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Support for the global feasibility of the Ages and Stages Questionnaire as developmental screener

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ABSTRACT

Objective: To investigate the psychometric properties of the Dutch version of the 48 months Ages and Stages Questionnaire (D_ASQ_48).
Design: Prospective cohort study of a community-based sample of children born in 2002 and 2003 whose parents filled out the D_ASQ_48 and a questionnaire on school status at 60 months. The ASQ was translated into Dutch and back-translated into English by three independent translators.
Setting: Well Child Centers covering 25% of the Netherlands.
Participants: Parents of 1510 preterm and 562 term children born in 2002–2003 attending routine Well Child visits at age 45–50 months.
Main outcome measures: Reliability, validity and mean population scores for D_ASQ_48 compared to other countries.
Results: Mean population scores for the D_ASQ_48 were mostly similar to those in the USA, Norway and Korea. Exceptions (effect sizes of difference >0.5) were problem solving (USA) and fine motor (Korea). Reliability was good for the total score (Cronbach alpha 0.79) and acceptable for all domains (0.61–0.74). As expected, infants born at gestational age <32 weeks, children from low income families, of low educated mothers, and boys were more likely to fail on several domains (odds ratios, OR ranging from 1.5 to 4.9). The only unexpected association concerned children from one-parent families. Sensitivity to predict special education at five years of age was 89% and specificity 80%.
Conclusions: The good psychometric properties of the Dutch ASQ_48 and the small differences when compared to other countries support its usefulness in the early detection of developmental problems amongst children worldwide.

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1. Introduction

An estimated 5–10% of all children have a developmental disability [1]. The benefits of early intervention-therapy for young children at risk of developing a disability have been shown in randomized controlled trials [2–6]. Several countries are now setting high standards for the detection and treatment of developmental delay in children before school entrance [7–9]. However, detecting developmental delay with limited resources in the community setting is difficult [10]. Only 30% of children with developmental problems are identified before school age when relying solely on clinical judgment [11].

Developmental screening can help the pediatrician to identify more children with a possible developmental delay or disability. Screening is "a brief assessment procedure designed to identify children who should receive more intensive diagnosis or assessment" [1,7,8]. Child development is a dynamic process, and includes various streams of development namely fine and gross motor, language, cognitive and adaptive behavioral components which are all interrelated and therefore quite complex. Developmental screening has limited ability to predict future functioning but is a valid and reliable way to assess subject skills in a variety of domains. Developmental screening tools undergo extensive testing for validity, reliability and accuracy and are standardized with a population representative sample. Sensitivity and specificity are measured by comparing the test to a gold standard developmental evaluation tool, and should both be between 70 and 80%, because of the nature and the complexity of

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measuring the continuous process of child development [1,7,8]. This always leads to over-referral, and under-referral. But children who are not picked up by a first screen might well be found a next time if screening occurs periodically, and children who are over-referred often still benefit from more close surveillance [12]. Some well known examples of developmental screeners that can be utilized by trained professionals are the Denver II screening test, the Bayley Neuro-developmental screener and the Batelle Developmental Inventory. The major disadvantage of these tests is that they take relatively much time and effort to administer and interpret.

In the past parental reporting of current skills and concerns was considered to be too inaccurate to be used in screening, but in the last twenty years several studies have shown that parent-completed screening tools are highly accurate in detecting true problems [13]. Examples of parent-completed screening tools are the Parents' Evaluation of Developmental Status [14], the Child Development Inventories [15], and the Ages and Stages Questionnaires [16]. The parent based developmental screeners that can be completed by parents in the home setting are being used more and more frequently, due to the fact that they are relatively inexpensive and accurate [1].

Amongst the parent-completed questionnaires for young children, the Ages and Stages Questionnaire (ASQ) is currently the most widely used [18,20]. It consists of 19 different questionnaires covering the age-range of 4 to 60 months. The reading level that is needed to fill in the various ASQ questionnaires is grade 4–6, thus ensuring easy parental comprehension. They take 10–15 min to complete. The questionnaires cover five different domains: communication, gross motor, fine motor, problem solving and personal social skills. Each domain is assessed by six questions on developmental milestones. They are chosen so as to represent a developmental quotient of 75–100%. Parents can answer them with “yes”, “sometimes” or “not yet”, with a respective score of 10, 5 or 0 points. Referral for further assessment is advised when the score on any domain falls below the cut-off point, which is set at 2 standard deviations below the mean of the reference group.

