

PREMATURITY

The State of Research on Extreme Prematurity and Related Vulnerabilities: Comments on McCormick, Saigal and Zelkowitz

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Introduction

For more than 50 years, science has faced the challenging problem of prematurity and its impacts on the health and development of children. The gradual rise in prematurity rates in Canada and the United States (7.1% and 7.6% respectively at the present time) is forcing clinicians, researchers and policy-makers to work together to determine what actions should be given priority in this area. In addition to providing a realistic assessment of the obstacles involved in studying this particular population, the articles by McCormick, Saigal^a and Zelkowitz^b summarize the current state of knowledge and point to possible avenues for research on prematurity. The authors express convergent views and concerns with respect to three main points: (1) the

consequences of the rising survival rate among children whose gestational age and birth weight are at the limit of viability; (2) the factors associated with short-term and long-term developmental problems; and (3) the implementation of effective intervention programs for children and their families. We will review and comment on each of these points in the light of the most recent research.

Research and Conclusions

1. Impact of the rising survival rate of extremely premature children

McCormick raises the issue of the rising survival rate among extremely premature children and the deficiencies that extreme prematurity may cause. This is a concern in both ethical and scientific terms, and as McCormick points out, a sensitive matter inasmuch as affected children may be stigmatized despite the absence of scientific evidence associating extreme prematurity with specific deficits. While there has indeed been a decline in perinatal mortality, this is the result of aggressive, targeted and balanced medical interventions that have led to an increase in the gross rate of survival among premature children. The progress stops there, however, and today we do not know enough to be able to accurately anticipate the developmental trajectory of these children. Statistical probabilities are the only reassurance we can offer worried parents. The main challenge for research at this point is to estimate the precise effects of perinatal complications on brain functions and on the development of the brain, which is subject to a range of premature stimulations for which it is not prepared by its genetic program of maturation. Research in neurology and clinical neuropsychology that would give us a better understanding of the impact of extreme prematurity on the evolution of various neurological functions needs to become a major priority.

We also know that "less extreme" prematurity is associated with cognitive development problems or behavioural problems and that several hypotheses point to the neurological deficits acquired at the end of the extra-uterine gestation period. We would therefore suggest that a comprehensive picture of the impact of prematurity on development cannot be formed by focusing exclusively on these extreme populations; it also requires, following the example of Amiel-Tison et al.,¹ that we study the "macropremies" (1,500-2,500 grams) who make up 5% to 7% of the neonatal population and 20% to 40% of children who present adjustment problems at school age.

2. Factors associated with short-term and long-term developmental problems

In most of the recently published studies, prematurity is associated with short-term and long-term developmental problems. But the very diversity of these problems and their inconsistency from study to study have led researchers to take a cautious approach, avoiding drawing a direct association between prematurity and specific developmental problems. The dominant conceptual framework suggests that the observed deficits are due to biomedical and environmental factors associated with prematurity rather than to prematurity itself. But the findings remain ambiguous because of the low predictive value (less than 10% of the variance is explained by these factors) and because the controlled variables are not consistent from one study to the next. The most recent methodologies seek instead to identify mechanisms whereby the medical and neurological determinants at birth are associated with problems of psychological and social development.² The most widely shared hypothesis is that the consequences of prematurity are indirect and are mediated by the cumulative effects over time of immaturity acquired at birth.^{2,3,4} These deficits would become measurable in the child's maturation after a period of latency, the length of which remains to be defined, and would result in subsequent problems of social and academic adjustment. The mediating mechanisms that have been investigated relate primarily to the child's social development (parent-child relationships) and to cognitive and neurological maturation. Two mechanisms have been proposed to explain these indirect effects: (a) prematurity affects neurological maturation and modifies the development of cognitive processes during childhood, thereby increasing the risk of adjustment problems when the child reaches school age; and (b) prematurity induces early (parent-child) problems that affect the development of cognitive and social functions during childhood, thus increasing the risk of social adjustment problems at school age. It is further posited that these two biomedically or psychologically-based processes are influenced by the environment, which is seen as having an additive effect: the quality of the child's environment combines with prematurity to increase or decrease the risk.^{5,6}

