Title	**Evaluating the risk of child abuse: the Child Abuse Risk Assessment Scale (CARAS)**
Author(s)	**Chan, KL**
Citation	**Journal of Interpersonal Violence, 2011, v. 27 n. 5, p. 951-973**
Issued Date	**2011**
URL	**http://hdl.handle.net/10722/134457**
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Journal of Interpersonal Violence
XX(X) 1–23

DOI: 10.1177/0886260511423252
http://jiv.sagepub.com
SAGE

Evaluating the Risk of Child Abuse: The Child Abuse Risk Assessment Scale (CARAS)

Ko Ling Chan[1]

Abstract

The present study developed the Child Abuse Risk Assessment Scale (CARAS), an actuarial instrument for the assessment of the risk of physical child abuse. Data of 2,363 Chinese parents (47.7% male) living in Hong Kong were used in the analyses. Participants were individually interviewed with a questionnaire assessing their perpetration of child abuse and some theoretically or empirically tested factors associated with child abuse. Using the split-half validation procedure, the 5-factor, 64-item CARAS was created and validated. When applying to the second half of the split sample, the CARAS had a sensitivity of 81.9%, a specificity of 77.8%, and an overall accuracy of 78.1%. The area under the receiver operating characteristic curve (AUC) was .91. Overall, our findings showed that the CARAS is a simple, systematic and validated instrument identifying at-risk population of child maltreatment in Chinese societies.

Keywords

child abuse, risk assessment, prediction, Chinese

[1]University of Hong Kong, Pokfulam, Hong Kong

Corresponding Author:
Ko Ling Chan, Department of Social Work and Social Administration, University of Hong Kong, Pokfulam, Hong Kong
Email: eklchan@hkucc.hku.hk

Accurate evaluation of the risk or potential of child maltreatment has been one of the most important but challenging tasks in preventing violence against children. Current common practice in risk evaluation, which is the basis of professional decisions whether, and if so how, to protect at-risk children, requires a reliable and accurate assessment of the likelihood of future violence (Shlonsky & Wagner, 2005). However, human decision making is prone to errors and bias (Kahneman & Tversky, 1982). Without assistance, risk predictions may be unwarranted and erroneous, and the resulting inaccurate evaluations may, in turn, result in harm being caused to children. For example, missed predictions may mean abusive acts go undetected, whereas false alarms may lead to unnecessary interventions and even the unwarranted separation of children from their parents. To prevent children from suffering any further harm, risk assessment must be made as accurately and consistently as possible (Baird, Wagner, Healy, & Johnson, 1999). This is often achieved by using a formal risk assessment tool for assistance.

Existing Child Abuse Risk Assessment Tools

A number of risk assessment tools are commonly used to capture actual child abusive acts as well as to estimate the risk of violence recidivism. Examples include the Washington Risk Assessment Matrix (WRAM) developed by the Washington State Social Service Agency in1986, and the California Family Risk Assessment (the Fresno Model) developed in Illinois in the United States. These risk assessment tools have been demonstrated to have satisfactory performance in estimating the risk of future child maltreatment based on the history of past violence incidents (Baird & Wagner, 2000).

Evaluation of recidivism risk of child maltreatment among families with current violence is extremely important; however, the importance of identifying at-risk population from general public should not be omitted. Yet most existing risk assessment tools may not be suitable to apply to general population. One reason is the limited generalizability of the predictive power of the tools resulted from the use of clinical or convenience samples recruited from clients of child protective services in testing the tools' reliability and validity (Brewer, 2000; Camasso & Jagannathan, 1995; Kolko, 1998; Mossman, 2006). Another issue concerns the use of current or past abusive behaviors to predict future child maltreatment. At-risk population may not have a history of child maltreatment, and risk assessment tools that rely on past violence incidents to predict future risk may not be effective in screening or identifying at-risk population who do not have maltreatment history.

To estimate the potential of child maltreatment and identify at-risk population from general public, Milner (1986) developed the Child Abuse Potential (CAP) Inventory, a 160-item self-report questionnaire of which past child abusive incidents are not necessary for determining child abuse potential. There are 77 items in its physical abuse subscale, which are divided into 6 main factors: distress (36 items; for example, anger, depression, loss of control, etc.), rigidity (14 items; for example, the belief that a child should always be obedient), unhappiness (11 items; for example, lack of personal fulfillment, loneliness, etc.), problems with child and self (six items; for example, having a problematic or trouble-making child), problems with family (four items; for example, having family members that are fighting), and problems with others (six items; for example, believing that someone makes one's life hard). Other subscales include lie, random response, and inconsistency scales, which are to ensure the validity of responses made by caretaker reporters. Rather than being used to be an investigatory tool or a judge or jury, the CAP inventory is to be used for prevention of child maltreatment by screening at-risk families in public.

Factors Associated With Child Abuse

In order to improve the accuracy and reliability of professional predictions of the risk of child abuse, researchers have consistently put effort to identify factors associated to child abuse or maltreatment and its disclosure. Among them, a number of factors are parent related, for example, anger expression and management skills (Denicola & Sandler, 1980; Rodriguez & Green, 1997; Sanders et al., 2004), depression (Chaffin, Kelleher, & Hollenberg, 1996; Shay & Knutson, 2008), substance abuse (Chaffin et al., 1996; DeBellis et al., 2001; Smith, Johnson, Pears, Fisher, & DeGarmo, 2007), life stresses and parenting stresses (Chan, 1994; Crouch & Behl, 2001; Milner, 2000; Rodriguez & Green, 1997), violence approval (Straus et al., 1999), experience of using corporal punishment in the past (Crouch & Behl, 2001; Straus & Kaufman-Kantor, 1994), experience of intimate partner violence (IPV; DeGarmo, Patterson, & Forgatch, 2004; Hazen, Connelly, Kelleher, Landsverk, & Barth, 2004), experience of in-law conflict (Chan et al., 2009), experience of witnessing parental IPV during childhood (Cappell & Heiner, 1990; Doumas, Margolin, & John, 1994), experience of suffering from physical or sexual abuse during childhood (Belsky, 1980; Hall, Sachs, & Rayens, 1998), lack of social support (Albarracin, Repetto, & Albarrac, 1997; Chan, 1994; Kitamura, Takauma, Tada, Yoshida, & Nakano, 2004), self-esteem (Oates & Forrest, 1985; Shorkey, 1979), financial stresses such

as poverty and unemployment (Drake & Pandey, 1996; Freisthler, Merritt, & LaScala, 2006; Gillham et al., 1998), and social desirability (Rosenbaum & Langhinrichsen-Rohling, 2006).

