PROF. PETER J ANDERSON (Orcid ID : 0000-0001-7430-868X)

Article type : Editorial (for Editors only)

Commentary

Social and demographic factors modify outcome in children born preterm

Peter J Anderson^{1,2}

Author affiliations

1. Turner Institute for Brain and Mental Health, School of Psychological Sciences, Monash University, VIC, Australia
2. Murdoch Children's Research Institute, Monash University, VIC, Australia

Email: peter.j.anderson@monash.edu

It is well established that preterm birth (prior to 37 weeks' gestation) is associated with poorer learning, educational, motor, behavioural and social outcomes,¹ with children born at earlier gestations at higher risk for severe deficits.² For this reason, the majority of long-term cohort studies have focused on children born very preterm (prior to 32 week's gestation). Numerous neonatal and socio-environmental factors have been reported to be

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the [Version of Record](#). Please cite this article as [doi: 10.1111/PPE.12606](https://doi.org/10.1111/PPE.12606)

This article is protected by copyright. All rights reserved

related to neurodevelopmental outcomes following preterm birth, but despite this knowledge our capacity to predict functional consequences following preterm birth at an individual level is modest at best. Accordingly, research is needed to investigate risk and resilience factors associated with severe impairments such as cerebral palsy and intellectual impairment, as well as more common but less severe impairments such as attention and language difficulties.

The article by Mallison and colleagues³ in this issue of *Pediatric and Perinatal Epidemiology* investigated whether socioeconomic and demographic factors moderated the relationship between gestational age and kindergarten level literacy skills. This population-based data linkage study included all eligible children born in Wisconsin between 2007-2010 (n=153 145), and focused on *maternal* Medicaid coverage, education, age, race/ethnicity, and marital status. As expected, the infant's gestational age at birth, along with the socioeconomic and demographic factors of interest, were associated with kindergarten level literacy. The primary analyses revealed that the relationship between gestational age and early literacy was modified by mother's Medicaid coverage and education level. More specifically, Medicaid coverage and lower education level strengthened the association between gestational age and literacy relationship, while non-Medicaid coverage and higher education attenuated the relationship. These findings have important implications for prognostic counselling, identifying the most at-risk infants for close surveillance and early intervention, and informing remediation strategies.

Studies with sufficient power to investigate weekly gestational age effects are rare given the small numbers of surviving infants born at the lower gestational ages (i.e., 24 to 27 weeks). The large population-based cohort is a major strength of the study by Mallinson and colleagues, and can only be achieved by linking data from different population level databases. While data linkage studies enable the collation of large, highly representative cohorts, they are limited to what information is available for analysis. In this case, the outcome of interest was kindergarten level literacy, which is an important domain for at-risk children and was available for the vast majority of children in the cohort. However, the generalisability of these findings to other developmental outcomes is not known. One may expect kindergarten level literacy to be strongly related to general cognitive functioning,

social-emotional maturity, and future academic functioning, but early literacy is possibly more strongly influenced by environmental exposures than other developmental domains. Further, while the cohort is highly representative of the Wisconsin area, the authors note that this cohort had a lower rate of preterm birth and higher rate of Caucasian and college educated mothers than the overall US population. Thus, caution is needed when generalising these early literacy findings to other developmental outcomes and to other geographic regions.

The child's environment is critical for shaping their development, especially for at-risk children. Mallinson and colleagues utilised broad socioeconomic and demographic variables available from birth records such as Medicaid coverage, maternal education, age, ethnicity and marital status. These factors influence child development indirectly, rather than directly, via more proximal environmental factors such as parenting behaviours, role modelling, communication styles, access to books and cognitively engaging activities, opportunities for support and interventions, and good health and nutrition. These proximal factors are unlikely to be recorded in population level databases so observational studies are needed to truly understand how socio-environmental factors contribute to child development including early literacy. For example, preterm research has demonstrated that the quality of the home environment (physical environment, provision of appropriate play materials, variety in daily activities) is positively associated with cognitive and social-emotional development,⁴ while early positive parenting behaviours are related with better school-aged outcomes and negative parenting behaviours are associated with poorer school-aged outcomes.⁵

Social, demographic and environmental factors are not mutually exclusive, and further research is needed to appreciate the additive and interactive contribution of these factors to developmental outcomes. For example, in a follow-up study of a large cohort of very low birthweight children, multivariable analyses revealed that maternal education, paternal education and caregiver employment status have independent and additive effects on gains in cognitive scores across the preschool period.⁶ Higher maternal education was associated with a 6.0 point gain in cognitive scores in the preschool period, while higher paternal education and caregiver employment were associated with 5.9 and 5.6 point gains

respectively. On average, children with all three of these social advantages had a 10.9-point gain in cognitive scores when contrasted with children without any of these advantages, demonstrating the additive effects of these social factors. Given socio-environmental factors are not independent and have interacting effects, studies exploring risk and resilience factors should perform multivariable modelling to document the additive effects.

