Original Article

Validity and Reliability Determination of Parents Evaluation of Developmental Status (PEDS) in 4-60 Months old Children in Tehran

Roshanak Vameghi; Firoozeh Sajedi; Soheila Shahshahani^{*}; Akbar Biglarian Pediatric Neurorehabilitation Research Center University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

Objectives: There are various developmental screening tools that are different in terms of psychometric characteristics and choosing the best one is challenging for the pediatrician. This research was designed to identify the validity and reliability of Parents Evaluation of Developmental Status, a developmental screening questionnaire, in 4-60 months-old children in the city of Tehran.

Methods: In order to validate the Parents Evaluation of Developmental Status, a precise translation of the questionnaire was performed by the research team. A Persian version was back-translated by three English language experts who were unfamiliar with the Parents Evaluation of Developmental Status. The back-translated version was compared with the original version. The content validity of the finalized Persian version was verified by three pediatricians. The questionnaire was performed on 648 children ranging from 4 to 60 months old in healthcare clinics. A test-retest method with 2-3 weeks interval and Cronbach's α were used in order to determine the reliability of the questionnaire.

Results: All of the questions in Parents Evaluation of Developmental Status had desirable content validity and there was no need to change them. The total Cronbach's α coefficient was 0.63, which, when considering the low number of items in Parents Evaluation of Developmental Status, is acceptable. The test-retest correlation coefficient was determined to be 0.87, which is desirable. The estimated Kappa measure agreement between Parents Evaluation of Developmental Status and Ages and Stages Questionnaires was 0.30. Due to the rather large sample size and similarity of the screening results by both questionnaires in 71.5% of cases, it is possible to conclude that this measure is an acceptable one.

Discussion: This research showed that Parents Evaluation of Developmental Status has a good content validity and reliability and can be used for developmental screening of children in Tehran city. Because the test is brief, using it can lead to saving time and resources.

Keywords: development, developmental delay, screening, PEDS, ASQ

Submitted: 12 March 2015 Accepted: 27 May 2015

Introduction

One of the most important aspects of health for children is normal development. In recent years there is increasing interest and attention on child development. Although health policymakers have tried to increase the rate of early detection and referral for early intervention services, developmental delays are still a challenging issue in pediatric medicine. According to reports, about 10-16% of children in various countries have developmental disabilities (1-4). This high prevalence indicates the importance of early detection and referral for intervention services. Although the importance of early detection and intervention for developmental disorders is wellknown, there are different barriers to its fulfillment. Limitation of time, resources and also professional expertise and knowledge about screening are some of these barriers. There are various developmental screening tools that are different in psychometric characteristics and choosing the best one is challenging for the pediatrician. One of the most important challenges is the cultural differences between various populations. It is clear that any judgment about child development must be done while considering the cultural impacts (5,6).

The developmental screening tools that can be used for this purpose are of two types, including objective ones that are performed by health care providers and subjective ones (questionnaires) that can sometimes be completed directly by parents or caregivers. In



^{*} All correspondences to: Soheila Shahshahani, email: < sol_shah@yahoo.com >

Iranian Rehabilitation Journal

recent years there is an increasing tendency to use parent-report developmental screening questionnaires. Many researches have shown that when the questionnaires are correctly presented to parents, despite the socio- economic status, geographic region, educational level and child rearing experiences, nearly all parents can present correct information about their child's development. If we provide the questionnaires in a correct manner to them, their concerns about their child's development is very reliable and is able to increase the detection rate of childhood developmental disorders (7-13). It is clear that objective tests are time-consuming and need more time and expertise. On the other hand, many researches have shown that clinical judgment alone isn't enough for detecting developmental delays (12,14,15). Thus, using parental questionnaires is an easy and practical way for screening. In this study, we used Ages and Stages Questionnaires (ASQ) and Parents Evaluation of Developmental Status (PEDS), two commonly used developmental questionnaires. Human development is affected by dynamic between biologic factors interactions and experiences, risk factors and protective ones. About

