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Pre-school screening for developmental and emotional health: comparison with neurodevelopmental assessment

Nataliia Burakevych¹, Christopher Joel Dorman McKinlay^{1,2}, Jane Marie Alsweiler^{1,2}, Trecia Ann Wouldes³, and Jane Elizabeth Harding¹ for the CHYLD Study Team

¹Liggins Institute, The University of Auckland, Auckland, New Zealand ²Department of Paediatrics: Child and Youth Health, The University of Auckland, Auckland, New Zealand

³Department of Psychological Medicine, The University of Auckland, Auckland, New Zealand

Abstract

Aim—To compare detection of and referral for developmental and emotional problems in a school readiness screening programme (New Zealand Before School Check, B4SC) with that of a comprehensive neurodevelopmental assessment.

Methods—Prospective cohort study of children (n=274) born at risk of neonatal hypoglycaemia and recruited to a follow-up study of neurodevelopmental outcomes at 4.5 years (CHYLD Study). Children identified as of significant concern for developmental and emotional problems, and referrals made, were compared in the B4SC and CHYLD Study. Scores of the parent-completed Strengths and Difficulties Questionnaire (SDQ-P) used in both assessments were compared.

Results—Of 274 children who underwent clinical neurodevelopmental assessment at a mean (SD) age of 53.3 (1.8) months, 237 had the B4SC developmental and emotional health screening. Of these, 44 (19%) children met B4SC referral criteria and 15 (6%) were referred but only 21 (9%) children met CHYLD referral criteria and 10 (4%) were referred. Twelve children (5%) met both the B4SC and CHYLD referral criteria and 2 were referred by both. When assessed twice 39 (17%) children changed SDQ-P category. Children who did not have B4SC screening had higher mean total difficulties score (10.5 vs 8.2, $P=0.009$) and were more likely to have cognitive delay than those who were screened (19% vs 8%, $P=0.04$).

Correspondence to: Prof Jane Harding, Liggins Institute, University of Auckland, Private Bag 92019, Auckland 1010, New Zealand; j.harding@auckland.ac.nz; tel. +64 9 9235872.

Contributors

NB and the CHYLD Study team collected data. NB wrote the initial draft. CJDM, JMA, JEH and TAW reviewed and revised the manuscript. All authors participated in the analysis, interpretation of results and discussion, and approved the final manuscript.

Conflict of interests None.

Ethics approval Approved by the Northern Y Health and Disability Ethics committee (approval number NTY/10/03/021).

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Data sharing statement Additional information is available on request from the corresponding author.

Conclusions—More children met referral criteria for the B4SC screening programme than for a more comprehensive neurodevelopmental assessment. Children who did not have screening had higher incidence of cognitive and behaviour problems than those who did.

Keywords

child behaviour; emotional disturbances; early intervention; referral

Introduction

Developmental and emotional health problems are common in young children, with an incidence of up to 18% in the general population,¹⁻³ and may lead to social and academic difficulties in later childhood and beyond.^{4, 5} Early intervention in children with developmental and emotional problems has been shown to improve outcomes.^{6, 7} However, these problems are difficult to detect during regular health check visits. Low sensitivity and specificity has been reported when identifying these problems based solely on clinical judgement.⁸ As a result, children are often only identified as having a difficulty after they enter school, when they have missed the opportunity for early intervention.⁶ Therefore, many countries have implemented screening for developmental and emotional problems as part of routine child health surveillance to enable early detection and referral to child development services.⁹⁻¹³

While the value of parent evaluation of children's developmental and emotional status remains controversial,¹⁴⁻¹⁶ most screening programs use brief parental questionnaires to identify children with problems. Clinical assessment by a psychologist is usually not included because of cost and time constraints. However, an assessment using cognitive tests and a multidisciplinary clinical approach would be expected to provide a more comprehensive understanding of a child's abilities and problems.¹⁷

The Before School Check (B4SC) is a school readiness screening programme available for all 4-year-olds in New Zealand. It includes screening for developmental and emotional health problems using questionnaires completed by parents and preschool teachers¹⁸, and results are used to initiate referral for additional assessment and intervention where required.

