BUROS
CENTER FOR TESTING

Conners Kiddie Continuous Performance Test 2nd Edition

Purpose

Designed to "assess attention-related problems in children."

Population

Ages 4 through 7.

Publication Dates

2001-2015.

Acronym

Conners K-CPT 2.

Scores, 14

Response Style, Detectability (d-prime), Ommissions, Commissions, Persevertions, Hit Reaction Time (HRT), Hit Reaction Time Standard Deviation, Variability, HRT Block Change, Omissions by Block, Commissions by Block, HRT Inter-Stimulus Interval (ISI) Change, Ommissions by ISI, Commissions by ISI.

Administration

Individual.

Price Data, 2015

$599 per unlimited use kit including manual (2015, 108 pages) and software; $399 per pay-per-use kit including manual, software, and 10 uses; $100 per 10 additional uses after purchase of pay-per-use kit; $99 per manual.

Time

7.5 minutes.

Comments

Administered and scored via computer.

Authors

C. Keith Conners and Multi-Health Systems, Inc. staff.

Publisher

Multi-Health Systems, Inc.

Cross References

For reviews by Brian F. French and by Scott A. Napolitano and Courtney Miller of the original edition, see 16:67.

Review of the Conners Kiddie Continuous Performance Test 2nd Edition by GARY L. CANIVEZ, Professor of Psychology, Department of Psychology, Eastern Illinois University, Charleston, IL:

DESCRIPTION

The Conners Kiddie Continuous Performance Test 2nd Edition (Conners K–CPT 2) is an individually administered computerized test of various elements of attention for children ages 4 through 7. It is a screening measure similar in design to the previous version. The Conners K–CPT 2, like its predecessor, includes five blocks of 40 trials, each divided into two sub-blocks of 20 trials that have either 1.5-second or 3.0-second Inter–Stimulous Intervals varying between sub-block 1 and 2. With the child sitting in front of a computer screen, target pictures (any picture except a soccer ball) and the non-target picture (soccer ball) are presented for 500 milliseconds; the child is instructed to press the keyboard space bar or wired mouse only when target pictures are presented. The purpose of the Conners K–CPT 2 is to aid in diagnoses of attention difficulties (e.g., attention–deficit/hyperactivity disorder; ADHD), clinical assessments, early identification of attention problems, and educational classification. The computer program is contained on a USB drive that may be plugged into a desktop or laptop computer to allow portability. The Conners K–CPT 2 technical manual notes that the measure may be administered by those who do not have advanced formal training in clinical psychology or psychometrics, provided they are trained and follow explicit procedures; however, interpretation must be provided by "suitably–accredited professionals" (manual, p. 3). Details of qualifications are also provided.

Once the Conners K–CPT 2 is administered, score reports (Assessment Report: single administration results, and Progress Report: combined results from 2-4 administrations compared) are generated and results saved on the computer. Scores include Response Style, Detectability (d-prime), Omissions, Commissions, Perseverations, Hit Reaction Time (HRT), HRT Standard Deviation (SD), Variability, HRT Block Change, Omissions by Block, Commissions by Block, HRT Inter-Stimulus Interval (ISI) Change, Omissions by ISI, and Commissions by ISI. All results are defined and described in terms of the attention-related problem. A variety of scores is available (raw scores, T-scores, and percentile ranks), and cautions are provided regarding use of raw scores. Confidence intervals based on internal consistency estimates are also provided to account for measurement error in score interpretation.

DEVELOPMENT

The Conners K–CPT 2 is a revision of the previous version, and a number of modifications were made. The previous version presented white images on a black background; the current version presents black images on a white background, which reduces glare. Another change was the addition of one unscored trial to orient examinees to the task and to prepare them for the scored trials. The age range of the Conners K–CPT 2 was increased to include 6- and 7-year olds who previously would have taken the Conners Continuous Performance Test II (Conners CPT II), which was 14 minutes long. It was observed that children ages 6-7 often had difficulty with the 14-minute version, so the shorter administration time of the Conners K–CPT 2 (7.5 minutes) should better accommodate them. Changes to some scores were also noted to improve psychometric and clinical properties. Changes to Response Style, Perseverations, Commissions, d-prime, response speed consistency, and clinical likelihood were changed from the original version and described in the test manual. Original Conners K–CPT dimensions of attention (inattentiveness, impulsivity, and vigilance) were also redefined and reconceptualized with different indicators (except Impulsivity, which was not changed). The original Conners K–CPT included the option for using ADHD norms, but this option was eliminated based on the observation that different presentations of ADHD produce different profiles; only general population norms are now included.

