

The relative severity of acts of physical violence in heterosexual relationships: An item response theory analysis

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Abstract

This study evaluated the structure of an expanded version of the physical violence scale of the Conflict Tactics Scales (CTS). A community sample of 1,092 randomly selected men and women reported on perpetration and receipt of 14 violent acts in their relationships. Item response theory analyses indicated that the violence items were unidimensional for recipient and perpetrator reports of men's and women's violence. There was convergence between severity of acts as reported by perpetrators and recipients for both men's and women's violence. Results indicated that adding together the number of different acts endorsed to form a total score is appropriate for both men's and women's violence. Total scores were strongly related to likelihood of injury, supporting the validity of CTS-type measures to assess severity of violence.

Partner violence in close relationships is a relatively common phenomenon, occurring in about 12% of heterosexual married or cohabiting couples (e.g., Straus & Gelles, 1986) and at least 25% of young couples over a 1-year period (e.g., Magdol et al., 1997). Partner violence ranges from relatively minor, noninjurious acts such as pushing and shoving to severe, injurious acts such as beating up a partner (Straus, 1990b). The physical assault scale of the Conflict Tactics Scales (CTS; Straus,

1979), the most commonly used measure of partner violence, is often used to derive separate reports of minor and severe violence (e.g., Magdol et al., 1997). A number of studies that have examined the structure of the CTS and related violence measures have, however, indicated that items assessing acts of violence may measure a single construct of violence, rather than minor and severe violence constructs (e.g., Moffitt et al., 1997). Whereas these studies have typically relied on linear factor analysis to examine simply whether violence items “hang together” well, little work has been done to examine the severity of the individual items themselves. Consequently, the goal of the present study was to assess the ordering, in terms of severity, of items assessing acts of violence within heterosexual relationships in a randomly selected sample of women and men. Using item response theory (IRT) models, we examined whether the physical violence items of an expanded version of the CTS form a single continuum of severity of violence. We also examined whether the individual items represent similar or differing

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levels of severity for men's and women's violence. For example, is being slapped by one's partner as severe, relative to other violent acts (such as pushing), for men as it is for women?

The CTS presents questions about violent acts to respondents as a general investigation of how couples resolve differences and conflict. The CTS can be used to measure both perpetration and receipt of violence. Although the CTS2 (the newest version of the CTS; Straus, Hamby, Boney-McCoy, & Sugarman, 1996) and other violence measures contain a number of subscales (e.g., a psychological aggression scale), in this study we focused exclusively on physical violence items. These items do not address all forms of partner abuse, such as psychological or sexual abuse, but they do refer to acts that, within the criminal justice system, constitute assault.

Straus' (1979) initial analyses of the CTS indicated a single physical violence factor. When the more serious violent acts of using a knife or gun were added to the scale, however, these formed a factor separate from the less serious acts (Straus, 1979). Straus (1979, 1990a, 1990b) therefore argued that the CTS physical violence items fall into "minor" and "severe" categories based on their presumed risk of injury. This division has been criticized for ignoring the intent behind an act and for assuming that severe items entail a greater risk of injury than do minor items (e.g., R. P. Dobash, R. E. Dobash, Wilson, & Daly, 1992; see also Straus, 1990a). For example, a man shoving his partner (a minor item) could result in greater harm than a man punching his partner (a severe item).

If any measurement instrument is to be widely used in research, how well it measures the construct of interest needs to be established. One way to understand a scale is to examine its structure. This can be done in several ways, including assessing the dimensionality of a scale using either linear factor analysis (e.g., Moffitt et al., 1997) or nonlinear factor analysis, that is, IRT (e.g., Schafer, 1996). Although the IRT model is mathematically equivalent to the factor analytic model, it is more appropriate for dichotomous items (McDonald, 1981; Thissen, Steinberg, Pyszczynski, & Greenberg, 1983). IRT also

allows for the assessment of how individual items are functioning relative to one another.

Studies that have assessed the factor structure of measures of violence in heterosexual relationships using linear factor analysis have generally found that, for men's and women's violence, a single factor underlies physical violence items rather than minor and severe factors as proposed by Straus (1979). These findings have been remarkably consistent, despite differences in the nature of the populations studied, as well as the methods of administering and scaling the CTS. Unidimensional structures for the CTS violence items have been confirmed (using confirmatory factor analysis) in samples of married couples (Barling, O'Leary, Jouriles, Vivian, & MacEwan, 1987), young adults (Moffitt et al., 1997), incarcerated men (Cook, 1998), and high school students in dating relationships (Cascardi, Avery-Leaf, O'Leary, & Slep, 1999). Similar findings have been reported with other measures of relationship violence. For example, in a sample of high school students, Wolfe et al. (2001) used confirmatory factor analysis and found that the physical violence items of the Conflict in Adolescent Dating Relationships Inventory were unidimensional. Similarly, in a sample of female college students, Hudson and McIntosh (1981) found that the physical abuse items of the Index of Spouse Abuse were unidimensional.

In contrast to studies indicating a unidimensional structure underlying reports of relationship violence, two studies have found a two-factor structure underlying the CTS violence items. In a sample of U.S. military personnel, Pan, Neidig, and O'Leary (1994) found that items relating to choking, beating up, and using a knife or gun on one's partner loaded on a separate factor.¹ In a sample of university students reporting on their own aggression, Caufield and Riggs (1992) found that an item about beating up one's partner

1. This was the case for recipient and perpetrator reports of women's violence and for perpetrator reports of men's violence. For recipient reports of men's violence, only the item relating to using a knife or gun on one's partner loaded on a separate factor. All other physical violence items loaded on one factor.

loaded on its own factor. These studies, however, used exploratory rather than confirmatory factor analysis, and it may be that the findings would not stand up to the more stringent test of confirmatory factor analysis. A few studies have, however, found two-factor structures using confirmatory factor analysis of non-CTS abuse measures. Based on perpetration reports from a sample of college students, Borjesson, Aarons, and Dunn (2003) found that the violence items of the Abuse within Intimate Relationships Scale were best represented by a second-order factor model. The overall physical violence factor consisted of two first-order factors representing overt violence (e.g., *pushed, shoved*) and restrictive violence (e.g., *forcefully squeezed*). Based on reports of violence receipt from a community sample, Marshall (1992a, 1992b) found that a second-order factor model also best represented the items in her Severity of Violence Against Women Scales and Severity of Violence Against Men Scales. The higher order physical violence factor consisted of four first-order factors representing mild, minor, moderate, and severe violence for men, with the addition of a sexual violence factor for women.