The present study undertook the development and initial validation of a risk assessment tool for physical child abuse—the Child Abuse Risk Assessment Scale (CARAS)—using a pool of potential risk factors covering parental characteristics. Following the CAP inventory, the CARAS was developed as a tool for use in identifying at-risk population from general public rather than for application solely in court or child protective authorities as a judge. Using a concept-based approach, the CARAS was developed with various risk factors that have been found related in child maltreatment literature. Taking into consideration the need for a risk assessment instrument that can be applied to the general population, the CARAS was developed using a representative sample of households in Hong Kong.

The CARAS would be different from existing risk assessment tools by the following:

1. The inclusion of personal and family risk factors and exclusion of sensitive items about previous or current child abuse or neglect to evaluate future risk of perpetration of child abuse. The use of personal and family factors other than previous perpetration of child abuse would make the CARAS a less sensitive instrument, which may otherwise be effective in reducing underreporting caused by social desirability.
2. The inclusion of different risk factors in the scale, which could give a profile of the parent respondent for professionals to follow up. Rather than providing only the score and risk or probability of perpetrating child maltreatment, the CARAS also provides scores of different risk factors of child maltreatment for each respondent. This offers a concrete basis for professionals to tailor make prevention or intervention programs for the clients.
3. The use of a large and representative sample in its development and validation. Existing risk assessment tools are mainly developed using clinical or convenience samples, for example, criminal records and child protection service records. Whether their performance can remain satisfactory when used on general populations is uncertain. On the other hand, the present study developed and validated the CARAS with a representative sample of Chinese parents and intended to obtain a reliable and validated assessment tool for predicting risk of child abuse perpetration that was especially suitable for use in the Chinese populations.

Method

Sample

The present study employed a subsample of the data in a representative household population study on family violence in Hong Kong in 2004. In the 2004 study, eligible households were selected using a random sampling procedure from the Register of Quarters maintained by the Census and Statistics Department of the Government of Hong Kong, which was the most up-to-date and complete sampling frame available in Hong Kong. All Chinese family members who spoke Cantonese, Mandarin, or English and were able to give informed consent during the study period were invited to participate. All eligible family members who had agreed to participate were interviewed face to face by trained interviewers. A total of 5,049 Chinese adults were interviewed individually and separately, representing a response rate of 71%. About 46.4% were male and 53.6% were female. About 88.5% were married and a further 6.4% were widowed. Only about 1.9% were in a cohabiting union with their intimate partner. For items on sensitive topics, respondents were provided with a separated, self-administered questionnaire that was to be completed and sealed in an envelope by the respondents themselves. This was to ensure respondents' privacy and to avoid their partners knowing their disclosure of any IPV. Upon completion of the interview, respondents were also given a card containing information about social services related to violence prevention. All procedures were approved by the Ethics Committee of the University of Hong Kong (for more detailed information on recruiting and surveying procedures, see Chan, Brownridge, Tiwari, Fong, & Leung, 2008).

A subsample of the data, which comprised all records of parent respondents of the 2004 study, was used. In the present study, 2,363 parents (47.7% male) were included, with a modal age group of 35 to 54 years.

Measures

In developing the CARAS, we included items pulled from existing scales. Unless otherwise specified, all scales were translated into Chinese using the back-translation procedure, and all scale scores were calculated by dividing the sum of item scores by the number of items. Brief description, sample items, and Cronbach's alpha values of the measures employed are listed in Table 1.

Child abuse. We employed the 7-item physical maltreatment subscale of the Parent-Child Conflict Tactics Scale (CTSPC; Straus, Hamby, Finkelhor, Moore, & Runyan, 1998) to assess any child abuse perpetration by the parent

Table 1. Brief Descriptions, Number of Items, and Cronbach's Alphas of the Scales Used in Developing the CARAS

Scale	Brief description	Number of items	Cronbach's alpha	Scale scoring
PRP				
Anger management	The extent to which the respondent being able to control anger using different ways	6	.43	Average of item scores
Violence approval	The extent of which the respondent accepts using physical force as a proper way to respond to varying interpersonal situations	9	.74	Average of item scores
Depressive symptoms	The level of disturbances in mood and dysphoric cognitions the respondent is suffering	8	.69	Average of item scores
Social desirability	The degree to which the respondent will tend to avoid admitting undesirable behavior such as assault or other crime	13	.60	Average of item scores
Stressful conditions	The extent of stress and hassles experienced by the respondent	10	.77	Average of item scores
Substance abuse	The excessive use of alcohol or other mind-altering drugs	7	.96	Average of item scores
Alcohol abuse		3	.90	
Drug abuse		4	.98	
Childhood witnessed parental IPV	The experience of witnessing any of the physical, psychological and sexual IPV between the respondent's parents during respondent's childhood—derived from the Revised Conflict Tactics Scale (CTS2)	26	.75	1 or 0
In-law conflict	Previous experience of verbal or physical conflict with father-in-law and mother-in-law	2	—	Average of item scores
Social support	The level of feeling supported in life or having someone to offer help when needed—derived from the Family Needs Screener	10	.72	Average of item scores