TECHNICAL

The Conners K–CPT 2 normative sample included 320 children ages 4-7 equally sampled across age and sex/gender (40 in each age x sex/gender group). Stratification variables included race/ethnicity (White, Hispanic, Black, Other), geographic region (Northeast, Midwest, South, West), and parent education level (High School or less, some college, university or higher; a proxy for SES); and sample proportions were close to population-based targets based on the 2010 U.S. Census. The technical manual provides univariate comparisons of demographic proportions from the sample to the population, but no comparisons are made crossing two or more demographic variables, so it is unknown to what extent certain subgroups might be under- or over-sampled. A clinical sample of 152 children ages 4-7 with existing clinical diagnoses was also obtained for psychometric comparisons (reliability, validity, diagnostic utility). Additional criteria were required to be included (single primary diagnosis, qualified professional [e.g., psychiatrist, psychologist] made diagnosis, met DSM–IV–TR or ICD–10 criteria, and appropriate methods [record review, rating scales, observation, and interview] were used in diagnosis. Compared to the normative sample, the clinical sample was disproportionately male (62.5%) and older (6 [32.2%], 7 [46.7%]), with more Black (20.4%) and fewer Hispanic (14.5%) participants. Statistically significant age differences were observed in the normative sample for all Conners K–CPT 2 scores except Commissions and HRT Block Change. Medium to large effect sizes were observed that reflected

developmental changes. No statistically significant sex/gender differences were found among the small effect sizes, and no statistically significant Age x Sex/Gender interactions were observed.

Spearman-Brown corrected split-half reliability estimates were provided to assess internal consistency of Conners K–CPT 2 scores for the normative sample and clinical sample separately for males and females as well as combined sex/gender (but not by age). Internal consistency estimates for the combined normative sample were generally adequate, ranging from .76 to .98. Coefficients for d-prime, Omissions, Commissions, HRT, and HRT SD exceeded .90, with values of .94, .95, .90, .98, and .95, respectively. Standard errors of measurement were estimated with the internal consistency estimates for use in developing obtained score confidence intervals for interpretation. When the assessment question is concerned with estimating the true score of the individual at the time of the evaluation the obtained score confidence interval is appropriate, but if a long-term estimate is desired then the estimated true score confidence interval would be of use (Glutting, McDermott, & Stanley, 1987; Sattler, 2008). In addition to internal consistency estimates, test-retest stability estimates were obtained with a small sample (n = 45) of children from the general population sample assessed at Time 1. The retest interval ranged from 8 to 34 days. Obtained stability coefficients ranged from .05 to .68, and corrected coefficients ranged from .06 to .85. These stability coefficients were reportedly used for estimating critical values for determining significant changes over time. Mean differences from Time 1 to Time 2 were trivial, indicating no meaningful group changes in scores across the retest interval (although it would have been useful to see the distribution of change scores and to know how many individuals had significant changes across the retest interval).

Validity evidence was provided by comparing Conners K–CPT 2 scores between groups that should differ (ADHD [n = 100] vs. matched general population [n = 100]), clinical probability, incremental validity of additive value of Conners K–CPT 2 scores, comparisons to other clinical groups, and comparisons with other variables (general intelligence and executive functions). The ADHD group differed significantly from the matched general sample on d-prime, Omissions, Commissions, and HRT SD with medium to large effect sizes, but not on other attention variables. Probabilities of ADHD diagnoses also increased as a function of higher levels of Conners K–CPT 2 problems and a function of more attention problem areas. Although discriminant function analyses and diagnostic efficiency statistics were not examined with the Conners K–CPT 2 scores correctly classifying individuals to the ADHD or matched general sample, Conners K–CPT 2 scores were examined for incremental improvement of classification of ADHD when added to the Conners Early Childhood–Parent (Conners EC–P; 18:34) in a small validity sample of 18 ADHD and 41 non-clinical participants. Sensitivity and specificity were improved when both measures (Conners K–CPT 2 and Conners EC–P) were used together.