10-16% of children are at risk of developmental disorders. By early detection and referring for early intervention services (EIS), especially in the first 3 years of life, there is increasing chance that these children can reach their maximal developmental potentials. Identifying developmental disorders before 3 years of age has a great impact on childhood health and well-being (16,17). The adaptability of the growing brain in the first 3 years of life leads to a high effectiveness of intervention services. Studies have shown that low income children who received EIS between birth and 5 years of age had better reading and mathematical skills at age 15, in comparison to those who received these services between 5 to 8 years of life (18). Empowering the children before school entry, especially in low income regions, can result in a reduction of the rate of early academic failure, behavioral problems in school including drop-out in high school, delinquency, joblessness and mental health problems (18). Delayed diagnosis of those problems that can be treated or at least managed effectively in the early years of life leads to the increase of costs of using special education as well as special medical services (4). Thus American Academy of Pediatrics (AAP) emphasizes frequent and timely scheduled developmental screening in order to diagnose at-risk children. The best setting

for performing developmental screening is the pediatrician's office, because this is the only place where professionals have formal, longitudinal and routine contact with young children in their early years of life (19,20).

Because PEDS is a brief, simple and easy-to-use developmental screening tool, we decided to evaluate its validity and reliability in the city of Tehran in order to provide a simple tool for childhood developmental screening in this large capital city.

Methods

This research is an action research that was performed from August 2013 to April 2014 in 4 child healthcare centers located in the north, south, east and west regions of Tehran. PEDS is one paper questionnaire containing 10 simple questions that elicit parental concerns about different developmental or behavioral domains. The questions don't ask about a specific developmental skill. There are two open end questions that provide opportunities to identify more general concerns of parents (21). Based on the test instructions, the value of each question is different for various age groups. It means that based on the child's age, some questions are considered "predictive" and are more likely to be indicative of a developmental issue (22). After completing the form, the provider scores it and categorizes children in 5 possible paths: Path A: when 2 or more significant concerns are present and the child should be referred. Path B: when there is only one significant concern and the provider may administer a second screen or refer for further screening. Path C: parents have $1 \ge \text{non-significant concerns}$. Path D: when parents have difficulty communicating and providers have to consider alterative detection methods. Path E: when there are no concerns (23). In this study, the examiners only provided the PEDS form to parents and scoring was performed by the research team. We categorized children in 3 main groups compatible with path A (fail), path B (suspect) and a group including those compatible with paths C, D or E (normal). First, a precise translation of the questionnaire was done by the research team and then the Persian version was back-translated by three English language experts, who were unfamiliar with the PEDS. The backtranslated version was compared with the original version. Next, the content validity of the finalized Persian version was verified by three pediatricians familiar with child development and also by

63

reviewing relevant books and journals. Then, the parents of 648 children 4-60 months old completed the questionnaires in four healthcare clinics located in the north, south, east and west regions of Tehran city. The inclusion criteria were: 1- age between 4 to 60 months, 2- Iranian nationality, 3- living in Tehran city and 4- parental consent and cooperation. Exclusion criteria were: 1- having obvious developmental delay or disability, 2- parental refusal to cooperate.

Since no developmental gold standard diagnostic tests were accessible at the time of the study, these children were also evaluated by ASQ simultaneously and the Kappa agreement coefficient between PEDS and ASQ was estimated. Available sampling was used until the desired sample number was achieved. Test-retest methods (by 2-3 weeks interval) and Cronbach's α were used in order to determine the reliability of the test. This research was approved by the ethical committee of the University of Social Welfare and Rehabilitation Sciences. Parents

completed a written consent form for participation. The parents whose children were detected to have developmental problems were informed and guided.

Results

The mean age of the children studied was 26.0 ± 16.11 , and 54% (350) of them were boys. In 95% of cases the person who completed the questionnaire was one of the parents. 3% of children were born preterm for whom the corrected age was calculated and used, if under 24 months old. Educational levels of 51.7% and 34.3% were seen in mothers at college and high school level, respectively. All of the questions in PEDS had desirable content validity and there was no need to change them. The total Cronbach's α coefficient was 0.63. As table (1), the correlation coefficient of the test and retest of the questionnaire was 0.87 (P<0.001) and the interclass correlation coefficient interval was 80-91 % (P<0.001).

