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Original Article

Agreement between the Denver II and Parents' Evaluation of Developmental Status tests, with and without the assistance of a table of categorical responses

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Abstract

Background Among standardized developmental screening tools, the Denver II is commonly used by Indonesian pediatricians, but the Parent's Evaluation of Developmental Status (PEDS) test has gained in popularity. The Denver II test is filled by physicians, while the PEDS test is meant to be filled by parents. From a practical standpoint, however, parents often require assistance from doctors when filling out the PEDS forms. Hence, the advantage of the PEDS test over the Denver II test is not fully realized.

Objective To compare the agreement between Denver II and PEDS tests, with and without parental use of a table of categorical responses taken from the PEDS manual.

Methods We conducted a cross-sectional study in children aged 6 months to 5 years in Bandung from November 2015 to March 2016. Subjects were divided into two groups using block randomization. One group of subjects' parents filled the PEDS questionnaires with the assistance of a table of categorical responses taken from the PEDS manual, while the other group of subjects' parents filled PEDS forms without this table. All subjects underwent Denver II screening by pediatricans. The agreement between the PEDS and Denver II results were assessed by Kappa score.

Results Of 254 children, 239 were analyzed. Kappa scores between the Denver II and PEDS tests were 0.05 (95%CI: -0.10 to 0.20) without the table of categorical responses, and -0.06 (-0.23 to 0.10) with the table of categorical responses.

Conclusion Agreement between the Denver II and PEDS tests is poor. The table of categorical responses does not increase the agreement between Denver II and PEDS. **[Paediatr Indones. 2016;56:267-71. doi: 10.14238/PI56.5.2016.267-71]**.

Keywords: *developmental screening tool; PEDS; Denver II; agrreement; Kappa score*

Developmental disorders occur in approximately 15% of children.[1] Early detection and early intervention are important for improving children's long term academic ability and behavior.[2-4] Previous studies showed that pediatricians' assessments of child developmental status were often inaccurate, without the use of a standardized developmental screening tool.[5,6] In Indonesia, one such tool commonly used by pediatricians is the Denver II test. However, the PEDS test is starting to be used more frequently in Indonesia.[7] The benefit of using PEDS is that it can be filled by the parents themselves in only 2-10 minutes, unlike the Denver II test, which is usually administered by a physician/health care worker.[8-10]

In practice at the Growth and Developmental Outpatient Clinic, Hasan Sadikin Hospital, parents often have difficulty filling out the PEDS forms by themselves, requiring the doctors to assist them.

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Hence, the advantage of using PEDS (to save physicians' time and effort) is not optimally achieved. Therefore, we considered ways to make it easier for parents to fill the PEDS forms. The PEDS manual contains a table of categorical responses to the questions in the PEDS form.[11,12] This table might help parents to better comprehend the questions in the PEDS form, so that they would hopefully be able to fill out the PEDS form unassisted.

The objective of the study was to determine if the use of the table of categorical responses helped parents comprehend PEDS questions, by comparing the agreement of Denver II and PEDS, that were filled by parents with and without the table of categorical responses.

Methods

We conducted a cross-sectional study in Bandung, on children from Puter Primary Health Care (PHC), Garuda PHC, and the Bunda Ganesha Child Care and Kindergarten, from November 2015 to March 2016. Informed consent was obtained from parents at the time of recruitment.

Participants were children aged 6 months to 5 years whose parents could speak Indonesian and had an educational status of at least 5th grade of primary school. Exclusion criteria were (1) parents who had filled the PEDS questionaire at a time prior to our study, (2) children previously diagnosed as having a developmental disorder by doctors, (3) children who were blind or deaf, according to the parents, (4) children with abnormalities of the arms or hands that disrupted the ability to grasp objects, or (5) children with abnormalities of the legs or feet that disrupted the ability to walk. We estimated our minimum required sample size to be 112 per group, or a total of 224 subjects.

We divided the parents/children who met the study criteria into two groups using block randomization, those who received the table of categorical responses from the PEDS manual (**Table 1**) and those who did not. Parents from both groups filled out the PEDS forms unassisted. Afterward, the children from both groups underwent Denver II screening by a pediatrician who did not know their group status.

The PEDS results were defined to be "of concern" if parents circled "yes" or "a little" in at least one of the categories of expressive language and articulation, receptive language, fine motor, gross motor, or self-help. Otherwise, the PEDS result was defined to be "of no concern." Denver II results were defined to be "suspect" or "normal," in accordance with the Denver II manual.[13]

Assessing the agreement between PEDS and Denver II results was done by calculating Kappa scores with 95% confidence intervals (CI).[14,15] Kappa scores of >0.75 represented excellent agreement, while scores of 0.40-0.75 represented fair-to-good agreement, and <0.40 represented poor agreement.[16]

This study was approved by the Health Research Ethics Committee of the Universitas Padjadjaran Medical School.

