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Measuring Teen Dating Violence Perpetration: A Comparison of Cumulative and Single Assessment Procedures

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Abstract

Objective: There are concerns about the measurement of teen dating violence (TDV) perpetration. The current study compares data on TDV perpetration derived from a cumulative assessment procedure and a single assessment procedure. The prevalence and frequency of TDV perpetration are examined, as well as their associations with hypothesized precursors of TDV.

Method: A sample of court-referred adolescents ($n = 147$, $M_{age} = 15.85$) completed a baseline assessment that included measures of three hypothesized precursors to TDV: externalizing problems, exposure to community violence, and attitudes about dating violence. For the cumulative assessment procedure, adolescents then completed up to 6 phone interviews on their TDV perpetration (physical, sexual, and emotional), once every 2 weeks over the course of a 3-month period. Data from these interviews were aggregated to form a cumulative measure of TDV perpetration over the 3 months. For the single assessment procedure, adolescents completed an identical interview on their TDV perpetration in a lab assessment 3 months after baseline, but were asked about perpetration over the entire 3 months.

Results: Results of within-subjects comparisons indicated that, compared to the single assessment procedure, the cumulative assessment procedure yielded higher prevalence and greater frequency of physical, sexual, and emotional TDV. Across analytic methods, all types of TDV perpetration were more strongly related to externalizing problems, and sexual TDV perpetration was more strongly related to exposure to community violence, when measured cumulatively.

Conclusions: Cumulative assessment procedures might provide a more sensitive and valid measurement of TDV perpetration than single assessment procedures.

Keywords

teen dating violence; perpetration; cumulative assessment; measurement

Teen dating violence (TDV) in the United States is a widespread problem, and a wealth of data exist on the prevalence, frequency, and precursors of TDV perpetration (Park, Mulford,

& Blachman-Demner, 2018; Wincentak, Connolly, & Card, 2017). Yet, many researchers voice concerns about the current methods for measuring TDV (e.g., Hickman, Jaycox, & Aronoff, 2004; Jackson, 1999; Jouriles, McDonald, Garrido, Rosenfield, & Brown, 2005; Teten, Ball, Valle, Noonan, & Rosenbluth, 2009; Wincentak et al., 2017). Accurate, sensitive measurement is important for determining the scope of TDV perpetration, identifying and understanding its precursors, and for documenting the extent to which prevention programming and clinical interventions reduce it. The latter is especially relevant given the lack of evidence from rigorously-designed evaluation studies indicating that interventions for TDV perpetration are effective (Aaron & Beaulaurier, 2016), which may be partly due to measurement insensitivity.

There is a substantial empirical literature on the measurement of interpersonal violence and efforts to improve it. For example, researchers have investigated how instructions for completing measures (e.g., Hamby, 2016; Sargent, Yule, Bridges, Jouriles, & Grych, 2019), item wording (e.g., Anderson, Cahill, & Delahanty, 2018), and frames of reference (e.g., Abbey, Parkhill, & Koss, 2005) influence reports of perpetration, victimization or both. This work has resulted in recommendations for violence researchers, such as advice to use behaviorally-specific terms for violence over more abstract or generally-worded terms. The current study is designed to add to the literature on the measurement of interpersonal violence by examining the effects of different measurement procedures on reports of TDV perpetration. Specifically, the current study compares data on TDV perpetration derived from two different methods: a cumulative assessment procedure and a single assessment procedure.

TDV perpetration is typically assessed via a single administration of a measure on which youth report how frequently they perpetrated specific acts of violence over a designated period of time (single assessment procedure). The time period varies from study to study, with some assessing TDV over a one-year period or longer (Wincentak et al., 2017). However, poor memory of past actions over time is well documented (Rubin & Bernsten, 2003), and recall is especially poor for acts that are viewed as negative, such as TDV (Moradi, Taghavi, Neshat-Doost, Yule, & Dalgleish, 2000; Rubin & Berntsen, 2003). Additionally, highly frequent events are especially vulnerable to memory bias as such events become increasingly harder for participants to accurately recall as the reference period becomes longer (Schwarz, 2007). Certain types of TDV, such as psychological or emotional violence, occur frequently (Bonomi et al., 2012; Shepherd-McMullen, Mearns, Stoeks, & Mechanic, 2014), and are likely affected by such memory bias. In short, acts of TDV may be under-reported with the single assessment procedure due to memory failure, particularly if the measure asks about violence over a long period of time.

