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Mothers of Very Low Birth Weight Children at School Age: Quality of Life Outcomes from the Newborn Lung Project Statewide Cohort Study

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Abstract

Purpose—This study aimed to: (1) determine the health-related quality of life (HRQoL) in mothers of five year old very low birth weight (VLBW) and normal birth weight (NBW) children; (2) determine what extent stress mediates the relationship between case status and maternal HRQoL; and (3) examine the pre-pregnancy, pregnancy, birth, and child health-related factors in predicting maternal HRQoL among mothers of five year old VLBW children.

Methods—A telephone interview was administered to 297 mothers of VLBW children and 290 mothers of NBW children who were enrolled in the Newborn Lung Project Statewide Cohort Study.

Results—Mothers of VLBW children experienced worse physical and mental HRQoL than mothers of NBW children (52.8 versus 55.3 points, $p < 0.0001$, and 48.9 versus 50.5 points, $p = 0.02$, respectively). Adjusted analyses showed that maternal mental HRQoL was similar between cases and controls while physical HRQoL when children were age five was significantly different between cases and controls (Beta: -2.02 , $p = 0.0006$); this relationship was mediated by maternal stress. Among mothers of VLBW children, stress significantly contributed to adverse HRQoL outcomes when children were age five. Child behavior problems at age two were also associated with worse subsequent maternal mental HRQoL (Beta: -1.8 per SD, $p = 0.004$), while each week of neonatal intensive care unit stay was associated with worse physical HRQoL (Beta: -0.26 , $p = 0.02$).

Conclusions—While caring for a VLBW child negatively impacts the HRQoL of mothers, this relationship was partially explained by maternal stress. Addressing maternal stress may be an important way to improve long-term HRQoL.

Key Terms/Phrases

Very low birth weight; maternal stress; maternal health-related quality of life; life course

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INTRODUCTION

Caring for a very low birth weight (VLBW, <1500 g) child can have a significant and lasting impact on maternal stress [1, 2] and psychological distress [3], [1, 3, 4] and can have a negative effect on the overall well-being of the entire family[5]. Maternal psychological sequelae may begin immediately after birth, and persist throughout early childhood [1, 3–5].

The mechanisms by which caring for a VLBW child influences subsequent maternal stress and quality of life outcomes are important but unknown. Few studies have examined health-related quality of life (HRQoL) as an outcome among this population; and existing studies yield inconsistent results regarding HRQoL among mothers of preterm and VLBW infants. Eiser et al. found that mothers of preterm infants at 2 years reported worse HRQoL than mothers of full-term infants [6], while another study found that HRQoL did not differ between caregivers of VLBW 1-year old infants and their counterparts.[7] These studies may be limited by the (1) focus on short-term HRQoL outcomes in parents; (2) use of convenience samples; and (3) lack of emphasis on a life-course perspective, thereby not controlling for important confounders. In addition, it has not been investigated what role stress may play in HRQoL of mothers of VLBW children.

To date, no studies have examined the health trajectories of mothers and children to determine the long-term HRQoL of parents of VLBW children. In order to address this gap in the literature, our study utilized a regional population-based cohort of now school-aged children born VLBW and matched controls to (1) determine the HRQoL in mothers of five-year-olds born VLBW and five year old children born normal birth weight (NBW); (2) determine to what extent stress mediates the relationship between parenting a child born VLBW and maternal HRQoL; and (3) examine the pre-pregnancy, pregnancy, birth, and child health-related factors which predict subsequent maternal HRQoL among mothers of five year old VLBW children. Using a between and within group approach, our study examined the relative impact on maternal health and sought to understand risk and resilience among mothers of children born VLBW.

The underpinning conceptual framework for this study is derived from a life-course developmental perspective [8], social-ecological systems theory [9], Sameroff's transactional model [10], role theory [11], and stress theory [12], which suggest that children's health problems may contribute to chronic stress for the parent, which may lead to poor parental HRQoL and well-being. In addition, our research incorporates a biopsychosocial approach to understanding parental health and HRQoL outcomes, by including the biomedical, behavioral and environmental dimensions of health [13]. This approach takes into account the biopsychosocial processes that may explain the mechanisms by which stress affects parental health outcomes. Understanding the mechanisms by which caring for school-aged children born VLBW affects subsequent parental well-being could help pediatricians and family practitioners monitor and treat at-risk parents, and lead to improved interventions for both parents and children.