The original ASQ has been proven to be reliable and cost-effective with excellent psychometric properties. Concurrent validity ranges from 76 to 88% [19]. Overall sensitivity and specificity are 75% and 86%, respectively. In a recent multinational trial involving 18 countries in Asia, Africa, Europe, North- and South-America, sensitivity was 88% and specificity was 82.5% [17,20]. Test–retest reliability within two weeks was 94% for the original version. Inter-observer reliability between parents and professional examiners was 94%.

The ASQ is widely used in preventive and curative health care programs in the US and in Canada. It has been translated into Spanish, Korean, Chinese, French, Danish and Norwegian, and several other local translations exist [21–26]. Although the ASQ is translated and used all over the world, few studies have examined its psychometric properties in their own cultural setting after translation [21,24,26,27].

For our study, we have selected the four year questionnaire of the ASQ, because it will help to identify children which have been missed by early developmental screening programs, who might still benefit from more formal neurodevelopmental testing at this young age. We believe that identifying children with possible developmental delays at the start of formal schooling, instead of waiting for serious problems to arise later on, could help to prevent unnecessary hardship for these children and their parents. In our country this age (4 years) coincides with a routine visit to our Well Child Preventive Health Care Clinics. The aim of this study was to determine the psychometric properties of the Dutch 48 months ASQ questionnaire (D_ASQ_48) in a large community-based sample of children, as the first step towards determining the psychometric properties of the entire series of ASQ questionnaires in the Netherlands.

2. Methods

2.1. Population

We drew a stratified sample from a community-based cohort of 45,446 children born in 2002 and 2003 from 12 Preventive Child Healthcare (PCH) organizations. In the Netherlands, 96% of all children attend routine Well Child Clinics offered by the PCH organizations [28]. All children born before a gestation of 36 completed weeks (further mentioned as preterm children) were selected, plus a sample of term-born children. The latter group comprised the first child from the same birth year with a gestational age (GA) between 38^{+0} and 41^{+6} weeks that was filed after each second preterm child.

We enriched the sample with children from five of the ten newborn intensive care units (NICUs) in the Netherlands who were born at a gestational age of <32 weeks in 2003. Children with major congenital malformations, chromosomal abnormalities and syndromes were excluded. The demographic and socioeconomic background, of the children enrolled in the study are shown in Table 1.

2.2. Procedure

The ASQ was translated into Dutch using the Guilléman method with three separate forward and backward translations [29]. The final version was reached through a consensus discussion involving an expert panel. Efforts were made to keep the exact meaning of the original items.

Parents, with their child, were invited to participate in the study. The invitation was sent by mail, 4 weeks before the scheduled PCH visit for the age group of 45–50 months. They received an explanatory letter, the Dutch ASQ_48 and a general questionnaire with regard to their child's health and socio-demographic background. Children who did not keep their appointment were traced, (as far as was possible) by the PCH. Questionnaires were returned to the research center. When their child reached five years of age, the parents who had completed the ASQ, once more received a general questionnaire by mail. They were asked if their child was in mainstream education, had special educational needs within mainstream education, or was attending a school for children with special educational needs.

The data were coded according to standard practices for maintaining confidentiality. The study was approved by the local Institutional Review Board.

2.3. Analyses

We first assessed the background characteristics of the study samples. Next, we compared mean scores for the Dutch ASQ_48 with those from the US, Korean, and Norwegian ASQ 48 months versions [19,21,25]. We limited these analyses to children for which the Dutch ASQ_48 had been filled in within two months of their fourth birthday, in a similar fashion to the Danish and international Magpie trials that employed the ASQ [17,20,22]. Moreover, we weighted our sample to reflect the total Dutch population with regard to gestational age [30,31]. Thirdly, we assessed internal consistency as a measure of reliability for the Dutch ASQ by computing Cronbach alpha coefficients; we compared our findings with those of the US ASQ. Fourthly, we assessed validity by defining cut-off points for deviant scores at 2 SDs below the mean for the reference group, in accordance with the ASQ manual [32]. Because the distributions of the child-ages at which the Dutch ASQ_48 had been completed did not differ between groups, we used all the data when comparing the preterm and control children. We used the following methods to assess validity:

- Content validity and cultural appropriateness were checked by an expert panel.

