NICU fathers with control fathers

	Mothers (n = 342)		Fathers (n = 294)	
	NICU (n = 242)	Control (n = 100)	NICU (n = 205)	Control (n = 89)
Age (years)	30.1 (5.4)	30.7 (5.4)	33.1 (5.9)	33.7 (6.0)
Marital status				
Married	58% (140)	68% (68)		
De facto	30% (73)	22% (22)		
Separated/divorced	3% (6)	1% (1)		
Never married	10% (23)	9% (9)		
Education				
Obtained one or more subject in school certificate	74% (179)	83% (83)	82% (167)	74% (66)
Completed sixth form	55% (133)	61% (61)	56% (115)	58% (52)
Completed seventh form	32% (77)	40% (40)	31% (64)	37% (33)
Completed further tertiary qualification	52% (126)	56% (56)	66% (136)	66% (59)
Trade/secretarial qualification	48% (61)	52% (29)	63% (86)	54% (32)
Professional qualification	52% (65)	52% (29)	37% (50)	46% (27)
Family income over past year				
Less than \$15000 a year	7% (16)	6% (6)		
\$15000 to <\$25000 a year	17% (40)	12% (12)		
\$25000 to <\$40000 a year	20% (49)	11% (11)		
\$40000 to <\$50000 a year	17% (41)	12% (12)		
\$50000 to <\$70000 a year	19% (46)	18% (18)		
\$70000 and over a year	20% (49)	41% (41)*		

Values are percentage (number) except for age where values are mean (SD).  
\*Significantly different from NICU parent, p = 0.001 (Mann-Whitney U test).

Eligible families were then approached to be recruited into the larger project. As part of this process, one in every three eligible families was selected at random (using a table of random numbers) to be recruited as a control group for this study (n = 100). Of the 120 families approached, 100 (83%) families (100 mothers; 89 fathers) consented to participate in the study.

**Procedure**

After informed written consent had been obtained, an experienced interviewer met each parent to conduct an assessment. This usually occurred within three weeks of the infant’s date of admission (mode 13 days, mean (SD) 17 (11.2) days). The assessment consisted of a clinical interview<sup>14</sup> and self report questionnaires assessing depression and anxiety symptoms: Edinburgh postnatal depression scale (EPDS)<sup>15</sup>; hospital anxiety and depression rating scale (HADS).<sup>16</sup> The quality of the couple relationship and social adjustment were also examined: the dyadic adjustment scale (DAS)<sup>17</sup>; social adjustment scale (SAS).<sup>18</sup> Mothers and fathers were interviewed separately, and they completed self report questionnaires independently of each other.

**Infant characteristics**

Assessment of infant health status was collected in a companion study. The gestation of NICU infants ranged from 23 to 42 weeks (mean (SD) 35.1 (3.8)), and weight

ranged from 370 to 4850 g (mean (SD) 2477 (889.1)). The control group included one set of twins. Control group infant gestation ranged from 36 to 42 weeks (mean (SD) 40.0 (1.2)), and the weight ranged from 2260 to 4940 g (mean (SD) 3518 (491.6)). Of the NICU infants, 19% (49, including seven sets of twins and one set of triplets) had a gestation of less than 33 weeks, 32% (85, including nine sets of twins) had a gestation of 33–35 weeks, and 59% (129, including three sets of twins) were near or full term (36–42 weeks). The most common reasons for term infants to be admitted to the NICU were respiratory distress (36%), hypoglycaemia (16%), suspected sepsis (9%), feeding difficulties (8%), possible hypoxic-ischaemic encephalopathy (7%), jaundice treatment (6%), and surgical conditions (5%).

**Statistical analysis**

Basic characteristics, pregnancy related factors, and psychiatric history were compared between groups independently for mothers and fathers using *t*,  $\chi^2$ , and non-parametric Mann-Whitney U tests. Current psychological functioning was compared between NICU and control groups using a mixed model analysis of covariance, which allowed for the dependence of the data derived from mothers and fathers from the same family. The appropriateness of parametric analyses of the measures of psychological functioning was verified graphically by assessing the normality of residual plots. Probable cases of anxiety and depression were

**Table 2** Comparison of neonatal intensive care unit (NICU) mothers with control mothers and NICU fathers with control fathers across pregnancy related factors

	Mothers		Fathers	
	NICU	Control	NICU	Control
Number of previous pregnancies	1.7 (2.3)	1.6 (1.5)		
Age first pregnant	24.9 (6.1)	25.6 (5.9)		
Number of live births (incl current)	2.0 (1.2)	2.0 (1.0)		
Had a previous NICU admission	17% (42)	9% (9)*		
Regarded the pregnancy as planned	59% (143)	62% (62)	67% (137)	67% (60)

Values are mean (SD) or percentage (number).  
\*Significantly different from NICU mother,  $\chi^2 = 3.893$ , p = 0.048.