The aims of this study were threefold: first, to compare the frequency of identification of developmental and emotional problems and of referrals made as a result of parent reports obtained for the B4SC with those as a result of a comprehensive neurodevelopmental assessment obtained by trained examiners; second, to determine whether parent-reported behavioural assessments give similar results when administered in different environments and for different purposes (screening vs research); and third, to compare the developmental characteristics of children who did and did not participate in B4SC screening.

Methods

Design

This study was part of a larger prospective cohort study of babies born at risk of neonatal hypoglycaemia, the CHYLD Study.¹⁹ Children were enrolled at birth (2006-2010) to either

the BABIES²⁰ or Sugar Babies²¹ studies at Waikato Women's Hospital, Hamilton, New Zealand. Babies were born with one or more risk factors for neonatal hypoglycaemia: diabetic mother, late preterm (32 to 36 completed weeks' gestation), small (<2500g or <10th centile), large (>4500g or >90th centile) or other risk (feeding difficulties or respiratory distress). From 614 babies recruited to neonatal studies, 604 were eligible for 4.5 year follow-up. A cohort of 274 children born between 2006 and 2010 and assessed at 4.5 years in the CHYLD Study before August 2014 are reported here.

Families were invited to participate in this follow-up study when the child was 4.5 years' corrected age. Children underwent a detailed assessment of neurodevelopment, vision, and general health status. Data were collected by questionnaire on household demographics, including income, education, and number of children. New Zealand deprivation index (NZDEP), based on the place of residence, was used as a measure of socio-economic status, where decile one is the least deprived and ten is most deprived.²²

The study was approved by the Northern Y Health and Disability Ethics Committee (reference number NTY/10/03/021). Parents provided written consent for the assessment and to access the B4SC information.

Neurodevelopmental assessment

Neurodevelopmental assessment for the CHYLD Study was undertaken by trained examiners who were blinded to perinatal history. Each assessment was videoed to standardise assessment administration and scoring. Neurodevelopmental tests included the Wechsler Preschool and Primary Scale of Intelligence 3rd edition (WPPSI-III),¹⁷ Beery-Buktenica Developmental Test of Visual Motor Integration, 6th Edition, Phelps Kindergarten Readiness Scale (Items 6-8), Strengths and Difficulties Questionnaire for 4-10 year olds (SDQ-P), Child Behaviour Checklist for ages 1.5-5 years (CBCL), Social Communication Questionnaire (SCQ) and tests of executive function. Parents completed paper-pencil questionnaires at the time of assessment or took it home for completion and posted it back.

Children who had WPPSI full Scale IQ (FSIQ) composite score or two or more subset scores ≥ 79 , or who did not complete the neurodevelopmental assessment due to behavioural problems, or when an examiner or a parent had significant concerns about the child's development or social-emotional status, were considered 'of concern'. For these children, results of all assessments (WPPSI, Beery, Phelps, SDQ, CBCL, SCQ) and video recording of WPPSI assessment were reviewed by a developmental psychologist who made a clinical judgement whether the child met clinical criteria for referral. Parents were informed about the need of referral and referral was made when they agreed to it. Children were not excluded from the analysis if they had vision, neurological or other deficits identified during the neurodevelopmental assessments.

Preschool screening assessment

All children in New Zealand are encouraged to have a screening assessment of school readiness after their fourth birthday, the Before School Check (B4SC).¹⁸ Development and emotional health are assessed using the Parental Evaluation of Developmental Status (PEDS) questionnaire, and SDQ completed by parents (SDQ-P) and preschool teachers

(SDQ-T). We accessed PEDS and SDQ scores from the B4SC national information system using the National Health Index number assigned to each child at birth.