METHODS

This ancillary study of the Newborn Lung Statewide Cohort Study (NBL) was approved by the Health Sciences Institutional Review Board of the University of Wisconsin-Madison.

NBL is a cohort study of VLBW children born in Wisconsin in 2003 or 2004 and their primary caregivers, with a regionally matched cohort of NBW children born in the same years, and their primary caregivers (hereafter "parents"). The NBL cohort consists of 640 parents of surviving VLBW children and 464 parents of NBW children who participated in the 2005–2006 NBL follow-up study, and agreed to future follow-up. Detailed descriptions

of NBL participant recruitment, data collection, and previous findings have been previously published [14]. Data for this ancillary study were collected when the children were approximately 4–5 years of age (2008–2009).

Participants

The parents who completed the 2005–2006 NBL follow-up study were invited to participate in this study. Of the 1,104 parents in the cohort, 908 (82.2%) had up-to-date contact information and could be reached. Of these, 16 parents refused to participate and 17 were non-English speakers and thus ineligible. Two hundred and fifteen parents were reached but could not be scheduled to participate within the study time frame. In total, 344 parents of VLBW children (64.7%) and 316 parents of NBW (79.8%) children provided informed consent and participated in the study. After omitting participants with missing data (9.7%) and restricting the sample to biological mothers only, 297 mothers of VLBW children and 290 mothers of NBW children were included in the final sample. For mothers of multiples, one child was randomly selected for this study. Participants with missing data were less educated, reported worse mental HRQoL and more stress, and had children with more behavior problems than those who were included in the final sample.

Procedures

Research staff contacted participants by phone between October 2008 and July 2009 to complete an interviewer-assisted survey measuring symptoms of stress and HRQoL. Data from the original NBL (2003–2004), 2005–2006 NBL follow-up survey, and this ancillary study (2008–2009) were linked for each mother-child dyad.

Measures

Outcome Measure—The *Short Form-12* (SF-12) version 2, a widely used measure of health status, was used to assess the overall HRQoL of the mothers [15]. The *Short Form-12* has eight subscales which are condensed into two summary scales that measure physical HRQoL and mental HRQoL. Scores range from 0 to 100, with higher scores indicating better HRQoL and population mean=50, SD=10. The test-retest reliability for the summary scores is 0.89 and 0.76, respectively [15].

Independent Variables—Using a lifecourse perspective to determine long-term HRQoL, we examined the health trajectories of mothers and their children using the following characteristics. *Maternal health status* prior to and during pregnancy was evaluated by creating indicator variables to identify the presence of any pre-pregnancy health problems (diabetes or hypertension) or any pregnancy-related health problems (abruption placenta, gestational diabetes, pregnancy-induced hypertension, pre-eclampsia, eclampsia, oligohydramnios, placenta previa, polyhydramnios, bleeding during pregnancy, or other condition of pregnancy/labor), respectively. *Child health at birth* was evaluated as the number of weeks spent in the neonatal intensive care unit (NICU), the five-minute Apgar score, whether or not the child was small for gestational age (weight below the 10th percentile for gestational age), and whether or not the child had experienced any grade of intraventricular hemorrhage. *Child health at age two* was evaluated as whether or not the child had taken asthma medication during the first 2 years of life, and the child's scores on 3 subscales of the Pediatric Evaluation of Disability Inventory (PEDI): self-care, mobility, and social function. Internal consistency for the PEDI subscales is high, ranging from 0.95 to 0.99 [16]; scores were normalized to have a mean of 50 and standard deviation of 10. *Child HRQoL* was evaluated at 2 years of age using the PedsQL [17]. The PedsQL has a total scale score composed of two subscales: physical and psychological health summary scores.

The internal consistency-reliability of these scores was 0.90, 0.88, and 0.86, respectively [17].