Evidence supporting construct validity of test score use is reported using Conners K–CPT 2 scores and comparing them to scores obtained on measures of other constructs–in this case, intelligence and

executive functioning. Correlations between Conners K–CPT 2 scores and FSIQ scores from the WISC–IV in a small sample (n = 21) were low to near zero, as might be expected with the proposed theoretical independence of these constructs (intelligence and attention), but replication with a larger sample is needed. Correlations between Conners K–CPT 2 scores and CEFI (executive function) scores yielded coefficients that ranged from low/near zero to moderate in a small sample (n = 60).

COMMENTARY

Analyses recommended by reviewers of the original Conners K–CPT were provided for the Conners K–CPT 2 such as test-retest (stability) analyses and effect sizes for discriminative/distinct group differences. Presenting images on a white background to reduce glare and improve visibility appears a useful change. Improvements in reliability and validity evidence appear to have been achieved although there remain a number of lingering shortcomings. Not all Conners K–CPT 2 scores have acceptable reliability estimates for diagnostic use or individual decision–making, which is not surprising for a measure described as a screening measure. Caution is noted in the technical manual that Conners K–CPT 2 scores should not be used alone in diagnostic applications. Although medium to large effect sizes were present for some Conners K–CPT 2 score comparisons between the ADHD group and matched general sample, no logistic regression/discriminant function analyses, diagnostic efficiency statistics (Kessell & Zimmerman, 1993), or receiver operator characteristic curve analyses (Swets, 1996; Treat & Vicken, 2012) were provided for this basic comparison. Also helpful would have been assessment of differential diagnostic utility in differentiating ADHD from other clinical disorders. It was noted several times in the technical manual that various profiles of attention difficulties might be present, and the use of cluster analyses or latent class analyses might help to identify what, if any, empirically defined patterns or profiles exist.

SUMMARY

The Conners K–CPT 2 appears to be an improvement over its predecessor in terms of psychometric features, stimulus presentation, and inclusion of 6- and 7-year-olds. It also appears useful for screening purposes and assisting in providing information on attention variables. Some Conners K–CPT 2 scores have acceptable indices of internal consistency for individual use, but others do not. Stability of scores over a short-term interval produced lower correlation coefficients, but mean scores did not vary much. Some preliminary evidence of validity is provided in the technical manual, but much more is required to help guide interpretation of Conners K–CPT 2 scores.

REVIEWER'S REFERENCES

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establishing confidence limits for test scores. Educational and Psychological Measurement, 47, 607-614.

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Cite this review

Review of the Conners Kiddie Continuous Performance Test 2nd Edition by TRACY THORNDIKE, Associate Professor of Special Education and Education Leadership, Western Washington University, Bellingham, WA:

DESCRIPTION

The Conners Kiddie Continuous Performance Test 2nd Edition (Conners K–CPT 2) is a computer-administered test of attention intended for use with children ages 4 years, 0 months to 7 years, 11 months. The Conners K–CPT 2 provides performance-based information to be used in conjunction with evidence from other sources to aid in identification and diagnosis of a child's attention-related problems.

Additional potential uses include screening, progress monitoring over time, and evaluation of program effectiveness. A testing session consists of a 1-minute practice test followed by 7.5 minutes for the assessment. Two types of reports—one for the initial detailed assessment and another for progress monitoring–are available. Administration and scoring software for the Conners K–CPT 2 is available on a portable USB drive with minimum hardware and software requirements for use clearly specified in the test manual.

The Conners K–CPT 2 uses a "non-X" response paradigm—in which test takers respond to all stimuli except a particular target (in this case a picture of a soccer ball)—and varying time intervals between presentations of stimuli. Age- and gender-specific norms are used to generate 14 scores that, in most instances, are presented as T-scores with 90% confidence intervals and percentile ranks. Higher T-scores indicate poorer performance, and any T-score in excess of 60 is flagged as atypical. Based on the number, magnitude, and pattern of atypical T-scores, estimates of the clinical likelihood of an attention-related disorder in one or more of four dimensions—inattentiveness, impulsivity, sustained attention, and vigilance—are created. When used for progress monitoring, computer-generated reports can compare up to four administrations with differences in T-scores of 10 points or more indicative of significant change. Detailed explanations of scores and guidelines for score interpretation are provided in the test manual and in each section of the redesigned computer-generated report(s).