**Table 3** A comparison of the psychiatric history of neonatal intensive care unit (NICU) mothers with control mothers and NICU fathers with control fathers

	Mothers		Fathers	
	NICU	Control	NICU	Control
Life time diagnosis of major depressive episode	27% (66)	26% (26)	21% (42)	11% (10)
Alcohol abuse (life time)	9% (21)	12% (12)	14% (28)	23% (20)
Alcohol dependence (life time)	10% (25)	6% (6)	13% (26)	8% (7)
Ever had psychotherapy or counselling	39% (94)	38% (38)	28% (58)	22% (19)
Ever attended an outpatient specialist mental health service	10% (23)	9% (9)	3% (7)	2% (2)

Values are percentage (number).

compared independently for mothers and fathers using logistic regression. The effect of gestational age on psychological functioning was explored separately for mothers and fathers using analysis of covariance, and, where this indicated a significant effect of gestational age, Fisher's protected LSD tests were used for pairwise comparisons among the four gestational age groups.

## RESULTS

### Basic characteristics

There were no significant differences in age, marital status, or education between the NICU and control mothers and fathers (table 1). The only difference was in income, where 40% of control families earned over \$70 000 a year compared with only 20% of NICU families (table 1). Because of the possible confounding effects of income and group status (NICU *v* control), further analyses on symptoms and probable cases incorporated income as a covariate.

### Pregnancy factors

There were no significant differences in the number of previous pregnancies, age at first pregnancy, number of births, and percentage of the parents who regarded the pregnancy as planned (table 2). NICU mothers were significantly more likely than control mothers to have had an infant previously admitted to an NICU.

### Psychiatric history

There were no significant differences between groups in the rate of past depression, past alcohol problems (abuse and dependence), and past mental health treatment received (table 3).

### Current psychological functioning

#### Symptom averages

Overall, the mean level of depressive and anxiety symptoms in the NICU and control groups were low. There was no significant difference between NICU and control parents on the average HADS depression subscale. The NICU parents had significantly higher HADS anxiety scores than the control parents (5.9 (3.8) *v* 4.7 (3.1), *p* = 0.010). Similarly,

the NICU parents had higher total HADS scores than the control parents (9.7 (7.0) *v* 8.1 (5.2), *p* = 0.034). There was no significant difference between NICU and control parents on the average EPDS scores. There were no significant differences between the NICU and control groups on levels of social adjustment (SAS) and perceived quality of their couple relationship (DAS).

### Probable cases of depression or anxiety

A score of 11 or greater on the HADS and 12.5 or greater on the EPDS indicates a probable—that is, clinically relevant—case of depression or anxiety. Probable anxiety was found in 11% (20/180) of the NICU fathers and 3% (2/80) of control fathers (*p* = 0.045), and 18% (35/199) of NICU mothers and 7% (6/93) of control mothers (*p* = 0.023). Four per cent (7/180) of NICU fathers were probable cases of depression on the HADS. No control fathers had HADS depression scores over 11. Six per cent (11/199) of NICU mothers and 4% (4/93) of control mothers were probable cases of depression on the HADS (*p* = 0.769). Six per cent (10/181) of NICU fathers and 1% (*n* = 1/79) of control fathers were probable cases of depression on the EPDS (*p* = 0.190). Twenty two per cent (45/202) of NICU mothers and 12% (*n* = 11/92) of control mothers were probable cases of depression on the EPDS (*p* = 0.080).

### Current psychological functioning and gestation: fathers

Fathers with an infant in the NICU (regardless of gestation) had higher total HADS scores and anxiety subscale scores than control fathers. Fathers who had very premature infants (<33 weeks) had significantly higher depressive symptoms scores on the EPDS than fathers of full term infants in the NICU or in the control group (table 4).