Even when linear factor analysis indicates just one factor underlying physical violence items, rather than separate factors for minor and severe violence, this does not indicate that all physical violence items assess the same severity of violence. Some of the acts such as pushing one's partner may not be as severe as other acts such as punching one's partner. In addition to testing the unidimensionality of a measure, IRT models show how the items in a scale are functioning relative to one another and where on the continuum of the construct of violence, from low to high severity, each item lies (e.g., Schafer, 1996).

IRT models are mathematical expressions of the relation between an individual's responses on individual items and an underlying construct that is presumed to give rise to these responses (Crocker & Algina, 1986). An IRT analysis allows for a probabilistic rank ordering of the items comprising a measure along an underlying dimension, in this case severity of violence. An item characteristic curve (ICC)

graphically represents how the probability of a response on the item varies with the level of the underlying construct.

Two characteristics of ICCs are important—their slope and their position on the underlying construct. The slope (a or discrimination parameter) indicates how well an item distinguishes between different levels of the construct. Larger values of the discrimination parameter indicate steeper curves of the ICC. Items with steeper curves are more useful for distinguishing between different levels of the latent construct than are items with less steep curves. That is, for items with steeper curves, the probability of a “yes” response to the item, plotted on the y -axis, changes quickly from a low to a high value within a brief range of the construct. For example, on a test of mathematical ability, items with steep slopes are able to discriminate between people with similar levels of ability. The discrimination parameter is similar to a factor loading in linear factor analysis in that it refers to the strength of the relation between an individual item and the underlying construct.

The position (b or location parameter) of the item in relation to the underlying construct indicates at what level of the underlying construct the item differentiates between a “yes” and a “no” response. The location parameter is equal to the latent score at which half the respondents answer “yes” to the item. When two items are located relatively close to one another, this indicates that they are assessing similar levels of the underlying construct. The location parameter provides additional information over what can be obtained from linear factor analysis: It identifies how each item is positioned relative to the other items in terms of the degree to which it assesses the underlying construct. For example, on a test of mathematical ability, items with higher location parameters would be more difficult and items with lower location parameters would be easier.

We are only aware of one study that has used an IRT analysis to assess the structure of the physical violence items of the CTS in a heterosexual sample. Using data from a sample of 533 college students reporting on their own perpetration of violence, Schafer (1996)

found that the physical violence items of the CTS followed a pattern from generally less severe to more severe. For women's violence, most items had fairly steep curves, indicating good differentiation between different levels of severity of violence. The only exception was the item referring to the use of a gun or knife, which had a fairly flat slope suggesting that it did not differentiate well between different levels of severity of violence. For women's violence, the items showed fairly good dispersion along the continuum of severity of violence. For men's violence, the less severe items (as suggested by Straus, 1990b) had fairly steep curves and were well dispersed, but the more severe items had much flatter slopes and were clustered together at the more severe violence end of the scale. Overall, the IRT model showed fairly good fit for women's violence, indicating unidimensionality. The IRT model did not show good fit for men's violence, suggesting that the violence items may not have been assessing a single severity of violence construct. For both women's and men's violence, pushing, grabbing, or shoving one's partner was the item located lowest in terms of severity.

Regan, Bartholomew, Oram, and Landolt (2002) applied an IRT analysis to an expanded version of the CTS as applied to same-sex relationships. The sample consisted of 284 gay and bisexual men reporting on experiences of both receipt and perpetration of violence in their same-sex relationships. For analyses of both receipt and perpetration, the CTS items were unidimensional, fairly well dispersed along the continuum of severity of violence, and had steep slopes. However, the rank ordering of the items generally did not follow the severity ordering suggested by Straus (1990b). Although a minor violence item (*pushed or shoved*) was ranked as the least severe, some more severe violence items were ranked as less severe than some minor violence items. For example, *punched* was ranked as relatively less severe than other items, such as *slapped* and *threw something that could hurt*.

One other study has used IRT methodology to examine a more general measure of violence in a sample of 250 male prisoners randomly selected from Scotland's largest prison (Michie & Cooke, 2000). Participants were

asked whether they had been subjected to particular violent behaviors and if they had engaged in those behaviors themselves since the age of 18. The items in the measure of violence, with the exception of a question about slapping, had fairly steep slopes and discriminated effectively at different points on the underlying violence continuum. The items were not, however, ordered as expected in terms of severity of violence. For example, hitting someone with a fist or beating someone discriminated at relatively low levels of the construct, whereas throwing something at someone fell in the middle range of severity. Given that much of the violence reported likely took place in male peer relationships, these findings may not generalize to violence in heterosexual intimate relationships.

Overview of the current study

Previous studies applying an IRT analysis to reports of violent acts have been limited to samples of college students (Schafer, 1996), gay men (Regan et al., 2002), and male prisoners (Michie & Cooke, 2000). Moreover, Schafer only assessed perpetration reports and Michie and Cooke assessed violent acts across all relationship contexts. Therefore, we examined the structure of a modified version of the physical abuse subscale of the CTS, including reports of both perpetration and receipt, in a randomly selected community sample of women and men. IRT analyses were used to determine whether the physical violence items formed a unidimensional construct in this sample for men's and women's violence, as well as where and how well items discriminated along the severity of violence continuum. We also examined consistencies between the relative severity of items based on perpetrator and recipient reports for both men's and women's violence. To confirm that this continuum represents severity of violence, we assessed the relationship between receipt of violence and degree of injury.