PEDS assigns children to pathways (A, B, C, D, E) according to parental concerns about cognitive development, language, motor skills, emotional health and self-help.²³ Reported sensitivity is 86% and specificity is 83% to predict any developmental and emotional health problems.²⁴

SDQ is a behavioural screening questionnaire that has 25 questions divided into 5 subscales.²⁵ Four of the subscales, emotional symptoms, conduct problems, hyperactivity, and peer problems, are combined to give a total difficulties score. Children are classified as 'normal', 'borderline' and 'abnormal' based on the total SDQ score. The fifth subscale, the strengths of a child, is not used in the B4SC referral process. SDQ completed by multiple informants was reported to predict disorders with a sensitivity of 63.3% and specificity of 94.6% in a community sample of 5-15 year olds.²⁶ For the subgroup of 5-10 year-old children, SDQ-P predicted problems with sensitivity of 30% and this figure increased to 62% when SDQ-T scores were added. Similar findings were reported for 3-year-olds when SDQ-P abnormal cut-offs predicted problems with a 30% sensitivity and 96% specificity.²⁷ Test-retest reliability within 4-6 months assessments was 0.62.²⁵

The B4SC referral criteria are an abnormal score on SDQ-P (≥ 17) or SDQ-T (≥ 16), or PEDS pathway A (two or more significant predictive concerns) or B (one significant predictive concern) and these children are classified 'of significant concern'. Children who do not meet referral criteria but have borderline SDQ-P (14-16) or SDQ-T (12-15) scores or are in PEDS pathway C (non-significant concerns) or D (difficulties communicating) are classified as 'of some concern'.

Statistical analysis

Analyses were performed using JMP Software, Version 11.2.0 (SAS Institute Inc., Cary, NC, 2013). SDQ-P scores were compared from the B4SC and the CHYLD assessment, and between first and second assessments, using paired t-tests. Agreement between the first and second assessments was compared by change in clinical category (chi-square test), and by kappa agreement coefficient.²⁸ Referral outcomes of the B4SC and CHYLD assessment were compared using chi-square tests and ANOVA. Data are presented as number (percent), mean (standard deviation), median (interquartile range) and mean difference (95% confidence interval).

Results

For 274 children included in the analysis mean (SD) age at assessment was 53.3 (1.8) months. Of these, 237 children underwent B4SC screening at 49.8 (2.8) months. The subgroup of included children was not different from the rest of the study children eligible for the 4.5 year follow-up in ethnicity and neonatal risk factors (data not shown), but lived in less deprived areas (NZ DEP 6 (4; 9) vs 7 (5; 9) for the rest of study children).

Half of the cohort were boys and one third were M ori (Table 1). The majority of households had two children. Over two thirds of mothers had attended a tertiary education institution.

Preschool screening vs clinical neurodevelopmental assessment

At the B4SC 44/237 (19%) children were rated as of significant concern, of whom 15 (34%) were referred (Figure 1). Six children not meeting criteria were also referred (Figure 1). PEDS identified more children of parental concern than SDQ, but more were referred because of SDQ results (Table 2). In the CHYLD Study, 21/237 children (9%) were of significant concern after review of all assessments by psychologist, and 10/21 (48%) of these children were referred (Figure 1). Twelve (5%) children met both the B4SC and CHYLD Study referral criteria, two of whom were referred after both assessments. Five of 29 children who met the B4SC criteria and were not referred met CHYLD referral criteria, and were all referred after that assessment. Similarly, of 11 children that met CHYLD referral criteria and were not referred, 5 met the B4SC referral criteria and 2 of them were referred by the B4SC programme (Figure 1).

Screening outcomes using SDQ-P in different settings

The mean (SD) SDQ-P total difficulties score was 6.5 (4.7) at the B4SC and 8.2 (4.7) in the CHYLD Study, with a mean difference (95% CI) of 1.7 (1.2, 2.3, $P=0.0001$). The median (IQR) interval between the B4SC and CHYLD SDQ-P assessments was 111 (43; 149) days, and 206 (89%) children completed the B4SC before the CHYLD Study assessment. Mean (SD) total difficulties score was 6.7 (4.7) at the first assessment and 8.0 (4.8) at the second assessment, with a mean difference (95% CI) of 1.3 (0.7, 1.9; $P=0.0001$) and fair overall agreement between assessments (kappa 0.26). More children had borderline scores at the second than the first assessment. Almost a fifth of the cohort changed category between assessments, but the interval between assessments did not appear to affect this (Table 3).

Developmental and emotional health of children who did not have the B4SC

Thirty seven children (14%) in the CHYLD Study cohort did not have the B4SC. Demographic and neonatal characteristics of these children were not significantly different from those who did have the B4SC (Table 1). However, children who did not have the B4SC were twice as likely to have concerning cognitive scores, had significantly lower FSIQ and higher mean SDQ-P score than children who did have B4SC screening (Table 4).

