



EDITORIAL

Early childhood care, support and research: how early screening and longitudinal studies can help children thrive [☆]



Linda Booij ^{ib a,b,*}, Melissa Nicolosi ^{ib a,b}

^a Concordia University, Department of Psychology, Montreal, Canada

^b Sainte-Justine University Hospital Research Center, Montreal, Canada

Early childhood is a stage of life in which key neurodevelopmental processes occur at the structural, functional and neurochemical levels. For example, within the first two years of life, the basic structural and functional organization of the brain is being established.¹ In parallel, at this time, the serotonin system has largely matured and will serve as a key driver of early developmental brain processes at the functional and structural level, and emotional and cognitive functioning.² The rapid neurodevelopmental changes occurring in the first years of life make the brain highly sensitive to adverse environmental experiences, but also to enrichment.³ Therefore, early childhood is a formative stage of life that requires regular follow-ups, such that health-driven prevention initiatives and interventions can be swiftly implemented when necessary.

Research into the early causes of health and disease has gained momentum with the increased application and further refinement of the Developmental Origins of Health and Disease (DOHaD) model, which contributes to the theoretical framework of longitudinal and transgenerational research worldwide.⁴ Evidence from longitudinal studies supports the notion that innate predispositions (e.g., emotional reactivity) can interact with the environment and lead to vulnerabilities, both psychological⁵ and physical.⁶ Such longitudinal designs allow for the detection of meaningful associations between early childhood indicators (e.g.,

birth weight and temperament) and later life outcomes (e.g., metabolic diseases and psychiatric disorders).⁴ Moreover, studies based on longitudinal designs have provided abundant evidence in support of early childhood screening. Regular follow-ups in early life, together with developmental assessments covering multiple domains, are beneficial to children who are failing to thrive emotionally, socially or cognitively,^{6,7} but also to society as a whole, since early life interventions can yield positive long-term health outcomes and possibly decrease healthcare expenditures.⁶

Yet, detection of developmental delays is a challenge, even in high-income countries. Although standardized screeners are available and have been shown to increase detection rates of developmental delays, many pediatricians in the U.S. still rely on clinical impressions and non-standardized checklists due to issues such as limited appointment time, lack of training and difficulty to obtain insurance reimbursements.⁸ Such challenges are likely greater in Brazil, both due to the scarcity of validated early childhood screeners and their cost,⁹ especially within the Brazilian public health system, which faces challenges related to funding, resources and infrastructure.¹⁰ In addition, the available childhood screening instruments were developed in high-income countries, where the socio-cultural profile of at-risk populations is not necessarily the same as in low- and middle-income countries.¹¹

One way around these challenges is to develop assessment tools locally, which is the case of the Dimensional Inventory of Child Development Assessment (IDADI¹¹); a 435-item, commercially available instrument. The IDADI encompasses cognition, motor function, communication, and language, as well as socioemotional and adaptive

DOI of original article:

<http://dx.doi.org/10.1016/j.jped.2021.01.005>

[☆] See paper by Mendonça et al. on pages 603-609.

* Corresponding author.

E-mail: linda.booij@concordia.ca (L. Booij).

<https://doi.org/10.1016/j.jped.2021.05.001>

0021-7557/© 2021 Published by Elsevier Editora Ltda. on behalf of Sociedade Brasileira de Pediatria. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

behavior. It is completed by caregivers of children aged zero to 72 months (i.e., infants and preschoolers) and has different versions, each suitable for a different age bracket. The inventory also has the advantage of accounting for Brazilian socio-economic and cultural realities because, methodologically, the authors did their due diligence. They carried out the step-by-step work of creating a culturally relevant theoretical framework, had their preliminary version assessed by a panel of Brazilian experts and by a focus group of target questionnaire responders before they conducted their pilot study.¹¹

However, with administration time ranging from 30 to 40 min, the IDADI is a relatively lengthy assessment that likely requires dedicated sessions. Therefore, the inventory cannot be used in the context of a general appointment in healthcare or childhood education settings. To address this issue, members of the same research group developed a brief version of the inventory; the IDADI-B, whose detailed validation process and psychometric properties feature in this issue of *Jornal de Pediatria*.⁹

For the validation of the IDADI-B, authors recruited a sample composed of mothers (N = 1865) with children aged 4 to 72 months who filled out the IDADI questionnaire referent to their child's age group. Participants were recruited from all regions of Brazil via educational and healthcare settings (e.g., universities and health care centers) or the internet. Researchers then conducted detailed analyses of the psychometric properties of the subscales per age bracket to determine which 7 items from each domain would best reflect child developmental status at a given age. The result is a series of 49-question screeners, each version adapted to a specific age bracket (IDADI-B).⁹

In their study, the authors incorporated a modern test theory approach (i.e., Item Response Theory (IRT) modeling) to develop and test the psychometric properties of the IDADI-B. The chosen analytical strategy is of interest given that, in spite of the many advantages of IRT modeling^{9,12}, it has been underused for shortening tests.¹² With IRT modeling, de Mendonça et al.⁹ showed the overall appropriate model fit of the selected items. Each of the subscales of the short version correlated highly with each of the subscales of the long version and Receiver Operating Characteristic curves indicated high sensitivity and specificity. Furthermore, criterion validity was supported by observing relatively strong associations between the scores on each of the domains of the IDADI-B and neurodevelopmental diagnoses.

