THE PREDICTIVE VALIDITY OF THE AEDI: PREDICTING LATER COGNITIVE AND BEHAVIOURAL OUTCOMES

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Dr Sally Brinkman is a social epidemiologist whose research focuses mainly on the impact of society on child development. Sally is the Co-Director of the Fraser Mustard Centre, an innovative new initiative between the Telethon Kids Institute and the South Australian Department of Education and Child Development aimed at improving research translation.

Sally is well known for spearheading the use of the Early Development Instrument (EDI) in Australia, being the first to pilot the instrument outside Canada. Sally continues to work across the country to help facilitate the use of the Australian EDI (AEDI), working with communities, service providers and governments. Locally, Sally consults with the Department of Children's Services Policy Directorate, primarily on data-linkage; the Children's Centres Operational Group on evaluation; and the SA AEDI Team on community advocacy and research translation.

Internationally, Sally works with governments and donor organisations such as the World Bank, UNICEF, AusAID; and the Bernard Van Leer Foundation on various measures of child development for monitoring and evaluation purposes.

Sally has over 60 publications, including books, chapters, monographs and journal articles, covering topics such as infant mouthing behaviours, child physical activity and nutrition levels, the measurement of alcohol-related violence, the evaluation of teenage pregnancy prevention programs, how child development varies across communities and the impact of socioeconomics and service integration on child development.

Sally brings locally, nationally and internationally recognised epidemiological skills, particularly in relation to population monitoring of child development and education. She has a commitment to practical, pragmatic and translatable research.

Abstract

The Australian Early Development Index (AEDI) is a measure of early childhood development based on an instrument developed in Canada that is now used internationally. In Australia, the AEDI is a Federal Government National Progress Measure, and provides an evidence base for communities, governments and service providers to use for advocacy, policy development and resource allocation. The Australian government administers the AEDI as a triennial census of all children across the country in their first year of full-time schooling. Although the 2009 AEDI provided the first Australia-wide population baseline, which future data collections will now be compared to, the instrument has been used in Australia since 2002. Despite some reliability and validity studies and its adoption as a National Progress Measure, the instrument is only now being validated in terms of its ability to predict later outcomes. This paper presented will investigate the (1) comparative associations, (2) sensitivity and specificity, and (3) discriminatory power of the AEDI to predict indicators of social and emotional wellbeing and educational outcomes (such as the National Assessment Program – Numeracy and Literacy [NAPLAN]) to 15 years of age. The results indicate that the Social Competence, Language and Cognitive Development and Communication Skills and General Knowledge domains of the AEDI are good predictors of both cognitive and behavioural outcomes. Further to that, the AEDI performs as well as or better than established instruments such as the SDQ, PEDS, PedsQL™ and PPVT-III, and shows high specificity with moderate sensitivity. The paper supports a universal population approach, coupled with selectively targeting regions that show high numbers of children who are developmentally vulnerable on one or more of the five AEDI domains.

Background

Predictive validity refers to how well an instrument predicts later outcomes—in this case, how well the AEDI predicts the later literacy, numeracy and other cognitive and behavioural outcomes of children. The aim is to determine if the AEDI has enough predictive validity so that it can be confidently used as a population measure to predict later capabilities. If the AEDI misclassifies too many children in a community or population group as having developmental vulnerabilities, needless worry could be caused for those communities or population groups that are then subsequently targeted with early childhood and parenting support programs on the basis of their results. The instigation of community-level early childhood and parenting support programs should be on the basis of robust population data.

Aims

This research investigates how well the AEDI predicts a child's later literacy, numeracy and other cognitive and behavioural outcomes.

Key findings

The AEDI is a population measure that focuses on all children in the community, in their first year of school.

In focusing on the community rather than individual children we can better support efforts to create optimal early childhood development. All AEDI results are reported at the community, rather than individual child, level. Schools also receive their own school-specific AEDI results matched against their local community.

