

Comparing the Results of Developmental Screening of 4 to 60-Month-Old Children in Tehran Using Parents Evaluation of Developmental Status and Ages and Stages Questionnaires

Soheila Shahshahani,^{1*} Roshanak Vameghi,¹ Firoozeh Sajedi,¹ and Akbar Biglarian¹

¹Pediatric Neurorehabilitation Research Center, University of Social Welfare & Rehabilitation Sciences (USWR), Tehran, IR Iran

*Corresponding author: Soheila Shahshahani, Pediatric Neurorehabilitation Research Center, University of Social Welfare & Rehabilitation Sciences (USWR), Tehran, IR Iran. Tel: +98-2122180142, Fax: +98-2122180142, E-mail: sol_shah@yahoo.com

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Abstract

Objectives: This research was designed to evaluate the developmental status of children aged 4 to 60 months in Tehran city by two parent-based developmental screening questionnaires, parents evaluation of developmental status (PEDS) and ages and stages questionnaires (ASQ), and also to determine the consistency coefficient between these two tests.

Methods: In this cross-sectional study, PEDS and ASQ were performed on 648 children (350 boys and 298 girls), aged 4 to 60 (mean, 23.5 ± 16.10) months at four health centers in Tehran city.

Results: Developmental disorders were observed in 23.1% of children (4.6% delayed and 18.5% suspicious), who were examined by PEDS, and in 26.4% of children, who were examined by ASQ (14.7% delayed and 11.7% suspicious). The estimated values of kappa measure of agreement and Pearson Chi-Square for the results of the two screening tests were 0.30 ($P < 0.001$) and 115.98 ($P < 0.001$), respectively. The results of these tests were similar in 93.3%, 94% and 91% of cases in fine motor, gross motor and language domains of development, respectively. 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.

Conclusions: This study showed that PEDS and ASQ have acceptable agreement, thus it seems that PEDS can be used for children's developmental screening especially in child care visits.

Keywords: Children, Development, Developmental Delay, Screening, PEDS, ASQ

1. Background

Children are one of the most valuable assets and a major basis of development for every country. Ensuring that children's growth and development are moving in the right direction, providing the opportunity for having a healthy life and obtaining the decision for health promotion of children are some of the main duties of governments. One important aspect of health in children is normal development. Although great improvements have been made in pediatrics medicine, yet developmental disorders are still an important challenge in this field of knowledge (1). Child development refers to the biological, psychological and emotional changes that begin before birth in human beings, as the individual progresses from dependency to increasing autonomy. It is a continuous process with a predictable sequence yet with a unique course for every child. Several studies have shown that 10 to 16% of children in different countries have developmental disorders (2, 3). In other words, it seems that more than 200 million children under five years of age all around the world don't reach their potential developmental abilities

(4). One possible reason for this rather high prevalence rate may be inappropriate early detection and early intervention for these disorders. The first three years of life is an important period for the growing brain and also a good opportunity for optimizing different aspects of the child's development (5). Adaptability of the brain in the first three years of life can increase the effect of early intervention services on developmental and behavioral outcomes in children (Anderson, 2003), lowering early school incompetency, behavioral problems at school and school dropout at higher grades, delinquency, and also preparing children for school entry especially in lower income societies (6). Detecting children with developmental disorders at a younger age and introducing intervention services can lead to a decrease of the incidence of these disorders (7). Early detection of developmental disorders especially before school entrance has an important impact on children's health and well-being. For detecting at risk children and offering them necessary interventions, the American academy of pediatrics (AAP) has recommended that developmental surveillance and monitoring should be performed periodically by using an appropriate tool (8).

At first, this recommendation was presented when several studies showed that primary health care providers underestimated young children with developmental disorders because of not using a high quality developmental screening tool (9-11). In other words, diagnosis of developmental disorders is usually much lower than the real prevalence rate (2, 10, 12) and without using a suitable tool, only 30% of children with developmental disorders can be identified before school entrance (13, 14).