Method

This study was conducted in the City of Vancouver, British Columbia, Canada, during

1997, with the purpose of learning more about domestic abuse in a community sample.

Participants

Over 1,200 respondents, 614 men and 635 women, aged 19 and older from the City of Vancouver were contacted via random-digit dialing and completed a 10- to 15-min telephone survey that assessed demographics; physical, emotional, and sexual violence in intimate relationships; and family-of-origin violence. The sample was drawn from the current City of Vancouver telephone exchanges, and a constant was added to the last digit of each listing to increase the chance of reaching newly listed and unlisted respondents. Respondents in each household were chosen using the most recent birthday method. Surveyors ensured that respondents were able to complete the survey in private. The overall response rate, calculated as the number of completed interviews (1,249) divided by the number of known eligible respondents (2,933), was 43%. The survey was conducted in English, Mandarin, and Cantonese. Five respondents completed the survey in Cantonese or Mandarin. All analyses were redone with these respondents removed from the sample, and results did not differ substantively from those reported here.

Ninety percent (90%) of respondents identified themselves as heterosexual, 5% self-identified as gay or lesbian, 3% self-identified as bisexual, and 2% did not answer the question. Only those respondents who identified themselves as heterosexual were included in the present study. Respondents who had never been in a romantic relationship ($n = 31$) were excluded from the sample. Consequently, the sample consisted of 531 men and 561 women. The mean age of the sample was 38.6 years ($SD = 14.1$, range = 19–88 years). The reported marital status of participants was as follows: 34% married, 10% living with a romantic partner, 41% single and never married, 8% divorced, 3% separated, and 4% widowed. Of the participants not married or living with a partner, 37% were in an ongoing romantic or sexual relationship at the time of the survey. The level of education for the sample was as

follows: 21% of respondents had some high school education, 61% had some college or university education, and 16% had some post-graduate education. The ethnic breakdown of the sample was as follows: 29% British; 24% other European; 18% Chinese/East Asian; 2% Latin, Central, or South American; and 18% Other. Ten percent of respondents did not identify an ethnic background. The distribution of personal income in Canadian dollars was: less than \$20,000 (28%), \$20,000–\$29,000 (20%), \$30,000–\$39,000 (16%), \$40,000–\$49,000 (10%), and over \$50,000 (18%). Finally, 8% of the sample either did not know their personal income or declined to answer the question.

A comparison with the 1996 Canadian Census data revealed that, compared to the adult population of the City of Vancouver, the current sample was younger (12% more were 19–34 years of age and 13% less were 50 years of age or older), had a higher education (11% fewer had some high school education and 19% more had some university or college education), and had a higher personal income (27% more had an income greater than \$20,000). Despite translating the survey into Cantonese and Mandarin, the Chinese ethnicity was underrepresented by approximately 10%.

Measures

After demographics were assessed, respondents were asked about acts of psychological, physical, and sexual violence that they might have been the perpetrators or recipients of in their romantic relationships. Subsequent questions assessed injury and experiences of family violence during childhood. Questions about psychological, physical, and sexual violence were asked using the general format of the CTS2 (Straus et al., 1996), assessing both lifetime and 1-year time frames.

Measure of physical violence. A 14-item measure was developed from the CTS (Straus, 1979) and the CTS2 (Straus et al., 1996) to assess participants' reports of receipt and perpetration of physically violent acts (see Table 1). This measure included all the items from the original CTS, using the revised wording of the CTS2 where these items had been

Table 1. *Physical violence items used in current study and women's and men's reported rates of perpetration and receipt*

Physical violence items	Men's violence (%)		Women's violence (%)	
	Men's perpetration	Women's receipt	Women's perpetration	Men's receipt
1. Pushed or shoved	17.3	20.9	17.1	25.8
2. Slapped	8.1	13.9	12.7	21.7
3. Threw something that could hurt	1.7	6.1	5.9	13.0
4. Twisted arm or hair	3.6	9.1	1.2	4.5
5. Grabbed or held down in anger	12.2	15.3	3.6	4.9
6. Scratched or bit	0.9	2.7	4.1	9.2
7. Hit with something that could hurt	1.1	3.6	2.1	7.5
8. Punched	3.2	7.8	6.4	13.7
9. Slammed against a wall	4.0	10.0	2.0	1.3
10. Kicked	1.1	4.1	3.6	6.4
11. Beat up	0.6	4.5	0.2	0.9
12. Choked	0.8	4.3	0.4	1.1
13. Used a knife or gun	0	2.7	0.9	2.3
14. Burned or scalded on purpose	0	0	0.4	0.6
Any violence	25.6	28.5	28.1	36.9
Mean variety score (<i>SD</i>)	0.55 (1.20)	1.05 (2.29)	0.60 (1.32)	1.13 (2.04)

Note. Items 1–4 and 6 are classified as minor violence items; items 5 and 7–14 are classified as severe violence items.

changed. One item, *punched or hit with something that could hurt* was expanded into two items: *punched* and *hit with something that could hurt*. Another item, *grabbed*, was changed to *grabbed or held down in anger*, and an item relating to scratching or biting was added.² For each item, respondents were first asked if they had ever engaged in a particular behavior toward a partner. If they indicated that they had, they were asked how often they had done so in the past year. Next, they were asked if a partner had ever directed the same behavior toward them. Again, if participants indicated that a partner had done so, they were asked how many times in the past year this had occurred. This procedure provided two reports of men's violence, men's reports of perpetrated violence and women's reports of received violence, and two reports of women's violence, women's reports of per-

petrated violence and men's reports of received violence. The present study used only responses regarding behavior ever in the past.³

Measure of physical injury. Five items assessed physical injuries resulting from receipt of physically violent acts. Respondents who reported any receipt of violence ever in the past were asked questions about injuries sustained as a result of this violence. Three items were taken from the CTS2 (Straus et al., 1996): whether respondents had ever seen a doctor because of an injury resulting from conflict, if they had needed to do so but had not, and whether they had felt physical pain that still hurt the next day as a result of conflict with a partner. Two additional items were

2. Scratching and biting are commonly thought of as tactics that women are likely to engage in more than are men, often in self-defense.