Table 1. ICC for test – retest examination by PEDS

Cronbach's a	ICC interval	ICC amount
0.87	0.80-0.91	0.886

The estimated Kappa measure agreement between PEDS and ASQ was 0.30 (P<0.001) and the Pearson's chi squared test was determined to be 115.98 (P<0.001). Developmental disorders were observed in 23.1% of children (4.6% delayed and

18.5% questionable) who were examined by PEDS, and in 26.4% of children who were examined by ASQ (14.7% delayed and 11.7% questionable) (table 2).

	Table 2.	Comparing	the results	of ASQ and	PEDS
--	----------	-----------	-------------	------------	------

		PEDS results: No. (%)		
ASQ results No. (%)	Normal	Delayed	questionable	total
Normal	415(64)	9(1.4)	53(8.2)	477(74.6)
Delayed	54(8.3)	11 (1.7)	30(4.6)	95(14.7)
questionable	29(4.7)	10 (1.5)	37(5.7)	76(11.7)
total	498(76.9)	30(4.6)	120(18.5)	648

For factor analysis we used the Kaiser-Meyer-Olkin measure, and the value of this measure was 0.77 (P<0.001). Also, Rotative method showed that questions 5-9 and 2-4 were the most and more important questions, respectively. Questions 1 and 10, the two open-ended ones, were the least important questions.

Discussion

64

This study showed that PEDS has good content validity. The test also had good reliability in test-retest. The total Cronbach's α coefficient wasn't very high, but when considering the low number of

items in PEDS, the estimated value is acceptable. Although the kappa measure agreement between PEDS and ASQ was not good, because of the large sample size and the similarity of results in 71.5% of cases, it is possible to conclude that this measure is acceptable and good enough for screening 4-6 month-old children in Tehran city. A study performed in the USA showed that PEDS had high validity and reliability (test-retest reliability of 0.98-0.99 and inter-rater reliability of 0.82-0.92) (24). According to the literature, the sensitivity (0.79) and specificity (0.89) of PEDS is moderate (25-27). The questionnaire has been re-standardized recently and is actually being using in several countries for children's developmental screening. There was no significant difference between the developmental status of term and preterm children; nor did birth order, maternal educational level or child's relation to the person who completed the questionnaire have any significant relationship with the results of PEDS. However, there was a significant relationship between the place of living, and the age (p < 0.001)and sex (p=0.03) of children with the test results. National studies performed in Iran using ASQ, PDQ and DDST-II have showed no relationship between place of residence, sex, age and maternal educational level with the results of these tests (28-30). These studies have also showed weak agreement between the results of developmental screening using ASQ and PDQ, ASQ and DDST-II and also PDQ and DDST-II (28-30). Scies et al. also showed that the agreement between results of PEDS and ASQ was low and the disagreement was greater in the speech and communication domain (31). According to the authors of the same study, since using both of these two tests is recommended by AAP, the importance of interpreting test results by practitioners becomes evident(31). Although there are still some challenges facing developmental screening overall, recent studies show that the use of these two questionnaires is increasing today. The result of a study that compared the use of developmental screening tools by practitioners between 2002 and 2009 showed that the rate of using the ≥ 1 developmental screening tool in 2009 was twice as great as 2002. In 2009, a larger number of practitioners used ASO and PEDS (20). However, these two tools have different approaches: ASQ asks parents about the child's specific skills but PEDS includes more general questions and seeks parental concerns (31). PEDS is currently used in many countries for childhood developmental screening. The results of one study showed that it was useful to present PEDS to parents before a well-child visit and practitioners believed that the tool improved their ability to diagnose developmental disorders (32). A study carried out by King showed that the number of suspect cases resulting from developmental screening by PEDS were twice that of screening by ASQ, but that practitioners tended to refer the suspect cases resulting from ASQ more than those of PEDS (33). In this study, 4.6% and 18.5% of children were categorized as path A (fail) and B (suspect), respectively. In one study designed to determine the