The results of a study showed that only 23% of professionals used developmental screening tools (12). Another research that was done by Scies, showed that without using standard developmental screening tools, family practitioners or pediatricians did not refer suspected children for using early intervention services (15). Restriction of time and resources, insufficient skilled personnel for screening and underestimating self-competency for performing developmental screening, were some of the reasons for delayed detection and referral of children. In 2006, the American academy of pediatrics (AAP) recommended that developmental screening should be done at 9, 18 and 24 or 30-month child supervision visits by using a "good tool" (sensitivity and specificity) (8). Radecki showed that in 2009, practitioners used more than one standard tool twice more than in 2002 and using the Ages and stages questionnaires (ASQ) and denver developmental screening test II (PEDS) was more common in 2009 (13). Also this study showed that after passing several years, the previous problems for finding a suitable developmental screening tool were still persistent. One of these problems was absence of a gold standard tool for evaluating young children (16, 17). Other researches showed that there are several tools but their sensitivities and specificities are limited (13, 18), thus it is clear that despite AAP recommendation, there are many barriers in this way (19). Several studies were done in order to choose a suitable developmental screening test and many researchers concluded that using a tool should be done by considering the population needs and center's activities (20, 21). There are two types of developmental screening tools: 1) screening tests, using which examiners directly observe and interpret the child's behavior and 2) developmental questionnaires that are completed by the child's care provider. Because the objective developmental screening tools have more practical problems, many practitioners prefer to use parent-based questionnaires.

There are a few standardized developmental screening tools available in Iran and practitioners need more information about these tests. By knowing the differences between available tools, health care providers will have the opportunity to use the most suitable screening tool for their practice. In this study we compared the results

of two parent-based developmental screening questionnaires, ASQ and PEDS, because they are easy to use and both of them are amongst the tools recommended by AAP. The ASQ was standardized in Iran (22). Some of the items of PEDS were previously inserted in "guideline of well child care visits" and recommended by ministry of health for use in primary health care centers. A recent study evaluated its psychometric characteristics in Tehran and the result of the research showed that it could be used for developmental screening in Tehran (23). There are certain researches that have compared developmental screening tools with each other. A study that was done in Tehran, showed that the agreement coefficient of ASQ and DDST-II was weak (24, 25). In that study the researchers compared an objective developmental screening test, the DDST-II, with a parent-based developmental screening questionnaire, the ASQ. The results of another study showed weak agreement between the results of the other two developmental screening tools, DDST-II and PDQ-II (26). In a recent study the researchers found that the ASQ and PEDS may not identify the same children (27).

2. Objectives

Since at the present time, developmental screening is not routinely performed for all children in Iran, pediatricians need to find a suitable, valid, cost beneficial and easy to use developmental screening tool for their practice. As mentioned above, ASQ was standardized in Iran (22, 28, 29) and is being used for selected ages in primary health care centers. However, the result of a study showed that in a crowded and populated location, especially in low-income urban health care centers, the parents might not spend 15 to 20 minutes' time to complete the ASQ. Sending the test by e-mail may be difficult and also is not feasible for all communities (19). In these situations, PEDS could be a more practical developmental screening test. Thus we decided to compare these two parent-based developmental screening tools and learn more about their agreement rate.

3. Methods

This study was a cross sectional research that was done from July 2013 to April 2014.

The ASQ is a developmental screening tool and has 19 age-specific questionnaires that can be completed by the parents or caregiver. Each questionnaire has 30 simple questions about communication, fine and gross motor, problem solving and person-social areas of development. Completion and scoring of the test needs up to 15 and two

to three minutes, respectively. Sensitivity (0.70-0.90%) and specificity (0.76-0.91%) of the test is moderate to good and reliability is good (for test-retest and inter-rater 0.95%)(30-32).

The PEDS consists of 10 simple questions and can be used for 0-8 year-old children. Two to five minutes is needed for its completion. Sensitivity (0.74-0.80%) and specificity (0.70% - 0.80%) of the test is moderate and in comparison to other developmental screening tools, is suitable (19, 27). The validity and reliability of the Persian version of PEDS has been reported to be acceptable (23). Eight of 10 questions of the test ask about a developmental or behavioral area and the first and the last ones are open-ended questions and designed for determining more general problems (7). The PEDS classifies children in five groups; path A: high risk for developmental disabilities, path B: moderate risk for developmental disabilities, Path C: low risk of developmental disabilities but elevated risk for mental health problems, Path D is rare but is used for parent-provider communication difficulties, Path E: low risk for problems (33). Because ASQ categorizes children in three groups (normal, delayed and suspect), in order to determine the measure of agreement between PEDS and ASQ results, considering the fact that for cross tabulating two tests, they must have similar number of choices, we considered path C, D and E of the PEDS concordant with the normal group of the ASQ.

