

# The Impact of Prematurity on Social and Emotional Development

Angela Leon Hernandez, MD

## KEYWORDS

• Social and emotional development • Preterm birth • Screening and treatment

## KEY POINTS

- High incidence of behavioral and emotional problems in children born prematurely have an impact on quality of life.
- Supporting social and emotional development in this high-risk population, with an emphasis on promoting protective factors and minimizing the factors that are known to be deleterious requires a multifaceted approach, and collaborative efforts among academic institutions, the private sector, and governmental programs.
- Lack of correlation between brain lesions and behavioral problems might indicate that premature birth affects social and emotional development through different mechanisms than brain injury, and that children affected by encephalopathy of prematurity may have impaired capabilities to adapt, respond, and overcome negative experiences, making them less resilient to the effects of psychosocial adversity.

## INTRODUCTION

Advances in neonatal intensive care in the past 2 decades have led to an increase in survival rates of premature infants. Reports on long-term follow-up cohorts of children, adolescents, and young adults born prematurely, in particular very low birth weight infants (VLBW infants <1500 g), provide critical information about the prevalence of chronic conditions, functional outcomes, and quality of life in this population.<sup>1,2</sup> Among these chronic conditions, the high prevalence of behavioral and emotional problems, specifically deficits in attention, autism spectrum disorder (ASD), anxiety, and depression, have been a focus of concern due to their impact on family life, social interaction, and school performance.<sup>3–6</sup> In 2013, based on a study population of 96,677 children living in the United States aged 2 to 17 years old, Singh and colleagues<sup>7</sup> found 28.7% prevalence of parent-reported mental health problems among VLBW infants compared with 15% in children born full-term. Multiple studies have supported these findings, even after correcting for socioeconomic factors, severe developmental impairment, and other chronic

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Neonatology Division, Emory University School of Medicine, 49 Jesse Hill Jr drive SE, Atlanta, GA 30030, USA

*E-mail address:* [angela.leon-hernandez@emory.edu](mailto:angela.leon-hernandez@emory.edu)

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conditions.<sup>8–10</sup> Johnson and colleagues<sup>11</sup> conducted an 11-year follow-up cohort study of 219 children born at less than 26 weeks' gestation compared with 153 term controls and found that premature infants were 3 times more likely to have a psychiatric disorder, had a significantly increased risk of attention-deficit/hyperactivity disorder (ADHD) (11.5% vs 2.9%; odds ratio [OR] 10.5; confidence interval [CI] 1.4–81.8); autism (8% vs 0%,  $P = .000$ ), and other emotional disorders (9% vs 2.1%; OR 4.6; CI 1.3–15.9). Along with advances in neuroimaging and neurobiology have led to a better understanding of the extent of brain injury beyond intraventricular hemorrhage and periventricular leukomalacia (PVL) in premature infants. After the initial axonal injury hypomyelination or PVL, caused by the effects of hypoxemia, free radicals, and inflammatory mediators, a secondary insult to the developing brain, mediated by impaired cell-to-cell interactions, results in the arrest of neuronal and axonal proliferation in other areas of the brain and translates to the decreased volumes of cerebral cortex, thalamus, and basal ganglia seen in VLBW infants.<sup>12</sup> This widespread brain involvement or encephalopathy of prematurity has been postulated as an explanation for the high prevalence of sensory, cognitive, and behavioral deficits even in the absence of major motor impairment. However, unlike the patterns associated with motor outcomes and academic deficits, brain abnormalities on MRI are not predictors of behavioral outcomes.<sup>13</sup> Lack of correlation between brain lesions and behavioral problems might indicate that premature birth affects social and emotional development through different mechanisms than brain injury, and also that children affected by encephalopathy of prematurity may have impaired capabilities to adapt, respond, and overcome negative experiences, making them less resilient to the effects of psychosocial adversity.

## EMOTIONAL-SOCIAL DEVELOPMENT AND PREMATURE BIRTH

To elucidate the different mechanisms by which premature birth affects behavior, it is important to start with the description of what it is known about normal early emotional and social development. According to the bio-behavioral synchrony model,<sup>14</sup> coordinated, predictable, and repetitive exchanges between mother-infant and father-infant establishes the framework for future stress reactions, emotional regulation, and socialization. These exchanges, mostly mediated by the epigenetic effects of oxytocin and cortisol on central nervous system (CNS) maturation and function, further enhances the ability of the infant and the parents to sense, process, and respond in a synchronous manner to each other.<sup>15</sup> Oxytocin not only plays a crucial role in reorganizing neuronal networks, but also affects stress, immune, and inflammatory responses.<sup>16</sup> According to this model, the potential for reorganization of neuronal networks, or neuronal plasticity, makes reparation possible during the first years of life.

In the event of premature birth, the need for intensive care support limits the opportunities for synchronous interactions. Following the bio-behavioral synchrony model, it is postulated that mother-infant separation and lack of synchronous interactions or “maternal deprivation” not only impairs an infant’s ability to process information and to modulate responses, but also affects maternal responsiveness to the infant’s cues. To support this theory, multiple studies of infant-maternal dyads, participating in kangaroo care programs in neonatal intensive care units (NICUs) have shown positive effects on infant and maternal responsiveness in addition to decreasing maternal anxiety when compared with the standard of care.<sup>16–18</sup> Long-term protective effects of kangaroo care have been reported, including a lower incidence of problems with inattention, impulsivity, and antisocial behavior.<sup>18</sup> Even though literature tends to focus on the negative effects of premature birth on

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