For both cases and controls, *child behavior problems* were measured during the 2005–2006 NBL follow-up survey (when the children were approximately two years old) using the *Child Behavior Checklist* (CBCL), a well-validated instrument used to evaluate mother-reported child behavior problems in the past two months [18]. Higher summary scores on the CBCL (total behavior problems T-score) indicated more problems. Mothers' stress symptoms in the last week were measured using the 56-item *Calgary Symptoms of Stress Inventory* (C-SOSI) [19]. The C-SOSI has 8 subscales (depression, anger, muscle tension, cardiopulmonary arousal, sympathetic arousal, neurological/GI, cognitive disorganization, and upper respiratory symptoms), utilizing a biopsychosocial model of stress symptoms. Responses for the C-SOSI are recorded on a five-point Likert scale ranging from 0 (never) to 4 (very frequently) and summed across subscales with a maximum total possible score of 224. Internal consistency for the subscales ranges from 0.80 to 0.92, with an overall Cronbach's $\alpha = 0.95$ for cancer patients [19].

Additional covariates include: child sex, maternal age (adjusted to age during this study), race (white; non-white), maternal education (high school degree or less; some college; bachelor degree or equivalent; post graduate), single parent household status (among cases only), and annual income (less than \$10,000; \$10,000–\$30,000; \$30,000–\$40,000; \$40,000–\$60,000; \$60,000–\$100,000; more than \$100,000 per year).

Analytic Approach

All analyses were conducted using SAS version 9.2. Cross-tabulations and chi-square tests were used to compare VLBW and NBW children and their parents on key sociodemographic characteristics. T-tests were performed to test for mean differences on continuous variables, by child birth-weight status. Maternal health status, child health at birth and age two, and child HRQoL at age two were summarized using descriptive statistics.

Case-Comparison Analyses—Multiple linear regression analyses were conducted to evaluate the association between VLBW status and maternal HRQoL, controlling for relevant sociodemographics. Maternal age was included in the regression model *a priori*. Single covariates that were statistically significant ($p < 0.05$) or impacted point estimates of maternal HRQoL for VLBW status were included in the final models (Model 1). Maternal symptoms of stress (Model 2) were then added to Model 1 to test if this impacted the relationship between VLBW status and maternal HRQoL. In order to further assess mediation, we used Sobel tests [20] to determine the statistical significance of the mediating effects of stress on the relationship between parenting a child born VLBW and maternal HRQoL.

Case-Only Analyses—Multiple linear regression analyses were also conducted to evaluate the association between maternal health status, child health status at birth and age two, and child HRQoL on maternal HRQoL, controlling for relevant sociodemographics. Parsimonious model were constructed as above, and maternal age was again included *a priori* (Model 1). Maternal symptoms of stress (Model 2) were then added to Model 1 to test if this impacted the relationship between the independent variables and maternal HRQoL.

RESULTS

Descriptive Results

The final sample included 587 mothers, of whom 50.6% parented a VLBW child. VLBW children were slightly younger (2.4 months on average) and were more likely to have behavior problems than NBW children. There were no significant differences in child sex, by birthweight status (Table 1).

Mothers of VLBW children were younger and more likely to be non-white, less educated, have a lower income as compared with mothers of NBW children. Mothers of VLBW children had worse mental and physical HRQoL, and more symptoms of stress. Of the mothers of VLBW babies, 7.2% had pre-pregnancy health problems and 80.8% had any health problems during pregnancy.

Maternal HRQoL Results

Figure 1 shows the unadjusted HRQoL among mothers of VLBW and NBW children. Mothers of VLBW children reported significantly worse HRQoL than mothers of NBW children on all domains.

Case-comparison Analyses – Mental HRQoL—To further evaluate the impact of birth weight on maternal HRQoL, regression analyses were performed separately for maternal mental and physical HRQoL (Table 2). Maternal *mental* HRQoL was not significantly associated with child birth weight; however, reporting more symptoms of stress was associated with worse maternal mental HRQoL, independent of birth weight status (Beta: -0.21 per point, $p < 0.0001$, or -5.1 per SD).

Case-comparison Analyses – Physical HRQoL—On average, mothers of VLBW children had significantly worse *physical* HRQoL (Beta: -1.87 , $p = 0.001$) than their counterparts, accounting for covariates (Model 1). When symptoms of stress were added to the model (Model 2), the coefficient for birth weight status was significantly attenuated (from -1.87 to -1.55 ; Sobel test Z-score: -3.34 ; $p = 0.0008$). Maternal symptoms of stress were also independently associated with worse maternal physical HRQoL (Beta: -0.08 per point; $p < 0.001$, or -2.0 per SD).