AEDI data from a study in Western Australia in 2002, which was then linked to later education records, showed that all five of the AEDI domains predicted literacy and numeracy outcomes for children as measured by the National Assessment Program – Literacy and Numeracy (NAPLAN) in Years 3, 5 and 7. The Language and Cognitive Development, and Communication Skills and General Knowledge domains of the AEDI at age 5 were the best predictors of scores on the NAPLAN assessments. The strengths of these relationships were very stable over time despite the continuing development of the children. The strength of the relationship between AEDI scores and both numeracy and reading scores was equivalent at Year 3. However, as the children got older, there was evidence that the AEDI was a better predictor of reading scores than of numeracy scores.

The research also indicated that children who were vulnerable on one or more of the AEDI domains at age 5 were more likely to be in the bottom 20 per cent of all students' scores on the NAPLAN assessments in Years 3, 5 and 7 than children who were not vulnerable
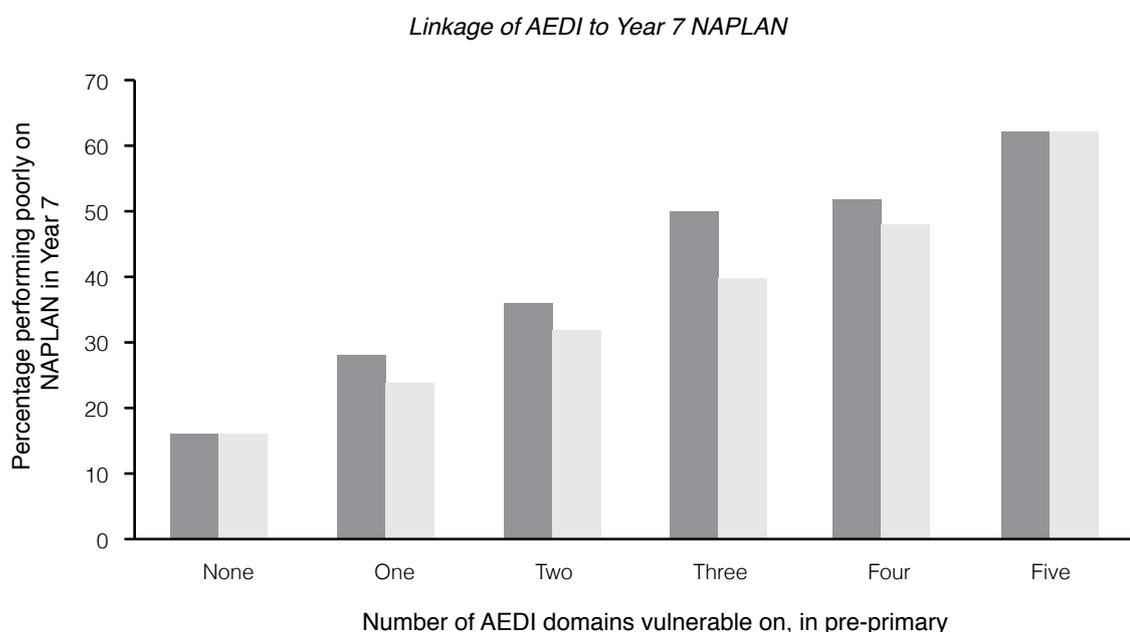
Linkage of AEDI to Year 7 NAPLAN