### Current psychological functioning and gestation: mothers

For mothers, there were significant differences within the NICU gestation groups. Specifically, increasing prematurity was associated with increasing HADS total and depression

**Table 4** Current psychological functioning across infant gestational age in fathers only

	NICU (n = 30)	NICU (n = 53)	NICU (n = 97)	Control (n = 80)	p Value
	<33 weeks	33–35 weeks	36–42 weeks	36–42 weeks	
HADS					
Total score	9.6 (6.4)	8.5 (6.6)	8.3 (6.7)	6.2 (6.3)	0.043
Anxiety subscale	6.0 (3.6)	5.4 (3.7)	5.1 (3.8)	3.8 (3.5)	0.012
Depression subscale	3.7 (3.7)	3.1 (3.8)	3.2 (3.9)	2.4 (3.7)	0.354
EPDS					
Total score	6.1 (4.0)	4.6 (4.1)	4.3 (4.2)	3.5 (4.0)	0.020

Values are mean (SD).

HADS, Hospital anxiety and depression scale; EPDS, Edinburgh postnatal depression scale.

**Table 5** Current psychological functioning across infant gestational age in mothers only

	NICU (n = 32)	NICU (n = 63)	NICU (n = 104)	Control (n = 93)	p Value
	<33 weeks	33–35 weeks	36–42 weeks	36–42 weeks	
HADS					
Total score	12.6 (6.4)	11.7 (6.6)	9.4 (6.8)	9.7 (6.4)	0.031
Anxiety subscale	7.2 (3.7)	6.6 (3.8)	5.8 (3.9)	5.6 (3.7)	0.124
Depression subscale	5.4 (3.3)	4.9 (3.5)	3.6 (3.6)	4.2 (3.3)	0.017
EPDS					
Total score	8.5 (5.1)	7.7 (5.3)	6.8 (5.4)	6.8 (5.1)	0.285

Values are mean (SD).

HADS, Hospital anxiety and depression scale; EPDS, Edinburgh postnatal depression scale.

subscale scores. There was no significant difference between the NICU mothers of full term infants and the control mothers of full term infants (table 5).

## DISCUSSION

### Depression and anxiety

Overall, the average level of anxiety and depressive symptoms in both the NICU and control parents was low, suggesting that for most parents the hospital experience was not associated with obvious depression or anxiety, even if their infant was admitted to a NICU. The latter finding is contrary to generally held assumptions that the NICU experience and environment is intrinsically distressing for all parents.

Although symptom scores were modest overall, significantly more of the NICU mothers (18%) and fathers (11%) did have clinically relevant anxiety symptoms (probable cases) compared with control mothers (7%) and fathers (3%). The nature of the relationship between having an infant in the NICU and heightened anxiety in mothers and fathers is uncertain. It is possible that higher levels of anxiety and depression during pregnancy may lead to an increased chance of having an infant requiring admission to a NICU; however, there was no significant difference in the psychiatric history of NICU and control parents in this study. A more likely explanation is that the combination of a parent's personal psychological resources, contextual sources of support and stress, and infant health status all interact to determine parental response.<sup>19</sup>

The percentage of NICU and control parents with clinically relevant depressive symptoms, measured on the HADS and the EPDS, was not significantly different. Although originally designed for use with mothers, several studies have used the EPDS with fathers. In their recent study, Matthey *et al*<sup>20</sup> validated the EPDS for men and reported that this questionnaire is a reliable and valid measure of mood in fathers. These researchers also suggested that the cut off for a case for fathers may be two points lower than the cut off for mothers. It is possible therefore that the same cut off for mothers and fathers, which was used in this study, may underestimate the probable cases of depression in fathers.

### Basic and psychosocial variables

The parents of NICU and control infants were very similar with respect to their basic characteristics, a number of pregnancy related factors, social adjustment, and couple functioning. The mothers of NICU infants were more likely to have had an infant previously admitted to the NICU, and NICU families were in a lower income bracket. Studies with low birthweight infants have also reported the latter finding and also report that infants born into socioeconomically disadvantaged families are at increased health risk.<sup>21–23</sup> It is noteworthy that, in this study, increased rates of anxiety symptoms in NICU mothers and fathers compared with

control mothers and fathers remained when family income was taken into account.