Table 1
Demographic and socioeconomic background of the sample by gestational age groups: numbers (% of gestational age group).

		<32 weeks	32–36 weeks	38–41 weeks	*P*-value
Number of children	($n=2072$)	541 (26.1)	969 (46.8)	562 (27.1)	
Gestational age in weeks	($n=2072$)				
Mean		29^{+2}	34^{+0}	39^{+2}	$p<0.001$
Range		23^{+6}–31^{+6}	32^{+0}–35^{+6}	38^{+0}–41^{+6}	
Gender	($n=2072$)				$p<0.01$
Boys		276 (51.0)	554 (57.2)	279 (49.6)	
Girls		265 (49.0)	415 (42.8)	283 (50.4)	
Child age at completing ASQ (days)	($n=2014$)				n.s.
Mean		1390	1391	1390	
Range		1278–1811	1090–1789	1090–1811	
Educational level mother	($n=2062$)				n.s.
Maximum lower vocational (<12 years)		150 (27.8)	292 (30.3)	145 (25.9)	
Medium level (13–16 years)		228 (42.3)	416 (43.2)	243 (43.4)	
Applied university (17+ years)		161 (29.9)	255 (26.5)	172 (30.7)	
Household composition	($n=2050$)				$p<0.05$
Two parents		500 (93.8)	896 (93.5)	540 (96.8)	
Single parent		33 (6.2)	62 (6.5)	18 (3.2)	
Ethnicity mother	($n=2039$)				n.s.
Mother born in the Netherlands		504 (94.7)	904 (94.8)	527 (95.3)	
Mother born outside the Netherlands.		28 (5.3)	50 (5.2)	26 (4.7)	
Monthly family income	($N=1622$)				$p<0.001$
<1150 euros		26 (5.9)	63 (8.6)	23 (5.1)	
1151–3050 euros		277 (63.1)	520 (70.8)	316 (70.4)	
>3050 euros		136 (31.0)	151 (20.6)	110 (24.5)	
Mother's age in years	($n=2067$)				n.s.
<20		5 (0.9)	12 (1.2)	3 (0.5)	
20–35		465 (86.1)	827 (85.7)	468 (83.3)	
36–46		70 (13.0)	126 (13.1)	91 (16.2)	
Type of pregnancy	($n=2059$)				$p<0.001$
Singleton		350 (64.7)	688 (71.7)	548 (98.2)	
Twin		184 (34.0)	254 (26.5)	10 (1.8)	
Triplet		7 (1.3)	18 (1.9)	0 (0)	

P-values of chi-square tests for trends; n.s. = not statistically significant.

- Construct validity was analyzed using the following biological and environmental criteria: early prematurity (gestational age <32 weeks), child's gender, mother's educational level, mother's age, household situation and family income.
- Predictive validity was assessed using the child's educational status at 5 years. We used enrolment in special education, or having special educational needs in mainstream education as criteria for developmental disability.

All analyses were done using SPSS for Windows 14.0. All tests were two-sided and considered to be statistically significant if $p<0.05$.

3. Results

3.1. Sample and mean scores

Of the 3175 eligible children 2508 (79%) participated in the whole study, of which the parents of 2072 children completed the Dutch ASQ_48.

Table 2
Comparison of Dutch mean scores with US, Norwegian and Korean scores on the ASQ 48 months form.

