The Reliability Paradox of the Parent-Child Conflict Tactics Corporal Punishment Subscale

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Abstract

In the present investigation we consider and explain an apparent paradox in the measurement of corporal punishment with the Parent-Child Conflict Tactics Scale (CTS-PC): How can it have poor internal consistency and still be reliable? The CTS-PC was administered to a community sample of 453 opposite sex couples who were parents of 3- to 7-year-old children. Internal consistency was marginal, yet item response theory analyses revealed that reliability rose sharply with increasing corporal punishment, exceeding .80 in the upper ranges of the construct. The results suggest that the CTS-PC Corporal Punishment subscale reliably discriminates among parents who report average to high corporal punishment (64% of mothers and 56% of fathers in the present sample), despite low overall internal consistency. These results have straightforward implications for the use and reporting of the scale.

Keywords: Parent-Child Conflict Tactics Scale, corporal punishment, reliability, psychometrics, item response theory.

The Reliability Paradox of the Parent-Child Conflict Tactics Corporal Punishment subscale

The Parent-Child Conflict Tactics Corporal Punishment subscale (CTS-PC; Straus, Hamby, Finkelhor, Moore, & Runyan, 1998) is among the most widely used measures of corporal punishment, defined as physical discipline (e.g., spanking and slapping) that falls short of physical abuse. The scale exhibited interparental agreement, suggesting its convergent validity, in Lee et al. (2012). Cross-sectional and prospective associations with constructs in its nomological network, such as parental age, parent-child psychological aggression, intimate partner violence, and child externalizing behaviors (e.g., Straus et al., 1998; Taylor, Guterma, Lee, & Rathouz, 2009; Xing, Wang, Zhang, He, & Zhang, 2011), suggest its concurrent and predictive validity. Such findings support aspects of the scale's validity for measuring interparental differences in the use of corporal punishment.

The reliability of the CTS-PC corporal punishment subscale, however, is a more nuanced issue. Reliability is formally defined as the proportion of total variance accounted for by true score variance ($\sigma^2_{\text{true}} / \sigma^2_{\text{true}} + \sigma^2_{\text{error}}$) per Kim and Feldt (2010). Conceptually it reflects measurement precision – in this case, how well the CTS-PC discriminates among individuals who use corporal punishment to varying extents. By one measure of reliability, the CTS-PC corporal punishment subscale performs well in that it exhibits longitudinal stability (e.g., Maguire-Jack, Gromoske, & Berger, 2012; Xing & Wang, 2013). Yet by another measure of reliability, internal consistency, the scale often exhibits seemingly suboptimal performance. Cronbach's α for the scale frequently hovers just below the .60 mark (e.g., Dietz, 2000; Taylor et al., 2009). Although fixed thresholds for acceptable values of α are difficult to defend, a typical heuristic benchmark for an acceptable α is .70 (e.g., Bland & Altman, 1997); lower alphas are often described with terms such as “undesirable” (.60 to .65) and “unacceptable” (below .60)

(DeVellis, 2012). In classical test theory, low internal consistency suggests an unacceptably high rate of measurement error. From this perspective, the CTS-PC Corporal Punishment subscale's frequently low internal consistency may suggest that it is an imprecise measure of corporal punishment.

From another perspective, however, poor internal consistency may be expected (Shortt, Capaldi, Kim, & Owen, 2006; Straus et al., 1998). Even within the Corporal Punishment subscale, which is by definition restricted to forms of physical punishment with low injury potential, CTS-PC items are built to range from less to more extreme physical discipline tactics per Straus et al. The less extreme behaviors (e.g., spanking and slapping) are typically reported by many parents. By contrast, few parents report using the more extreme behaviors (e.g., shaking). Parents who exhibit less extreme forms of corporal punishment most often do not exhibit more extreme forms of corporal punishment. Accordingly, the correlations among the rarer/more extreme and more common/less extreme behaviors are often fairly low and the rarer/more extreme items often do not have sizable item-total correlations. Alphas are often low despite the fact that (a) the low and high frequency forms of physical discipline measured by the CTS-PC Corporal Punishment subscale all clearly fall within the domain of corporal punishment, and (b) the scale exhibits multiple other indications of psychometric adequacy. Thus in our own work, we have tended not to report α . Yet reviewers have occasionally demanded it (e.g., one of the reviewers of Lorber & Slep, 2015).