(while 10% was anticipated), 60% as path C or nonspecific concern (while 20% was anticipated) and 5% as path E (while 20% was anticipated). It is possible that using the word "concern" in the test items of PEDS was responsible for this high rate of path A children. Actually, many mothers were worried about the high rate of malaria and other extrinsic environmental threats and concerns such as decreased appetite, nutrition, fever, etc., instead of developmental disorders. Thus the authors recommended that before deciding about the widespread use of PEDS in this country, it would better to be standardized for children of Tanzania (23). Another study showed that the results of screening with PEDS in Australia was similar to the norm population of USA, and thus PEDS was recognized as suitable for using in this country (34). King et al. used PEDS in 1801 preschool children and their parents in Singapore. They concluded that in comparison to the norm population in USA and Australia, parental worries and concerns were greater in Singapore. By adjusting the cut off points, they found similar results to the norm American population. The authors recommended that interpreting the results of the test be performed by considering the cultural backgrounds of each community (35). Another study on 100 two-year-old children in Milton Keynes, England showed that PEDS is suitable for timely detection of developmental, behavioral, social and emotional status of children, timely referral for intervention services, good communication between parents and health care providers, and designing a clear plan for providing child health care (36). In one study, researchers evaluated parental notes written on 752 PEDS forms. 90% of parents had at least one concern and in 27% of cases they wrote notes on the forms. 23.7% of the written comments weren't related to the question and 25% of the concerns were advanced for the child's age. The authors emphasized that although developmental screening is useful in empowering well-child visits, they shouldn't replace the parent-physician relationship (22). Although in recent years child health policymakers have paid more attention to child development, the greatest attention of pediatricians is still focused on physical growth and their interest, sensitivity and education about child development is limited .In this situation using simple and easy-touse tools such as PEDS, is highly recommended.

delays of children in Tanzania, the researchers

showed that 35% of children were defined as path A

Iranian Rehabilitation Journal

success of PEDS in identifying developmental

65

Although intervention services may not be accessible in all communities, researchers have shown that early diagnosis itself provides an opportunity for parental education and then parents can incorporate this knowledge in the daily care of their children such as bathing, holding, dressing, feeding, clothing, etc. Evidently, if these cares can be accompanied by intervention services, it will lead to a considerable impact on child development (37). As there was not any diagnostic gold standard test accessible, we had to compare the PEDS with another screening tool, the ASQ that was recently standardized in Iran(38, 39). Due to the limitation of time and resources it wasn't possible to re-evaluate those children who were categorized as path A or B.

References

66

- 1. Guevara JP, Gerdes M, Localio R, Huang YV, Pinto-Martin J, Minkovitz CS, et al. Effectiveness of developmental screening in an urban setting. Pediatrics. 2013;131(1):30-7.
- 2. Regalado M, Halfon N. Primary care services promoting optimal child development from birth to age 3 years: review of the literature. Archives of Pediatrics and Adolescent Medicine. 2001;155(12):1311-22.
- Rosenberg SA, Zhang D, Robinson CC. Prevalence of developmental delays and participation in early intervention services for young children. Pediatrics. 2008;121(6):e1503e9.
- Sandler AD, Brazdzuinas D, Cooley W, Gonzalez de Pijem L, Hirsh D, Kastner T, et al. Developmental surveillance and screening of infants and young children. Pediatrics. 2001;108(1):192-6.
- Vameghi R, Hatamizadeh N, Sajedi F, Shahshahanipoor S, Kazemnejad A. Production of a native developmental screening test: the Iranian experience. Child: care, health and development. 2010;36(3):340-5.
- Sajedi F, Vameghi R, Kraskian Mujembari A. Prevalence of undetected developmental delays in Iranian children. Child Care Health Dev. 2014 May;40(3):379-88. PubMed PMID: 23461377.
- Ahsan S, Murphy G, Kealy S, Sharif F. Current developmental surveillance: is it time for change? Irish medical journal. 2008;101(4):110-2.
- Al-Ansari S, Bella H. Translation and adaptation of the revised Denver pre-screening developmental questionnaire for Madinah children, Saudi Arabia. Annals of Saudi medicine. 1998;18(1):42-6.
- Chen IC, Lin C-H, Wen S-H, Wu C-H. How Effectively Do Parents Discern Their Children's Cognitive Deficits at a Preschool Age? Journal of the Chinese Medical Association. 2007;70(10):445-50.
- 10. Glascoe F. The value of parents' concerns to detect and address developmental and behavioural problems. Journal of paediatrics and child health. 1999;35(1):1-8.
- 11. Glascoe F. Evidence-based approach to developmental and behavioural surveillance using parents' concerns. Child: Care, Health and Development. 2000;26(2):137-49.
- Glascoe FP. Early detection of developmental and behavioral problems. Pediatrics in Review. 2000;21(8):272-80.