Table 1. Table of categorical responses

Number of question	Typical responses
1	Seems behind, can't do what other kids can, slow and behind other kids, immature, learns slowly, late to learn to do things, learn but takes a long time, problem with learning everything.
2	Not talking like he should, uses short sentences, can't always say what she means, doesn't always make sense, can't talk plain, nobody understand what he is saying but me.
3	Doesn't understand what you say, doesn't listen well.
4	Can't stay in the line when colors, can't write name, can't draw shapes, can't hold a pencil right, can't get food to mouth with a spoon yet and so is a messy eater.
5	Clumsy, walks funny, can't ride a bike yet, falls a lot, limps, poor balance, hates soccer.
6	Stubborn, over-active, short attention span, spoiled, aggravating, throws fit, only does what she wants.
7	Wants to be left alone, whiny, bother by changes, angry, easily frustated, shy, bossy, mood swing.
8	Won't do things for herself, won't tell me when he's wet, not toilet trained yet, still wants a bottle, can't get dressed by herself.
9	Can't write his name, doesn't know colors or numbers, just not learning to read, can't remember letter sounds, knows spelling words one day but not the next.
10	Ear infections, asthma, small for age, sick a lot, I don't think he hear, I worry about her sight.

Results

Two hundred fifty-four children were included and randomly assigned (**Figure 1**). Of these, 15 children could not be tested by Denver II, 6 from the group without the table of categorical responses and 9 from group with the table. Hence, a total of 239 children were analyzed (**Figure 1**).

Table 2 shows the characteristics of subjects. Both groups had similiar background characteristics, as analyzed by Chi-square and Mann Whitney U tests. **Table 3** shows the agreement between the PEDS and Denver II results in the group without the table of categorical responses. In this group, 46.3% of subjects had PEDS "of concern" results and 20.7% of subjects had Denver II "suspect" results. In addition, 9.9% of subjects with Denver II "suspect" results had "of no concern" PEDS results, and 35.5% of subjects with "of concern" PEDS results had "normal" Denver II results. **Table 4** shows the agreement between the PEDS and Denver II results in the group with who used the table of categorical responses. In this group, 42.4% of subjects had PEDS "of concern" results and 25.4% of subjects had "suspect" Denver II results. In addition, 16.1% of subjects with "suspect" Denver II results had "of no concern" PEDS results, and 33.1% of subjects with "of concern" PEDS results had "normal" Denver II results.

Kappa score in the group that did not use the table of categorical responses was higher than that of the group with the table of categorical responses, but this difference was not statistically significant, based on the value of confidence interval. Furthermore, the Kappa scores in both groups were categorized as in poor agreement (<0.40).

Discussion

The Kappa score agreement between the Denver II and PEDS test results in the group that used the table of categorical responses was not better than the Kappa score in the group that did not use the table. We may infer from this observation that the table of categorical responses did not aid the parents in their filling of the PEDS questionnaires, perhaps because the table was designed to help examiners (including doctors) to categorize parents' concerns. Thus, the table of categorical responses may have been more suitable for the examiners, than for parents.

Use of the table of categorical responses as additional information for parents may also have distracted parents when filling out the PEDS form, because they had to divide their attention between thinking about their child's concerns and understanding the table. This divided attention may