By considering the 95% confidence interval, a 90% test power and at least a 0.6 test correlation between the two tests, the estimated sample size was 570 children. Convenient sampling was used. The inclusion criteria were: age between 4 and 60 months, Iranian nationality, living in Tehran city, and parental cooperation. Exclusion criteria were: having obvious developmental delay or disability, and parental refusal to cooperate with the research.

The study was approved by the research committee and thereafter by the ethical committee of the university of social welfare and rehabilitation sciences. Consent for participation was obtained from parents. For ethical purposes, the parents whose children were detected as delayed or suspicious were referred for additional evaluations and interventions. The PEDS and ASQ were presented to parents of 648 children 4 to 60 months old at four primary health care clinics located in south, north, east and west regions of Tehran. The examiners had Bachelor of Science in child psychology or occupational therapy and were trained in a one-day workshop for performing ASQ and PEDS. Parents were informed and completed a written consent. Age groups were selected based on the age groups of the ASQ questionnaires. We used Kolmogorov-Smirnov test for evaluating the normal distribution of age subgroups, kappa measure of agreement and Pearson Chi-

Square for comparing the results of the two tests. Data was analyzed using SPSS version 16.

4. Results

In this study we screened 648 children 4 to 60 months old. Kolmogorov-Smirnov test showed normal distribution in age subgroups ($P > 0.05$). Three hundred and fifty (54%) were boys. In 614 (95%) cases, parents completed the tests. Furthermore, 611 (94%) of the children were born term. For those children, who were younger than 24 months and were born prematurely, we calculated and considered the corrected age. Three hundred and twenty-five (50.2%) children were the first child of the family. The educational level of 335 (51.7%) and 223 (34.4%) of mothers were university and high school levels, respectively. The demographic characteristics and the results of developmental status of children by these two tests are shown in Tables 1 and 2, respectively. The results of these tests were similar in 93.3%, 94% and 91% of cases in fine motor, gross motor and language domains of development, respectively. The estimated values of kappa measure of agreement and Pearson Chi-Square for the results of the two screening tests were 0.30 ($P < 0.001$) and 115.98 ($P < 0.001$), respectively.

Table 1. Demographic Characteristics of the Participants

Variable	Results	No. (%)
Gender	Girl	298 (46)
	Boy	350 (54)
Person who completed the questionnaires	Parents	614 (95)
	Others	11 (2)
	Missing	23 (3)
Gestational age	> 37 weeks	611 (94)
	< 37 weeks	37 (6)
Birth order	First	325(50.2)
	Second	179(27.6)
	Third	34(5.2)
	Fourth	5 (0.8)
	Missing	105 (16.2)
Mother's education	Illiterate	11 (1.7)
	Primary school	25 (3.9)
	Guidance school	50 (7.7)
	High school	223 (34.4)
	University	335 (51.7)

This study showed that in our sample size, delayed results were more in north and west regions of Tehran using

Table 2. Comparing the Results of Parents Evaluation of Developmental Status (PEDS) and Ages and Stages Questionnaires (ASQ)

ASQ Results No. (%)	PEDS Results: No. (%)			Total
	Normal	Delayed	Suspicious	
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)
Suspicious	29 (4.7)	10 (1.5)	37 (5.7)	76 (11.7)
Total	498 (76.9)	30 (4.6)	120 (18.5)	648

ASQ ($P < 0.001$) and also in north by using PEDS ($P < 0.001$). In both developmental screening tools, the rate of delayed results was more with male gender ($P = 0.02$ for ASQ and $P = 0.03$ for PEDS).

5. Discussion

This study was done to compare the results of developmental screening of 4 to 60 month-old children in Tehran city by using ASQ and PEDS. The estimated Pearson Chi-Square measure was significant. Although the observed kappa measure of agreement for the tests result was low, by considering the high sample size and similarity of results in 71.5% of cases, it is possible to conclude that agreement between the two tools is acceptable.

Some national researches have shown weak agreement between the results of developmental screening using ASQ and prescreening developmental questionnaire-II (PDQ), ASQ and denver developmental screening test II (DDST-II), and also PDQ and DDST-II (25, 26, 34).

Sices et.al showed that agreement between the results of PEDS and ASQ was low and the observed disagreement was greater in language and communication area. They concluded that PEDS and ASQ developmental screening tests may not identify the same children. Although these two questionnaires are both among the tools that are recommended by the AAP for developmental screening of children, the authors emphasized that practitioners should be cautious in interpreting the results of developmental screening with these two tools (27).