	Dutch ($N=605$)		US ($N=336$)		Norwegian ($N=100$)		Korean ($N=224$)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Communication	53.5	8.7	56 ***	9	56 ***	6	52.6	9.7
Fine motor	44.7	13.1	44	14	50 *** #	13	52.5 *** # $	8.3
Gross motor	49.5	10.6	52 ***	10	54 ***	9	51.1*	10.0
Problem solving	52.0	8.9	57 *** # $	8	54 *	9	52.1	8.7
Personal social	53.0	9.2	49 ***	13	56 ***	7	53.9	7.3

*$p<0.05$, **$p<0.01$, ***$p<0.001$ for US, Norwegian and Korean scores compared to Dutch scores. # raw score difference ≥5 points, $ Cohen's delta>0.5 for US, Norwegian and Korean scores compared to Dutch scores.

605 children (438 preterm infants and 167 term infants) completed the Dutch ASQ_48 within the time frame of 46–50 months. The other children were older or younger due to random variations in the dates of the Well Child visits due to logistical reasons.

The mean scores of Dutch children for all domains except for the fine motor domain differed significantly from the US mean scores. Moreover, Dutch mean scores were statistically significantly lower than the Norwegian scores in all domains. The Dutch and Korean children differed significantly with regard to the fine and gross motor domains. Differences were generally small, being only clinically relevant (effect sizes (Cohen's delta) >0.5, or differences in raw scores >5 points, the smallest possible increment in domain scores) in the problem solving domain (US) and the fine motor domain (Norway and Korea). Results are summarized in Table 2.

3.2. Internal consistency

Cronbach alpha for the total Dutch ASQ_48 score was 0.79. For domain scores, it ranged from 0.61 to 0.73. Cronbach alphas for the five domains and the total ASQ score in the Dutch and US samples are shown in Table 3. Item deletion did not improve standardized alpha coefficients.

Table 3
Reliability (Cronbach alphas) for domain scores of the Dutch and US ASQ 48 months forms among term children.

Cronbach alphas	Dutch	US
Fine motor	0.69	0.69
Communication	0.74	0.71
Gross motor	0.64	0.77
Problem solving	0.61	0.67
Personal social	0.61	0.56
Total score	0.79	–

Table 4
Cut-off scores for the domains of the Dutch ASQ 48 months form in a community-based sample.

Domain	Cut-off score
Communication	36.0
Fine motor	18.6
Gross motor	28.4
Problem solving	34.3
Personal social	34.7
Total score	36.6

3.3. Content validity and cultural appropriateness

All items were discussed at length by an expert panel. This consisted of a leading Dutch researcher and professor in preventive child healthcare, a leading researcher and professor in neonatology, three child healthcare doctors and a general pediatrician. No major concerns were raised regarding the cultural or age-appropriateness for Dutch children in any item of the Dutch ASQ_48. All items were then discussed with a group of seven parents of children in the appropriate age group each with varying levels of education. No problems were encountered.

3.4. Construct validity

Dutch cut-off points were constructed according to the ASQ manual [16], results are shown in Table 4. Children born at a gestational age of <32 weeks failed on the total and all domain scores significantly more often than controls, with clinical and statistical significance. Odds ratios (OR) ranged from 2.5 to 4.9. Children in low income families were more likely to have deviant scores on communication (OR 4.7), problem solving (OR 3.4), personal social (OR 3.3), and total score (OR 4.7). Children from one-parent families were less likely to have deviant scores on communication (OR 0.3) problem solving (OR 0.2) and total score (OR 0.3). Children of lower educated mothers were more likely to fail on fine motor (OR 1.7), problem solving (OR 1.9), personal social (OR 2.1) and also total score (OR 1.8). These differences only reached statistical significance for personal social and total scores. Boys scored below the cut-off for all domain scores and total score significantly more often than girls(OR 1.5–4.7). Maternal age at delivery had no significant association with Dutch ASQ_48 scores. Results are summarized in Table 5.

3.5. Predictive validity

The Dutch ASQ_48 correctly identified 25 out of 28 children who were in special education or medical child care centers at the age of 5 years, i.e. an outcome showing severe developmental impairment one year later. Among those not identified, one was in special education because of behavioral problems and one because of medical problems related to having a tracheotomy. Sensitivity in our sample was 89% and specificity 80%. Negative (NPV) and positive predictive values (PPV) were 99.7% and 9.1%, respectively. When having special educational needs in mainstream education was added to the predictive criterion, sensitivity was 76%, specificity 81%, NPV 98.8% and PPV 13.5%.