Case-Only Analyses – Mental HRQoL—In order to evaluate the impact of caring for a VLBW child over time, we regressed parental mental HRQoL on child health status at birth (NICU factors), child health at age two, and child psychosocial factors at age two (Table 3). NICU factors and child health at age two were not associated with maternal mental HRQoL when children were age five and were therefore not included in the final model. However, child behavior problems at age two were associated with significantly worse maternal mental HRQoL when children were age five (Model 1; Beta: -0.18 per point, $p = 0.0043$, or -1.8 per SD). Experiencing pre-pregnancy related health problems was also associated with significantly worse maternal mental HRQoL (Beta: -4.43 ; $p = 0.01$), accounting for other covariates.

When stress was added into this model (Model 2), the effects of child behavior problems and pre-pregnancy health problems on maternal mental HRQoL were attenuated and no longer statistically significant. Its inclusion in the model also resulted in a statistically significant effect for child psychological HRQoL at age two (Beta: 0.10 , $p = 0.01$). Symptoms of stress were independently associated with worse mental HRQoL (Beta: -0.20 per point; $p < 0.001$, or -5.3 per SD).

Case-Only Analyses – Physical HRQoL—Regression analyses also evaluated the relationship of child factors at birth and age two with maternal *physical* HRQoL (Table 4). A longer stay in the NICU was associated with worse maternal physical HRQoL when children were age five (Model 1; Beta: -0.26 per week, $p=0.02$), controlling for covariates. Interestingly, controlling for child health factors at age two did not influence this association and were therefore not included in the final regression model. Having health problems during pregnancy and being in a single parent household were also significantly associated with worse maternal physical HRQoL.

Accounting for maternal symptoms of stress (Model 2) attenuated the effect of being in a single parent household on maternal physical HRQoL, but did not appreciably influence the effects of the length of NICU stay or having health problems during pregnancy. However, maternal stress did display a statistically significant independent association with worse maternal physical HRQoL (Beta: -0.09 per point, $p<0.0001$, or -2.4 per SD).

DISCUSSION

This population-based study of stress and HRQoL in mothers of children born VLBW contributes new and salient findings to the literature. Our results indicate differential effects of parenting a VLBW child on future maternal HRQoL, supporting prior work [6, 21]. Specifically, our study found that when the children are age five, maternal physical health is worse among VLBW mothers while mental HRQoL did not differ between mothers of VLBW and NBW children. This study also revealed that stress appears to mediate the relationship between having a VLBW child and maternal physical HRQoL. This study also examined early maternal and child predictors of maternal HRQoL among mothers of VLBW children. Specifically, our results suggest that while the severity of VLBW children's health problems at birth was associated with maternal *physical* HRQoL when children were age five, maternal *mental* HRQoL is more strongly associated with child well-being and behavior problems.

Most existing studies of stress in parents of preterm or VLBW children have focused specifically on *parenting* stress [1–3, 22–24], yielding conflicting results. Our study shows that parents of VLBW children have worse *general* stress (including psychological and somatic) than parents of NBW children. Moreover, stress appears to attenuate the relationship between caring for a child born VLBW and physical HRQoL, suggesting one potential pathway by which poor physical HRQoL may occur. Parenting stress and other stressors associated with caring for a VLBW child may contribute to chronic stress, which may in turn lead to poor physical HRQoL as we have reported previously [25].

Previous research has established the relationship between child behavior problems and deleterious outcomes among parents of VLBW children [2, 6]; and this study confirms that child behavior problems at age two are significantly associated with worse maternal mental HRQoL when the child was age five. It is possible that our measurement of child behavior characteristics at age two was indicative of continued behavior problems at age five [26, 27]. The stress of caring for a child with behavior problems may also accumulate and lead to worse maternal mental HRQoL over time. Future longitudinal research using sophisticated statistical models should be conducted to better understand these nuanced relationships.