Discussion

This study compared detection of and referral for developmental and emotional problems in the New Zealand preschool screening programme with that of a comprehensive neurodevelopmental assessment. More children were identified as of significant concern in the B4SC, based on parent-completed questionnaires, than in the CHYLD neurodevelopmental assessment. However, 14% of our cohort did not have the B4SC and these children had higher incidence of cognitive delay and developmental and emotional problems than children who did have B4SC screening. Furthermore, our findings show that

using SDQ-P as a single assessment screening tool can lead to different outcomes when completed in different settings and for different purposes.

Preschool screening tests vs clinical neurodevelopmental assessment

In the B4SC almost one fifth of children were identified as being of significant concern, thus meeting criteria for referral for additional assessment. In contrast, in the CHYLD neurodevelopmental assessment only 9% of children were considered of significant concern.

Parent completed questionnaires identified around 15-20% of concerning children in other screening programs; referral rates ranged from less than a third²⁹ to over half³⁰ of these children. Similar to our results, not all children identified as concerning by a questionnaire have a cognitive problem when tested using examiner administered cognitive tests.³¹ This is appropriate, as screening programs are designed to identify children with possible health problems who may benefit from further assessment, some of whom will then be found not to have a significant difficulty. Parental questionnaires may also over-identify children with problems, as parents may not understand what normal development is for age.³²

Many children who met criteria for referral were not referred; 29 (66%) in the B4SC and 11 (52%) in CHYLD. These non-referral rates are similar to previously reported for the B4SC in a single region of New Zealand, where 129 of 199 children (65%) who met referral criteria were not actually referred.¹⁰ In the CHYLD Study some children were not referred because their low WPPSI scores were judged to be due to limited English language rather than cognitive delay. Conversely, some children who had low language scores were referred at parental request. The B4SC expects to refer all children in PEDS pathway A and rate of referral for other pathways to be lower. Discussion with parents regarding the need for referral is included in the B4SC screening, and this can help clarify additional concerns that may reflect inappropriate expectations of some parents. We have no information about why some children who met B4SC criteria in our cohort were not referred, but of 199 children who met the B4SC referral criteria in one region of New Zealand in 2010-2011, 57 (29%) were judged by clinicians as not in need of a referral, 36 (18%) were already under care, and parents of another 36 (18%) children declined referral.¹⁰ An internal review of the B4SC also reported in 2014 that there was wide variation in referral processes and inconsistent recording of examiners' decisions about referrals.³³

Our results show that using different tools (clinical assessment vs parent-completed questionnaire) that test different domains result in different referral outcomes for the same group of children.³⁴ This is consistent with other studies that have shown that implementation of screening programmes is challenging, and that children who fail screening have variable referral outcomes.³⁵ This may be due to many factors such as parental view of the need for services and availability of services that could accept the referral. Therefore, clear referral criteria and pathways are essential to ensure that those identified by screening programmes as having problems do indeed receive the additional assessment and interventions intended.

Screening outcomes using SDQ-P in different settings

Overall, the mean total difficulties score in our cohort was similar to those obtained in other studies.³⁶ However, scores were higher at the second assessment, which in most cases was the CHYLD Study assessment. Importantly, the agreement between first and second assessment was only fair, and outcome category differed in 39 (17%) children, independent of the time between assessments.

Such differences in outcome categories might be due to changes in a child's behaviour over time or changes in parental perception. For example, it is possible that parents may be more critical in their evaluation of a child's behaviour or have accepted the presence of a problem when completing the SDQ a second time.³⁷

The change in a category between assessments could also be due to the change in the setting where the SDQ was completed. Almost 90% of first assessments were part of the B4SC which included examination of several other aspects of health such as hearing and vision. CHYLD assessments included an in-depth assessment of neurodevelopment in a home-like setting, which may give the impression to parents that their answers had greater value.