Issues with memory bias have previously been addressed in other fields of psychology with the use of innovative measurement techniques. For instance, many health and clinical psychology researchers have begun utilizing repeated measurements of behaviors and constructs through ecological momentary assessment (EMA) (Shiffman, Stone, & Hufford, 2008) or daily diary assessments (Garry, Sharman, Feldman, Marlatt, & Loftus, 2002). Such assessment methods typically lead to more accurate measurements of behaviors and constructs compared to single, retrospective assessments (McAuliffe, DiFranceisco, & Reed,

2007), and this difference is especially pronounced for very frequently occurring phenomena (Leigh, Gillmore, & Morrison, 1998). Although these methods demonstrate promise in improving measurement accuracy, such procedures may be viewed as impractical or overly burdensome for measuring behaviors that typically do not occur on a daily basis, such as TDV perpetration.

One procedure that strikes a balance between the higher participant burden of daily assessments and the poor memory recall of a single retrospective assessment covering a long period of time, involves interspersing measurements regularly throughout the course of the reference period, and aggregating across the repeated measurements (Jouriles et al., 2005). This method, which we refer to as a *cumulative assessment procedure*, has been used successfully used to measure violence victimization (e.g., Caiozzo, Houston, & Grych, 2016; Jouriles et al., 2005). For example, Jouriles et al. (2005) assessed violence victimization repeatedly over a two-month reference period, and then aggregated the multiple reports to yield a measurement of victimization across the two months. This cumulative assessment procedure yielded a higher prevalence rate of victimization than did a single assessment that covered the same two-month period. In addition, victimization scores obtained from the cumulative assessment procedure were more strongly associated with trauma and anxiety symptoms, compared to victimization scores obtained from the single assessment procedure. A similar pattern has emerged when cumulative and single assessment procedures have been used to assess mental health problems: the cumulative method yields higher prevalence rates (Copeland, Shanahan, Costello, & Angold, 2011; Costello, Mustillo, Erkanli, Keeler, & Arnold, 2003; Jaffee, Harrington, Cohen, & Moffitt, 2005; Kim-Cohen et al., 2003; Moffitt et al., 2010).

Cumulative assessment procedures might help circumvent certain obstacles to accurate reporting (e.g., faulty memory), but not all obstacles. For example, social desirability, or the tendency to present in a favorable way, may have greater effects on reports of TDV perpetration than on reports of either TDV victimization (Sugarman & Hotaling, 1997) or mental health problems. It seems reasonable to think that individuals whose reports of violence perpetration are heavily influenced by social desirability will be no less influenced by those factors whether they report via a cumulative or single assessment procedure. Thus, it is not clear if the results using a cumulative measurement approach will differ when measuring TDV perpetration, as compared to TDV victimization or mental health problems.

Study Goals and Hypotheses

The current study aimed to compare a cumulative assessment procedure to a single report of TDV perpetration over a 3-month time period. We recruited a sample of court-referred adolescents because of the high prevalence of TDV in this population (Cadely et al., 2017; Nocentini, Menesini, & Pastorelli, 2010). We compared estimates of the prevalence and frequency of TDV perpetration yielded by the two procedures. We hypothesized that: (1) TDV perpetration measured via cumulative assessments would yield higher prevalence and frequency of TDV perpetration than would the single report. However, even if a cumulative assessment procedure yields higher prevalence and frequency estimates of TDV perpetration, it should not be assumed that those estimates are more valid than a single

report would provide. Thus, we also assessed the validity of scores yielded by these different assessment procedures.