(continued)

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1 or 0

Table 1. (continued)

Scale	Brief description	Number of items	Cronbach's alpha	Scale scoring
Self-esteem	The extent of worth the respondent sees in him or herself—derived from the Rosenberg Self-Esteem Scale	10	.73	Average of item scores
Sexual abuse history	Previous experience of victimization of sexual assault	4	.74	1 or 0
Criminal history	The experience of committing various criminal or antisocial acts in the respondent's lifetime	8	.82	1 or 0
Preceding-year IPV	The experience of perpetration and victimization of any of the physical, psychological, and sexual IPV as well as injury in the preceding year——derived from the CTS2.	33	.88 to .96	1 or 0
Preceding-year corporal punishment	The experience of perpetration of corporal punishment against their children in the preceding year—derived from the CTSPC.	4	.71	1 or 0

Note: CARAS = The Child Abuse Risk Assessment Scale; CTSPC = Parent-Child Conflict Tactics Scale; IPV = Intimate Partner Violence.

respondents in the year preceding the survey interview. Sample items include "hit with a fist or kicked hard" and "burned or scolded on purpose." Items were rated on a forced-choice, binary scale (yes/no). Respondents who reported the use of any type of physical child abuse would score "1" for this factor. The psychometric characteristics of the CTSPC, including its reliability and discriminant and construct validity, have been well documented (Straus et al., 1998). In the original study by Straus et al., the internal consistency of the physical maltreatment subscale was .55, and the test–retest reliabilities ranged from .49 to .80. In the present study, the Chinese version of CTSPC, which had been widely used in research among the Chinese populations (e.g., Chan, Brownridge, Yan, Fong, & Tiwari 2011; Lau, 2010, Tang, 2006), demonstrated satisfactory reliabilities (Cronbach's alpha = .76).

Anger management. The anger management subscale of the Personal and Relationship Profile (PRP) (Straus et al., 1999) was used to assess respondents' ability to control anger using different ways such as self-soothing and self-talk. The subscale consists of six items, which were rated using a 4-point Likert-type scale (1 = *strongly disagree*, 4 = *strongly agree*). Sample items included "I can calm myself down when I am upset," and "There is nothing I can do to control my feelings when my family member hassles me (reverse item)."

Violence approval. The violence approval subscale, also derived from the PRP, was used to measure the level of acceptance of the use of physical force as a proper way to respond to different situations such as being hit by others and disciplining children. The nine items of the subscale were rated using a 4-point Likert-type scale (1 = *strongly disagree*, 4 = *strongly agree*). Sample items included "I can think of a situation when I should approve of a husband slapping a wife's face," and "It is sometimes necessary to discipline a child with corporal punishment."

Depressive symptoms. The 8-item depressive symptoms subscale of the PRP, rated using a 4-point Likert-type scale, was used to capture the experience of mood disturbances and dysphoric cognitions that the respondent was suffering. Samples included "I feel sad quite often," and "I have thought about killing myself." There was no specific timeframe set for the items in this scale, and respondents were asked to report their current status during the interview.

Social desirability. The social desirability subscale of the PRP measured the tendency of the respondent to avoid admitting undesirable behavior such as partner assault and other forms of crime. The subscale consists of 13 items such as "I am always willing to admit it when I make a mistake" and "I am always courteous, even to people who are disagreeable." All items were rated with a 4-point Likert-type scale (1 = *strongly disagree*, 4 = *strongly agree*); the higher the score, the higher the tendency for the respondent to deny undesirable behaviors.

Stressful conditions. The stressful conditions subscale of the PRP consists of 10 items assessing the extent of stress and hassles experienced by the respondent. Sample items include "My partner often nags me," and "This is a very stressful time for me." Items were rated using a 4-point Likert-type scale; the higher the score, the higher the level of stress and hassles.

Substance abuse. The experience of excessive use of alcohol or other mind-altering drugs was captured by the alcohol abuse (three items) and drug abuse (four items) subscales. The items were rated against a 4-point Likert-type scale, and a higher score indicated a greater extent of substance abuse.

Childhood-witnessed parental violence. Three subscales of the Chinese version of Revised Conflict Tactics Scale (CTS2; Chan, 2004), which were physical assault, psychological aggression, and injury, were used to assess the experience of witnessing parental IPV during the respondent's childhood. The internal consistencies of the CTS2 subscales were satisfactory to excellent, with Cronbach's alpha ranging from .79 to .95 in the initial study (Straus, Hamby, Boney-McCoy, & Sugarman, 1996). The time frame of all items was modified and restricted to childhood. All items were rated using a 2-point scale (Yes or No). Any experience of witnessing IPV between parents reported by respondents was coded as "having witnessed parental violence" and scored "1" for this factor. On the other hand, respondents having no history of witnessing parental IPV during childhood would score "0" for this factor.

In-law conflict. The in-law conflict was developed and proved to be associated with partner violence (Chan et al., 2009). The frequency of in-law conflict was assessed using two items (one concerning father-in-law and the other concerning mother-in-law). Respondents were asked to report the number of incidences of conflict (verbal or physical) with their parents-in-law over the previous 12 months. The response categories were 0 = *never*, 1 = *once*, 2 = *twice*, 3 = *3 to 5 times*, 4 = *6 to 10 times*, 5 = *11 to 20 times*, 6 = *20 times or more*, and 0 = *none in the past 12 months, but it has happened before*.

Social support. The social support scale of the Family Needs Screener (FNS; Kantor & Straus, 1999) was adopted to measure the degree of self-perceived social support provided by others when the respondent was in need. The 10 items were rated using a 4-point Likert-type scale (1 = *strongly disagree*, 4 = *strongly agree*), and samples include "There is someone who makes me feel confident," and "There is someone from whom I can borrow money in an emergency." The scale was translated into Chinese version and was demonstrated a satisfactory reliability (Chan, 2010).