3. We did not also analyze responses regarding violence in the past year because rates of endorsement of the physical violence acts were quite low for the past-year time frame. Low rates of endorsement make it difficult to adequately fit an IRT model to the data, particularly when coupled with a relatively large number of items and a relatively small sample size, as in the present study (Hulin, Drasgow, & Parsons, 1983).

modifications of the corresponding CTS2 injury items: whether respondents had sustained severe injuries, such as broken bones or a concussion, and whether they had sustained less severe injuries, such as sprains or bruises. (In the CTS2, the severe item asks only about a broken bone and the minor item asks about a small cut in addition to a sprain or bruise.) For each injury question, respondents were first asked whether this had ever happened to them in the past. If they indicated that it had, they were asked how many times it had happened in the past year. This study only used reports about injuries sustained ever in the past to correspond with the reports regarding violent behavior ever in the past. The injury items relating to injuries sustained ever in the past were combined to form an injury index ($\alpha = .74$).

Results

IRT models for the violence items were estimated separately for men’s and women’s violence, for reports of both perpetration and receipt. Items were excluded from the analyses if they were not endorsed at all or when only one participant had either been the recipient or been the perpetrator of that act. Multilog 7

(Scientific Software International, Inc., 2003) was employed to fit the two-parameter logistic model to the item responses. In order to assess the goodness of fit of the model (the fit between the estimated ICCs and the observed data), we examined the standardized residuals, which were computed for each response option of each item. Thus, for the 14 items there were 28 standardized residuals. If the model is correct and the items assess a unidimensional underlying construct, then these statistics will have an approximately standard normal distribution with roughly 95% being less than 1.96 in magnitude (Hambleton & Swaminathan, 1985).

Men’s violence

The results of analyses for men’s violence, that is, men’s reports of perpetration and women’s reports of receipt, are shown in Table 2 and Figure 1. The item numbers on Figure 1 correspond to the item numbers in Table 2.

Men’s reports of perpetration. Used a knife or gun and burned or scalded on purpose were excluded from this analysis because no men reported perpetrating these acts ever in the

Table 2. Estimates of IRT parameters for men’s violence (men’s perpetration and women’s receipt)

Physical violence items	Men’s perpetration		Women’s receipt	
	<i>a</i> (SE)	<i>b</i> (SE)	<i>a</i> (SE)	<i>b</i> (SE)
1. Pushed or shoved	6.93 (1.36)	.99 (.04)	5.19 (.65)	0.86 (.05)
2. Slapped	1.97 (.35)	1.88 (.18)	3.17 (.44)	1.24 (.08)
3. Threw something that could hurt	1.94 (.62)	2.92 (.55)	3.10 (.57)	1.75 (.12)
4. Twisted arm or hair	2.69 (.59)	2.17 (.22)	4.01 (.65)	1.45 (.08)
5. Grabbed or held down in anger	2.00 (.32)	1.55 (.15)	3.35 (.49)	1.15 (.08)
6. Scratched or bit	2.79 (1.39)	2.80 (.49)	3.74 (.85)	2.06 (.16)
7. Hit with something that could hurt	1.63 (.68)	3.49 (.97)	4.47 (1.28)	1.87 (.13)
8. Punched	2.34 (.66)	2.34 (.29)	5.43 (1.22)	1.47 (.07)
9. Slammed against a wall	3.32 (.78)	2.00 (.16)	4.12 (.75)	1.39 (.07)
10. Kicked	2.11 (.95)	3.03 (.70)	4.11 (1.10)	1.84 (.13)
11. Beat up	2.90 (1.56)	2.98 (.56)	6.88 (1.53)	1.69 (.09)
12. Choked	2.15 (1.22)	3.22 (.86)	3.57 (.80)	1.87 (.14)
13. Used a knife or gun			2.76 (.76)	2.24 (.23)
14. Burned or scalded				

Note. *a* refers to the discrimination parameter; *b* refers to the location parameter. SE are in parantheses.

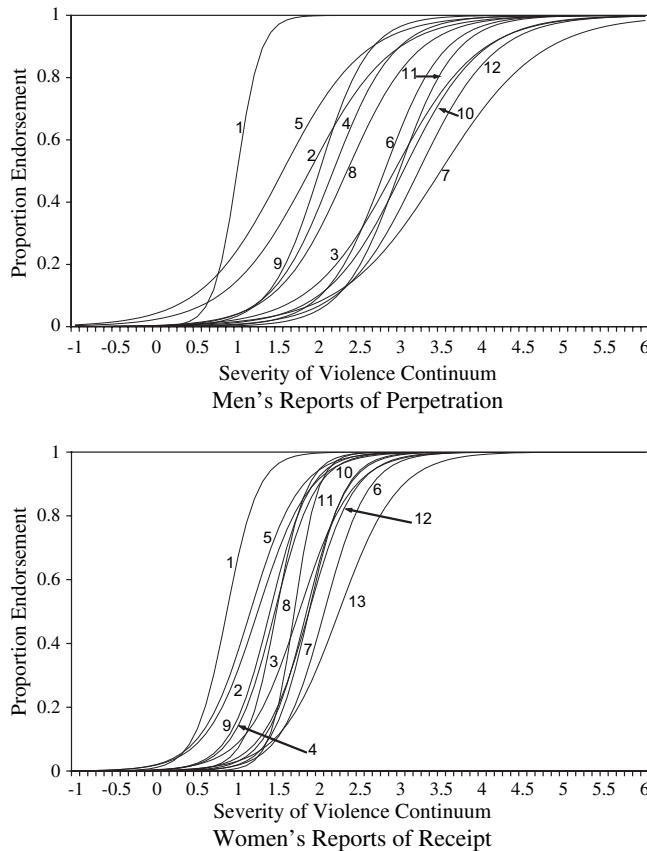


Figure 1. ICCs for men's violence.