To assess the comparative validity of these two assessment procedures, we examined the respective associations of scores derived from each procedure with hypothesized precursors of TDV perpetration. In order to adequately assess the two assessment procedures, we chose precursors that were consistently associated with TDV perpetration in previous studies. Specifically, previous research has consistently demonstrated a positive association between externalizing problems and TDV, suggesting that elevated rates of externalizing problems are associated with higher rates of TDV perpetration. This has been empirically demonstrated with TDV measures that aggregate physical, sexual, and emotional TDV together, as well as to separate measures of physical and sexual TDV (Olsen, Parra, & Bennett, 2010; Rosenfield, Jouriles, Mueller, & McDonald, 2013; Vagi et al., 2013). Similarly, researchers have documented relations between broad measures of TDV and exposure to community violence among adolescents (Johnson, Parker, Rinehard, Nail, & Rothman, 2015; Reed, Silverman, Raj, Decker, & Miller, 2011), suggesting that teens who experience neighborhood violence are more likely to perpetrate TDV compared to those who do not. Previous work consistently finds that attitudes about dating violence predict TDV perpetration (Vagi et al., 2013). Specifically, a positive relation between physical, sexual, and emotional TDV, aggregated together, and attitudes about dating has also been established (Olsen et al., 2010). Thus, our second hypothesis was: (2) the associations between TDV perpetration and each of the hypothesized precursors of TDV would be stronger for the cumulative assessment procedure than for the single assessment procedure.

Method

Participants

Participants were 147 teens (52.4% male) aged 14 to 17 ($M = 15.85$, $SD = 1.05$). This age group was chosen because many teens begin dating outside of mixed-group activities around this time, and relationships begin to include intimacy and exclusivity (Connolly, Craig, Goldberg, & Pepler, 2004; Meier & Allen, 2009). The majority (88%) were recruited through county truancy courts in a large city in the Southern United States; the remainder were recruited through juvenile probation and victim services offices. Most teens identified as Black or African American (62.6%), followed by White (22.4%), more than one race (5.4%), American Indian/Alaska Native (2.7%), and Asian (2.0%). Four participants did not report information on race. Most also identified as non-Hispanic (84.4%).

Procedures

Data for the current study were collected as part of a larger study on teens' relationships with family and friends (Jouriles, Mueller, Rosenfield, McDonald, & Dodson, 2012; Jouriles, Rosenfield, McDonald, Kleinsasser, & Dodson, 2013; Rosenfield et al., 2013). Participants were recruited via fliers distributed at the courts, juvenile probation offices, and victim services offices. Fliers indicated that the purpose of the study was to "learn more about families and about children's peer and dating relationships." Interested teens and their mothers called to complete a screening interview to assess eligibility. To participate,

teens must have spoken English well enough to complete assessment materials, been in a relationship at the time of the initial contact, and been living with their mother for the past 6 months. Teens were excluded if they indicated that they had ever sustained a head injury that caused them to lose consciousness, or if a professional had ever told them that they had autism spectrum disorder, might have an intellectual disability, or might be a slow learner. The university's Institutional Review Board approved all procedures.

Mothers provided consent and teens provided assent prior to study participation. Afterward, a baseline assessment was completed in the lab (research offices). During the subsequent 3-month period, teens were contacted every two weeks by phone and asked to report their TDV perpetration during the previous two weeks. If a participant could not be reached within the 4-day window to complete an assessment, attempts to perform the assessment were ceased and a letter was mailed to the participant reminding them of their next telephone interview. At the 3-month assessment, participants returned to the lab, providing information on TDV over the past 3 months via an in-person interview. Mothers and teens each received \$50 for completing the baseline and 3-month assessment, and teens received \$10 for each completed 2-week assessment. The current study includes only data collected from teens.