However, we informed their parents and referred them for additional evaluation by experts.

Conclusion

This research showed that the validity and reliability of PEDS were acceptable for developmental screening of 4-60 month-old children in Tehran. Although the test is simple and doesn't refer to any specific skill, using it can lead to organizing the child health evaluation process. Also, it should lead to more thought about child development and, if there is any problem, referral for more evaluation and intervention services.

- 13. Levine DA. Guiding Parents Through Behavioral Issues Affecting Their Child's Health: The Primary Care Provider's Role. Ethnicity And Disease. 2006;16(2):S3-21.
- Glascoe FP, Shapiro HL. Introduction to developmental and behavioral screening. Pediatric development and behavior. 2004:766-70.
- Rydz D, Srour M, Oskoui M, Marget N, Shiller M, Birnbaum R, et al. Screening for developmental delay in the setting of a community pediatric clinic: a prospective assessment of parent-report questionnaires. Pediatrics. 2006;118(4):e1178-e86.
- Anderson LM, Shinn C, Fullilove MT, Scrimshaw SC, Fielding JE, Normand J, et al. The effectiveness of early childhood development programs: A systematic review. American journal of preventive medicine. 2003;24(3):32-46.
- 17. de Moura DR, Costa JC, Santos IS, Barros AJ, Matijasevich A, Halpern R, et al. Risk factors for suspected developmental delay at age 2 years in a Brazilian birth cohort. Paediatric and perinatal epidemiology. 2010;24(3):211-21.
- Morelli DL, Pati S, Butler A, Blum NJ, Gerdes M, Pinto-Martin J, et al. Challenges to implementation of developmental screening in urban primary care: a mixed methods study. BMC pediatrics. 2014;14(1):16.
- 19. Kim EY, Sung IK. The ages and stages questionnaire: screening for developmental delay in the setting of a pediatric outpatient clinic. Korean Journal of Pediatrics. 2007;50(11):1061-6.
- Radecki L, Sand-Loud N, O'Connor KG, Sharp S, Olson LM. Trends in the use of standardized tools for developmental screening in early childhood: 2002–2009. Pediatrics. 2011;128(1):14-9.
- Glascoe FP. If you don't ask, parents may not tell: noticing problems vs expressing concerns. Archives of pediatrics & adolescent medicine. 2006 Feb;160(2):220; author reply -1. PubMed PMID: 16461882. Epub 2006/02/08. eng.
- 22. Cox JE, Huntington N, Saada A, Epee-Bounya A, Schonwald AD. Developmental screening and parents' written comments: an added dimension to the Parents' Evaluation of Developmental Status questionnaire. Pediatrics. 2010;126(Supplement 3):S170-S6.
- 23. Kosht-Fedyshin M. Translation of the Parents' Evaluation of Developmental Status (PEDS) Developmental Screening

Vol. 13, Issue 2, Summer. 2015

Tool for Identification of Developmental Delay in Children from Birth to Five Years of Age in the Karagwe District of Northwestern Tanzania, East Africa: A Pilot Study. The Internet Journal of Tropical Medicine. 2006;3(1):3.