Note. Numbers in the figure refer to items in Table 2.

past. The two-parameter logistic model showed good fit for men's perpetration of violence ever in the past, with all 24 standardized residuals less than 1.96 in magnitude.

Table 2 and Figure 1 show that the 12 items discriminated well on the underlying severity of violence continuum, with discrimination parameter estimates ranging between 1.63 and 6.93. This indicates a strong relation between each of the items and the underlying violence construct. The items were generally ordered according to their presumed level of severity. There were, however, several exceptions to the expected ordering of items. *Grabbed or held down in anger* and *slammed against a wall*, both considered severe items (see Table 1), had low location parameters, indicating that they discriminated best at lower levels of the continuum. In addition, *threw*

something that could hurt, considered a minor item, had a fairly high location parameter, indicating that it discriminated best at high levels of the continuum.

For this analysis, the violence items covered a fairly wide range on the underlying continuum ($bs = 0.99\text{--}3.49$) and were fairly evenly spaced out over that range. *Pushed or shoved* was somewhat separate from the rest of the items at the lower end of the continuum, as was *hit with something that could hurt* at the upper end of the continuum.

Women's reports of receipt. *Burned or scalded on purpose* was excluded from this analysis because no women reported being the recipient of this act ever in the past. The two-parameter logistic model showed good fit for women's receipt of men's violence ever in

the past, with all 26 standardized residuals less than 1.96 in magnitude.

Table 2 and Figure 1 show that the 13 items discriminated well on the underlying severity of violence continuum, with discrimination parameter estimates ranging from 2.76 to 6.88, again indicating a strong relation between each item and the underlying violence construct. The items were generally ordered according to their presumed level of severity. There were again, however, several exceptions to the expected ordering of items. *Grabbed or held down in anger* and *slammed against a wall*, considered severe items, both had low location parameters, indicating that they discriminated best at lower levels of the continuum. In addition, *threw something that could hurt*, considered a minor item, had a fairly high location parameter, indicating that it discriminated best at high levels of the continuum.

Although covering a reasonably wide range on the underlying continuum ($bs = 0.86-2.24$), the violence items near the middle and upper end of the distribution tended to cluster together. *Pushed or shoved* was somewhat separate from the other items at the lower end of the continuum, as was *used a knife or gun* at the upper end of the continuum. The rest

of the items tended to form several smaller clusters in between the extremes, and there was one tie on the location parameter: both *hit with something that could hurt* and *choked* had a value of $b = 1.87$.

Women’s violence

The results of analyses for women’s violence, that is, women’s perpetration and men’s receipt, are shown in Table 3 and Figure 2. The item numbers in Figure 2 correspond to the item numbers listed in Table 3.

Women’s reports of perpetration. *Beat up* was excluded from this analysis because only one woman reported perpetrating this act ever in the past. The two-parameter logistic model showed good fit for women’s perpetration of violence ever in the past, with all 26 standardized residuals less than 1.96 in magnitude.

Table 3 and Figure 2 show that the 13 items discriminated well on the underlying severity of violence continuum, with discrimination parameter estimates ranging between 1.68 and 4.50. This indicates a strong relation between individual items and the underlying violence construct. The items were generally

Table 3. Estimates of IRT parameters for women’s violence (women’s perpetration and men’s receipt)

Physical violence items	Women’s perpetration		Men’s receipt	
	<i>a</i> (SE)	<i>b</i> (SE)	<i>a</i> (SE)	<i>b</i> (SE)
1. Pushed or shoved	2.63 (.36)	1.15 (.09)	4.70 (.67)	.71 (.05)
2. Slapped	1.68 (.27)	1.65 (.17)	2.69 (.37)	.94 (.08)
3. Threw something that could hurt	2.81 (.57)	1.85 (.15)	2.72 (.43)	1.34 (.10)
4. Twisted arm or hair	3.12 (.98)	2.53 (.29)	3.52 (.86)	1.86 (.15)
5. Grabbed or held down in anger	2.49 (.68)	2.21 (.24)	1.54 (.38)	2.53 (.41)
6. Scratched or bit	2.91 (.72)	2.03 (.17)	3.26 (.62)	1.50 (.11)
7. Hit with something that could hurt	2.25 (.76)	2.58 (.40)	4.03 (.90)	1.55 (.10)
8. Punched	2.77 (.48)	1.81 (.14)	2.71 (.45)	1.30 (.10)
9. Slammed against a wall	4.06 (1.44)	2.21 (.18)	2.96 (1.14)	2.57 (.43)
10. Kicked	3.14 (.71)	2.06 (.18)	2.89 (.62)	1.77 (.14)
11. Beat up			2.52 (1.26)	2.89 (.61)
12. Choked	4.50 (3.28)	2.72 (.43)	2.70 (1.07)	2.73 (.48)
13. Used a knife or gun	2.45 (.92)	2.91 (.54)	3.33 (.83)	2.23 (.23)
14. Burned or scalded	2.88 (3.38)	3.10 (1.35)	1.39 (.63)	4.38 (1.60)

Note. *a* refers to the discrimination parameter; *b* refers to the location parameter. SE are in parantheses.