In the present investigation we consider and explain the apparent paradox in the measurement of corporal punishment with the CTS-PC: How can it have poor internal consistency and still be a reliable (i.e., precise) measure of parents' varying usage of corporal punishment? We used item response theory (IRT) analyses to probe its reliability in detail. IRT

models allow for the possibility that the reliability of a scale depends on the level of the construct being measured (Embretson & Reise, 2000). We thought it possible that the reliability of the CTS-PC Corporal Punishment subscale would increase at higher levels of corporal punishment, more precisely discriminating among parents who use more corporal punishment. Such variability in measurement precision would not be captured in single estimate measures of reliability such as α . If reliability varied along the corporal punishment continuum, it would explain how the measure could be acceptably reliable despite yielding poor α . Prior to the IRT analyses, we confirmed the unifactorial structure of the Corporal Punishment subscale.

Method

The study described in this paper was approved by Stony Brook University's Committee on Research Involving Human Subjects (Title/Protocol#: Understanding Family Conflict/Models of Partner and Parent Aggression 1010738 1 007685). A more extensive description of the sample and recruitment methods is reported in Slep, Heyman, Williams, Van Dyke, and O'Leary (2006).

Participants

Four hundred and fifty-three opposite sex couples (94.5% married) with 3- to 7-year-old children (51.9% female) were recruited via random digit dialing (RDD) in the suburbs of an American city between 1999 and 2002. To be included, the couples must have been intact and living together for at least one year and the child must have been biologically related to at least one parent. The racial/ethnic composition of the study parents was non-Latino/Hispanic White (81.9% and 79.4%), non-White Latino/Hispanic (7.7% and 9.5%), African-American (5.7% and 6.6%), Asian (2.2% and 1.8%), Caribbean (1.5% and 1.3%), and "other" (0.2% and 0.7%) for mothers and fathers, respectively. The median annual family income was \$71,000 and the mean

years of education were 14.3 and 14.2 for mothers and fathers, respectively. As reported in detail in Slep et al., (2006), the response rate was 45% and the sample demographics were comparable to those of the participants' county of residence, based on US Census data.

Procedures

Both parents from each couple independently completed a battery of questionnaires in separate rooms at a university laboratory, along with other tasks that are not of present focus.

Measure

The 6-item Corporal Punishment subscale of the CTS-PC (Straus et al., 1998) includes the following items: (1) spank on bottom with hand, (2) slap on hand, arm or leg, (3) hit on bottom with object, (4) slap on face, head or ears, (5) pinch, and (6) shake. Response choices reflect the frequency of each behavior's use in the last 12 months: 0 = *never*, 1 = *once*, 2 = *twice*, 3 = *3-5 times*, 4 = *6-10 times*, 5 = *11-20 times*, and 6 = *more than 20 times* during the past 12 months. A final response option, 7, indicates that the behavior was not used in the past 12 months, but was used at some time in the past. This response was recoded as 0 in the present analyses to reflect the absence of the behavior in the past 12 months.

Results

Analyses were conducted with Mplus version 7 software (Muthén & Muthén, 1998-2012). Missing data were handled via full information maximum likelihood methods, allowing for a constant $N = 453$ for all analyses. The rate of missing data was extremely low at 0.15%. Analyses were conducted separately for mothers and fathers.

Descriptive Analyses

Item endorsement probabilities are reported in Table 1. Two behaviors were more common than the others: "spank" and "slap hand, arm, or leg." They were reported by the

majority of parents, with parents endorsing the entire range of response options. Each of the other behaviors were reported by fewer than 20% of parents with a sharp taper in the proportion of parents reporting the higher frequencies.

Confirmatory Factor Analyses

CFAs using the weighted least squares means and variance adjusted (WLSMV) estimator were conducted to verify the unidimensionality of the Corporal Punishment subscales prior to conducting IRT analyses. WLSMV is a common estimator for modeling categorical variables in SEM (Beauducel & Herzberg, 2006). This method treats the factor indicators (i.e., items) in their native ordinal scaling, rather than assuming interval or ratio level scaling as in ordinary CFA. In WLSMV estimation with ordinally-scaled indicators, the probit link is used to measure the relationship between latent factors and their items. All six items were used as indicators of a single corporal punishment variable, its mean set to 0 and variance to 1; factor loadings were freely estimated. Model fit was evaluated against conventional guidelines for acceptable fit: comparative fit index (CFI) and Tucker–Lewis Index (TLI) $\geq .90$ and a root mean square error approximation (RMSEA) $\leq .08$ (Browne & Cudeck, 1993; Kline, 2010). By these standards, model fit was acceptable for mothers' ($\chi^2 [9] = 25.96$, RMSEA = 0.06, CFI = 0.97, TLI = 0.95) and fathers' ($\chi^2 [9] = 14.86$, RMSEA = 0.04, CFI = 0.99, TLI = 0.99) models. Standardized factor loadings ranged from .31 to .85 ($M = .58$), $ps < .001$ (Table 2).