DEVELOPMENT

While maintaining many key characteristics of its predecessor, the Conners K–CPT 2 features new scores and scoring algorithms that provide more precise information about the specific nature of a child's attention difficulties, an extended upper limit on the recommended age range, redesigned computer-generated reports to facilitate accurate interpretation and reporting of results, and a new larger and more representative norming sample to increase the reliability of norm-referenced score interpretations. Other changes include improved visibility of on-screen stimuli (e.g., glare reduction) and an unscored trial at the beginning of the test to help prepare the child for the assessment.

A pilot study was conducted to evaluate the effectiveness of the proposed changes to the stimulus display and the tenability of expanding the age range. A sample of 119 children ages 6 and 7 years, 93 from the general population and 26 with diagnoses of attention deficit/hyperactivity disorder (ADHD), took the 7.5-minute Conners K–CPT 2 and the 14-minute Conners Continuous Performance Test 3 (Conners CPT 3), which was originally intended for children ages 6 years and older. No issues with visibility of the new display were noted. Given that performance of the 6- and 7-year-olds on the Conners K–CPT 2 and Conners CPT 3 was statistically comparable and a shorter test is both more efficient and developmentally more appropriate, the test publisher now recommends the Conners K–CPT 2 for children ages 4 to 7 years and the Conners CPT 3 for individuals ages 8 years and older.

Analyses of data from larger normative and clinical samples prompted changes to some of the scores from the original Conners K–CPT. Collectively these changes resulted in improved psychometric properties of some individual scores, better differentiation between conceptually different dimensions of attention that had been combined in the previous edition, and more clearly defined variables that should enhance the interpretability of results.

TECHNICAL

Normative information for the Conners K–CPT 2 is based on a stratified sample of 320 children ages 4 to 7 years. The sample is representative of the U.S. population of children in this age range in terms of race/ethnicity, parent education level, and geographic region and includes an equal number of males and females. Norms are grouped by age (4-, 5-, 6-, and 7-year-olds) with separate norms reported for males and females. Data from both the normative sample and an additional sample of 152 children with clinical diagnoses, 100 of whom had been diagnosed with ADHD, were included in analyses estimating the psychometric properties of score-based inferences from the Conners K–CPT 2.

Internal consistency for all scores was estimated using the split-half method and adjusted with the Spearman-Brown formula to estimate reliability of the full-length assessment. Coefficients ranged from .76 to .98 in the combined normative sample with a median value of .87 and from .69 to .98 with a median of .86 in the clinical sample. Indicators of sustained attention had the lowest levels of internal consistency in both samples. Overall, most values are in the acceptable range for internal consistency and indicate that the majority of scores on the Conners K–CPT 2 adequately quantify single facets of attention.

A subset of the standardization sample (n = 45) took the Conners K–CPT 2 on two occasions to estimate score stability over time. Test-retest reliability was calculated over an average interval of 20 days. Reliability coefficients, adjusted for restriction of range, varied from .06 to .85 with a median value of .57. Most scores, with the exception of two indicators of sustained attention, show acceptable levels of stability over time. The test author offers several possible explanations for the low reliability coefficients observed for the two indicators mentioned above, each of which is plausible. However, users may wish to proceed with caution when interpreting these scores, particularly in the context of progress monitoring.

Test scores used in diagnostic decision-making must, at minimum, accurately differentiate between clinical and non-clinical groups to be valid and useful. To establish a case for discriminative validity, data from a sample of 100 children diagnosed with ADHD and 100 children drawn from the normative sample matched to the ADHD group in terms of age, gender, race/ethnicity, parent education level, and

geographic region were used to explore group differences on individual Conners K–CPT 2 scores and the different patterns of scores associated with the four dimensions of attention-related difficulties. Those diagnosed with ADHD had statistically significantly worse performance on most individual Conners K–CPT 2 scores. Additional analyses demonstrated that the probability of having a diagnosis of ADHD increased in the predicted direction based on the number and severity of atypical levels of performance (captured in the clinical likelihood statements).