Figure 1   For every additional domain on the AEDI that a child is vulnerable on, there is an increased level of poor performance on the NAPLAN in Year 7
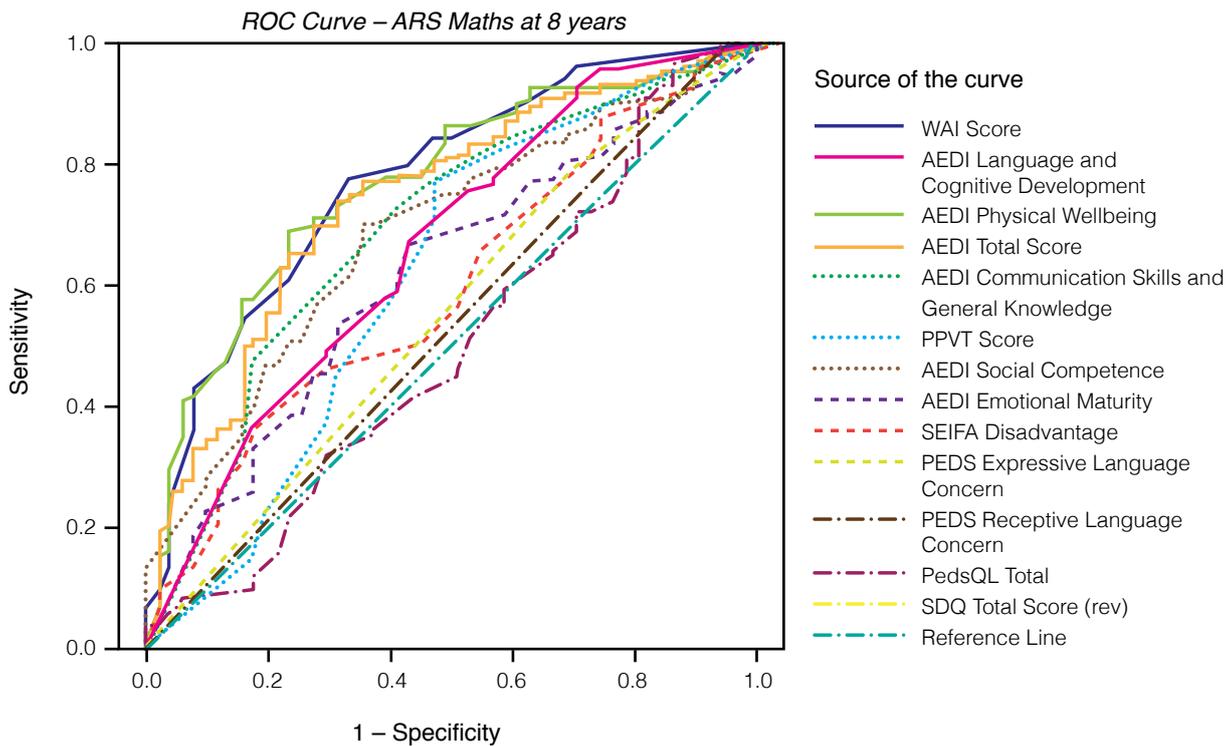
ROC Curve – ARS Maths at 8 years

Source of the curve

- WAI Score
- AEDI Language and Cognitive Development
- AEDI Physical Wellbeing
- AEDI Total Score
- AEDI Communication Skills and General Knowledge
- PPVT Score
- AEDI Social Competence
- AEDI Emotional Maturity
- SEIFA Disadvantage
- PEDS Expressive Language Concern
- PEDS Receptive Language Concern
- PedsQL Total
- SDQ Total Score (rev)
- Reference Line

