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Development of a triage tool for neurodevelopmental risk in children aged 30 months



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ABSTRACT

Neurodevelopmental and neuropsychiatric disorders in young children predict educational, health and social problems. Early identification may significantly reduce this burden but relevant tools largely lack validation. We aimed to develop and evaluate the predictive validity of a simple screening tool for neurodevelopmental problems in a community sample of 30 month old children.

A sample of children was selected from a community cohort screened at 30 months by health visitors using the *Sure Start Language Measure (SSLM)* and the *Strengths and Difficulties Questionnaire (SDQ)* in 2011. Predictive validity was assessed by comparing screening results with detailed psychometric data from the same sample 1–2 years later. Screening performance using different thresholds was explored using Receiver Operating Characteristic (ROC) with ROC area under the curve (AUC) and bootstrapping techniques.

The *SSLM* predicted both language disorder identified by the New Reynell Developmental Language Scales (*NRDLS*) at follow-up (AUC 0.905) and global developmental delay assessed by the Griffiths Mental Development Scales (AUC 0.983). The *SDQ* administered at 30 months predicted psychiatric disorders identified by the *Development and Wellbeing Assessment (DAWBA)* at follow-up (AUC 0.821).

Using optimal cut-offs for the *SDQ* and *SSLM* at 30 months, both tools together had sensitivity 87%; specificity 64%; positive predictive value 31%; and negative predictive value 97% in the prediction of any kind of neurodevelopmental problem 1–2 years later.

The combined measure reported here is not yet sufficient as a stand-alone population screening tool for neurodevelopmental disorders. The *SSLM* and *SDQ* did however show promise in identifying preschool children at risk of ongoing language, psychiatric disorders and global developmental delay 1–2 years later but with fairly high false positive

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rates. Given that current developmental risk prediction in resource-poor settings is little better than random assignment, the *SDQ* and *SSLM* may aid clinical judgement when used as interim triage tools for practitioners with no specialist knowledge, in the context of longitudinal follow-up arrangements.

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1. Introduction

Criteria for population screening programmes for non-infectious diseases were first elaborated in 1968 (Wilson & Jungner, 1968) and subsequently adopted by the World Health Organisation (WHO); but screening for neurodevelopmental disorders generally fails to meet these criteria. Many countries nevertheless offer frequent assessments of child development in the preschool years despite a lack of evidence for the effectiveness of such programmes (Nelson, Nygren, Walker, & Panoscha, 2006). Our group proposed in 2009 that life-course-persistent conduct disorder is close to meeting the ten essential criteria for screening programmes; but evidence for superior effectiveness of early treatment (as opposed to treatment following symptomatic presentation) was lacking, and there was limited evidence for the validity of any specific screening tool (Wilson, Minnis, Puckering, & Gillberg, 2009). It is likely that other neurodevelopmental problems such as language delay and attention-deficit/hyperactivity disorder may also be close to meeting the WHO screening criteria. A large body of research already supports the view that language delay and neuropsychiatric disorders identified in the preschool years can be problematic, enduring (Caspi, Moffitt, Newman, & Silva, 1996; Gillberg, 2010) and produce negative outcomes in later life (Arseneault, Moffitt, Caspi, Taylor, & Silva, 2000; Billstedt, Gillberg, & Gillberg, 2005; Caspi et al., 1996; Dodge, Pettit, & Bates, 1997; Odgers et al., 2007). Here we report on our assessment of the predictive validity of “a test that is easy to perform and interpret, acceptable, accurate, reliable, sensitive and specific” (Wilson & Jungner, 1968) in relation to language, neurodevelopmental and neuropsychiatric disorders. We have already provided descriptive data on the use of the screening tools (Sim et al., 2013).

There appears to be an increasingly strong case for identification of language and psychiatric disorders in early childhood given the range of effective interventions for early neurodevelopmental and communication problems (Bornstein, Hahn, & Haynes, 2004; Ellis Weismer, 2000; Law, Rush, Cox, & Wood, 2012; Parsons, Schoon, Rush, & Law, 2011; Tickell, 2011). Socio-emotional and behavioural difficulties identified in the preschool years often persist (Caspi et al., 1996; Gillberg, 2010) and there is a growing body of evidence reporting adverse physical, mental health and forensic outcomes into adulthood (Arseneault et al., 2000; Billstedt et al., 2005; Caspi et al., 1996; Dodge et al., 1997; Odgers et al., 2007). As with neurodevelopmental disorders more generally, language problems identified at this age can persist in some form into later childhood (Conti-Ramsden, Botting, Simkin, & Knox, 2001; Johnson et al., 1999; Rice, Taylor, & Zubrick, 2008), adolescence (Aram, Ekelman, & Nation, 1984; Stothard, Snowling, Bishop, Chipcase, & Kaplan, 1998) and adult life (Beitchman et al., 2008; Clegg, Hollis, Mawhood, & Rutter, 2005; Richards, Power, & Sacker, 2009; Schoon, Parsons, Rush, & Law, 2010). Language development is closely related to broader social development, and there is a high prevalence of language/communication disturbance in children with social and emotional difficulties (Cohen, Davine, Horodezky, & Lipsett, 1993; Cohen, Barwick, Horodezky, Vallance, & Im, 1998; Cohen et al., 1998; Nelson et al., 2013; Ripley & Yuill, 2005; Sim et al., 2013).

One of the criteria underpinning screening is that there are interventions that are available which meet the needs of the children concerned and have been shown to be effective. In examining the issue of early developmental screening, Hall and Elliman concluded that the evidence was not at that time sufficient to warrant its recommendation (Hall & Elliman, 2003). Law and colleagues in a Cochrane Review found acceptable evidence from a number of small scale relatively heterogeneous randomised controlled trials; but the majority of these studies were targeted and it can be difficult to track the children back to the population from which they were derived. Positive results have been obtained in some recent studies (Broomfield & Dodd, 2011; Wake et al., 2013) but a recent review carried out for the Better Communication Research programme found only five interventions with a universal focus with reasonable underpinning evidence (Law, Roulstone, et al., 2012). The case for public health interventions focusing on behaviour in young children has also been reviewed (Adi, Killoran, Janmohaned, & Stewart-Brown, 2007) but these tend to focus on management in the nursery and classroom rather than the community. As far as we are aware, no interventions have attempted to address the needs of children identified using screens for both language and behaviour.

There is little international consensus on the value of neurodevelopmental screening and on its content (Fernell et al., 2014), and the Scottish context in which this work took place was an unusual one. Routine child health surveillance for children older than 16 weeks had been abandoned within the Scottish health service in 2005 because of lack of evidence of effectiveness. Because of evidence that many children with important and, in some cases, potentially remediable disorders such as language delay were reaching school age without receiving support, in 2010 the Scottish Government’s Health Department mandated a new universal child health contact between 24 and 30 months to identify children who might benefit from intervention. Given the very limited resources and expertise available in Scotland for neurodevelopmental screening at the time, simple standardised measures which could be used by nurses without specialist training were chosen for evaluation in the present study. This paper further explores the screening performance of a tool introduced in a paper by the current authors (Sim et al., 2013) for use in the 24–30 month contact.

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