Self-esteem. The Rosenberg Self-Esteem Scale (Rosenberg, 1965) was used to measure the extent of worth the respondent saw in him or herself. The 10 items were rated using a 4-point response scale ranging from 1 = *strongly*

disagree to 4 = *strongly agree*. The higher the score, the higher the respondent's self-esteem. Sample items include "I take a positive attitude toward myself," and "At times I think I am no good at all (reverse item)."

Sexual abuse history. Four yes/no items were used to assess the respondent's lifetime experience of sexual abuse. Respondents were asked (1) whether they had been forced to touch someone in a sexual way, (2) whether someone had touched them in such a way, (3) whether they had ever been forced to have anal or oral sex with someone, and (4) whether someone had carried out other behaviors with them, which they considered or interpreted as sexual coercion. Respondents who reported any of the above experience would score "1" (otherwise "0") for this scale.

Criminal history. Eight yes/no items were used to capture the criminal history of the respondents. The criminal or antisocial acts assessed include "abusing children," "having been arrested," and "hitting or threatening others." Respondents who chose "yes" in any of the above items would score "1" (otherwise "0") for this scale.

Preceding-year IPV. The respondents were asked whether they had experienced any intimate partner violence (IPV) in the year preceding the interview. Their experience of perpetration and/or victimization of IPV were measured by the physical violence, psychological aggression, sexual abuse, and injury subscales of the Chinese version of the CTS2 (Chan, 2004). The 33 items of the Chinese CTS2 were rated using a yes/no response scale. Respondents who reported experience of perpetrating any kind of IPV in the preceding year were coded as "being a perpetrator of IPV" (and scored "1" for this factor); and those who reported having been victimized by IPV were coded as "being a victim of IPV" (and scored "1" for this factor).

Preceding-year corporal punishment. Respondents were also asked whether they had used corporal punishment on their children in the preceding year with the use of a modified subscale of the CTSPC. There were six yes/no items in the subscale, including items such as "hit on bottom by bare hand" and "shook your child." Respondents who reported inflicting any kind of corporal punishment on their children were coded as "being a perpetrator of corporal punishment" (and scored "1" for this factor).

Demographic and socioeconomic characteristics. Respondents were interviewed using a series of items covering age, education level, work status, and income, whether they had chronic illness, whether they had any disability, whether they (or their wives) were pregnant, whether they were new immigrants to Hong Kong, and whether they were receiving social security.

Statistical Analyses

We used the split-half validation procedure to examine the accuracy of the newly developed risk assessment tool in predicting the risk of child abuse. The sample was split randomly in two: one for identification of significant predictors of child abuse, and the other for cross-validation. With the first half of the sample, separate univariate logistic regression analyses would be used to find out the odds ratios (ORs) for the association between the perpetration of physical child abuse and individual risk factors. All significant risk factors were then included in the subsequent multivariate stepwise logistic regression analysis, which gave the best set of predictors for physical child abuse. This set of factors was validated with the second half of the sample, and the sensitivity, specificity, and overall accuracy were obtained for further comparison.

A receiver operating characteristic (ROC) curve was also compiled from the results from the regression analyses. The ROC curve is a graph plotting sensitivity against 1 specificity, and thus, a graphical representation of the tradeoff is made possible between the positive and negative predictive values at every possible cutoff. The accuracy of assessment tools is usually measured by the area under the curve (AUC). The AUC ranges from 0.50 to 1, and a higher value indicates a greater effectiveness of the assessment tool.

Results

Sample Characteristics and the Prevalence of Physical Child Abuse

Table 2 shows a summary of the demographic characteristics of the split samples. Results from the chi-square tests revealed no significant difference in the demographic profile between the two randomly split samples.

With the present sample, the lifetime incidence of physical maltreatment at severe and very severe levels was 112 (9.5%), whereas the incidence of such violence in the preceding year was 66 (5.6%).

Selection of the CARAS Items

Results of the univariate logistic regression analyses are listed in Table 3. The dependent variable was defined as the presence of preceding-year physical maltreatment at severe and very severe levels as measures by the

Table 2. Demographic Profile of the Two Randomly Split Samples

Characteristic	*n* (%) First half (*n* = 1,181)	*n* (%) Second half (*n* = 1,182)	χ^2
Age group			
Under 34	136 (11.5)	148 (12.5)	3.239
35 to 54	969 (82.0)	976 (82.6)	
55 or above	76 (6.4)	58 (4.8)	
Disability	8 (0.7)	~~0.2~~ 2 (0.2%)	3.620
Income group[a]			
No income	333 (28.2)	363 (30.7)	1.988
~~US~~$4,999 or below	117 (9.9)	108 (9.1)	
~~US~~$5,000 or above	729 (62.0)	710 (60.1)	
In-law conflict	56 (4.7)	47 (4.0)	0.830
Mother pregnancy	37 (3.1)	47 (4.0)	1.501
New immigrant of Hong Kong	383 (32.4)	365 (30.9)	0.656
Receiving social security	90 (7.6)	95 (8.0)	0.135
Unemployed	389 (32.9)	426 (36.0)	2.517

Note: N = 2,363.
a. In Hong Kong dollars (HKD). 1 HKD = 0.128 USD.
*$p < .05$.

CTSPC. Of all factors, 16 had a significant *OR* (all $p < .05$) and were included in the subsequent multivariate logistic regression analysis. Table 4 **[AQ: 1]** shows the set of factors in the final regression model, including anger management, stressful conditions, violence approval, being a victim of IPV in the preceding year, and using corporal punishment on children in the preceding year (all $p < .05$; Nagelkerke $R^2 = .39$).

The five significant factors were grouped to form an assessment tool for the child abuse risk in the Chinese population. The 64-item assessment tool was named *The Child Abuse Risk Assessment Scale (CARAS)*.