Figure 2 Overall validity of each instrument collected at 4 years of age predicting poor mathematical outcomes at the age of 8 years
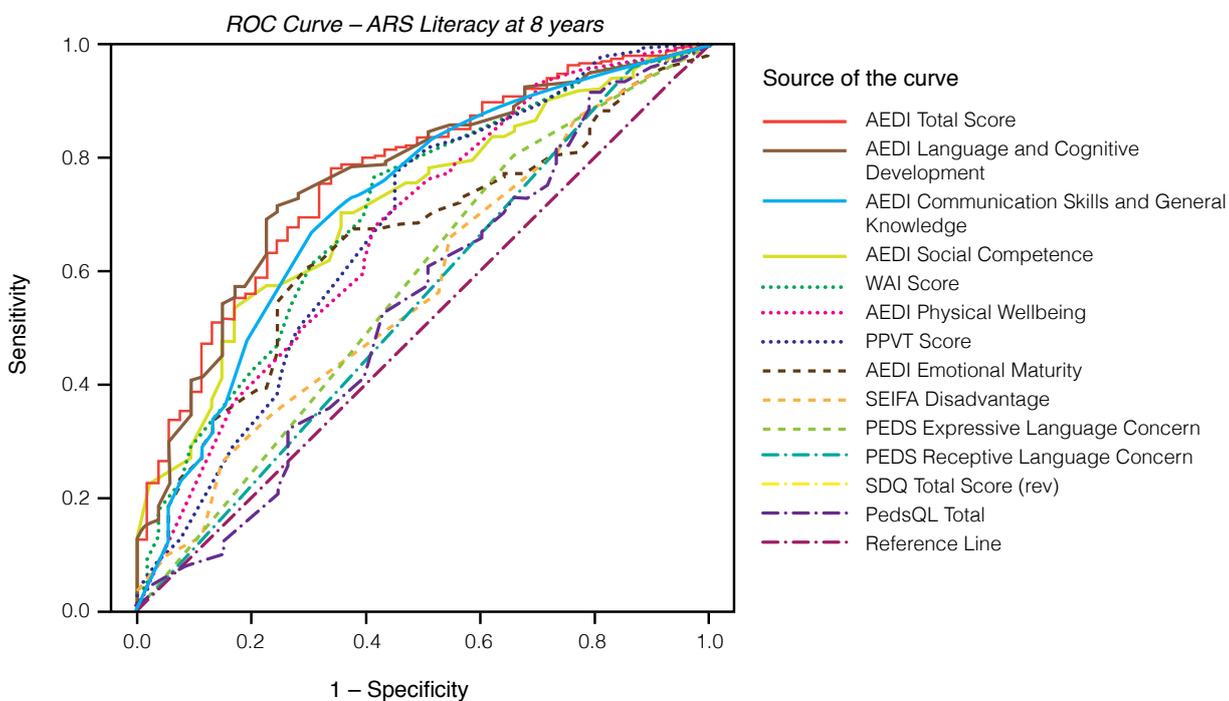
ROC Curve – ARS Literacy at 8 years

Source of the curve

- AEDI Total Score
- AEDI Language and Cognitive Development
- AEDI Communication Skills and General Knowledge
- AEDI Social Competence
- WAI Score
- AEDI Physical Wellbeing
- PPVT Score
- AEDI Emotional Maturity
- SEIFA Disadvantage
- PEDS Expressive Language Concern
- PEDS Receptive Language Concern
- SDQ Total Score (rev)
- PedsQL Total
- Reference Line

Figure 3 Overall validity of each instrument collected at 4 years of age predicting poor literacy at the age of 8 years