### Impact of prematurity

Given that most of the previous research has focused on the impact on parents of having a premature infant, we also examined the effect of gestation on current psychological functioning. For NICU fathers, anxiety symptoms shortly after the birth of their infant were associated with having an infant admitted to the NICU, but not with prematurity per se. In contrast, increased depressive symptoms were associated with prematurity for both mothers and fathers. These results confirm the findings of previous research on the impact of infant prematurity or low birth weight on mothers functioning.<sup>5–7, 24</sup> Our results also extend the research in this area by showing that the impact of low birth weight and prematurity is not confined to the mother, but similarly impacts on fathers, in addition to the stress of having an infant admitted to the NICU.

### Strengths and weaknesses

In contrast with other research in this area, the sample for this study was selected from a large geographical catchment area and therefore included parents with diverse socioeconomic status and infant health status. In addition, by recruiting parents who did not have an infant admitted to the NICU, we were able to compare their experience with that of the NICU parents, including the experience of fathers. A weakness of this study is that parental psychiatric and psychosocial functioning was based on self report measures. The recruitment strategy was changed in the last four months of the target year to overcome the lower than expected recruitment rate. However, the sample obtained is still representative, and we consider it unlikely that this sampling process will have affected the results of this study.

### Implications of research

Overall, this study suggests that, at least initially, most parents make a relatively successful adaptation to having their infant admitted to the NICU, and therefore the addition of a general intervention—that is, beyond those measures already in place—targeted at all parents with an infant admitted to the NICU is not necessary. In common with many NICUs, the Christchurch Women's Hospital unit has, over the past decade, adopted several aspects of care designed to create a "parent friendly" atmosphere. These aspects of care include open access to the NICU and the infant's medical record, involvement in clinical decision making, skin to skin contact between parents and infant(s) from an early stage, and having a named clinical nursing coordinator as the prime contact person.

There is, however, a small but significant group of mothers and fathers who do suffer from significant distress, and this group may benefit from intervention. In particular, increased attention to the parents, including the father, of premature

infants may be warranted. Follow up research in this sample is being conducted to determine if any psychological distress persists over time and also to determine the factors that identify this group. Once identified, interventions specifically targeted to the needs of these parents can be implemented.

## ACKNOWLEDGEMENTS

This research was funded by a University of Otago Research Grant, the NZ Health Research Council, and the NZ Lottery Grants Board. Thanks to John Horwood and Chris Frampton, biostatisticians, for advice during this study and in the preparation of this paper. Thanks also to the research team (Lynne Haslett, Nicola Ebert, Beth Wynn-Williams, and Nina Mogridge) for their invaluable contributions. Finally, a sincere thanks to all of the parents who participated in this study.

## Authors' affiliations

**J D Carter, R T Mulder, A F Bartram**, Department of Psychological Medicine, Christchurch School of Medicine and Health Sciences, PO Box 4345, Christchurch, New Zealand

**B A Darlow**, Department of Pediatrics, Christchurch School of Medicine and Health Sciences, PO Box 4345, Christchurch, New Zealand

Competing interests: none declared

## REFERENCES

- 1 **Bell P**. Adolescent mothers' perceptions of the neonatal intensive care unit environment. *J Perinat Neonatal Nurs* 1997;**11**:77–84.
- 2 **Miles MS**, Carter MC, Hennessey J, *et al*. Testing a theoretical model: correlates of parental stress responses in the pediatric intensive care unit. *Matern Child Nurs J* 1989;**18**:207–19.
- 3 **Griffin T**. Nurse barriers to parenting in the special care nursery. *J Perinat Neonatal Nurs* 1990;**4**:56–67.
- 4 **Sullivan J**. Development of father-infant attachment in father of preterm infants. *Neonatal Netw* 1999;**18**:33–9.
- 5 **Singer LT**, Salvator A, Guo S, *et al*. Maternal psychological distress and parenting stress after the birth of a very low-birth-weight infant. *JAMA* 1999;**281**:799–805.