Determination of the Optimal Cutoff Score

In the present study, we selected a cut-off score at 11%, at which the sensitivity and specificity rates met. At this cutoff, the sensitivity and specificity values were found to be 84.1% and 81.7%, respectively. The positive predictive

Table 3. Odds Ratios of the Risk Factors as Found With Univariate Logistic Regression Analyses

Risk factor	Odds ratios
Anger management	0.213***
Child witnessed parental violence	1.663
Chronic illness	2.664**
Criminal history	4.202***
Depressive symptoms	3.482**
In-law conflict	4.756***
New immigrant to Hong Kong	1.577
Receiving social security	3.882***
Self-esteem	0.247**
Sexual abuse history	2.890
Social desirability	0.209**
Social support	0.216***
Stressful conditions	7.637***
Substance abuse	
Alcohol abuse	2.306*
Drug abuse	3.722*
Violence approval	7.844***
Violence experience in the preceding year	
Being an IPV perpetrator	1.012***
Being an IPV victim	1.015***
Being a perpetrator of corporal punishment	1.045***

Note: Dependent variable = presence of preceding-year physical maltreatment at severe and very severe levels as measures by the CTSPC; IPV = intimate partner violence; OR = odds ratios.
*$p < .05$. **$p < .01$. ***$p < .001$.

value, which is the percentage of correct prediction of occurrence, and the negative predictive value, which is the correct prediction of nonoccurrence, were 21.9% and 98.8%, respectively. The overall accuracy for the correct prediction of both occurrence and nonoccurrence was 81.8%.

Scoring of the CARAS

Based on the results obtained from the logistic regression analysis, the scoring procedures of the CARAS were

Table 4. The Final Multivariate Stepwise Logistic Regression Model

Risk factors	*B*	*SE*	Wald χ^2 (*df* = 1)	Odds ratio (95% CI)	Model LL	Change in –2LL
Anger management	–0.970	0.456	4.532	0.379 (0.155, 0.926)*	–160.461	4.590
Stressful conditions	1.098	0.513	4.574	2.997 (1.096, 8.193)*	–160.515	4.699
Violence approval	1.091	0.468	5.436	2.977 (1.190, 7.449)*	–161.125	5.919
Being an IPV victim in the preceding year	0.010	0.004	6.940	1.010 (1.003, 1.017)**	–161.429	6.528
Using corporal punishment in the preceding year	0.042	0.007	32.921	1.042 (1.028, 1.057)***	–211.587	106.844
Constant	–8.213	2.106	15.205	—	—	—

Note: $N = 1{,}181$. Dependent variable = presence of preceding-year physical maltreatment at severe and very severe levels as measures by the CTSPC; IPV = intimate partner violence; LL = log likelihood; CI = confidence interval. Nagelkerke R^2 of the final model = .39.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 5. Rates of Hits, Correct Rejections, Misses and False Alarms of the Second Half of the Split Sample Based on a Cutoff Score of 11%

	Predicted					
	Did not happen		Happened		Total	
Actual	*n*	%	*N*	%	*N*	%
Did not happen	859 (correct rejections)	72.7	246 (false alarms)	20.8	1,105	93.5
Happened	14 (misses)	1.2	63 (hits)	5.3	77	6.5
Total	873	73.9	309	26.1	1,182	100

Note: *N* = 1,182. Sensitivity = hits / total happened = 63/77 = 81.9%; specificity = correct rejections/total not happened = 859/1,105 = 77.8%; overall accuracy = correct rejections + hits = 72.7% + 5.3% = 78.0%.

$$V = -8.213 - 0.970\,(\text{Anger Management}) + 1.098\,(\text{Stressful Conditions}) + 1.091\,(\text{Violence Approval}) + 0.010\,(\text{Preceding-Year IPV Victimization}) + 0.042\,(\text{Preceding-Year Corporal Punishment Perpetration})$$

$$P(\text{risk}[v]) = \exp[V] / (1 + \exp[V])$$

The cutoff probability was 11%; that is, individuals whose $P(\text{risk}_{[v]})$ were higher than 11% were identified as "potential physical child abuse perpetrator" in the present study.

Validation of the CARAS

The CARAS was validated with the second half of the randomly split sample. Table 5 shows the rates of hits, correct rejections, misses, and false alarms of the second half of the split sample. The sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy of the CARAS with the second half of sample were 81.9%, 77.8% 20.5%, 98.4%, and 78.0%, correspondingly.

To evaluate the tradeoff between sensitivity and specificity over all possible cutoff probabilities of the CARAS, a maximum likelihood estimate of the ROC using the present sample of parent respondents was obtained. The AUC with the present data was 0.91 (95% CI = 0.88, 0.94), which was significantly greater than 0.50 under the 45-degree reference line ($p < .001$).

Discussion

Using a large and representative household sample of Chinese parents, we developed a risk assessment tool—the CARAS—for the assessment of future risk of physical child abuse and the identification of at-risk population from the general public. The CARAS is a five-factor, predominantly actuarial instrument designed for self-reporting, which demonstrated a good performance in the preliminary validation procedure in the present study. Wald and Woolverton (1990[AQ: 2]) have noted a lack of empirically validated child abuse risk assessments despite their wide application in different child protective service contexts. The CARAS is among the first to be validated empirically, and provides a systematic, reliable, and valid instrument for the estimation of child abuse risk among the general population (Shlonsky & Wagner, 2005).

The CARAS has potential to be a promising tool for identifying families at-risk of physical child abuse. Being developed with a large and representative Chinese population, the CARAS could be considered as highly generalizable and especially suitable for applying in Chinese populations. The inclusion of less sensitive or crime-related items, such as parental anger management and violence approval, probably allows the CARAS to reduce the influence of social desirability and may hence increase the probability for professionals to obtain frank responses from parents.