4. Comment

This study assessed the reliability and validity of the Dutch version of the ASQ_48 months questionnaire. Its results show that the Dutch ASQ_48 months has a good reliability. Mean scores are lower than in some other countries but most of the differences are small. Performance of the Dutch ASQ_48 months questionnaire on a number of aspects of validity generally confirmed validity. There was only one exception which was the unexpected lower percentage of children from one-parent families who failed the Dutch ASQ_48 months with regard to communication, problem solving and total score when compared to children from two parent families.

Despite the fact that 10 out of 15 comparisons of mean scores with other countries yielded statistically significant differences, most cross-country differences between the mean domain scores were remarkably small. Only three cross-country comparisons showed clinically relevant differences, the remainder probably being due to our large sample size and the resultant high power to detect relatively minor, clinically unimportant, differences. Problem solving scores were higher in the US sample. Fine motor scores were higher in the Norwegian and Korean samples. This was the only domain without a statistically significant difference in mean scores when comparing the Dutch and US data. We have no real explanation for these differences. The striking similarity between most mean scores and the failure to find more consistent clinically relevant cross-country differences suggests that the few differences that were found might be explained by chance. However, true differences in child rearing practices between countries could also contribute. The small effect size of most of the differences, and the absence of more clinically relevant differences, support the cross-continental usefulness of the ASQ.

Despite the fact that there are very few cross cultural differences, there is still the need for careful adaptation and validation of developmental screeners for different cultural settings and languages [32].

The effect of prematurity, maternal education, and family income were consistent with previous studies [33], reflecting the validity of the Dutch ASQ_48. The reduced risk of having a score below the cut-off score on communication, problem solving and total score for children from one-parent families might be explained by the fact that they possibly receive more attention at a young age in the household situation. The absence of an association with teenage pregnancies was probably due to small numbers, reflecting the low rate of teenage pregnancy in the Netherlands [34].

Girls in this study scored higher on all domains, which reached statistical significance for fine motor functioning, personal social, problem solving and total domain score. These differences are consistent with the Norwegian findings [24,25]. The “gold standard” neurodevelopmental tests have identical cut-off points for boys and girls in this age group [35,36]. It could be debated whether separate cut-off points are required for girls and boys, as is the case with behavioral measures like the Child Behavior Checklist [37].

4.1. Strengths and limitations

A major strength of our study is that the normative data are based on a large, random sample from the community, using PCHs with extremely high (>95%) attendance rates as sampling framework. The

Table 5
Regression analysis for deviant scores on domains of the Dutch ASQ 48 months form (odds ratios and 95% confidence intervals).

Criterion	Communication	Fine motor	Gross motor	Problem solving	Personal social	Total
Gestation <32 weeks (versus 38–41 weeks)	4.05 (2.33–7.07)***	4.25 (2.19–8.26)***	4.89 (2.72–8.80)***	2.48 (1.33–4.62)**	4.38 (2.21–8.67)***	4.59 (2.51–8.42)***
Male (versus female gender)	1.49 (1.15–3.47)*	4.69 (2.82–7.81)***	2.23 (1.48–3.35)***	2.32 (1.44–3.72)***	2.36 (1.47–3.78)***	3.30 (2.11–5.15)***
Low income (versus high income)	4.65 (2.09–10.3)***	n.s.	n.s.	3.32 (1.30–8.45)*	n.s.	4.74 (2.08–10.8)***
One-parent family (versus two parent family)	0.23 (0.23–0.64)**	n.s.	n.s.	0.17 (0.04–0.75)*	n.s.	0.29 (0.11–0.78)*
Low educ. mother (versus high education mother)	n.s.	1.72 (0.99–2.98)	n.s.	1.85 (0.97–3.53)	2.09 (1.09–4.00)*	1.82 (1.02–3.27)*

*$p<0.05$, **$p<0.01$, ***$p<0.001$, n.s. = not statistically significant.

response rate of 65% is high compared to other validation studies of the ASQ 48 months. This response percentage includes the randomly chosen control children. Due to our large sample we could also perform a separate analysis on a sample with close age-boundaries regarding the age of completing the ASQ.