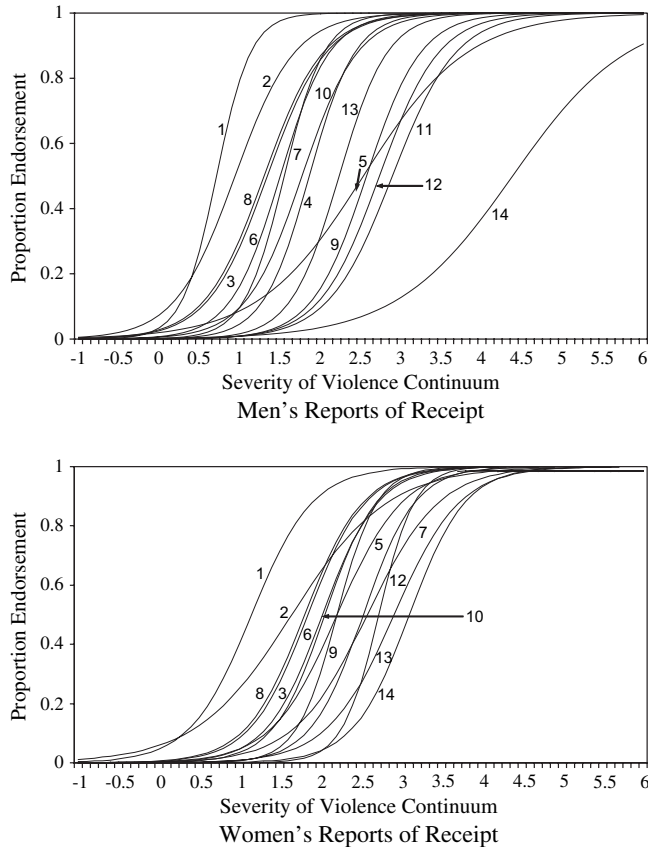


Figure 2. ICCs for women's violence.

Note. Numbers in the figure refer to items in Table 3.

ordered according to their presumed level of severity. There were again, however, several exceptions to the expected ordering of items. *Punched*, considered a severe item, had a low location parameter, indicating that it discriminated best at lower levels of the continuum. In addition, *twisted arm or hair*, considered a minor item, had a fairly high location parameter, indicating that it discriminated best at high levels of the continuum.

In this analysis, the violence items covered a fairly wide range on the underlying continuum ($b_s = 1.15\text{--}3.10$). The items near the middle of the distribution, however, tended to cluster together. *Pushed or shoved* was again fairly separate from the rest of the items at the lower end of the continuum, as was *burned or scalded on purpose* at the upper end of the continuum. The rest of the items formed several smaller clusters in between the extremes, and

there was one tie on the location parameter: Both *grabbed or held down in anger* and *slammed against a wall* had a value of $b = 2.21$.

Men's reports of receipt. No items were excluded from this analysis due to lack of endorsement. The two-parameter logistic model showed good fit for men's receipt of women's violence ever in the past, with all 28 standardized residuals less than 1.96 in magnitude.

Table 3 and Figure 2 show that the 14 items discriminated well on the underlying severity of violence continuum, with discrimination parameter estimates ranging from 1.39 to 4.70, again indicating a strong relation between each item and the underlying violence construct. The items were generally ordered according to their presumed level of severity. There were again several exceptions to the

expected ordering of items. *Punched*, considered a severe item, had a low location parameter, indicating that it discriminated best at lower levels of the continuum. In addition, *twisted arm or hair*, considered a minor item, had a fairly high location parameter, indicating that it discriminated best at high levels of the continuum.

Although covering quite a wide range on the underlying continuum ($bs = 0.71-4.38$), the violence items clustered together somewhat. *Pushed or shoved* was again fairly separate from the rest of the items at the lower end of the continuum, as was *burned or scalded on purpose* at the upper end of the continuum. The rest of the items tended to group together in a couple of smaller clusters in between the extremes.

Summary of IRT findings

In terms of discrimination, the slopes of the items in all analyses were fairly steep, indicating that they discriminated well between lower and higher severity of violence. As well, the values of the location parameters were generally well dispersed on the severity of violence continuum.

For all analyses, *pushed or shoved* had the lowest location parameter, indicating that it was the item associated with the lowest level of severity of violence. Most items were ordered as expected, although a few minor items were interspersed with the severe items in the lower and middle ranges of the continuum.

Across analyses, consistencies in terms of item ordering emerged. For both men's and women's violence, the items were ordered similarly according to perpetrator and recipient reports. Although the ordering of items was not identical for both reports in these analyses, the exceptions to the expected ordering of items were the same. For example, for men's violence, *grabbed or held down in anger* and *slammed against a wall*, both severe items, were located lower on the severity of violence continuum than expected for both men's reports of perpetration and women's reports of receipt. Also, *threw something that could hurt*, a minor item, was located higher on the continuum than expected for both reports.

To examine these consistencies further, we looked at similarities across form of violence (men's and women's) and reporter (perpetrator and recipient) by correlating the values of the location parameter (b) estimates from all four analyses. Table 4 presents these correlations. Bolded correlations indicate agreement between perpetrator and recipient reports of men's/women's violence about the relative severity of the violence acts. In contrast, the four other correlations assess agreement between (a) perpetrator reports of men's and women's violence, (b) recipient reports of men's and women's violence, (c) women's reports of own perpetration and receipt of violence, and (d) men's reports of own perpetration and receipt of violence. We expected that the bolded correlations (within-men's/-women's violence [across reporter]) would be stronger than the unbolded correlations (across-men's/-women's violence within reporter and across-men's/-women's violence across reporter).

Consistent with predictions, the correlations between perpetrator and recipient reports for both men's and women's violence were very strong ($r = .94$ and $r = .85$, respectively). These within-men's/-women's violence correlations were stronger than any of the four across-men's/-women's violence correlations.⁴ That is, the strongest agreement about the relative severity of items was across different reporters within men's violence and within women's violence.

Composite violence score

Because the model fits the data well for all four analyses discussed above, indicating that the items were unidimensional, it was appropriate to form a composite of the items (Thissen et al., 1983; see also Regan et al., 2002). When dealing with a unidimensional construct, the simplest method of scoring a measure is to add up the number of items that are endorsed by any given individual to form a total score

4. Because we did not have a straightforward means of generating the covariance matrix of the location parameter estimates, we were unable to test whether the within-men's/-women's violence (across reporter) correlations were significantly higher than the four other correlations.

Table 4. Correlations between *b* estimates for reports of men's and women's violence

	Men's violence		Women's violence	
	1	2	3	4
Men's violence				
1. Men's reports of perpetration	—	.94**	.63*	.34
2. Women's reports of receipt		—	.68*	.33
Women's violence				
3. Women's reports of perpetration			—	.85**
4. Men's reports of receipt				—

Note. Bolded correlations indicate within-men's/-women's (across reporter) correlations.