Measures

Teen dating violence perpetration.—TDV perpetration was assessed using three subscales from the Conflict in Adolescent Dating Relationships Inventory (CADRI; Wolfe et al., 2001): physical (4 items), including “pushed, shoved, or shook them;” sexual (4 items), including “touched them when they didn’t want me to;” and emotional (10 items), including “insulted them with put downs.” Participants reported the frequency of committing each act on a 5-point scale ranging from 0 (*Never*) to 4 (*Four or more times*). The CADRI is widely used as a measure of TDV perpetration (Smith et al., 2015), and retrospective reports of TDV on the CADRI are associated with observed abusive behavior in an interaction task (Wolfe et al., 2001) and theorized predictors of TDV perpetration (Niolon et al., 2015).

For the single assessments, the reference period was the past 3 months. To examine frequency of the different types of TDV perpetration, total scores for each subscale were calculated by summing the items on the subscale. Prevalence was coded dichotomously (0 for scores = 0; 1 for scores > 0). Because the distribution of TDV was skewed (skewness = 1.85 – 5.15 across types of TDV), we utilized the greatest lower bound (GLB) coefficient as an index of internal consistency in the current sample (Trizano-Hermosilla & Alvarado, 2016). GLB was .95 for physical TDV, .91 for sexual TDV, and .94 for emotional TDV.

For each of the cumulative assessments, the reference period was the past 2 weeks. Frequency scores for each 2-week period were computed using the same procedure as for the 3-month retrospective reports. These scores from each 2-week assessment were then summed to form a total frequency score covering the 3-month time period. Prevalence was calculated from these frequency scores (0 for frequency scores = 0; 1 for scores > 0). Cranford and colleagues' (2006) reliability model was used to compute internal consistency as it allows for measurement variability at the between- and within- subjects

level. Reliability across the six cumulative assessments was acceptable, $R = .96$ for physical, $R = .89$ for sexual, and $R = .98$ for emotional TDV.

Externalizing.—Participants completed the 11-item delinquent behavior and 19-item aggressive behavior subscales of the Youth Self Report – Revised (YSR-R; Achenbach, 1991) at baseline. Items assessing delinquent behavior include “I lie or cheat” and “I steal from places other than home.” Items assessing aggressive behavior include “I get in many fights” and “I scream a lot.” Participants were asked to indicate how true each item was for them in the past 3 months on a 3-point scale: 0 (*not true*), 1 (*somewhat or sometimes true*), and 2 (*very true or often true*). Subscale scores were combined to form an index of externalizing problems; GLB was .93. Previous research suggests externalizing symptoms measured with the YSR-R positively relate to TDV (Narayan, Englund, Carlson, & Egeland, 2014; Ohlert, Seidler, Rau, Fegert, & Allroggen, 2017).

Exposure to community violence.—A modified version of the Survey of Exposure to Community Violence was administered at baseline (SECV; Richters & Saltzman, 1990). Participants rated how often in the past 3 months they had experienced 11 events involving community violence. Responses were made on a 3-point scale ranging from 1 (*Never*) to 3 (*Four or more times*). Items included “I have heard guns being shot in my neighborhood,” and “I have seen someone get stabbed in my neighborhood.” Items were summed. GLB was .82 in the current sample. The SECV has been shown to relate to TDV perpetration (Black et al., 2015).

Attitudes about dating.—Beliefs about dating relationships were assessed with a modified version of the Attitudes About Dating and Sexual Relationships Measure (AADSR; Ward, 2002) at baseline. Two 7-item subscales were used: one involving themes of men as sex-driven, and one involving themes of women as sexual objects. Sample items include: “Men are always ready and willing for sex; they think about it all the time” and “Using her body and looks is the best way for a woman to attract a man.” Participants indicated their agreement on a 6-point scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Items from both subscales were summed to arrive at a total score, with higher scores indicating greater endorsement of traditional gender roles in dating relationships. GLB was .91. The AADSR is associated with attitudes about sex and risky sexual behavior (Ward, Epstein, Caruthers, & Merriwether, 2011).

Data Analysis Plan

To test hypothesis 1, we used McNemar’s test and the Wilcoxon signed-rank test to compare the TDV prevalence and frequency scores across measurement procedures. To test hypothesis 2, which examined differential associations between each TDV precursor and the three TDV types (physical, sexual, and emotional), we used multivariate generalized linear mixed models (MGLMM). The multivariate dependent variable was comprised of the frequencies of the three TDV types that were assessed using each assessment procedure. The three measures of TDV type were nested within individuals. Each TDV precursor was used as a predictor of the three TDV types in separate analyses.