- 6 **Gennaro S**. Postpartal anxiety and depression in mothers of term and preterm infants. *Nurs Res* 1988;**37**:82–5.
- 7 **Brooten D**, Gennaro S, Brown LP, *et al*. Anxiety, depression, and hostility in mothers of preterm infants. *Nurs Res* 1988;**37**:213–16.
- 8 **Bidder R**, Crowe E, Gray O. Mothers' attitudes to preterm infants. *Arch Dis Child* 1974;**49**:770–6.
- 9 **Scheiner AP**, Sexton ME, Rockwood J, *et al*. The vulnerable child syndrome: fact and theory. *J Dev Behav Pediatr* 1985;**6**:298–301.
- 10 **Trause MA**, Kramer L. The effects of premature birth on parents and their relationship. *Dev Med Child Neurol* 1983;**25**:459–65.
- 11 **Pederson W**. Parental relations, mental health and delinquency in adolescents. *Adolescence* 1994;**29**:975–88.
- 12 **Jeffcoate J**, Humphrey M, Lloyd J. Disturbances in parent relationships following preterm delivery. *Dev Med Child Neurol* 1979;**21**:534–8.
- 13 **Jeffcoate J**, Humphrey M, Lloyd J. Role perception and response to stress in fathers and mothers following preterm delivery. *Soc Sci Med* 1979;**134**:139–45.
- 14 **Sheehan D**, Baker J, Harnett-Sheehan K, *et al*. The Mini-International Neuropsychiatric Interview. *J Clin Psychiatry* 1992;**60**(suppl 18):38–79.
- 15 **Cox J**, Holden J, Sagovsky R. Detection of postnatal depression: development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry* 1987;**150**:782–6.
- 16 **Zigmond A**, Snaith R. The Hospital Anxiety and Depression Scale. *Acta Psychiatr Scand* 1983;**67**:361–70.
- 17 **Spanier G**. Measuring dyadic adjustment: new scales for assessing the quality of marriage and similar dyads. *J Marriage Fam* 1976;**38**:15–28.
- 18 **Cooper P**, Osborn M, Gath D, *et al*. Evaluation of a modified self-report measure of social adjustment. *Br J Psychiatry* 1982;**141**:68–75.
- 19 **Belsky J**. The determinants of parenting: a process model. *Child Dev* 1984;**55**:83–96.
- 20 **Matthey S**, Barnett B, Kavanagh DJ, *et al*. Validation of the Edinburgh Postnatal Depression Scale for men, and comparison of item endorsement with their partners. *J Affect Disord* 2001;**64**:175–84.
- 21 **Brown L**, Brooten D, Kumar S, *et al*. A sociodemographic profile of families of low birthweight infants. *West J Nurs Res* 1989;**11**:520–32.
- 22 **Lieberman E**, Ryan K, Nonson R, *et al*. Risk factors accounting for racial differences in the rate of premature birth. *N Engl J Med* 1987;**317**:743–8.
- 23 **Beckwith L**, Rodrig C. Intellectual functioning in children born premature: recent research. In: Okagaki L, Sternberg R, eds. *Directions of development: influences on the development of children's thinking*. Hillsdale, NJ: Erlbaum, 1991:25–58.
- 24 **Blumberg N**. Effects of neonatal risk, maternal attitude and cognitive style on early post-partum adjustment. *J Abnorm Psychol* 1980;**89**:139–50.



## Infants in a neonatal intensive care unit: parental response

J D Carter, R T Mulder, A F Bartram, et al.

*Arch Dis Child Fetal Neonatal Ed* 2005 90: F109-F113  
doi: 10.1136/adc.2003.031641

---

Updated information and services can be found at:  
<http://fn.bmj.com/content/90/2/F109.full.html>

---

### References

*These include:*

This article cites 23 articles, 4 of which can be accessed free at:  
<http://fn.bmj.com/content/90/2/F109.full.html#ref-list-1>

Article cited in:  
<http://fn.bmj.com/content/90/2/F109.full.html#related-urls>

### Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

---

### Topic Collections

Articles on similar topics can be found in the following collections

[Neonatal and paediatric intensive care](#) (170 articles)  
[Neonatal intensive care](#) (122 articles)  
[Child and adolescent psychiatry \(paediatrics\)](#) (65 articles)

---

### Notes

---

To request permissions go to:  
<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:  
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:  
<http://group.bmj.com/subscribe/>