Pre-pregnancy health problems (specifically, diabetes and hypertension) were also found to be associated with maternal mental HRQoL when the child was age five. Given the chronic nature of these health problems, it is likely that women who experienced these problems prior to pregnancy continued to experience them when the child was age five. Our findings also indicate that stress may mediate this relationship. Managing long-term chronic health

conditions such as hypertension or diabetes may cause additional stress for mothers of children born VLBW that negatively influences their mental well-being, over and above caregiving alone.

Interestingly, maternal physical HRQoL was associated with a very different set of maternal and child factors. The association with health problems during pregnancy is unsurprising, given that such factors can be a barometer for future health problems [28, 29]. However, the length of time the child spent in the NICU was *independently* associated with poor maternal physical HRQoL when the child was five, even after controlling for health problems during pregnancy, an important predictor of subsequent physical health of both the mother and child. Although it is possible that this may be due to incomplete ascertainment of prior health problems, direct and indirect effects of the length of the NICU stay on maternal HRQoL are certainly plausible. In addition, the child's health problems that lead to a prolonged NICU stay [30] may cause uncertainty and distress that may negatively impact mothers. The NICU environment itself can be incredibly stressful for parents [31, 32], and being a new mother is already a particularly emotional and overwhelming time. Thus, a prolonged separation from the newborn while in the NICU may expose new mothers to a tremendous life stressor when they are particularly vulnerable [33–35]. Such a monumental life event could cause an intense short term psychological response and corresponding long term physiological responses for mothers, explaining why length of stay in the NICU was associated with maternal *physical* health five years later, but not maternal *mental* health five years out.

Importantly, the relationship between the length of the NICU stay and maternal physical HRQoL was not influenced by child health problems at age two. This strengthens our interpretation of the results by indicating that enduring child health problems alone do not account for the effect of the NICU stay on poor subsequent maternal physical health. Previous work on the effects of stress indicates that chronic stress, even once resolved, can have long-term physiological influences on the body [36]. The intense conditions of the NICU environment, or the child's health problems for which length of NICU stay is a proxy, may incite a lasting physiologic response in mothers that is not influenced by children's health problems at later stages in the child's life.

The differences we see in the factors associated with physical and mental HRQoL suggest an interesting life-course trajectory connecting the birth of a VLBW child with parental outcomes. It is possible that the experience of having a VLBW child sets parents on a trajectory in which physical health is compromised over time, even when mental health returns to normal. The immediate stressor of having a child in the NICU may contribute to long-term physical health problems in mothers, without negatively impacting mental health long-term. Other ongoing aspects associated with caring for a VLBW child however, such as behavior problems, may be responsible for a lack of re-adjustment in mental health in some mothers over time, without immediately influencing physical health.

The evidence from this and other studies indicates that maternal HRQoL is influenced over time by factors of both the mother and the child. Therefore, parent, child, and family level interventions throughout the life-course may be advantageous in protecting families from the deleterious effects of caregiving. Future research should more closely examine the impact of stress immediately following the birth of a VLBW child on the long-term physical health of the family. Further, research exploring the impact of child-level behavioral interventions on maternal mental health is needed.

Study Limitations and Strengths

Several limitations of this study should be considered. First, a larger proportion of NBW parents than VLBW parents participated in this ancillary follow-up survey. However, it is likely that those who did not participate in our follow-up survey were experiencing the greatest stress and worst HRQoL. Excluding mothers with the worst outcomes would have biased our case-comparison outcomes toward an underestimation of the true effect of caring for a VLBW child.

Second, child behavior problems and HRQoL are based on parent reports, which may be influenced by parents' own health and mental health status. However, studies have indicated that maternal depressive symptoms do not substantially bias maternal reporting of externalizing behaviors [37] or internalizing behavior.[38]

Finally, limitations in the dataset restricted our ability to fully explore maternal health problems in our analysis of physical HRQoL. Our analysis of maternal pre-pregnancy health was limited to diabetes and hypertension; therefore, our results may be impacted by residual confounding of maternal health problems prior to and during pregnancy. However, a sensitivity analysis revealed that adjusting for maternal health problems did not substantially impact the effect of NICU stay on maternal physical health, indicating that this association may be independent of prior health. In addition, we were unable to examine child health and well-being factors at age five. Future research should examine whether these factors play a role in concurrent maternal physical or mental well-being.