Internal Consistency

As anticipated, Cronbach's α was marginal at .59 for mothers' and fathers' reports. Item-total correlations ranged from .16 to .55 (Table 2).

Item Response Theory Analyses

We next conducted IRT analyses to assess the reliability of the Corporal Punishment

subscale and its individual items in distinguishing among parents in different parts of the distribution of corporal punishment. Samejima's (1997) graded response model (GRM) was selected, reflecting the ordinal response choices of the CTS-PC. This procedure is closely related to categorical CFA, with the primary differences being that the maximum likelihood (ML) estimator and logit link are used. The GRM is a two parameter IRT model in which each item has its own rating scale structure. Seven parameters are estimated per item, one slope (a) and six thresholds (b). The slope ("discrimination parameter") reflects how well the item does in distinguishing among people at different levels of the underlying construct. It is akin to the unstandardized factor loading in CFA. Thresholds ("difficulty" parameters) reflect the points along the underlying latent construct (θ scores, which may be interpreted as z -scores) at which the probability of obtaining the next highest response is .50. With seven-point responses, there are six thresholds because there are six intervals between response categories. To illustrate, consider a case in which the first threshold of the spanking item is -1.5. This indicates that parents who report very little corporal punishment overall (θ score of -1.5; i.e., 1.5 SD s below the mean), have an equal probability of endorsing 0 (no spanking) or 1 (spanked once). With increasing corporal punishment ($\theta > -1.5$), the probability that the parent spanked surpasses .50. The slope and threshold estimates are presented in Table 3.

Rather than providing a single estimate of reliability such as internal consistency, the test information curve (TIC) in IRT reflects how reliably the Corporal Punishment subscale discriminates among parents at various points along the underlying corporal punishment continuum – how much *information* the scale contributes to the measurement of corporal punishment. Mathematically, $\text{reliability} = 1 - (1 / \text{information})$ (Embretson & Reise, 2000). As shown in Figure 1, reliability was low among parents who reported less corporal punishment,

rising to a nominally acceptable level (.70) at approximately 0.4 *SDs* below the mothers' mean ($\sim 36^{\text{th}}$ percentile of estimated theta scores [$\hat{\theta}$]; the equivalent of factor scores in IRT) and 0.2 *SDs* below the fathers' mean ($\sim 44^{\text{th}}$ percentile of $\hat{\theta}$). Reliability rose further at higher corporal punishment, eventually exceeding .80 at 1.6 ($\sim 97^{\text{th}}$ percentile of $\hat{\theta}$) and 0.8 ($\sim 82^{\text{nd}}$ percentile of $\hat{\theta}$) *SDs* above the mean for mothers and fathers, respectively.

Each information curve also plateaued and decreased somewhat at the very high tail of the distribution of corporal punishment, between 2 and 3 *SDs* above the mean. However, this region of the TICs extended beyond the $\hat{\theta}$ maxima observed in the present data: 2.15 and 2.18 for mothers and fathers, respectively. Thus, interpretive caution is warranted. Moreover, the TIC region below the $\hat{\theta}$ minima of -1.08 (mothers) and -0.91 (fathers) is uninterpretable as these minima represent the absence of corporal punishment. Descriptive statistics for $\hat{\theta}$ are presented in Table S1 of the on-line supplement to this article.

The individual items also contributed varying measurement precision along the corporal punishment spectrum, as illustrated in the item information curves (IIC) of Figure 2. IICs are the item-level parallel of TICs. For both mothers and fathers, the items tapping the two most prevalent forms of corporal punishment – slapping the hand, arm, or leg and spanking – contributed the greatest amount of information across the widest range of corporal punishment. For mothers and fathers, the lower frequency items contributed less overall information, increasing at the higher ranges of corporal punishment; most notably for “slap face, head, or ears” and “pinch” in fathers.

