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ORIGINAL ARTICLE

Likelihood ratios of multiple cutoff points of the Taipei City Developmental Checklist for Preschoolers, 2nd version

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Background/Purpose: This study aimed to examine the reliability and clinical decision validities of the Taipei City Developmental Checklist for Preschoolers, 2nd version (the Taipei II, which was filled out by parents) and the screening procedures conducted in the medical setting.
Methods: Methodology research and case control study designs were adopted. A total of 310 dyads consisting of children who were developing typically and 196 dyads of children with developmental delays and age 5.5 to 35.5 months were recruited for validity test. Among them, 165 mothers filled out the questionnaire twice within 1 week to examine the test–retest reliability of the total score and individual items. Validity indexes of the single cutoff strategy and multiple cutoff strategies were analyzed. With two cutoff point strategies, the likelihood ratios (LR) of the three test results, positive, neutral, and negative, were calculated.
Results: The test–retest reliabilities of the total scores of the seven checklists of the Taipei II (r_s = 0.54–0.89, $p<0.05$) and their individual items (agreement 92% to 100%) were acceptable, except for the 30-month checklist and three individual items. The positive LR (LR+) and negative LR (LR-) of the single cutoff strategy were acceptable with most LR+ more than 2, and all LR- less than 0.5. Most of the diagnostic odds ratios of single cutoff strategies were less than 50 and they did not meet the acceptable criteria. When multiple cutoff points were used, all of the LRs with

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positive test results were equal to infinity that met SpPin criteria, and all of the LRs with negative test results less than 0.5 had at least a small but important diagnostic impact.
Conclusion: Taipei II with multiple cutoff points could give more useful clinical information than using a single cutoff point. The multiple likelihood ratios of Taipei II for children older than 3 years and in different cultural backgrounds need further study.

Introduction

The benefits of early intervention for toddlers with developmental delays (DD) have been shown in randomized controlled trials.[1] Therefore, it is important that reliable and valid screening tests be administered earlier to avoid unreliable recall of milestones and the underdetection of clinical judgment (as in clinics, diagnoses of developmental delays based on clinical vignettes only could be misguided).[2,3]

A developmental screening test covering various developmental domains and with proper cutoff points of sound validity is helpful to detect children with DD earlier and correctly.[4,5] The Taipei City Developmental Checklist for Preschoolers, 2nd version (Taipei II), revised in 2005, is a concise screening instrument that aims to identify children who should receive further assessment due to the potential risks of developmental delays or disabilities. It has been applied widely in Taiwan in recent years[6,7] and it has four language versions: traditional Chinese, Indonesian, Thai, and Vietnamese.

The psychometric properties of previous studies of this test as completed by parent-targeted questionnaires are unknown in a medical setting, as testing has been carried out mostly in community settings and conducted by clinical psychologists. According to the screening policy in Taiwan proposed by the Department of Health, developmental surveillance of each infant and toddler is conducted six times before age 3 years to fit the vaccination schedule in medical settings. Involving parents in the assessment and intervention can enhance their knowledge of child development[8] and is cost-efficient.[9] Therefore, it is necessary to reexamine the validities of decisions made based on the Taipei II used in the medical setting and filled out by parents.

Validation is a key step in the development of the suggested cutoff point. Validation ideally is investigated on a group of children distinct from the group used to develop it.[10] The developmental surveillance of each child is conducted six times before age 3 in Taiwan. Therefore, the authors recruited a group of toddlers to examine the validity of the suggested cutoff strategies of the Taipei II. As multilevel likelihood ratios of a test with multiple cutoff points are more powerful and useful than one single cutoff point,[11] the purposes of this study were to investigate the test–retest reliability, its validity for decision making, and the multilevel likelihood ratios of the Taipei II in a medical setting for infants and toddlers less than age 36 months.

Materials and methods

Participants

We recruited dyads from two medical centers, one local hospital, and one developmental assessment center in Taipei City, as well as one local pediatric clinic in Chiayi City. Children with developmental delays were diagnosed as having developmental delays or developmental disabilities by a developmental assessment team and then referred for early intervention. Children developing typically were free from any neuromuscular, musculoskeletal, or cardiopulmonary disease. The children were ascertained by pediatricians as being developmentally typical after taking their histories, conducting physical examinations, using the developmental surveillance items of the Child Health Pamphlet,[12] and conducting a chart review at the well baby clinics. Parents signed a consent form that was reviewed and approved by the Institutional Review Board of one medical center.

A total of 310 dyads comprised of children developing typically (DT), and 196 dyads comprised of children having DD, were recruited for validity testing. Their ages ranged from 5.5 months to 35.5 months and the demographic data are shown in Table 1. Among the DT children, 165 mothers filled out the questionnaire twice within 1 week to examine the test–retest reliability of the Taipei II. Table 4 shows the numbers of the two groups divided into the Taipei II's seven age group checklists (6, 9, 12, 15, 18, 24 and 30 months).

Measurement

The Taipei II provides 13 checklists for 13 age groups: 4, 6, 9, 12, 15, 18, 24, 30, 36, 42, 48, 60, and 72 months. Each

Table 1 Basic data of children developing typically or with developmental delays.

	Developing typically (n = 310)	Developmental delay (n = 196)
Child characteristics		
Age of children, mean ± SD (months)*	16.7 ± 8.3	21.6 ± 8.1
Male sex, n (%)*	140 (45%)	124 (63%)
Premature, n (%)*	68 (22%)	63 (33%)
Family characteristics		
Maternal age, mean ± SD (years)	32.7 ± 4.2	33.4 ± 4.5
Career mother, n (%)*	154 (50%)	55 (29%)
Taiwanese mother, n (%)	294 (95%)	179 (92%)
Maternal education < high school, n (%)	7 (2%)	9 (5%)
Paternal age, mean ± SD (years)	35.3 ± 4.9	36.0 ± 5.3

Note: there were missing data for some variables.
*Significant differences between DT and DD groups ($p<0.05$, by independent t-test or Chi-square test).