Additional validation evidence is presented to support the assertion that scores on the Conners K–CPT 2 improve diagnostic accuracy when used to supplement information from behavioral rating scales. The Conners Early Childhood—Parent measure (Conners EC–P) and the Conners K–CPT 2 were administered to a sample of 59 children, 18 of whom had been diagnosed with ADHD, and their parents. Use of the Conners K–CPT 2 improved both diagnostic sensitivity and specificity when used in tandem with the Conners EC–P.

Finally, scores on the Conners K–CPT 2 were compared to those on a measure of general cognitive ability, the Wechsler Intelligence Scale for Children—Fourth Edition (WISC—IV; Wechsler, 2003; 16:262) and a measure of executive function, the Comprehensive Executive Function Inventory Parent Form (CEFI—Parent; Naglieri & Goldstein, 2012; 19:41). As expected, Conners K–CPT 2 scores had small partial correlations with WISC—IV Full Scale scores (median = -0.05) and small to moderate partial correlations with scores on the CEFI (median = -0.34). Attention difficulties are theoretically independent from general cognitive skill but do overlap to some degree with executive function. The observed pattern of correlations in these analyses supports the construct validity of inferences based on scores on the Conners K–CPT 2 about attention-related difficulties.

No additional evidence is presented to support claims that scores on the Conners K–CPT 2 are appropriate or uniquely useful for monitoring changes in a child's attention difficulties over time or for evaluation of intervention program effectiveness for groups of children. Users who wish to use scores on the Conners K–CPT 2 for these purposes are encouraged to gather local validation evidence before making decisions about intervention effectiveness for individuals or groups.

Generalizability across different input devices (keyboard vs. wired mouse), racial/ethnic groups, and U.S./Canadian populations was explored using the normative sample. No substantive differences were found in any of these analyses, supporting use of the Conners K–CPT 2 in a wide range of situations.

COMMENTARY

The Conners K–CPT 2 is an efficient performance-based measure of attention-related difficulties in young children ages 4 to 7 years. Administration and scoring software is portable, and the

hardware/software required to run the program is widely available in multiple settings. New norms based on a larger and more representative sample, an extended age range, and improved psychometric properties of scores make the Conners K–CPT 2 superior to its predecessor.

The test manual includes detailed information about administration, scoring, and score interpretation presented so clearly that even inexperienced test users should find it easy to understand. The redesigned computer-generated reports, which include interpretive information in tabular, graphic, and text-based formats, are so thorough that score misinterpretation seems highly improbable. Detailed step-by-step instructions for score and report interpretation are provided in the test manual, including numerous screen shots and a complete assessment report of an example case. Special topic sections explaining measurement and statistical concepts with which users might be unfamiliar are informative. Important cautions for users are highlighted, which should, if heeded, decrease the likelihood of score misuse.

The major goals for this revision, including a larger, more representative normative sample, improved usability, an expanded age range, and clearer score interpretation have largely been achieved. The Conners K–CPT 2 is a psychometrically adequate assessment that yields estimates of multiple dimensions of attention in an objective manner. Substantial validation evidence supports the use of the Conners K–CPT 2 for its primary intended purpose—providing unique information as part of a broader assessment of a child's attention-related difficulties. Conners K–CPT 2 scores provide different information than can be gained through clinical observation or behavior rating scales, incrementally improving diagnostic accuracy. The appropriateness and utility of scores on the Conners K–CPT 2 for alternative interpretation contexts such as progress monitoring and program evaluation have not been adequately addressed in this revision. Consequently, users are advised to proceed with caution if using scores on the Conners K–CPT 2 for these other applied purposes.

SUMMARY

The Conners K–CPT 2 is a 7.5-minute computer-administered test of attention intended for use with children ages 4 to 7 years. As part of a broad diagnostic assessment battery, scores on the Conners K–CPT 2 provide unique information about different dimensions of attention that helps pinpoint the precise nature of a child's attention-related difficulties. The administration and scoring software is portable, and computers available in most professional settings should easily meet the minimum hardware and software requirements. An expanded age range, clearer definition of variables, and redesigned reports that facilitate accurate interpretation of results enhance the clinical utility of the assessment. A larger, more representative normative sample supports the use of the Conners K–CPT 2 for identification and diagnosis of attention difficulties with a wide variety of groups in multiple settings.

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