Discussion

The present results suggest that the CTS-PC Corporal Punishment subscale is a reliable unifactorial instrument for measuring interparental differences in the use of corporal punishment

despite having internal consistency considered to be unacceptably low by common standards (DeVellis, 2012). Yet reliability was uneven across the range of corporal punishment. IRT analyses revealed that the instrument was weakly able to discriminate among parents who reported less corporal punishment (i.e., lower frequency, variety, and/or severity of physical discipline). From slightly below average to above average corporal punishment – 64% of mothers and 56% of fathers in this community sample – the CTS-PC Corporal Punishment subscale had reasonable measurement precision, with reliability exceeding .70.

An immediate implication of these findings is in the routine estimation of the CTS-PC Corporal Punishment subscale's reliability. Most measures of reliability (commonly Cronbach's α , but see also Raykov's [2012] latent coefficient) provide a single numeric reflection of measurement precision across the entire range of a construct, thus failing to reflect the reasonable ability of the CTS-PC to capture variation at average to high corporal punishment. Alpha is attenuated in measures that contain items that are not strongly associated with the scale's total. Items that are infrequently endorsed tend to have fairly low item-total correlations, yet the present results suggest that such items can make important contributions to distinguishing among parents who report more corporal punishment. Slapping of the face, head, or ears is a good example. Only about 15% of the present mothers and 10% of the present fathers reported its use. Its item-total correlations were not particularly high. Yet this item had the second highest information regarding fathers' average to high corporal punishment. It contributed somewhat less information in the analysis of mothers' reports, but still helped discriminate among mothers reporting more corporal punishment.

Given these findings, we believe that α should not necessarily be reported for the CTS-PC Corporal Punishment subscale. If it is reported, its limitations regarding the CTS-PC

Corporal Punishment subscale should be noted. Alpha may rise to levels considered acceptable in populations with more corporal punishment (e.g., child abusive parents). Yet in populations such as the present community sample, with widely varying corporal punishment, a low alpha yields an incomplete view of reliability, as it fails to capture the adequate reliability of the measure in the mid to upper ranges of corporal punishment. Moreover, users of the measure should not remove items with low item-total correlations in an effort to improve α , as this practice would likely remove low frequency items that contribute to the reliable measurement of the upper ranges of corporal punishment. These less frequently endorsed items require more corporal punishment to be reported before they are endorsed. Their removal may sacrifice measurement precision at the high end of the range of corporal punishment.

A second implication concerns the intended use of the measure. The present results support the use of the CTS-PC Corporal Punishment subscale for applications in which there is a premium placed on reliably measuring average to high corporal punishment. For example, in clinical or clinical research settings, a scale would need to provide especially reliable measurement of the upper ranges of corporal punishment. Approximately 64% of mothers and 56% of fathers in this community sample were in the range of corporal punishment that the scale measures well. Yet the present results do not suggest the adequacy of the CTS-PC Corporal Punishment subscale for measuring variation among parents reporting very little corporal punishment. For example, it may not sensitively assess the gradual initial emergence of corporal punishment in an investigation of normative development. Users should keep these factors in mind when considering the adequacy of the CTS-PC Corporal Punishment subscale for their particular applications.

The purpose of the present article was limited to the narrow scope of considering the apparent paradox of CTS-PC Corporal Punishment subscale's poor internal consistency yet adequate reliability to detect interparental differences in the use of corporal punishment. As described in the Introduction to this article, the results of prior investigations have supported other aspects of its psychometric quality, such as its longitudinal stability, as well as convergent, concurrent, and predictive validity. The present results add to this literature by enriching the understanding of the measure's reliability. They suggest its quality in measuring average to high corporal punishment. Yet they also suggest that there is room for improvement. Its reliability tops out at just above .80. Modern measures of other constructs often exceed that mark by a significant margin (e.g., Funk & Rogge, 2007). Moreover, its reliability is poor at low corporal punishment and only two of the scale's six items measure variability in the mid ranges of corporal punishment. Future modifications of the CTS-PC Corporal Punishment subscale may strengthen its ability to more reliably measure corporal punishment across a wider range of corporal punishment. Adding behaviors to the measure may help achieve this goal. Breaking apart composite items (e.g., slap hand, arm, leg) into their component behaviors may further allow for finer-grained measurement.