The same screening tools are often used to detect the need for and then measure the effect of interventions. One evaluation of children referred to mental health services showed a decrease of 3.2 SDQ points at 6 month follow-up.³⁸ In a New Zealand evaluation of a 4-6 week mental health camp intervention, SDQ scores decreased by 2.9 points in the high risk population and the number of children categorised as abnormal decreased by 13%, but several children previously categorised as normal changed category to borderline or abnormal.³⁹ Our findings suggest that changes in SDQ scores of this magnitude may occur with repeated administration of the questionnaire even in the absence of interventions when the setting where assessment is done changes. Thus, in children requiring repeated assessment to evaluate the effect of an intervention, use of additional tools such as the SDQ added value score⁴⁰ or follow-up questions on behavioural change since the last visit might be a more appropriate approach than repeated administration of the same SDQ.

Developmental and emotional health of children who did not have preschool screening

Children who did not have developmental and emotional health screening at the B4SC were more likely to have borderline cognitive scores, lower FSIQ and higher SDQ scores than those who were screened. This is of concern, as these children have missed the opportunity to receive support before school entry; the primary purpose of the B4SC programme. Other studies have also reported that children with significant concerns are less likely to attend surveillance programs.⁴¹ However, although low socio-economic status has been associated with high rate of emotional problems² and low utilisation of free health services,⁴² we did not find any difference in socio-economic status between those who did and did not have the B4SC screening.

Study limitations

We did not have information about the reasons for the B4SC referral decisions and could not investigate variation between test scores and referral outcomes in more detail. For example, advice may have been offered on the day of screening instead of referral.

In addition, we did not control for the time interval between SDQ-P administrations, and could not be sure that interventions of which we were not aware between the two assessments may have contributed to the different scores. It is also possible that a different parent or caregiver completed the SDQ on each occasion, although this was likely to have occurred infrequently as the mother accompanied the child for the majority of assessments.

This cohort of children may not be representative of New Zealand general preschool population, since they were all born with risk factors at a single hospital. However, it is a unique cohort of children with diverse neonatal and socio-demographic characteristics and therefore it is particularly important to provide effective screening and interventions in a timely manner to this group of children.

Conclusions

The B4SC pre-school screening assessment identified more children with developmental and emotional health problems than did clinical neurodevelopmental assessment. However, the majority of children meeting referral criteria for either assessment were not actually referred. Repeated administration of the SDQ-P in different settings and for different purposes may not be a reliable approach to evaluate behavioural interventions in pre-school children. Finally, children who miss out on preschool screening have higher rates of cognitive delay and behavioural difficulties. Pre-school screening programmes may be more effective if every effort is made to screen all children, and referral processes are clear and consistently applied. Further investigation of the reasons for failure to attend the B4SC may help improve the effectiveness of this programme.

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What is already known on this topic

- Parent questionnaires are often used to screen young children for developmental and emotional health problems as part of routine child health surveillance.
- Screening is intended to identify children who may benefit from further assessment and intervention where appropriate.
- Clinical neurodevelopmental tests are costly and time consuming, but may detect different problems from those identified by screening questionnaires.

What this study adds

- Screening for developmental and emotional problems using questionnaires results in a different referral pattern compared to clinical neurodevelopmental assessment, and referral criteria were inconsistently applied.
- Repeated screening using the same parental questionnaire in different settings and for different purposes may give different screening outcomes.
- Children who were not screened for developmental and emotional health had a higher incidence of cognitive delay and behavioural problems than children who were screened.

Figure 1.

B4SC and CHYLD Study referrals

B4SC, Before School Check. [†]5 of these children met CHYLD criteria and all were referred by CHYLD; [‡]5 of these children met B4SC referral criteria, 2 were referred by the B4SC.

See text for definitions of referral criteria.

Table 1

Cohort characteristics.