MGLMM allows repeated measures (TDV type) to be correlated through random effects and/or modeling the covariance structure of the errors of repeated measures. We chose this analysis over traditional methods such as comparing the magnitude of correlations, because MGLMM provides a more parsimonious and powerful test (Hox, Moerbeek, & Van de Schoot, 2017), and it appropriately models the count distribution of TDV. Traditional correlational methods do not model count distributions (although they can model rank order data), would result in nine comparisons (3 TDV types \times 3 precursors), and require a large sample for adequate power. MGLMM also allows multiple dependent variables to be included in a single model, which can reduce Type I error associated with multiple comparisons. Furthermore, multivariate analyses allow determination of whether the magnitude of the relations between a predictor (e.g., externalizing problems) and each of the dependent variables (each measure of TDV) differs across the dependent variables (Hox et al., 2017).

As is common when assessing TDV, our scores followed a count distribution; we therefore utilized a negative binomial distribution in all models, with robust standard errors (Atkins & Gallop, 2007). Although it is often advised that dependent variables are z-scored in MGLMM to account for differences in units of variables (Heck, Thomas, & Tabata, 2013), doing so would prevent the use of a negative binomial model, which requires whole numbers. We therefore retained the raw scores of TDV and included dummy codes for each subtype of TDV in the models to account for differences in scale. For instance, when examining sexual TDV, dummy codes for physical TDV and emotional TDV were included.

We examined differential associations between TDV precursors and TDV perpetration across assessment procedures using the following composite MGLMM model:

$$\text{TDV Perpetration}_{ij} = b_{0i} + b_{1i} * \text{Precursor}_i + b_{2i} * \text{Procedure}_{ij} + b_{3i} * \text{Precursor}_i * \text{Procedure}_{ij}$$

Where j subscripts refer to the three TDV measures (physical, sexual, emotional) duplicated across assessment procedure (cumulative vs. single), nested within individuals i.

We used separate models to examine the relation between TDV and each of the three precursors. For each model, we first examined whether the effect of assessment procedure on the relation between the precursor and TDV type differed by TDV type. To do so, we calculated dummy variables to code TDV type (two dummy variables to code the three TDV types) and included three-way interactions between assessment procedure, the precursor, and the dummy codes for each violence type (and the subcomponents).

Power Analysis

We evaluated the statistical power for detecting a difference in the prevalence and frequency of TDV with a sample size of 147 and alpha set at .05 using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007). Power exceeded .80 to detect an $OR = .50$ for the difference in prevalence using McNemar's test, and also exceeded .80 to detect a difference in frequency as small as $d = .25$ using the Wilcoxon signed-rank test.

Although there are several software programs that calculate the power of multilevel models, they are limited in the extent to which complex analytic models can be accurately

represented (Lane & Hennes, 2018). We therefore followed recommendations of Lane and Hennes (2018) to perform power analysis via simulations of the hypothesized model using SAS 9.4 (SAS Institute Inc., 2013). Due to lack of comparable models in the existing literature, we assumed a small-to-moderate effect of all fixed-effect predictors ($\beta = .10-.20$), with a small random slope variance (15%) and moderate residual variance (40%). Results from 1000 randomly generated simulations indicated adequate power to detect differential associations between TDV and its precursors across assessment procedures (power = .93).

Attrition and missing data

Of the 147 participants at baseline, 127 (84%) completed the 3-month assessment. In addition, 25 completed all six biweekly assessments, 31 completed five, 26 completed four, 24 completed three, 10 completed two, and 8 completed one. Analyses comparing completers vs non-completers indicated no statistically significant differences on any demographic variable or study variable at baseline, all p s > .05. We also examined whether missing data were missing completely at random (MCAR) using Little's MCAR test; all TDV variables, criterion variables, and demographic variables (e.g., age, sex, race, and ethnicity) were used in this test. Little's MCAR test was significant, $p = .01$, indicating that the data was not MCAR.