- Brothers KB, Glascoe FP, Robertshaw NS. PEDS: developmental milestones--an accurate brief tool for surveillance and screening. Clinical pediatrics. 2008;47(3):271-9.
- 25. Glascoe FP. Parents' Evaluation of Developmental Status. Nashville,TN: Ellsworth & Vandermeer Press; 1997
- 26. American Academy of Pediatrics, Council of children with disabilities section on developmental behavioral pediatrics, Bright Futures Steering Committee, committee. mhifcwsnpa. Identifying infants and young children with developmental disorders in the medical home: An algorithm for developmental surveillance and screening. Pediatrics. 2006;118(1):405-20.
- 27. Earls MF, Hay SS. Setting the stage for success: implementation of developmental and behavioral screening and surveillance in primary care practice-the North Carolina Assuring Better Child Health and Development (ABCD) Project. Pediatrics. 2006;118(1):e183-e8.
- 28. Shahshahani S, Sajedi F, Vameghi R, Kazemnejad A, Tonekaboni SH. Evaluating the Validity and Reliability of PDQ-II and Comparison with DDST-II for Two Step Developmental Screening. Iranian Journal of Pediatrics. 2011;21(3):343-9.
- 29. Shahshahani S, Vameghi R, Azari N, Sajedi F, Kazemnejad A. Validity and Reliability Determination of Denver Developmental Screening Test-II in 0-6 Year-Olds in Tehran. Iranian Journal of Pediatrics. 2010;20(3):313-22.
- 30. Shahshahani S, Vameghi R, Azari N, Sajedi F, Kazemnejad A. Comparing the Results of Developmental Screening of 4-60 Months Old Children in Tehran Using ASQ & amp; PDQ. Iranian Rehabilitation Journal. 2011;9(0):3-7. eng %@ 17353602 %[2011.

- 31. Sices L, Stancin T, Kirchner HL, Bauchner H. PEDS and ASQ developmental screening tests may not identify the same children. Pediatrics. 2009;124(4):e640.
- 32. Schonwald A, Huntington N, Chan E, Risko W, Bridgemohan C. Routine developmental screening implemented in urban primary care settings: more evidence of feasibility and effectiveness. Pediatrics. 2009;123(2):660-8.
- 33. King TM, Tandon SD, Macias MM, Healy JA, Duncan PM, Swigonski NL, et al. Implementing developmental screening and referrals: lessons learned from a national project. Pediatrics. 2010;125(2):350-60.
- 34. Coghlan D, Kiing J, Wake M. Parents' Evaluation of Developmental Status in the Australian day care setting: Developmental concerns of parents and carers. Journal of paediatrics and child health. 2003;39(1):49-54.
- 35. Kiing JSH, Low PS, Chan YH, Neihart M. Interpreting Parents' Concerns About Their Children's Development With the Parents Evaluation of Developmental Status: Culture Matters. Journal of Developmental & Behavioral Pediatrics. 2012;33(2):179-83.
- Davies S, Feeney H. A pilot of the Parents' Evaluation of Developmental Status tool. Community Practitioner. 2009;82(7):29-31.
- 37. Scherzer AL, Chhagan M, Kauchali S, Susser E. Global perspective on early diagnosis and intervention for children with developmental delays and disabilities. Developmental Medicine & Child Neurology. 2012;54(12):1079-84.
- Vameghi R, Sajedi F, Kraskian Mojembari A, Habiollahi A, Lornezhad HR, Delavar B. Cross-Cultural Adaptation, Validation and Standardization of Ages and Stages Questionnaire (ASQ) in Iranian Children. Iranian journal of public health. 2013;42(5):522-8.
- Sajedi F, Vameghi R, Habibollahi A, Lornejad H, Delavar B. Standardization and validation of the ASQ developmental disorders screening tool in children of Tehran city. Tehran University of Medical Sciences. 2012;70(7):436-46.

67