3. Implementation of intervention programs

For Zelkowitz and McCormick, the identification of biomedical and social factors should make it possible to develop early intervention programs designed to improve cognitive capabilities and lower the incidence of behavioural problems. To that end, they propose an experimental rather than an observational approach,⁷ in the sense that they advocate more random clinical trials and monitoring of premature populations in order to assess the long-term effectiveness of medical techniques or psychological interventions on the stability of the children and changes in their development. Along the same lines, recent neuro-developmental interventions that modify the

intensive-care environment have produced positive effects,^{8,9} clearly showing that a properly adjusted extra-uterine environment can indeed be conducive to the normal development of the cortex.¹⁰

Implications for Policies and Services

The central point of the recommendations made by all three authors relates to the disclosure of risks associated with premature birth to parents. Parents (the whole population, in fact) need to be told about the risk of neuromotor morbidity, the most serious cases of which are diagnosed by the age of two. But they must also be told about the risk of morbidity in the long term as far as their child's behaviour, academic performance and functional capabilities are concerned. We also feel that people in the schools, and particularly the professionals who evaluate these children, need to be made aware of the potential problems they face. However, any such disclosure must necessarily be based on scientific evidence; hence, research should be considered a priority as a means of continuing the fight against prematurity and evaluating the associated risks.

A better understanding of prematurity and its short-term and long-term effects will enable parents, clinicians, researchers and policy-makers to arrive at a position on the following question: Are we ready, as a society, to provide long-term services to children who are being born more and more prematurely? Rehabilitation departments are facing ever-longer waiting lists, and extremely premature children have needs that are increasingly difficult to meet. Any policy on extremely premature children should be based on the realization that survival at birth is not the end-point but the beginning of a long journey for these children, and that we have a moral obligation to invest the resources required to help them grow.

References

1. Amiel-Tison C, Allen MC, Lebrun F, Rogowski J. Macropremies: underprivileged newborns. *Mental Retardation and Developmental Disabilities Research Reviews* 2002;8(4):281-292.
2. Taylor HG, Klein N, Minich NM, Hack M. Middle-school-age outcomes in children with very low birthweight. *Child Development* 2000;71(6):1495-1511.
3. Nadeau L, Boivin M, Tessier R, Lefebvre F, Robaey P. Mediators of behavioral problems in 7-year-old children born after 24 to 28 weeks of gestation. *Journal of Developmental and Behavioral Pediatrics* 2001;22(1):1-10.
4. Nadeau L, Tessier R. Relations sociales entre enfants à l'âge scolaire : effet de la prématurité et de la déficience motrice. *Enfance* 2003;55(1/2):48-55.
5. Levy-Shiff R, Einat G, Mogilner MB, Lerman M, Krikler R. Biological and environmental correlates of developmental outcome of prematurely born infants in early adolescence. *Journal of Pediatric Psychology* 1994;19(1):63-78.

6. Liaw F-R, Brooks-Gunn J. Cumulative familial risks and low-birthweight children's cognitive and behavioral development. *Journal of Clinical Child Psychology* 1994;23(4):360-372.
7. Aucott S, Donohue PK, Atkins E, Allen MC. Neurodevelopmental care in the NICU. *Mental Retardation and Developmental Disabilities Research Reviews* 2002;8(4):298-308.
8. Symington A, Pinelli J. Developmental care for promoting development and preventing morbidity in preterm infants (Cochrane Review). *Cochrane Database Systematic Reviews* 2001;4:CD001814. Available at: <http://www.nichd.nih.gov/cochraneneonatal/symington/symington.htm>. Accessed May 3, 2004.
9. Tessier R, Cristo ME, Velez S, Giron M, Charpak N. Kangaroo Mother-Care: A method of protecting high-risk premature infants against developmental delay. *Infant Behavior and Development* 2003;26(3):384-397.
10. Als H, Gilkerson L. The role of relationship-based developmentally supportive newborn intensive care in strengthening outcomes for preterm infants. *Seminars in Perinatology* 1997;21(3):178-189.

Notes:

^a Comments on original paper published by Saroj Saigal in 2004. To have access to this article, contact us at cedje-ceecd@umontreal.ca.

^b Comments on original paper published by Phyllis Zelkowitz in 2004. To have access to this article, contact us at cedje-ceecd@umontreal.ca.