The IDADI and IDADI-B are based on sound theory and methodology and represent important initiatives in the Brazilian context, given the country's growing efforts to foster early childhood research, care and education.¹³ Yet, considering that children from families with low socioeconomic status (SES) are statistically more at risk for neurodevelopmental disorders (e.g.,¹⁴), it would be ideal to replicate the results of the study within a sample that is more representative of Brazil's educational and economic profile. For instance, in 2019, 80% of Brazilians had an average per capita household income of two minimum wages,¹⁵ whereas only 18% of the study sample accounted for that slice of the population. Further, as the study was based on a convenience sample, with a small number of children with a developmental disorder, it would be important to further test the psychometric properties in specific at-risk groups. In

addition, as pointed out by de Mendonça et al.,⁹ convergent validity can be further tested by comparing test results with measures assessing similar aspects of child development, such as the Ages and Stages Questionnaire and the Denver Developmental Screening Test. Lastly, as the same sample was used for both item selection and the actual testing of psychometric properties, replication of psychometric findings in an independent community sample would be important.¹²

The relevance of early detection of developmental issues cannot be overstated. Early childhood represents a narrow window for intense development that, if missed, can create significant obstacles for a successful trajectory.¹⁶ Brazilian prospective studies have yielded valuable evidence of health issues associated with the early childhood environment. Only to name a few, in Fortaleza (CE), children with severe early childhood diarrhea were more likely to present with deficits in verbal fluency at age 8 as compared to children with mild cases¹⁷; boys from Ribeirão Preto (SP) who were born small for their gestational age, from mothers with low educational level, were more at risk for mental health problems at age 10 in relation to boys who were born small, but in economically favored families and from mothers with high educational level¹⁸; and a study based on the Pelotas longitudinal cohort (RS) revealed that children from low SES families were nearly twice as likely to present with early-onset mental health problems than children born into high SES families (14% and 8%, respectively).¹⁹

As a brief and freely available screener for infants and young children, IDADE-B has the potential to become a versatile tool that could be easily administered by trained professionals in clinical, research or educational settings, where deficits are most likely to be flagged. The IDADE-B also has the advantage of being culturally appropriate for the Brazilian context, which could contribute to increasing the prevalence of early childhood screening in the country. Indeed, it could become valuable for identifying developmental delays during the window of time in which interventions are most useful—as opposed to later in childhood or adolescence, when the efficacy of mitigation strategies is not as great.¹⁶ Data from the Carolina Abecedarian Project (ABC) exemplify well the potential benefits of early support and intervention. The project took place in the 1970s and was a randomized cohort composed of at-risk children who received training for language development, emotional regulation and cognitive skills. Results of a follow-up study with ABC participants in their 30s showed that those in the intervention group were at a significantly reduced risk for cardiovascular and metabolic diseases in comparison to controls, even though the intervention had taken place more than two decades before.⁶

Nevertheless, it is important to keep in mind that screening for failure to achieve developmental milestones is not a goal as much as a means to an end. As developmental delays are flagged, resources which these children and their families can access have to be in place. Moreover, it is essential that these resources are equipped to offer effective interventions; something that can be determined primarily with longitudinal studies, ideally involving local cohorts. Reasons to justify the investment in prospective research in countries such as Brazil are twofold: (1), longitudinal designs create the possibility to understand the mechanisms of

developmental delays and the factors moderating them because researchers obtain within-subject data at a series of time points; (2), only by conducting studies with local cohorts is it possible to obtain data that fits nicely to that population because these data will reflect their realities.

More specifically, in longitudinal early childhood research, participants are often followed from birth, pregnancy or even pre-pregnancy. In recent longitudinal studies, data collection is multidimensional so as to record a broad range of bio-psycho-social variables, which then can be associated with later life outcomes. However, longitudinal cohorts with multidimensional assessments are relatively scarce in low- and middle-income countries¹⁶ and data sourced from high-income countries are unlikely to reflect certain nation-specific challenges. In turn, nationally sourced data will likely result in recommendations that take into consideration challenges that are specific to Brazilians and lead to interventions that account for cultural and socio-economic factors.²⁰

Finally, improving the long-term outcomes of at-risk children is a broad goal that requires initiatives from multiple areas. It is important to keep in mind that the whole support system for young children needs to be strengthened and that there is a serious need for investment in research so that appropriate interventions can be developed and implemented. Yet, the development and validation of a Brazilian-made early childhood screener could be a large step towards this goal. The IDADI-B is a positive initiative because detection and early prevention are some of the best strategies at our disposal today to identify individuals who need additional support to thrive. Therefore, screening instruments such as the IDADE-B have the potential to improve the chances of success of children who are falling behind, and to facilitate their access to the available support services. If further validation and replication studies are successful, the IDADE-B could serve as a significant step towards thriving future generations in Brazil.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgments

Dr. Linda Booij is supported by a career award from the Fonds de Recherche du Québec-Santé.