ROC Curve – SDQ at 8 years
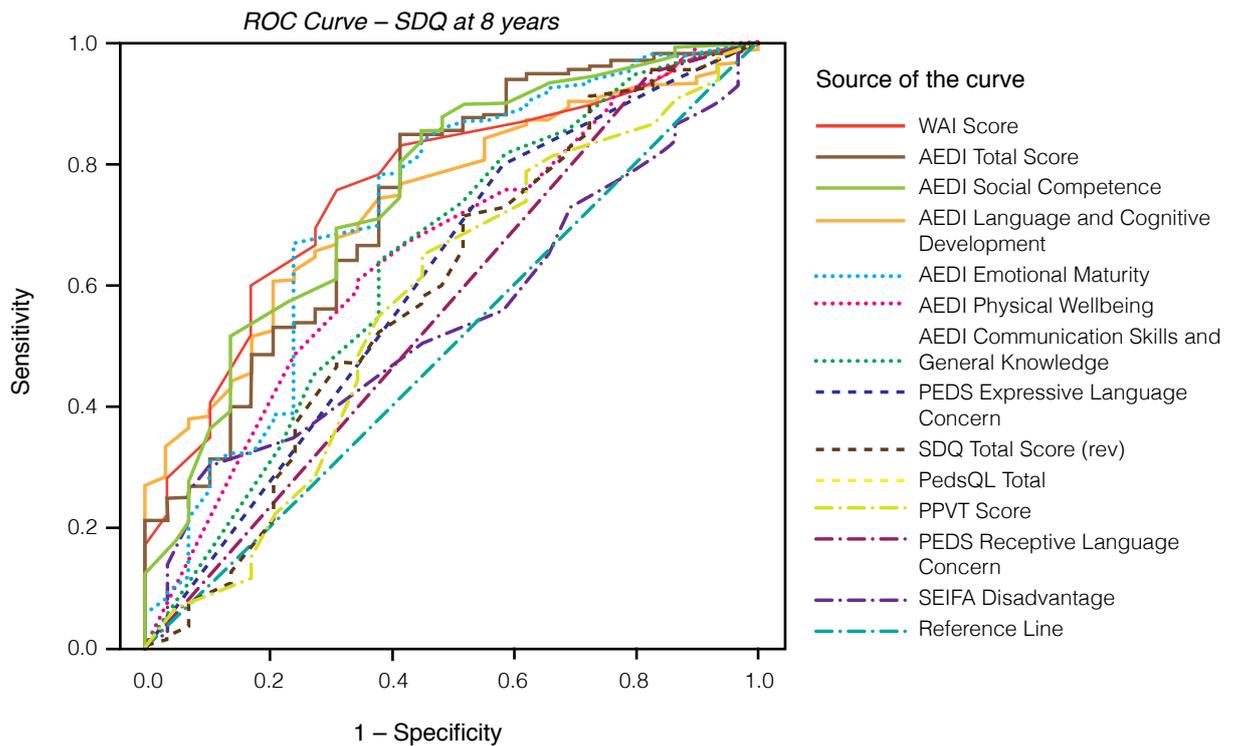
Source of the curve

— WAI Score
— AEDI Total Score
— AEDI Social Competence
— AEDI Language and Cognitive Development
······ AEDI Emotional Maturity
······ AEDI Physical Wellbeing
······ AEDI Communication Skills and General Knowledge
- - - PEDS Expressive Language Concern
- - - SDQ Total Score (rev)
- - - PedsQL Total
-·-· PPVT Score
-·-· PEDS Receptive Language Concern
-·-· SEIFA Disadvantage
-·-· Reference Line

Figure 4   Overall validity of each instrument collected at 4 years of age predicting poor behaviour at the age of 8 years

on any AEDI domains. A child who was developmentally vulnerable on one of the AEDI domains (independent of which developmental domain) was more than twice as likely to have been in the bottom 20 per cent of students for reading skills in Year 7 than a child who was not developmentally vulnerable on any domains of the AEDI. Children who were developmentally vulnerable in four or five AEDI domains were much more likely to have difficulties in reading and numeracy over the next few years than those without vulnerabilities in four or five domains. Regardless of which of the five domains, for each additional domain a child was vulnerable on in pre-primary there was an increased percentage of children with low reading and numeracy scores in Year 7 (Figure 1).

In a second study, where the AEDI was used, we further investigated the predictive validity of the instrument. In 2004, the Longitudinal Study of Australian Children (LSAC) included the AEDI in a nested sub-sample of their 4-year-old cohort. This sample of children were all aged between 4 and 5 years and on average a year younger than the standard age of use of the AEDI in Australia (i.e. the first year of full-time schooling). The five domains of the AEDI measured at age 4 performed relatively well in predicting age 8 mathematical thinking,