Finally, the characteristics of the present sample should be carefully considered as context for interpreting our results. The sample was recruited via RDD, which yielded a group of parents who were demographically comparable to their county of residence. This strengthens confidence in the generalizability of our results to similar populations. Moreover, the parents reported a wide range of corporal punishment, allowing us to evaluate the reliability of the CTS-PC Corporal Punishment subscale across a substantial range of physical discipline. These strengths are balanced against several limitations. The RDD response rate was 45%, which raises

the possibility of an unknown non-random mechanism distinguishing responders from nonresponders. Additionally, the net sample was a predominantly non-Latino white, middle income, suburban sample of two-parent families. The generalizability of our results to other demographic groups (e.g., single, poorer parents) is not assured. Moreover, although 13% of the children experienced severe aggression by either parent (see Slep & O’Leary, 2005), the number of parents reporting very high levels of corporal punishment was limited. Larger samples, and those with more parents who report very high levels of corporal punishment, would likely yield more stable estimates of reliability in the upper reaches of the construct. Nonetheless, the sample was still a valuable one for achieving the primary goal of the paper: resolving the reliability paradox of the CTS-PC Corporal Punishment subscale.

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Table 1

Item Endorsement Probabilities

Item and Reporter	Response						
	(frequency of behavior in last year)						
	0	1	2	3-5	6-10	11-20	>20
Shook							
Mothers	.834	.077	.06	.018	.004	.004	.002
Fathers	.881	.060	.038	.018	.002	.002	-
Hit on bottom with object							
Mothers	.870	.040	.046	.033	.009	.002	-
Fathers	.881	.044	.035	.022	.015	.002	-
Spank							
Mothers	.369	.100	.178	.189	.093	.053	.018
Fathers	.448	.102	.144	.175	.067	.029	.035
Slap hand, arm, leg							
Mothers	.471	.064	.146	.190	.093	.027	.009
Fathers	.577	.077	.148	.115	.042	.022	.018
Pinch							
Mothers	.887	.033	.046	.013	.015	.004	-
Fathers	.892	.029	.042	.022	.013	.002	-
Slap face, head, ears							
Mothers	.848	.091	.038	.020	.004	-	-
Fathers	.896	.026	.053	.022	.002	-	-

Table 2

Confirmatory Factor Analysis Loadings and Item-Total Correlations

Item	Standardized		Item-total	
	CFA Loadings		Correlations	
	Mothers	Fathers	Mothers	Fathers
Shook	.47	.46	.27	.21
Hit on bottom with object	.31	.37	.16	.17
Spank	.67	.64	.47	.45
Slap hand, arm, leg	.82	.85	.54	.55
Pinch	.58	.58	.32	.30
Slap face, head, ears	.54	.69	.30	.39

Table 3

Item Response Theory Analysis Parameters

	Slopes	Thresholds (<i>b</i>)					
Item, Reporter	(<i>a</i>)	1	2	3	4	5	6
Shook							
Mothers	0.91	1.86	2.64	3.88	4.87	5.39	6.51
Fathers	0.93	2.31	3.12	4.18	5.82	6.52	-
Hit on bottom with object							
Mothers	0.57	2.01	2.43	3.21	4.64	6.27	-
Fathers	0.82	2.23	2.77	3.47	4.32	6.43	-
Spank							
Mothers	1.66	-0.82	-0.22	0.87	2.34	3.54	5.19
Fathers	1.55	-0.29	0.29	1.15	2.58	3.55	4.28
Slap hand, arm, leg							
Mothers	2.62	-0.24	0.27	1.51	3.62	5.76	7.54
Fathers	2.60	0.64	1.30	2.76	4.45	5.54	6.58
Pinch							
Mothers	1.30	2.62	3.07	4.10	4.66	6.22	-
Fathers	1.41	2.77	3.17	4.08	5.05	7.03	-
Slap face, head, ears							
Mothers	1.21	2.14	3.27	4.32	6.10	-	-
Fathers	2.00	3.35	3.77	5.27	7.84	-	-

Figure 1. Test information curves for mother-to-child and father-to-child corporal punishment. Sample $\hat{\theta}$ ranged from -1.08 to 2.15 (mothers) and -0.91 to 2.18 (fathers).

Figure 2. Item information curves for mother-to-child and father-to-child corporal punishment. Sample $\hat{\theta}$ ranged from -1.08 to 2.15 (mothers) and -0.91 to 2.18 (fathers).

Table S1. *Descriptive Statistics for Corporal Punishment Estimated Theta Scores*

	Mothers	Fathers
Minimum	-1.08	-0.91
Maximum	2.15	2.18
Percentiles		
25	-0.62	-0.91
50	-0.04	-0.14
75	0.60	0.63

Note. Estimated theta scores ($\hat{\theta}$) are derived by the expected a priori (EAP) method from the IRT models reported in the main article.