One main differentiating advantage of the CARAS over existing risk assessment tools is the exclusion of items asking past or current child abuse incidents, which are believed to be sensitive and causing underreporting or inaccurate responses by reporters. The CARAS, which evaluates risk of child abuse perpetration without assessing history of child abuse, may also be effective in detecting potential perpetrators who have no prior experience of violence perpetration.

The CARAS is consisted of five subscales, of which “anger management” and “violence approval” assess one’s strategies to manage anger and attitude toward violence in general, and “stressful conditions” asks about one’s stresses in daily life. The remaining two subscales were related to violence, assessing one’s experience of IPV victimization, and use of corporal punishment against children. The former is not directly related to child maltreatment, and the latter is a minor form of child maltreatment. Yet, even corporal punishment is a form of child maltreatment; it is not considered as criminal in many countries and would not be charged or punished when parents admit using it. Therefore, it is believed that the CARAS is less stigmatizing than

other existing risk assessment tools, which directly asks about the child maltreatment behaviors.

Another strength of the CARAS is that it offers a score for each risk factor (subscale) along with the overall risk of child maltreatment. Since all subscales of the CARAS were derived from existing, validated scales assessing the risk factors, for example, "anger management" and "violence approval" from the PRP scales, their individual scores can be interpreted separately to indicate the level and influence of each risk factor. Rather than simply classifying the parents as at-risk or not, the scale provides, in addition to the overall risk, a profile of personal or family risk factors that the parents are having. By understanding the unique profile of each parent client, professionals are able to tailor make suitable prevention or intervention strategies for each family to prevent or stop child maltreatment.

The CARAS is straightforward and easy to use, and future use may improve its practicality in the child protective services context. Frontline service providers may adopt this user-friendly instrument without extensive knowledge of statistics or requiring training in its scoring and rating procedures. In fact, the CARAS is designed to allow self-reporting, and it is even feasible to be completed by parents entirely. Being less dependent on professionals for the completion of the instrument may help overcome the problems of increased demands on child protective services in an era of declining staff resources (Shlonsky & Wagner, 2005). In addition, the use of self-reporting may minimize the chances of bias that may be present in professional rating procedures (Dawes, Faust, & Meehl, 1989).

One point to note is the relatively low positive predictive value (PPV = 21.9%) of the CARAS. PPV of the CARAS indicates the proportion of respondents who have been predicted to be perpetrators actually abuse their children. In medicine, social work, and other helping professions, lower levels of PPV are generally more tolerable than low levels of negative predictive value (NPV), which is the proportion of abusing parents who have not been predicted as perpetrators. This is because false-alarming cases can be reevaluated, but missing cases may never be seen again until serious problems occur (Scheff, 1972). Therefore, we chose the present cutoff probability (11%) for the CARAS to maximize the NPV level and minimize the proportion of missing cases. And in fact, the overall accuracy, which is the total proportion of correct predictions, of the CARAS was 78%, which is comparable to other actuarial child abuse risk assessment instruments, for example, the CAP Inventory, the accuracy of which was 80% (Kutsal et al., 2010 **[AQ: 3]**).

Limitations

There were some limitations in the present study that should be addressed in future research. The study undertook a retrospective approach and relied heavily on respondents' memories. Any bias in their recall and responses might have had an undetectable effect on the results. Another limitation that resulted from the retrospective and cross-sectional design was the difference of time frames used with different variables. In the present study, the outcome being predicted was the child abuse "in the preceding year"; however, some of the factors were measured at the close of this 12-month period. Therefore, predictors could not be characterized as "risks" since we could not say for certain that these factors precede the abuse. In short, reverse causality is a major concern.

In addition, the retrospective design allowed only "predictions" of past child maltreatment but not the future one. One major assumption was that the risk factors measured in the study had the same value as they had had when measured a few years ago. However, this might or might not be true. Future studies are suggested to use a prospective design so as to make sure the risk factors measured at baseline are able to predict future perpetration of physical maltreatment against child.

The reliance of self-reports could be another limitation of the present study. Since child abuse is a socially undesirable, or even criminal, behavior, perpetrators might refrain from disclosing. This was especially true when the present study used face-to-face interviews. Future studies may work toward reducing underreporting by including multiple sources of data such as criminal records or records from child protective services. The use of computer-based procedures may also improve the accuracy of violence detection (Ahmad et al., 2009).

Given the nature of existing scales, there is always a possibility for the CARAS to have redundant items measuring similar concepts. The use of more modern approaches, for example, item–response theory, to develop the tool may help eliminate the issue of item redundancy, yet these approaches may lead to a final tool of individual items pulled from various existing scales. The tool resulted from using these approaches may be briefer and more powerful than the CARAS; however, it may not be possible to group the items that remain into meaningful or explainable factors. This would be opposite to what we intended to do in the present concept-driven study, in which risk factors identified by existing literature were used to develop a new risk assessment tool. Despite the possibility of item redundancy, the CARAS had satisfactory performance in the validation procedure in the present study

(sensitivity = 82%, specificity = 78%, and overall accuracy = 78%). Therefore, it was assumed that the presence of item redundancy, if any, would not cause great impact on the application of the CARAS in real-life settings.

Last, the sample consisted mainly cohabiting or married Chinese parents, with only a small portion of single parents in the present study. The reliability and validity of the CARAS when used on other populations such as single parents or parents of other countries has not been determined. Future studies may test the psychometric properties of the CARAS when used on other populations to see whether the instrument can be applied to them.

The present study has developed and validated a predominantly actuarial risk assessment tool for child abuse: the CARAS. The CARAS identifies population at-risk of perpetration of child maltreatment and provides each respondent a probability score as well as a profile of personal or family risk factors. The profile of risk factors, as one of the differentiating features of the CARAS from other tools, can provide a concrete basis for professionals to design follow-up programs or strategies to prevent the occurrence of child maltreatment among at-risk families. Overall, the CARAS is an empirically validated, systematic, and user-friendly risk assessment tool, which provides certain benefits by offering a simple but effective risk assessment instrument without adding an extra economic burden to public healthcare providers.