References

- Gilmore JH, Knickmeyer RC, Gao W. Imaging structural and functional brain development in early childhood. *Nat Rev Neurosci*. 2018;19:123–37.
- Booij L, Tremblay RE, Szyf M, Benkelfat C. Genetic and early environmental influences on the serotonin system: consequences for brain development and risk for psychopathology. *J Psychiatry Neurosci*. 2015;40:5–18.
- Shonkoff JP, Boyce WT, McEwen BS. Neuroscience, molecular biology, and the childhood roots of health disparities: building a new framework for health promotion and disease prevention. *JAMA*. 2009;301:2252–9.
- Suzuki K. The developing world of DOHaD. *J Dev Orig Health Dis*. 2018;9:266–9.
- Tremblay RE. Developmental origins of disruptive behaviour problems: the 'original sin' hypothesis, epigenetics and their consequences for prevention. *J Child Psychol Psychiatry*. 2010;51:341–67.
- Campbell F, Conti G, Heckman JJ, Moon SH, Pinto R, Pungello E. Early childhood investments substantially boost adult health. *Science*. 2014;343:1478–85.
- Leon AM, Holliker S, Pepe J. The importance of the first 5 years: Pediatrician identification of developmental delays and other related concerns. *J Soc Serv Res*. 2015;41:425–44.
- Weitzman C, Wegner L. Section on Developmental and Behavioral Pediatrics; Committee on Psychosocial Aspects of Child and Family Health; Council on Early Childhood; Society for Developmental and Behavioral Pediatrics; American Academy of Pediatrics. Promoting optimal development: screening for behavioral and emotional problems. *Pediatrics*. 2015;135:384–95.
- de Mendonça Filho EJ, Silva MA, Koziol NA, Bandeira DR. Validation of the short version of the dimensional inventory for child development assessment. *J Pediatr (Rio J)*. 2021;97:603–9.
- Massuda A, Hone T, Leles FAG, de Castro MC, Atun R. The Brazilian health system at crossroads: progress, crisis and resilience. *BMJ Glob Health*. 2018;3:e000829.
- da Silva MA, de Mendonça Filho EJ, Ruschel Bandeira D. Development of the Dimensional Inventory of Child Development Assessment. *Psico-USF*. 2019;24:11–26.
- Kruyen PM, Emons WH, Sijtsma K. On the shortcomings of shortened tests: A literature review. *Int J Testing*. 2013;13:223–48.
- Buccini G, Venancio SI, Pérez-Escamilla R. Scaling up of Brazil's Criança Feliz early childhood development program: an implementation science analysis. *Ann N Y Acad Sci*. 2021;1497:57–73.
- Petresco S, Anselmi L, Santos IS, Barros AJ, Fleitlich-Bilyk B, Barros FC. Prevalence and comorbidity of psychiatric disorders among 6-year-old children: 2004 Pelotas Birth Cohort. *Soc Psychiatry Psychiatr Epidemiol*. 2014;49:975–83.
- Instituto Brasileiro de Geografia e Estatística (IBGE). Síntese de Indicadores Sociais: Uma análise das condições de vida da população brasileira. Rio de Janeiro: IBGE, 2019.
- Aly Z, Taj F, Ibrahim S. Missed opportunities in surveillance and screening systems to detect developmental delay: A developing country perspective. *Brain Dev*. 2010;32:90–7.
- Pinkerton R, Oriá RB, Lima AA, Rogawski ET, Oriá MO, Patrick PD. Early childhood diarrhea predicts cognitive delays in later childhood independently of malnutrition. *Am J Trop Med Hyg*. 2016;95:1004–10.
- Saur AM, Loureiro SR. Mental health of small children for normal gestational age: a cohort study from Southeastern Brazil. *Psicol Reflexão Crít*. 2015;28:204–12.
- Santos IS, Barros AJ, Matijasevich A, Zanini R, Chrestani Cesar MA, Camargo-Figuera FA. Cohort profile update: 2004 Pelotas (Brazil) Birth Cohort Study. Body composition, mental health and genetic assessment at the 6 years follow-up. *Int J Epidemiol*. 2014;43:1437.
- Araujo WR, Santos IS, Menezes Filho NA, Souza MT, Cunha AJ, Matijasevich A. Brazilian cohorts with potential for life-course studies: a scoping review. *Rev Saude Publica*. 2020;54:48.