* $p < .05$. ** $p < .01$.

(Thissen et al.). In this case, we added the number of different acts that participants reported either receiving or perpetrating, with each act receiving equal weight. Note that items excluded from the analyses above were also excluded when computing the total score. The model-estimated reliability (i.e., precision of measurement) of these composites was high, and Cronbach's alpha was adequate, for both men's violence (men's reports of perpetration $r^2 = .90$, $\alpha = .72$; women's reports of receipt $r^2 = .96$, $\alpha = .89$) and women's violence (women's reports of perpetration $r^2 = .91$, $\alpha = .75$; men's reports of receipt $r^2 = .94$, $\alpha = .83$). This type of scoring has been used in the past with the physical violence items of the CTS, and the total scores have been referred to as *variety scores* (Moffitt et al., 1997).

To confirm that the variety scores do in fact represent the underlying construct of severity of violence, we looked at the relationship between each participant's variety score and his/her Multilog-estimated score on theta, the underlying dimension of severity of violence. The relationship was linear and almost perfect for both men's violence (men's reports of perpetration $r = .997$; women's reports of receipt $r = .998$) and women's violence (women's reports of perpetration $r = .996$; men's reports of receipt $r = .996$).

We also looked at how well the physical violence items were functioning as a measure of severity of violence by examining the relationship between receipt of violence and degree of injury. To do this, we looked at the

relationship between the injury index and individuals' variety scores and Multilog-estimated theta scores for respondents who had been the recipients of physically violent acts. The relationship between injury and theta scores was linear and strong for both women and men ($r = .74$ and $r = .60$, respectively), as was the relationship between injury and variety scores ($r = .75$ and $r = .61$ for women and men, respectively).

Discussion

This study examined the structure of the physical violence items of an expanded version of the CTS in a randomly selected sample of women and men. IRT analyses indicated that the physical violence items form a unidimensional construct for both receipt and perpetration (ever in the past) of both men's and women's violence. The item-specific results also confirm that the items do represent different levels of severity of violence. In fact, the strong associations between injury and individuals' theta and variety scores indicate that the items form a measure of severity of violence.

Some interesting findings emerged when we looked for consistencies in item ordering across the four analyses. The ordering of items for men's violence across different reporters (men's perpetration and women's receipt) followed a very similar pattern, as did the ordering for women's violence (women's perpetration and men's receipt). The strong consistency in ordering is somewhat surprising,

given that the violence was reported by different people (women reporting on their own receipt and men reporting on their own perpetration and vice versa) who were not partnered and who approached the issue from different perspectives (as recipient and perpetrator). These findings suggest general agreement between women and men about severity of partner violence. Notably, the placement of *pushed or shoved* at the low end of the continuum in all analyses is consistent with expectations and findings of previous studies (Michie & Cooke, 2000; Regan et al., 2002; Schafer, 1996).

For men's violence (men's reports of perpetration and women's reports of receipt), two items were located lower than expected on the severity of violence continuum: *slammed against a wall* and *grabbed or held down in anger*. It is possible that *slammed against a wall* is similar enough to *pushed or shoved* that it is located with the more minor items at the lower end of the continuum. As for *grabbed or held down in anger*, perhaps this is an act that is relatively common when a man is being violent and does not generally result in serious injury. Consistent with this speculation, 48% of men who reported having been violent endorsed this act. When we examined the degree of injury reported by women who reported having been grabbed or held down, most reported no (37%) or only minor (36%) injuries. In addition, *threw something that could hurt* was located higher than expected on the severity of violence continuum for men's violence. It is possible that this item was located higher than expected due to its potential to cause injury. Consistent with this speculation, only 20% of women who reported having something that could hurt thrown at them reported no injury; the majority reported severe (46%) or minor (34%) injuries. We cannot, however, be certain whether these injuries were in fact due to having something thrown at them, since almost all these women (96%) reported having been the recipients of more than one act of men's violence.

In contrast, for women's violence (i.e., women's reports of perpetration and men's reports of receipt), *punched* was located lower on the severity of violence continuum than

was expected. When perpetrated by a woman, a punch may be unlikely to result in injury. To explore this further, we examined the degree of injury reported by men who had been punched. The majority reported having sustained no (49%) or only minor (40%) injuries as a result of partner violence. In addition, *twisted arm or hair* was located higher than expected on the severity of violence continuum. Twisting a partner's arm or hair is an act that may only be used by women when they are engaging in a fairly serious violent incident in which they are closely involved with their partner. When we examined the degree of injury reported by men who had had their arm or hair twisted, relatively few (13%) reported not having sustained any injury as a result of partner violence. Almost two thirds (63%) reported having sustained minor injuries, and 25% reported having sustained severe injuries. We cannot ascertain whether these injuries were in fact due to the arm or hair twisting, since all these men did report having been the recipients of more than one act of women's violence.

It is interesting that the two violence items located higher than expected also tended to co-occur with other acts of violence. The fact that these acts (*threw something that could hurt* for men's violence and *twisted arm or hair* for women's violence) were rarely reported as the lone act of violence may speak to the context in which these acts take place. Their co-occurrence with other violent acts suggests that they take place within the context of more serious violent incidents, rather than being isolated acts. More broadly, it may be useful to distinguish between the severity of individual acts per se and the severity of acts as indicators of level of severity of partner violence in general. This allows for the possibility that certain items (ones which may have less injury potential if done in isolation from other violent acts) may serve as markers of higher levels of violence in a relationship.