Although there are many practical problems facing developmental screening, studies have shown that there is an increasing tendency to use these two questionnaires. The result of one study that compared the use of developmental screening tools in 2002 and 2009, showed that using ≥ 1 tool in 2009 is nearly twice that in 2002; and that in 2009, larger numbers of practitioners used ASQ and PEDS for screening purposes (13).

Actually, these two tests use different approaches. The items of ASQ are designed for evaluating the presence of specific developmental milestones but PEDS asks about

parental concerns regarding different developmental domains regardless of specific skills (27). Ryzd et al. showed that using ASQ in Canada detected a large number of developmental disorders. Although comparing the results of screening with a gold standard test was done three months later, in their study the overall estimated sensitivity of ASQ was low (14). Another study in Canada showed that the agreement between the ASQ and Bayley III was relatively poor (35). Some other researchers in USA and other countries such as Iran, China, Turkey and Korea reported that ASQ is a good developmental screening tool (2, 20, 21, 28, 36-42).

The PEDS and ASQ are used in many parts of the world and several researches have been done on both. The result of one study showed that it would be useful if PEDS was presented to parents before performing a health care visit, and practitioners believed that PEDS could increase their ability to detect a child with developmental problems (19). King's study showed that the suspected cases detected by PEDS were twice more than those detected by ASQ, but in practice practitioners were more likely to refer children, who were determined to be a "suspect" through screening by ASQ (43).

In a research done in Tanzania, the authors concluded that a possible reason for the high rate of high risk cases detected by PEDS was the utilization of the word "worry" in the questionnaire items. The authors speculated that due to higher environmental risks and hazards such as malaria or other health problems in their country, mothers were more worried about any abnormal medical signs and symptoms in their child, than their child's developmental status. Thus the authors recommended that before any decision-making about choosing the PEDS for developmental screening of children, it should be standardized for their population in Tanzania (33).

In another study in Australia, the results of developmental screening with PEDS was compared with that of the native population in USA and showed that PEDS was suitable for developmental screening in that country (44). The result of a research by King on 1806 preschool children and their parents in Singapore showed that the presence

of parental worries in that country was greater than that in USA and Australia. However, by adjusting the cut-off points, the results were similar. Thus the researchers concluded that interpreting the results of the tests, should be done by considering the cultural background of each population (45). In another study, PEDS was used for screening of one hundred two year-old children. The study showed that it was a useful tool for evaluating the developmental, behavioral, social or emotional status of children, communication between parents and health care centers, and planning a clear model of caring for the children (46). Schonwald et al. showed that using PEDS before performing health visits and then discussing with parents about the results and their concerns, was considered useful by practitioners and a large number of them believed that using PEDS increased their ability to detect childhood developmental problems (19). In another study, the parents' notes written on 752 PEDS forms were evaluated. Ninety percent of parents had at least one concern. In 27% of cases, they described their concerns. In 23.7% of cases where parents had concerns and wrote about them, their worries weren't compatible with the context of the question. In more than 25%, the written concerns were advanced in comparison with the children's age. This study emphasized that although developmental screening tools are necessary for increasing the efficacy of care during visits, they shouldn't replace the parent-physician relationship. Disproportionate developmental expectations come from insufficient parental knowledge and this could be overcome by consultation with a practitioner (47).

Although policy makers in the field of child health in the country are recently making many efforts to encourage pediatricians for developmental screening of young children, yet most pediatricians still pay more attention to children's physical growth. Thus, emphasizing on the utilization of simple tools may help overcome the lack of enthusiasm. Even when intervention services are not available everywhere, researches have shown that early detection per se can lead to parental education, which may lead to their ability to incorporate their knowledge in daily routine child care activities such as hugging, bathing, feeding, clothing, etc. If these caring behaviors are followed by appropriate intervention services, it would have great efficacy on child development (11).

This study had some limitations. Due to limitations in time and resources, we couldn't re-evaluate the suspected cases of PEDS or ASQ with a gold standard developmental diagnostic test for determining the concurrent validity of the two screening tests. Also for determining the measure of agreement between PEDS and ASQ results, we considered path C, D and E of the PEDS concordant with the normal group of the ASQ.

5.1. Conclusion

The ASQ is a developmental screening test that is standardized in Iran and now is being used all around the country for selected age groups. This study showed that PEDS and ASQ have acceptable agreement, thus it seems that PEDS can be used for children developmental screening, especially in child-care visits. Although its questions don't refer to any specific skill, using it will help organize the health evaluation process of children; practitioners will think about the development and if they detect any problem, they can refer the child for more extensive evaluation.

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