A limitation is that we could not compare the Dutch ASQ with a gold standard in developmental testing at 48 months, and had to rely regarding predictive validity of Dutch ASQ_48 scores on problems at school entry. Sensitivity and specificity of the predictions were acceptable. The Dutch ASQ_48 indeed identified almost all children with problems of a severity that already had led to (school) problems at this age, shown by the very high NPV. The test characteristics as found might even have been better if we had taken a time point at 7 or 8 years, when developmental delay has become even more pronounced.

5. Conclusions

Our results show that the ASQ 48 months questionnaire is a short parental developmental screener with excellent psychometric properties, which can be used in community settings outside the USA, to identify children who might benefit from more extensive developmental testing. The reliability and validity of the Dutch ASQ 48 months questionnaire, and the striking similarities with the data from the Norwegian and Korean validation studies are the first step in confirming the feasibility of the Ages and Stages Questionnaire for industrialized countries in general. Cross cultural studies on the entire series of questionnaires of the ASQ are needed to confirm these findings.

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References

[1] Rydz D, Shevell MI, Majnemer A, Oskoui M. Developmental screening. J Child Neurol 2005;20:4–21.
[2] Spittle AJ, Orton J, Doyle LW, Boyd R. Early developmental intervention programs post hospital discharge to prevent motor and cognitive impairments in preterm infants. Cochrane Database Syst Rev 2007:CD005495.
[3] Buschmann A, Jooss B, Rupp A, Dockter S, Blaschtikowitz H, Heggen I, et al. Children with developmental language delay at 24 months of age: results of a diagnostic work-up. Dev Med Child Neurol 2008;50:223–9.
[4] Nelson HD, Nygren P, Walker M, Panoscha R. Screening for speech and language delay in preschool children: systematic evidence review for the US Preventive Services Task Force. Pediatrics 2006;117:e298–319.
[5] McCormick MC, Brooks-Gunn J, Buka SL, Goldman J, Yu J, Salganik M, et al. Early intervention in low birth weight premature infants: results at 18 years of age for the Infant Health and Development Program. Pediatrics 2006;117:771–80.
[6] Law J, Garrett Z, Nye C. Speech and language therapy interventions for children with primary speech and language delay or disorder. Cochrane Database Syst Rev 2003:CD004110.
[7] Council on Children With Disabilities. Identifying infants and young children with developmental disorders in the medical home: an algorithm for developmental surveillance and screening. Pediatrics 2006;118:405–20.
[8] Council on Children With Disabilities. Developmental surveillance and screening of infants and young children. Pediatrics 2001;108:192–6.
[9] High PC. School readiness. Pediatrics 2008;121(4):e1008–15.
[10] Hix-Small H, Marks K, Squires J, Nickel R. Impact of implementing developmental screening at 12 and 24 months in a pediatric practice. Pediatrics 2007;120:381–9.
[11] Glascoe FP. Screening for developmental and behavioral problems. Ment Retard Dev Disabil Res Rev 2005;11:173–9.
[12] Glascoe F. Are overreferrals on developmental screening tests really a problem? Arch Pediatr Adolesc Med 2001;155:54–9.
[13] Glascoe F. The value of parents' concerns to detect and address developmental and behavioural problems. J Paediatr Child Health 1999;35:1–8.
[14] Schonwald A. Routine developmental screening implemented in urban primary care settings: more evidence of feasibility and effectiveness. Pediatrics 2009;123:660–8.
[15] Ireton H. Child Development Inventories Manual. Minneapolis MN Behavior Science Systems; 1992.