Authors' Note

This study is commissioned by the social welfare department and the Government of Hong Kong and funded by the Lotteries Fund.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. [AQ: 4]

Funding

~~The author(s) received no financial support for the research, authorship, and/or publication of this article.~~ [AQ: 5]

This study is commissioned by the Social Welfare Department, the Government of Hong Kong and funded by the Lotteries Fund.

References

Ahmad, F., Hogg-Johnson, S., S
Levinson, W. (2009). Comput
and control: A randomized trial. *Annals of Internal Medicine, 151*(2), 93-102.

Albarracin, D., Repetto, M. J., & Albarrac, M. (1997). Social support in child abuse and neglect: Support functions, sources, and contexts. *Child Abuse & Neglect, 21*(7), 607-615.

Baird, C., & Wagner, D. (2000). The relative validity of actuarial- and consensus-based risk assessment systems. *Children and Youth Services Review, 22*(11-12), 839-871. doi: 10.1016/s0190-7409(00)00122-5

Baird, C., Wagner, D., Healy, T., & Johnson, K. (1999). Risk assessment in child protective services: Consensus and actuarial model reliability. *Child Welfare Journal, 78*(6), 723-748.

Belsky, J. (1980). Child maltreatment: An ecological integration. *American Psychologist, 35*, 320-355.

Brewer, M. B. (Ed.). (2000). *Research design and issues of validity*. New York, NY: Cambridge University Press.

Camasso, M. J., & Jagannathan, R. (1995). Prediction accuracy of the Washington and Illinois risk assessment instruments: An application of receiver operating characteristic curve analysis. *Social Work Research, 19*(3), 174-183.

Cappell, C., & Heiner, R. B. (1990). The intergenerational transmission of family aggression. *Journal of Family Violence, 5*, 135-152.

Chaffin, M., Kelleher, K., & Hollenberg, J. (1996). Onset of physical abuse and neglect: psychiatric, substance abuse, and social risk factors from prospective community data. *Child Abuse & Neglect, 20*(3), 191-203.

Chan, Y. C. (1994). Parenting stress and social support of mothers who physically abuse their children in Hong Kong. *Child Abuse & Neglect, 18*(3), 261-269.

Chan, K. L. (2004). Correlates of wife assault in Hong Kong Chinese families. *Violence and Victims, 19*(2), 189-201. doi: 10.1891/vivi.19.2.189.64104

Chan, K. L. (2010). Co-occurrence of intimate partner violence and child abuse in Hong Kong Chinese families. *Journal of Interpersonal Violence*. Advance online publication. doi: 10.1177/0886260510369136.

Chan, K. L., Brownridge, D. A., Tiwari, A., Fong, D. Y. T., & Leung, W.C. (2008). Understanding violence against Chinese women in Hong Kong: An analysis of risk factors with a special emphasis on the role of in-law conflict. *Violence Against Women, 14*(11), 1295-1312.

Chan, K. L., Brownridge, D. A., Yan, E., Fong, D. Y. T., & Tiwari, A. (2011). Child maltreatment polyvictimization: Rates and short-term effects on adjustment in a representative Hong Kong sample. *Psychology of Violence, 1*(1), 4-15. doi: 10.1037/a0020284

Chan, K. L., Tiwari, A., Fong, D. Y. T., Leung, W.C., Brownridge, D. A., & Ho, P. C. (2009). Correlates of in-law conflict and intimate partner violence against Chinese pregnant women in Hong Kong. *Journal of Interpersonal Violence, 24*(1), 97-110.

Crouch, J. L., & Behl, L. E. (2001). Relationships among parental beliefs in corporal punishment, reported stress, and physical child abuse potential. *Child Abuse & Neglect, 25*(3), 413-419.

Dawes, R. M., Faust, D., & Meehl, P. E. (1989). Clinical versus actuarial judgment. *Science, 243*(4899), 1668-1674. doi: 10.1126/science.2648573

DeBellis, M. D., Broussard, E. R., Herring, D. J., Wexler, S., Moritz, G., & Benitez, J. G. (2001). Psychiatric co-morbidity in caregivers and children involved in maltreatment: A pilot research study with policy implications. *Child Abuse & Neglect, 23*, 923-944.

DeGarmo, D. S., Patterson, G. R., & Forgatch, M. S. (2004). How do outcomes in a specified parent training intervention maintain or wane over time? *Prevention Science, 5*(2), 73-89.

Denicola, J., & Sandler, J. (1980). Training abusive parents in child management and self-control skills. *Behavior Therapy, 11*(2), 263-270.

Doumas, D., Margolin, G., & John, R. S. (1994). The intergenerational transmission of aggression across three generations. *Journal of Family Violence, 9*(2), 157-175.

Drake, B., & Pandey, S. (1996). Understanding the relationship between neighborhood poverty and specific types of child maltreatment. *Child Abuse & Neglect, 20*(11), 1003-1018.

Freisthler, B., Merritt, D., & LaScala, E. (2006). Understanding the ecology of child maltreatment: A review of the literature and directions for future research. *Child Maltreatment, 11*(3), 263-280.

Gillham, B., Tanner, G., Cheyne, B., Freeman, I., Rooney, M., & Lambie, A. (1998). Unemployment rates, single parent density, and indices of child poverty: Their relationship to different categories of child abuse and neglect. *Child Abuse & Neglect, 22*(2), 79-90.

Hall, L. A., Sachs, B., & Rayens, M. K. (1998). Mothers' potential for child abuse: The roles of childhood abuse and social resources. *Nursing Research, 47*(2), 87-95.