	Cohort [†] N=274	Had B4SC screening	
		Yes N=237	No N=37
Boys	138(50)	118(50)	20(54)
Ethnicity:			
New Zealand European	144(54)	126(55)	18(50)
M ori	86(32)	72(31)	14(39)
Other	36(14)	32(14)	4(11)
Neonatal risk factor [‡] :			
Pre-term	124(45)	109(46)	15(41)
IDM	91(33)	82(35)	9(24)
Small	84(31)	68(29)	16(43)
Large	56(20)	55(23)	1(3)
Other	13(5)	9(4)	4(11)
Gestational age, weeks	37(36; 39)	37(36; 39)	37(36; 39)
Number of siblings:			
0	38(14)	32(14)	6(17)
1	107(41)	95(42)	12(33)
2	76(29)	65(29)	11(31)
3	43(16)	36(16)	7(19)
Mother's education [#] :			
School	75(29)	66(29)	9(26)
Tertiary	187(71)	161(71)	26(74)
Household income:			
\$30,000	36(16)	30(16)	6(21)
\$30,001 – 70,000	80(36)	67(35)	13(46)
\$70,001	104(47)	95(49)	9(32)
New Zealand deprivation index:	6(4; 9)	6(4; 9)	7(3; 10)

Data are number (percent) or median (IQR).

[†] Characteristics of children who did and did not have the B4SC are not significantly different. IDM, infant of a diabetic mother. Data missing for some variables: ethnicity, 8; number of siblings, 10; mother's education, 12; household income, 54; deprivation index, 1.

[‡] Risk factors not mutually exclusive.

[#] Highest level of education attended.

Table 2

The B4SC outcome categories and referrals.

	SDQ-P		SDQ-T	SDQ: P or T [‡]		PEDS		Any test [‡]		
	N=234	N=152	N=146(96)	N=237	Referred N=14	N=234	Referred N=10	N=237	Referred N=21	
No concern	214(91)		146(96)	213(90)	4(29)	173(74)	0(0)	163(69)	3(14)	
Of some concern	7(3)		3(2)	9(4)	2(14)	30(13)	3(30)	30(13)	3(14)	
Of significant concern	13(6)		3(2)	15(6)	8(57)	31(13)	7(70)	44(19)	15(71)	

Data are number (percent).

[‡] Categorised by the worst score category and referral outcome of all tests. SDQ, the Strengths and Difficulties Questionnaire, P, parent version; T, teacher version; PEDS, Parental Evaluation of Developmental Status.

Table 3

SDQ-P category outcomes for first and second assessments and for short and long time intervals between assessments.

Assessment order				
Second assessment	First assessment			
	Abnormal	Borderline	Normal	Total
Abnormal	4(2)	1(0)	7(3)	12(5)
Borderline	5(2)	2(1)	18(8)	25(11)
Normal	4(2)	4(2)	189(81)	197(84)
Total	13(6)	7(3)	214(91)	234(100)
Agreement between assessments	0.26(0.12; 0.39)			
Time between assessments				
	<4 months N=123		4 months N=111	
	First	Second	First	Second
Abnormal	6(5)	8(7)	7(6)	4(4)
Borderline	5(4)	8(7)	2(2)	17(15)
Normal	112(91)	107(87)	102(92)	90(81)
Changed category between assessments	19(15)		20(18)	
Normal at first but abnormal at second assessment†	4(3)		3(3)	
Abnormal at first but normal at second assessment	2(2)		2(2)	
Agreement between assessments	0.24(0.02; 0.45)		0.28(0.10; 0.46)	

Data are number (percent) or kappa coefficient (95% CI). SDQ-P, the Strengths and Difficulties Questionnaire (parent).

Table 4

CHYLD assessment outcomes and referral status for children who did and did not have B4SC screening.

Category	Cohort N=274	B4SC Screening		P
		Yes N=237	No N=37	
Mean (SD) SDQ-P score	8.5(4.9)	8.2(4.7)	10.5(5.6)	0.009
No concern SDQ-P	226(82)	200(84)	26(70)	0.06
Of some concern SDQ-P	30(11)	25(11)	5(14)	
Of significant concern SDQ-P	18(7)	12(5)	6(16)	
Low WPPSI scores [†]	25(9)	18(8)	7(19)	0.04
WPPSI Full Scale IQ	99(15)	100(14)	93(16)	0.004
Referred	11(4)	10(4)	1(3)	0.6

Data are mean (SD) or number (percent). SDQ-P, the Strengths and Difficulties Questionnaire (parent); B4SC, Before School Check.

[†]Full scale IQ (intelligence quotient) or 2 subset scores ⁷⁹. WPPSI Full Scale IQ scores were available for 274 (100%) children, all subtest WPPSI scores were available for 257 (94%) of children.