language and literacy and behavioural outcomes. The discrimination of each of the domains of the AEDI was measured relative to the other domains and a number of other measures designed to measure a child's development. The ROC curves in Figures 2, 3 and 4 show the relative discrimination of measures at 4 years and how they predict later outcomes at 8 years. The greater the area under the curve, the stronger the predictor. Discrimination in this context refers to the ability of an instrument to correctly differentiate between children who are doing poorly on a certain outcome from those that are doing well. In particular, the Language and Cognitive Development domain and the AEDI Total Score demonstrated moderate discrimination in mathematical thinking outcomes. When predicting the Language and Literacy Scale on the Academic Rating Scale at age 8, the AEDI Social Competence, Communication Skills and General Knowledge, and Language and Cognitive Development domains, as well as the AEDI Total Score at age 4, demonstrated moderate discrimination. The AEDI Social Competence domain, the Language and Cognitive domain and the AEDI Total Score all showed moderate discrimination against the age 8 Strengths and Difficulties Questionnaire (behavioural outcome) total score.

Key points

◗ The National AEDI progress measure (developmentally vulnerable on one or more domains) appears to be the strongest summary indicator.

◗ Analyses show that the AEDI performs as well or better than commonly used instruments when aiming to predict later academic and behavioural outcomes.

◗ All five of the AEDI domains predicted later literacy and numeracy outcomes for children as measured by NAPLAN.

◗ A child's development when they enter school has a strong and persistent relationship to how well they continue through primary school. With the AEDI being conducted across the country as a developmental census once every three years, we can now also look to the AEDI as an evaluation tool to further improve our knowledge around what are good investments to make in the early years.

◗ There are advantages in coupling a universal population approach with the selective targeting of areas showing high numbers of developmentally vulnerable children.

Implications

Overall, the results indicate that a combination of a universal and a targeted platform is likely to be of greater value than simply highly indicated/targeted interventions. Just targeting geographical regions or population groupings identified on the basis of the AEDI will indeed miss many children that could benefit from additional developmental supports.

Government departments of health, education and community development, as well as non-government agencies have traditionally worked independently in their delivery of early childhood care. From this research it is evident that the overall health and development of Australian children has implications for their success at school, and consequently there is a need for greater interagency collaboration to reduce the gap in service delivery between birth and school.

These are the first studies to investigate the relationship between the AEDI and later NAPLAN assessments as well as other cognitive and behavioural outcomes. The inclusion of the AEDI into the national data linkage networks means that there is increased opportunity to investigate the efficacy and efficiency of early child development and education interventions through pragmatic trials.

Methodology

Study 1

The data for the NAPLAN analyses came from the use of the AEDI across 121 primary schools in the North Metropolitan Health Service in Western Australia in 2003, resulting in a sample of 4420 children. These children have since undergone NAPLAN assessments in Years 3, 5 and 7. The children for whom the National 2009 AEDI was completed would have undertaken their first national school assessment (Year 3 NAPLAN) in 2012.

Study 2

In a separate study, the AEDI was embedded in a nested sample of participants in the 4-year-old cohort of the LSAC in 2004. LSAC is a nationally representative sample of two cohorts of Australian children: infants and 4-year-olds. LSAC data collection involves an interviewer spending time in a child's home, obtaining information from a parent or caregiver regarding their child. As part of this visit, the interviewer conducts direct measurement of the child via a number of instruments.

For this nested sample, teachers were also asked to provide some information on the child, including completion of the AEDI. These children were subsequently followed up, allowing us to investigate which instruments collected at age 4 (including the AEDI) best predicted later cognitive and behavioral outcomes at age 8.

For further details

Brinkman, S. A. (2012). Validity of the AEDI – Predictive validity through to cognitive and behavioural outcomes at age 8? (Chapter 3). In *The validation and use of a population measure of early childhood development in Australia: The Australian Early Development Index.* (Doctoral dissertation). University of Western Australia.

Brinkman, S. A., Gregory, T., Harris, J., Hart, B., Blackmore, S., & Janus, M. (2013). Associations between the early development instrument at age 5 and reading and numeracy skills at ages 8, 10 and 12: A prospective linked data study. *Child Indicators Research, 6*(4), 695–708. doi: 10.1007/s12187-013-9189-3.