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**Title: Establishing Reliability and Validity of the Child Evaluation Checklist -"CHECK"- A Screening Questionnaire for Detecting Developmental Delay among Children**

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**Abstract**

There is a growing population of children with atypical brain development, which is manifested in "light" delays such as attention deficits, motor dysfunctions and various learning disabilities. Most of these delays are diagnosed when the child reaches school age, which we believe is too late (Kaplan, Wilson, Dewey, & Crawford, 1998). Developmental delays are translated into difficulties in daily activities in various areas. Parents are the first to understand that something is wrong with their child's development and often turn to their children's pediatrician, but the pediatrician is also unable to provide an answer due to the lack of a reliable and efficient standard screening test for young children. This lack of knowledge, together with the proven fact that parents are able to give accurate information about their child's development (Glascoe, 2003), has led to the development of the CHECK (Child Evaluation Checklist) -a short standardized parent questionnaire for identifying developmental delay among children between the ages of 3-5 (Rosenblum, in process). The CHECK focuses on the child's daily routine functions with an emphasis on screening Executive Functions (EF). The questionnaire is one page long and divided into two sections. The first, in which the parent is requested to indicate the child's function on a scale of frequency: "always" (4) "often" (3) "seldom" (2) "never"(1), is composed of 30 sentences. The second section is composed of 10 sentences about the child's level of functioning on a scale of 1-5 compared to that of his peers .

**The objectives** of the current study were to establish reliability and validity for the CHECK:

1. Establishing internal validity (alpha Cronbach) of the entire questionnaire and for each of its parts.
2. Establishing construct (discriminative) validity of the questionnaire by comparing the differences of the average CHECK scores among children with Atypical Brain Development (ABD) and their peers with typical development.
3. Establishing its concurrent validity by examining the correlations between the CHECK scores and the scores of other validated assessment tools: Behavior Rating Inventory of

Executive Function- Preschool version (BRIEF-P) in which parents report the child's executive functions and the questionnaire about the child and his function which is filled out by the child's kindergarten teacher.

4. The correlations between the scores on the CHECK and the Visual-motor Integration test (VMI) which assesses visual motor functions, and the Star Wave Test (SWT) used for assessing perceptual motor skills, aspects of attention, motivation, delay, initiative, planning and time and spatial organization were also examined .
5. Establishing criterion (predictive) validity by a discriminate analysis between children referred to child developmental centers and typical children.

**The study hypotheses** were that the CHECK's internal validity would be satisfactory and that significant differences would be found in the CHECK's scores between children referred to developmental centers and typical children. Additionally, that significant correlations will be found between the scores of the CHECK and those of the BRIEF-P, a standardized questionnaire for Executive Functions (EF), and two standardized performance tests, the Test of Visual-motor Integration (VMI) and the Star Wave Test (SWT) .

**Participants:** the study included 58 children between the ages of three and five, 28 children referred to developmental centers (research group), and 30 controls with typical development. 50 were boys and 8 were girls. The participants of the research group were recruited through the Child Development Center of the Maccabi Health Care Services in Northern Israel. The controls were recruited through friends and neighbors, and matched with the research group children by age and gender variables.

**Measures:** Six measures were used to evaluate the participants and to gather information concerning their development and functioning: demographic questionnaire; the CHECK (Rosenblum in process); the BRIEF-P (Gioia, Espy & Isquith, 2003); the VMI (Beery, 1997); the Star and Wave Test (Ave'-Lallemant, 1997) and the kindergarten teacher questionnaire. The two performance tests (VMI and SWT) were combined with Computerized Penmanship Evaluation (Rosenblum, Parush & Weiss, 2003) that collected digital information about the writing/drawing.

**Procedure:** The children performed the VMI and SWT on an electronic tablet, which is a part of a computerized system. At the same time, the parents filled out the study questionnaires (BRIEF-P and CHECK). The parents were given the questionnaire for the kindergarten teacher who mailed it back upon completion.

**Data analysis:** The internal validity of the CHECK questionnaire was tested with Cronbach's alpha. A MANKOVA (a multivariate analysis) was performed to determine the differences between the two groups and was applied in order to measure the correlations between the scores of the CHECK and those of the other assessments. Predictive validity was tested by a discriminate analysis.

**Results:** The study hypothesis regarding the internal validity of the CHECK questionnaire was confirmed. A high internal validity was found for each of the parts (CHECK A  $\alpha=0.90$ , CHECK B  $\alpha=0.94$ ) and for the whole questionnaire ( $\alpha=0.95$ ).

The hypotheses regarding the differences between the groups were mostly confirmed. Significant group differences were found in the CHECK A scores ( $F(1,56)=66.1, p<.01 \eta=.55$ ), in the CHECK B scores ( $F(1,56)=58.5, p<.01 \eta=.52$ ), and in the BRIEF-P scores. Significant differences were found in the VMI scores ( $F(1,56)=44.64, p<.01 \eta=.44$ ) and the SWT scores ( $F(1,56)=30.36, p<.01 \eta=.35$ ), and only in a few measures of the computerized system. All the significant differences that were found showed better performances by members of the control group.

Simultaneously, the hypotheses pertaining to the correlations were mostly confirmed. In both groups a significant and strong correlation was found between the CHECK and the BRIEF-P and its categories ( $r=-.72$   $-.82, p<.01$ ). Correlation between the CHECK and the SWT ( $r=.61/.62, p<.01$ ), the VMI ( $r=.62/.64, p<.01$ ) and a few measures of the computerized system, were also significant.

Another important outcome revealed, that based on the CHECK discriminate analysis alone, 84.5% of the study participants, 93.3% of the children with typical development and 85.7% of the children with developmental delay, were classified correctly into their groups. Using both the CHECK and the BRIEF-P together, 89.7% of the study participants were classified correctly into their groups.

**Conclusions:** The current study confirms that the CHECK can reveal reliable and valid information concerning the presence of "soft" signs that may indicate a developmental delay at the ages of 3-5. In addition, the study shows that parent's opinion of the child's development is reliable, and using the parent as a source of information is effective. The CHECK was also found to be efficient, short and easy to use.

Therefore, the use of the CHECK can increase early detection of developmental delay amongst children and help professionals to refer children for comprehensive evaluation and intervention that, in the long run, can prevent secondary complications and improve quality of life. Finally, the second part of the questionnaire can help professionals focus upon the causes of the child's difficulty and thus enable them to refer the child to the appropriate treatments.