This study also has important strengths. Our study approaches the association between caring for a VLBW child and maternal health from a life-course perspective. By looking at the effects of child health and well-being over time, we were able to identify the long-term effects of child-level factors at specific points in the caregiving directory. In addition, our study is population-based, whereas most previous studies are gathered from clinics, limiting their generalizability. Finally, this study uses a measure of parental biopsychosocial *symptoms* of stress [19], which may better capture the physiologic impact of parenting a VLBW child.

Conclusion

This study extends previous research on stress and HRQoL among parents of children born VLBW using a longitudinal, population-based design. Caring for a VLBW child is significantly related poor physical HRQoL among mothers; however, the effect of having a VLBW child on maternal HRQoL appears to be explained, in large part, by maternal symptoms of stress. Moreover, our results suggest that while the severity of VLBW children's health problems at birth is associated with maternal physical HRQoL when children were age five, maternal mental HRQoL is more strongly associated with child well-being and behavior problems. These results highlight the need for coordinated caregiving interventions throughout the child's life that focus on all members of the family.

Understanding the factors associated with poor long-term maternal HRQoL will be crucial in developing interventions that will positively impact the well-being of the entire family.

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Abbreviations

HRQoL	health-related quality of life
VLBW	Very low birth weight (<1500 g)
LBW	Low birth weight (< 2500 g)
NBW	Normal birth weight
NBL	Newborn Lung Statewide Cohort Study

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Figure 1. Quality of Life (HRQoL) Among Parents of Children Born Very Low Birth Weight (VLBW) and Normal Birth Weight (NBW). This figure shows the subscale scores on the Short-form 12 (SF-12) among parents of children born VLBW and NBW. The subscales physical functioning, role limitation-physical, bodily pain, and general health make up the physical HRQoL component score, while vitality, social functioning, role limitation – emotional, and mental health make up the mental HRQoL component score. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 1

Characteristics of children born very low birth weight (VLBW) and normal birth weight (NBW) and their mothers

	VLBW	NBW	p-value
Number of Participants (n=587)	297	290	
<u>Child Characteristics</u>			
<i>Sociodemographic Factors</i>			
Age (mean [SD])	5.0 [0.5]	5.2 [0.4]	<.0001
Gender (%)			0.73
Male	46.9	45.5	
Female	53.1	54.6	
<i>Child Health at Birth</i>			
Length of NICU Stay (weeks) (mean [SD])	8.6 [4.7]		NA
5 Minute Apgar Score (mean [SD]) ^a	7.5 [1.5]		NA
Small for Gestational Age (%) ^b	26.2		NA
Intraventricular Hemorrhage (%) ^c	17.6		NA
<i>Health and Psychosocial Factors at Age 2</i>			
Took Asthma Medication (%)	33.5		NA
Self-Care (mean [SD]) ^d	45.8 [9.7]		NA
Social Function (mean [SD]) ^d	49.2 [13.9]		NA
Mobility (mean [SD]) ^d	45.0 [11.9]		NA
Child Behavior (mean [SD]) ^e			
Total Behavior Problems	47.8 [10.0]	43.5 [9.5]	<0.0001
Quality of Life (mean [SD]) ^f			
Overall	88.1 [11.6]		NA
Physical	90.0 [15.0]		NA
Psychological	86.7 [11.7]		NA
<u>Maternal Characteristics</u>			
<i>Sociodemographic Factors</i>			
Age (mean [SD])	34.9 [5.5]	35.9 [5.0]	0.02
Race (%)			0.0018
White	87.2	94.6	
Non-White	12.8	5.4	
Single Parent Household (%)	12.4		NA
Highest education level achieved (%)			<0.0001
High school degree or less	19.3	10.8	
Some college	37.6	28.3	
Bachelor degree or equivalent	31.0	39.1	
Post graduate	12.1	21.9	
Annual Income (%)			0.0001
<\$10,000	3.8	2.7	