Mallinson and colleagues utilised social factors available from birth records. Some of these variables are subject to change over time (e.g. access to Medicaid coverage and education level), which is a challenge facing those conducting data linkage and longitudinal observational studies. It should be remembered that other family members, such as fathers, also influence child development, and their contribution should not be dismissed. Another consideration when interpreting these findings is that the magnitude of the effect social factors has on developmental outcomes are subject to change as the child matures. Indeed, it has been suggested that the influence of socio-environmental factors on developmental outcomes increases with age,⁷ a finding supported by a small number of longitudinal studies.^{8,9}

In summary, it is difficult to predict the long-term outcome for individuals born preterm. Numerous neonatal, biological and socio-environmental risk and resilience factors have been identified, with the findings by Mallinson and colleagues reinforcing the important role of maternal socio-economic status and education level. An appreciation of the interactive nature of distal and proximal socio-environmental factors is necessary, which may vary at different ages and across different outcomes.

References

1. Saigal S, Doyle LW. An overview of mortality and sequelae of preterm birth from infancy to adulthood. *Lancet* 2008; 371: 261-269.
2. Johnson S. Cognitive and behavioural outcomes following very preterm birth. *Seminars in Fetal and Neonatal Medicine* 2007; 12: 363-373.

3. Mallinson DC, Grodsky E, Ehrenthal DB. Gestational age, kindergarten-level literacy, and effect modification by maternal socioeconomic and demographic factors. *Paediatric and Perinatal Epidemiology* 2019;
4. Treyvaud K, Inder TE, Lee KJ, Northam EA, Doyle LW, Anderson PJ. Can the home environment promote resilience for children born very preterm in the context of social and medical risk? *Journal of Experimental Child Psychology* 2012; 112: 326-337.
5. Treyvaud K, Doyle LW, Lee KJ, Ure A, Inder TE, Hunt RW, Anderson PJ. Parenting behavior at 2 years predicts school-age performance at 7 years in very preterm children. *The Journal of Child Psychology and Psychiatry* 2016; 57: 814-821.
6. Manley BJ, Roberts RS, Doyle LW, Schmidt B, Anderson PJ, Barrington KJ, Bohm B, Golan A, van Wassenhaer-Leemhuis AG, Davis PG, for the Caffeine for Apnea of Prematurity (CAP) Trial Investigators. Social variables predict gains in cognitive scores across the preschool years in children with birth weights 500 to 1250 grams. *Journal of Pediatrics* 2015; 166: 870-876.e2.
7. Miceli PJ, Goeke-Morey MC, Whitman TL, Kolberg KS, Miller-Loncar C, White RD. Brief report: birth status, medical complications, and social environment: individual differences in development of preterm, very low birth weight infants. *Journal of Pediatric Psychology* 2000; 25: 353-358.
8. Doyle LW, Cheong JLY, Burnett A, Roberts G, Lee KJ, Anderson PJ, for the Victorian Infant Collaborative Study Group. Biological and social influences on outcomes of extremely-preterm/low-birth weight adolescents. *Pediatrics* 2015; 136: e1513-20.
9. Nguyen TNN, Spencer-Smith M, Pascoe L, Treyvaud K, Lee KJ, Thompson DK, Cheong JLY, Doyle LW, Anderson PJ. Language skills in children born preterm (<30 weeks' gestation) throughout childhood: Associations with biological and socio-environmental factors. *Journal of Developmental and Behavioral Pediatrics* in press.

About the author

Peter Anderson is Professor of Paediatric Neuropsychology at the Turner Institute of Brain and Mental Health at Monash University. He is Director of the Victorian Infant Brain Studies (ViBeS) team, which has an international reputation for studying the impact brain injury and brain development has on cognitive, motor, educational and behavioural outcomes in high-

risk infants. Prof Anderson is a psychologist interested in the cognitive development of children, and for over 15 years has focused on understanding the mechanisms underlying cognitive and learning problems in children born very preterm. He serves as an Associate Editor of *Paediatric and Perinatal Epidemiology*.

Author Manuscript

Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:

Anderson, PJ

Title:

Social and demographic factors modify outcome in children born preterm

Date:

2019-11-01

Citation:

Anderson, P. J. (2019). Social and demographic factors modify outcome in children born preterm. PAEDIATRIC AND PERINATAL EPIDEMIOLOGY, 33 (6), pp.480-481. <https://doi.org/10.1111/ppe.12606>.

Persistent Link:

<http://hdl.handle.net/11343/286563>