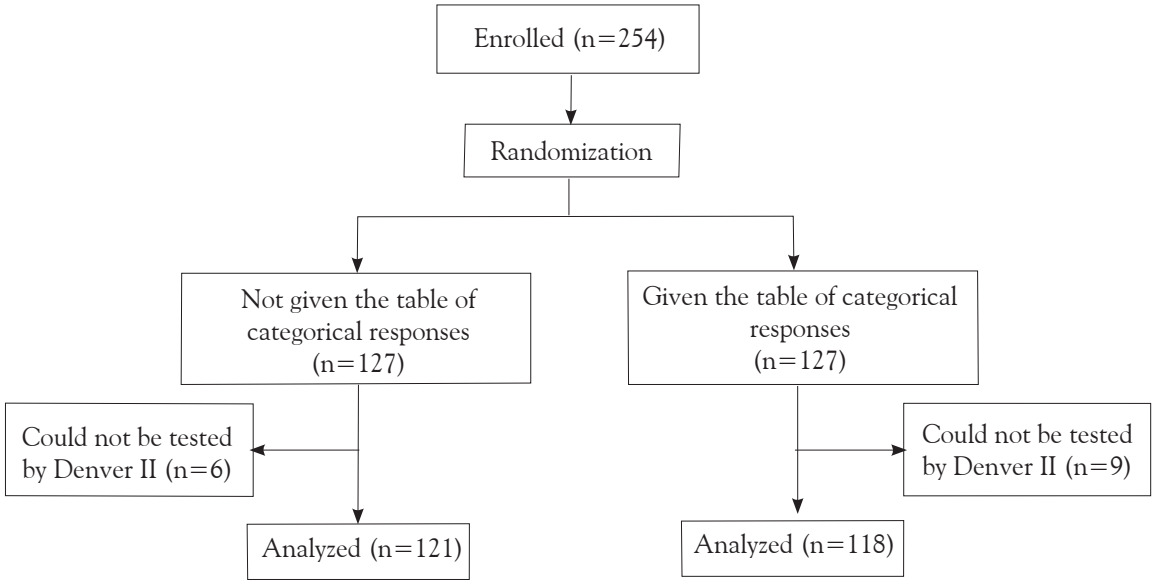

Figure 1. Study flow chart

Table 2. Characteristics of subjects

Characteristics	Without table of categorical responses (n = 121)	With table of categorical responses (n = 118)
Child's sequence in family, n (%)		
First	65 (53.7)	62 (52.5)
Second	42 (34.7)	39 (33.1)
Third	12 (9.9)	12 (10.2)
Fourth	1 (0.8)	3 (2.5)
Fifth	1 (0.8)	1 (0.8)
Sixth	0	1 (0.8)
Number of children in the family, n (%)		
One	50 (41.3)	43 (36.4)
Two	45 (37.2)	53 (44.9)
Three	21 (17.4)	16 (13.6)
Four	4 (3.3)	3 (2.5)
Five	1 (0.8)	2 (1.7)
Six	0	1 (0.8)
Family income per month, n (%)		
IDR < 1million	18 (14.9)	26 (22.0)
IDR 1-3million	63 (52.1)	61 (51.7)
IDR 3-5million	24 (19.8)	11 (9.3)
IDR ≥5million	16 (13.2)	20 (16.9)
Maternal education, n (%)		
Primary	4 (3.3)	10 (8.5)
Junior high	20 (16.5)	31 (26.3)
Senior high	55 (45.5)	50 (42.4)
Diploma degree	12 (9.9)	7 (5.9)
Bachelor's degree	30 (24.8)	20 (16.9)
Median age, years	4.94	4.79
Age by group, n (%)		
< 1 year	2 (1.7)	4 (3.4)
1- 2 years	5 (4.1)	3 (2.5)
3-5 years	114 (94.4)	111 (94.1)

also be the reason that the Kappa score agreement in the group that used the table of categorical responses was lower than that of the group that did not use the table, although this difference was not significant.

We found that the agreement between PEDS and Denver II was poor (Kappa score 0.05 in the group without the table of categorical responses). In contrast, Theeranate *et al*. found good agreement between PEDS and Denver II (Kappa score 0.43).[17] This difference was likely due to following: (1) In the Theeranate *et al*. study, the developmental aspects analyzed were language, fine motor, gross motor, but did not include self-help or personal social aspects, whereas the personal social aspect was analyzed in our study. (2) In the Theeranate et al. study, the PEDS form was completed by interviews, whereas

Table 3. Agreement between Denver II and PEDS in the group that did not use the table of categorical responses

Screening tool		PEDS			Kappa (95%CI)
		Of concern	Of no concern	Total	
Denver II	Suspect	13	12	25	0.05 (-0.10 to 0.20)
	Normal	43	53	96	
	Total	56	65	121	

Table 4. Agreement between Denver II and PEDS in the group that used the table of categorical responses

Screening tool		PEDS			Kappa (95%CI)
		Of concern	Of no concern	Total	
Denver II	Suspect	11	19	30	-0.06 (-0.23 to 0.10)
	Normal	39	49	88	
	Total	50	68	118	

in our study, the PEDS form was completed by parents themselves, without the help of a health care worker.

A previous study also found good agreement between PEDS and Denver II (Kappa score 0.52). This difference may have been due to differing subject inclusion criteria, as their subjects were children under 36 months with a high risk of developmental problems,[18] whereas our subjects were children aged 6 months to 5 years who were not known to have developmental disorders. Another study found poor agreement between PEDS and Denver II, similar to our findings. Their Kappa score was 0.29, which, although it was an equally poor result, it was higher than in our study (Kappa score 0.05). Artha *et al.* also differed with our study, specifically in the filling of the PEDS form, in which their parents were assisted by the health care workers.[19]

As mentioned, the three studies had varying Kappa scores from our study, possibly due to differing research methods (research subjects, filling of the PEDS form, and developmental aspects analyzed). But principally, the Kappa values may also have been influenced by prevalence.[20] The prevalences of subjects with "suspect" Denver II results in our study, as well as those of Kusnadar *et al.*, Artha *et al.*, and Theeranate *et al.* were 23%, 39%, 10.5%, and 3.2%, respectively.

Limitations of our study were as follows: (1) the age of 94% of our subjects was 3-5 years, thus, it was less representative of a population aged 6 months to 2

years, (2) the table of categorical responses was taken from the PEDS manual without modification. Thus, the additional information may not have been easily understood by parents, (3) The effect of the table of categorical responses to parents comprehension in this study was seen by comparing PEDS and Denver II. The Denver II test is not the gold standard for child developmental assessment, thus, there are probability that the effect of the table of categorical responses to parents comprehension can not be seen accurately.

Further studies using developmental screening tools with better sensitivity and specificity than that of Denver II, or using qualitative research methods is required. Understanding the gaps in parents' comprehension of the PEDS questionnaire to determine the type of additional information needed for parents to fill the form can also be very helpful.

In conclusion, we find that PEDS test results, completed by the parents themselves, have poor agreement with Denver II test results. In addition, the table of categorical responses do not help parents to understand more about the questions in the PEDS form.

Conflict of Interest

None declared.

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