	VLBW	NBW	p-value
\$10,000–\$30,000	14.8	5.4	
\$30,000–\$40,000	9.0	6.4	
\$40,000–\$60,000	28.6	23.9	
\$60,000–\$100,000	29.7	43.8	
>\$100,000	14.1	17.9	
<i>Psychosocial Factors</i>			
Mental Health (mean [SD]) ^g	48.9 [8.5]	50.5 [7.8]	0.02
Physical Health (mean [SD]) ^g	52.9 [8.0]	55.3 [6.1]	<0.0001
Symptoms of stress (mean [SD]) ^h	32.9 [26.7]	25.6 [21.4]	0.0003
<i>Prior Health Problems</i> ⁱ			
Pre-Pregnancy (%)	7.2		NA
During Pregnancy (%)	80.7		NA

Note: Totals may not add to 100% due to rounding error

NA: Not Applicable; NICU: neonatal intensive care unit

^a 5 minute Apgar scores range from 0 to 10, scores 7 and above are generally regarded as normal

^b Small for gestational age is defined as birth weight below the 10th percentile for gestational age

^c Intraventricular hemorrhage (any grade)

^d Subscale of the Pediatric Evaluation of Disability Inventory, normalized to mean of 50 and standard deviation of 10; higher score indicates positive functional change

^e Higher child behavior problems scores (evaluated using the Child Behavior Checklist) indicate more problems

^f Higher scores (evaluated using the Pediatric Quality of Life Index) indicate better HRQoL

^g Higher scores (Short-Form 12 component scores) indicate better HRQoL

^h Higher scores (Columbia Symptoms of Stress score for the past week) indicate greater symptoms of stress

ⁱ Pre-pregnancy health problems include diabetes or hypertension; Pregnancy-related health problems include: abruption placenta, gestational diabetes, pregnancy-induced hypertension, pre-eclampsia, eclampsia, oligohydramnios, placenta previa, polyhydramnios, bleeding during pregnancy, or other condition of pregnancy/labor

Table 2

Multivariate linear regression of mental and physical quality of life (HRQoL) among mothers of children born very low birth weight (VLBW) and normal birth weight (NBW)

	Mental HRQoL ^a				Physical HRQoL ^a			
	Model 1		Model 2		Model 1		Model 2	
	Beta	P-value	Beta	P-value	Beta	P-value	Beta	P-value
Intercept	53.53	<.0001	57.64	<.0001	56.16	<.0001	57.74	<.0001
Child Characteristics								
Child Birthweight Status								
VLBW child	-0.91	0.18	-0.08	0.89	-1.87	0.00	-1.55	0.01
NBW child	reference		reference		reference		reference	
Maternal Characteristics								
<i>Sociodemographic Factors</i>								
Maternal Race								
White	reference		reference		reference		reference	
Non-White	0.23	0.85	1.18	0.24	-0.58	0.59	-0.21	0.84
Highest education level achieved								
High school degree or less	-1.32	0.31	0.19	0.86	-1.59	0.16	-1.01	0.35
Some college	-1.08	0.29	-0.32	0.70	-0.88	0.33	-0.58	0.50
Bachelor degree or equivalent	-1.24	0.20	-0.95	0.22	1.44	0.09	1.55	0.06
Post graduate	reference		reference		reference		reference	
Annual Income								
<\$10,000	-10.94	<.0001	-2.63	0.15	-8.87	<.0001	-5.68	0.00
\$10,000-\$30,000	-6.29	<.0001	-1.93	0.11	-3.02	0.02	-1.35	0.28
\$30,000-\$40,000	-5.23	0.00	-2.84	0.02	-0.74	0.57	0.18	0.89
\$40,000-\$60,000	-1.18	0.27	-0.95	0.26	-0.76	0.41	-0.67	0.45
\$60,000-\$100,000	-2.08	0.03	-1.84	0.02	-0.39	0.64	-0.30	0.71
>\$100,000	reference		reference		reference		reference	
Maternal Age	0.01	0.87	0.07	0.16	-0.23	<.0001	-0.20	0.00
<i>Psychosocial Factors</i>								

Mental HRQoL ^a			Physical HRQoL ^a		
Model 1			Model 2		
Beta	P-value	Beta	P-value	Beta	P-value
Maternal Symptoms of Stress ^b					
		-0.21	<.0001		
				-0.08	<.0001