[16] Squires J, Bricker D, Potter L. Ages and Stages Questionnaires User's Guide. 2nd edition. Baltimore: Paul Brookes Publishing; 1999.
[17] Yu LM, Hey E, Doyle LW, Farrell B, Spark P, Altman DG, et al. Evaluation of the Ages and Stages Questionnaires in identifying children with neurosensory disability in the Magpie Trial follow-up study. Acta Paediatr 2007;96:1803–8.
[18] Lindsay NM. Use of the Ages and Stages Questionnaire to predict outcome after hypoxic–ischaemic encephalopathy in the neonate. J Paed Child Health 2008;44:590–5.
[19] Squires J, Bricker D, Potter L. Revision of a parent-completed development screening tool: Ages and Stages Questionnaires. J Pediatr Psychol 1997;22:313–28.
[20] Magpie Trial Follow-Up Study Collaborative Group. The Magpie Trial: a randomised trial comparing magnesium sulphate with placebo for pre-eclampsia. Outcome for children at 18 months. BJOG 2007;114:289–99.
[21] Heo KH, Squires J, Yovanoff P. Cross-cultural adaptation of a pre-school screening instrument: comparison of Korean and US populations. J Intellect Disabil Res 2008;52:195–206.
[22] Klamer A, Lando A, Pinborg A, Greisen G. Ages and Stages Questionnaire used to measure cognitive deficit in children born extremely preterm. Acta Paediatr 2005;94:1327–9.
[23] Plomgaard AM, Hansen BM, Greisen G. Measuring developmental deficit in children born at gestational age less than 26 weeks using a parent-completed developmental questionnaire. Acta Paediatr 2006;95:1488–94.
[24] Richter J, Janson H. A validation study of the Norwegian version of the Ages and Stages Questionnaires. Acta Paediatr 2007;96:748–52.
[25] Janson H, Squires J. Parent-completed developmental screening in a Norwegian population sample: a comparison with US normative data. Acta Paediatr 2004;93:1525–9.
[26] Tsai HLA, McClelland MM, Pratt C, Squires J. Adaptation of the 36-month Ages and Stages Questionnaire in Taiwan: results from a preliminary study. J Early Interv 2006;28:213–25.
[27] Elbers J, Macnab A, McLeod E, Gagnon F. The Ages and Stages Questionnaires: feasibility of use as a screening tool for children in Canada. Can J Rural Med 2008;13:9–14.
[28] Crone MR, Vogels AG, Hoekstra F, Treffers PD, Reijneveld SA. A comparison of four scoring methods based on the parent-rated Strengths and Difficulties Questionnaire as used in the Dutch preventive child health care system. BMC Public Health 2008;8:106.
[29] Reijneveld SA, Vogels AG, Hoekstra F, Crone MR. Use of the Pediatric Symptom Checklist for the detection of psychosocial problems in preventive child healthcare. BMC Public Health 2006;6:197.
[30] The Netherlands Perinatal Registry. Perinatal Care in the Netherlands 2002. Utrecht: The Netherlands Perinatal Registry; 2005.
[31] The Netherlands Perinatal Registry. Perinatal Care in the Netherlands 2003. Utrecht: The Netherlands Perinatal Registry; 2007.
[32] Hambleton RK, Kanjee A. Increasing the validity of cross-cultural assessments: use of improved methods for test adaptations. Eur J Psychol Assess 1995;11:147–57.
[33] Anderson PJ, Doyle LW. Cognitive and educational deficits in children born extremely preterm. Semin Perinatol 2008;32:51–8.
[34] Treffers PE. Teenage pregnancy, a worldwide problem. Ned Tijdschr Geneeskd 2003;147(22):2320–5.
[35] Livesey D, Coleman R, Piek J. Performance on the Movement Assessment Battery for Children by Australian 3- to 5-year-old children. Child Care Health Dev 2007:713–9.
[36] Hintz SR, Kendrick DE, Vohr BR, Kenneth PW, Higgins RD. For The Nichd Neonatal Research Network. Gender differences in neurodevelopmental outcomes among extremely preterm, extremely-low-birthweight infants. Acta Paediatr 2006;95:1239–48.
[37] Nair P, Black MM, Ackerman JP, Schuler ME, Keane VA. Children's cognitive–behavioral functioning at age 6 and 7: prenatal drug exposure and caregiving environment. Ambul Pediatr 2008;8:154–62.