Hazen, A. L., Connelly, C. D., Kelleher, K., Landsverk, J., & Barth, R. (2004). Intimate partner violence among female caregivers of children reported for child maltreatment. *Child Abuse & Neglect, 28*, 301-319.

Kahneman, D., & Tversky, A. (1982). On the psychology of prediction. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases* (pp. 50-98). New York, NY: Cambridge University Press.

Kantor, G. K., & Straus, M. A. (1999). *Report on the USAF Family Needs Screener*. Durham, NH: Family Research Laboratory, University of New Hampshire.

Kitamura, T., Takauma, F., Tada, K., Yoshida, K., & Nakano, H. (2004). Postnatal depression, social support, and child abuse. *World Psychiatry, 3*(2), 100-101.

Kolko, D. J. (1998). CPS operations and risk assessment in child abuse cases receiving services: Initial findings from the Pittsburgh Service Delivery Study. *Child Maltreatment, 3*(3), 262-275. doi: 10.1177/1077559598003003006

Kropp, P. R. (2004). Some questions regarding spousal assault risk assessment. *Violence Against Women, 10*(6), 676-697. doi: 10.1177/1077801204265019 [AQ: 6]

Kropp, P. R. (2008). Intimate partner violence risk assessment and management. *Violence and Victims, 23*(2), 202-220. [AQ: 7]

Lau, A. S. (2010). Physical discipline in Chinese American immigrant families: An adaptive culture perspective. *Cultural Diversity and Ethnic Minority Psychology, 16*(3), 313-322. doi: 10.1037/a0018667

Lyle, C. G., & Graham, E. (2000). Looks can be deceiving: Using a risk assessment instrument to evaluate the outcomes of child protection services. *Children and Youth Services Review, 22*(11-12), 935-949. doi: 10.1016/s0190-7409(00)00119-5 [AQ: 8]

Milner, J. S. (1986). Assessing child maltreatment: The role of testing. *Journal of Sociology & Social Welfare, Technology and social service delivery* [Special Issue], *13*(1), 64-76.

Milner, J. S. (2000). Social information processing and physical child abuse; theory and research. In D. J. Hansen (Ed.), *Nebraska symposium on motivation: Motivation and child maltreatment* (Vol. 45, pp. 39-84). Lincoln, NE: University of Nebraska Press.

Mossman, D. (2006). Another look at interpreting risk categories. *Sexual Abuse: Journal of Research and Treatment, 18*(1), 41-63. doi: 10.1177/107906320601800104

Oates, R. K., & Forrest, D. (1985). Self-esteem and early background of abusive mothers. *Child Abuse & Neglect, 9*, 38-92.

Rodriguez, C. M., & Green, A. J. (1997). Parenting stress and anger expression as predictors of child abuse potential. *Child Abuse & Neglect, 21*(4), 367-377.

Rosenbaum, A., & Langhinrichsen-Rohling, J. (2006). Meta-research on violence and victims: The impact of data collection methods on findings and participants. *Violence and Victims, 21*(4), 404-409. doi: 10.1891/vivi.21.4.404

Rosenberg, L. A. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.

Sanders, M. R., Pidgeon, A. M., Gravestock, F., Connors, M. D., Brown, S., & Young, R. W. (2004). Does parental attributional retraining and anger management enhance the effects of the triple P-positive parenting program with parents at risk of child. *Behavior Therapy, 35*(1), 513-535.

Scheff, T. J. (1972). Decision rules and types of error and their consequences in medical diagnosis. In E. Friedson & J. Lorber (Eds.), *Medical men and their work* (pp.309-322). Chicago, IL: Aldine de Gruyter.

Shay, N. L., & Knutson, J. (2008). Maternal depression and trait anger as risk factors for escalated physical discipline. *Child Maltreatment, 13*(1), 39-49.

Shlonsky, A., & Wagner, D. (2005). The next step: Integrating actuarial risk assessment and clinical judgment into an evidence-based practice framework in CPS

case management. *Children and Youth Services Review, 27*(4), 409-427. doi: 10.1016/j.childyouth.2004.11.007

Shorkey, C. T. (1979). A review of methods used in the treatment of abusing parents. *Social Casework, 60*, 360-367.

Smith, D. K., Johnson, A. B., Pears, K. C., Fisher, P. A., & DeGarmo, D. S. (2007). Child maltreatment and foster care: Unpacking the effects of prenatal and postnatal parental substance use. *Child Maltreatment, 12*(2), 150-160.

Straus, M. A., Hamby, S. L., Boney-McCoy, S., & Sugarman, D. (1996). The reivsed Conflict Tactics Scales (CTS2). *Journal of Family Issues, 17*(3), 283-316.

Straus, M. A., Hamby, S. L., Boney-McCoy, S., Sugarman, D., DeVoe, E., Dietz, T., . . . Yodanis, C. (1999). *The personal and relationships profile*. Durham, NH: Family Research Laboratory, University of New Hampshire.

Straus, M. A., Hamby, S. L., Finkelhor, D., Moore, D. W., & Runyan, D. (1998). Identification of child maltreatment with the Parent-Child Conflict Tactics Scales: Development and psychometric data for a national sample of American parents. *Child Abuse & Neglect, 22*(4), 249-270. doi: 10.1016/s0145-2134(97)00174-9

Straus, M. A., & Kaufman-Kantor, G. (1994). Corporal punishment of adolescents by parents: A risk factor in the epidemiology of depression, suicide, alcohol abuse, child abuse, and wife beating. *Adolescence, 29*(115), 534-561.

Tang, C. S. (2006). Corporal punishment and physical maltreatment against children: A community study on Chinese parents in Hong Kong. *Child Abuse & Neglect, 30*(8), 893-907. doi: 10.1016/j.chiabu.2006.02.012

Bio

Ko Ling Chan is with the Department of Social Work and Social Administration, the University of Hong Kong, Hong Kong.