Note: Maternal Age is centered at 35

^aHigher scores (Short-Form 12 component score) indicate better HRQoL

^bHigher scores (Columbia Symptoms of Stress Inventory score for the past week) indicate greater symptoms of stress

Table 3

Multivariate linear regression of mental health-related quality of life^a among mothers of very low birth weight children

	Model 1		Model 2	
	Beta	P-value	Beta	P-value
Intercept	51.18	<.0001	56.65	<.0001
<u>Child Characteristics</u>				
<i>Health and Psychosocial Factors at Age 2</i>				
Child Behavior Problems ^b	−0.18	0.00	−0.04	0.45
Psychological Quality of Life ^c	0.10	0.06	0.10	0.01
<u>Maternal Characteristics</u>				
<i>Sociodemographic Factors</i>				
Age	−0.06	0.51	0.04	0.63
Single Parent Household	−1.51	0.39	0.82	0.57
Annual Income				
<\$10,000	−2.80	0.38	2.92	0.27
\$10,000–\$30,000	−3.58	0.06	−1.31	0.41
\$30,000–\$40,000	−3.80	0.06	−2.14	0.19
\$40,000–\$60,000	0.77	0.61	−0.25	0.84
\$60,000–\$100,000	−0.96	0.52	−1.58	0.20
>\$100,000	reference		reference	
<i>Prior Health Problems</i>				
Pre-Pregnancy ^d	−4.43	0.01	−2.31	0.12
<i>Psychosocial Factors</i>				
Symptoms of stress ^e			−0.20	<.0001

Child Behavior Problems, Child Psychological Quality of Life, and Maternal Age are centered at their medians (45, 90, and 35, respectively).

^aHigher scores (SF-12 component score) indicate better HRQoL

^bHigher child behavior problems scores (evaluated using the Child Behavior Checklist) indicate more problems

^cHigher quality of life scores (evaluated at 2 years of age using the Pediatric Quality of Life Index) indicate better HRQoL

^dPre-pregnancy health problems include diabetes or hypertension

^eHigher scores (Columbia Symptoms of Stress Inventory score for the past week) indicate greater symptoms of stress

Table 4

Multivariate linear regression of physical health-related quality of life^a among mothers of very low birth weight children

	<i>Model 1</i>		<i>Model 2</i>	
	Beta	P-value	Beta	P-value
Intercept	56.59	<.0001	58.74	<.0001
<u>Child Characteristics</u>				
<i>Child Health at Birth</i>				
Length of NICU Stay (weeks)	−0.26	0.02	−0.24	0.02
5 Minute Apgar Score ^b	−0.01	0.98	0.02	0.94
<u>Maternal Characteristics</u>				
<i>Sociodemographic Factors</i>				
Age	−0.18	0.05	−0.13	0.12
Single Parent Household	−3.47	0.04	−2.35	0.15
Highest education level achieved				
High school degree or less	−0.29	0.88	0.11	0.95
Some college	0.12	0.94	0.59	0.69
Bachelor degree or equivalent	3.03	0.05	3.07	0.04
Post graduate	reference		reference	
Annual Income				
<\$10,000	−7.23	0.02	−3.86	0.21
\$10,000–\$30,000	1.01	0.61	2.28	0.23
\$30,000–\$40,000	0.02	0.99	0.84	0.67
\$40,000–\$60,000	0.16	0.91	−0.25	0.86
\$60,000–\$100,000	0.35	0.81	0.02	0.99
>\$100,000	reference		reference	
<i>Prior Health Problems</i>				
During Pregnancy ^c	−2.45	0.03	−2.59	0.02
<i>Psychosocial Factors</i>				
Symptoms of stress ^d			−0.09	<.0001

NICU: neonatal intensive care unit; Maternal Age is centered at the median (35).

^aHigher scores (Short-Form 12 component score) indicate better HRQoL

^b5 minute Apgar scores range from 0 to 10, scores 7 and above are generally regarded as normal

^cPregnancy-related health problems include: abruption placenta, gestational diabetes, pregnancy-induced hypertension, pre-eclampsia, eclampsia, oligohydramnios, placenta previa, polyhydramnios, bleeding during pregnancy, or other condition of pregnancy/labor

^dHigher scores (Columbia Symptoms of Stress score for the past week) indicate greater symptoms of stress