Overall, the results suggest that the severity of various violent acts may differ depending on who is being violent. In the present sample, *grabbed or held down in anger* and *twisted arm or hair* were ranked as less severe, relative to other acts measured, for men's violence

than for women's violence. As noted above, *grabbed or held down in anger*, is a fairly common act for men to engage in when they are being violent toward a partner and it is unlikely to result in serious injury. This may explain why this act is located lower for men's violence than for women's violence, relative to other acts measured. Conversely, it appears that *twisted arm or hair* is an act that takes place within the context of more severe women's violence. In contrast, *threw something that could hurt* and *punched* were more severe, relative to other acts measured, for men's violence than for women's violence. We speculate that men's greater strength, on average, makes these acts more severe when perpetrated by a man than by a woman.

The results of this study have implications for scoring the physical violence subscale of the CTS and similar measures. The results suggest that items assessing various acts of partner violence form a unidimensional construct. This finding converges with a growing body of work: Unidimensionality has been confirmed across diverse samples and with scales with somewhat different items and formats (e.g., Barling et al., 1987; Wolfe et al., 2001). Thus, it is more appropriate to speak of physical violence overall, rather than to discuss minor and severe physical violence as separate constructs. The results of the IRT analyses further indicated that minor violence items were not necessarily located lower on the severity of violence continuum than were severe violence items. Thus, the traditional approach to defining minor and severe physical violence may misrepresent what is actually happening in violent relationships.

Given that physical violence items are unidimensional, it is appropriate to use a scoring method that adds together the number of different acts endorsed to form a total variety score. The fact that the variety scores were strongly related to individuals' theta scores and to the likelihood of injury for receipt of violence provides support for the use of variety scores as a method of scoring violence measures. Variety scores have two main advantages. First, equal weight is given to all abusive acts; variety scores do not give more weight to more common acts (such as push-

ing), which tend to be less severe. The second advantage of variety scores is that the endorsement of more acts generally indicates greater severity since the most severe acts tend to be the least frequent. For example, of those women reporting having been the recipient of only a single act of men's violence, the majority (40%) reported having been pushed or shoved (the least severe act of violence). None reported having been punched or kicked, and only one reported either being slammed against a wall or choked. In contrast, those women recipients obtaining variety scores higher than the median of three reported experiencing more severe acts of violence such as being slammed against a wall (70%), punched (63%), choked (35%), and kicked (33%).

This study does have some limitations. Comparisons with Canadian Census data revealed that the respondents were younger, more educated, and had higher incomes than the general population. The Chinese population was also underrepresented. Therefore, generalization of these findings must be done with caution. As well, the tendency of both men and women to underreport their own aggression has been well documented (see Archer, 1999). A pattern of underreporting one's own violence was also evident in our sample (see Table 1). Mean variety scores for men's violence were .55 for men's reports of perpetration and 1.05 for women's reports of receipt. Mean variety scores for women's violence were .60 for women's reports of perpetration and 1.13 for men's reports of receipt. This underreporting bias is particularly relevant for researchers assessing rates of violence. It is, however, less of a concern with the type of analysis employed in the present study because systematic underreporting of one's own violence is unlikely to change the relative severity of the violence items.

This study focused exclusively on acts of physical violence toward an intimate partner. Other forms of abuse, notably psychological and sexual abuse, are important in their own right, and their role in heterosexual relationships needs to be further examined. Psychological and physical violence are highly correlated (e.g., Moffitt et al., 1997), and psychological

abuse may have as harmful an effect as physical violence (e.g., Follingstad, Rutledge, Berg, Hause, & Polek, 1990). It is important to keep in mind, however, that within the criminal justice system, the physical violence acts assessed in this study would constitute assault.

Another limitation of this study is that we were unable to fit IRT models to the data for reports of violence in the past year due to low rates of item endorsement (relative to the sample size). In a later study, we assessed severity of CTS violence items over a 1-year time frame in a sample selected for high rates of violence: men in a treatment program for assaultive husbands (Regan, Bartholomew, Dutton, & Tweed, 2005). Consistent with the current findings, the IRT model fit the data well, and minor and severe violence items were somewhat overlapping on the severity of violence continuum. Previous work has also confirmed unidimensionality of items assessing partner violence over 12 months in heterosexual couples (e.g., Barling et al., 1987) and in male same-sex relationships (Regan et al., 2002).

In this study, we examined the validity of an expanded version of the physical abuse subscale of the CTS by assessing the structure of the scale. We also confirmed that severity of violence as assessed by this measure is strongly related to injury level. The results suggest that the physical violence items of the CTS and similar measures are appropriate to use when examining both men's and women's violence. The high reliability of all four composite measures, coupled with the strong associations between variety scores and injury, suggests that these composite measures are equally valid for men's and women's violence. Moreover, there were no systematic differences in severity of acts as reported by recipients and perpetrators for both men's and women's violence. The mean total scores for men's and women's violence obtained in the present study also suggest similarities in levels of men's and women's violence, as has been found in other studies (e.g., Straus & Gelles, 1986). The convergence of these reports can be taken as further evidence of validity of the violence reports.

Convergence does not, however, speak to the overall severity of men's and women's violence. Evidence of this can be seen in the fact that in our study women recipients of violence reported a mean injury score of 1.14, whereas men recipients of violence reported a mean injury score of .60, suggesting greater overall severity of male-to-female than female-to-male violence. Thus, although variety scores can help us understand the relationship between severity of violence and injury, they cannot disentangle the differences in injury potential of violent acts perpetrated by men and women. Convergence of violence reports also does not address whether individual violent acts perpetrated by men and women are equally severe. To address this issue, future research could examine the severity of individual items by assessing injury associated with each act of violence. The present study could also be expanded to assess validity of violence reports by looking at agreement about severity of items in a sample of couples reporting on their own and each others' violence. Further, the results of the present study need to be replicated in clinical samples with higher levels of both women's and men's violence.

In summary, this study investigated the structure of the physical violence items of an expanded version of the CTS in heterosexual relationships. IRT analyses indicated that these items represent a single latent dimension. The analyses also indicated that the items fall on a continuum of severity of violence. The present study suggests that, although it is reasonable to use the physical violence items of measures such as the CTS to assess the severity of both men's and women's violence in heterosexual relationships, it may not be appropriate to discuss minor and severe violence as separate constructs.

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