Missing data are common in studies involving frequent assessments (Silvia, Kwapil, & Walsh, 2014); however, missing data may still introduce bias. Thus, missing TDV data at the cumulative and single assessments were imputed using R missForest (Stekhoven & Bühlmann, 2011), an imputation technique appropriate for nonlinear data. MissForest utilizes a random forest technique that can manage continuous and categorical data; it trains random forests on observed variables that are then used to predict missing values. This procedure is run iteratively, and compares each computed data matrix with predicted values to the previous imputed matrix. When the difference between two consecutive matrices increases, the iteration process is stopped and the last imputed data matrix is retained. Based on Ender's (2017) recommendations to include demographic variables and all independent variables in the imputation of dependent variables, we included demographic variables (age, gender, race/ethnicity) and all hypothesized TDV precursors (externalizing problems, exposure to community violence, and attitudes about dating) in the imputation model. The missForest imputation process completed in three iterations. In sensitivity analyses to evaluate the replicability of results across methods, we did not statistically impute the missing data. Instead, missing 3-month assessments were left missing (and hence unused) and data from the cumulative assessments were simply averaged over the obtained assessments.

Results

Descriptive data

Means, standard deviations, and prevalence of TDV perpetration are presented in Table 1. For the single assessment, around 15% of adolescents reported physical TDV and 15% reported sexual TDV, while almost 80% reported emotional TDV. These prevalence rates are similar to those reported in previous research using similar, single assessment methods (e.g.,

Coker et al., 2014; Niolon et al., 2015). Prevalence rates with the cumulative assessment were generally higher (see the analysis below): almost 26% reported physical TDV, about 22% reported sexual TDV, and over 90% reported emotional TDV.

Correlations between TDV perpetration and precursors of TDV perpetration are presented in Table 2. Correlations were generally higher when TDV perpetration was measured cumulatively rather than with a single assessment. Correlations among the TDV precursors were Spearman's $\rho = .28$, $p < .001$, between externalizing problems and exposure to community violence; Spearman's $\rho = .23$, $p < .001$, between externalizing problems and attitudes about dating relationships; and Spearman's $\rho = .26$, $p < .001$, between exposure to community violence and attitudes about dating relationships.

Prevalence and frequency of TDV perpetration (Hypothesis 1)

McNemar's tests indicated higher prevalence (0 = no TDV, 1 = any TDV) of each type of TDV perpetration when it was measured cumulatively, as compared to being measured at a single assessment: physical TDV, $p < .001$, $OR = 5.77$; sexual TDV, $p < .001$, $OR = 2.84$; emotional TDV, $p < .001$, $OR = 20.17$ (see Table 1). Wilcoxon signed-rank tests indicated greater frequency of TDV perpetration when measured cumulatively, as compared to the single assessment, for all three types of TDV: physical TDV, $Z = -7.64$, $p < .001$, $r = -.63$; sexual TDV, $Z = -5.14$, $p = .001$, $r = -.42$; emotional TDV, $Z = -11.96$, $p < .001$, $r = -.99$ (see Table 1).

Associations of types of TDV perpetration with precursors of TDV (Hypothesis 2)

Externalizing problems.—We first examined whether the effect of assessment procedure on the relation between externalizing problems and TDV differed by type of TDV (physical, sexual, and emotional). No three-way interaction effects emerged, indicating no differences by TDV type: sexual vs. emotional TDV, $b = -0.01$, $SE = 0.03$, $p = .86$; sexual vs. physical, $b = 0.02$, $SE = 0.03$, $p = .58$; and emotional vs. physical, $b = 0.02$, $SE = 0.02$, $p = .21$. Thus, we dropped the three-way interactions and re-computed the analysis. Results indicated a moderator effect for assessment procedure, with a stronger relation between externalizing problems and TDV when TDV was measured cumulatively rather than with a single assessment (Table 3). These findings are consistent with the pattern of correlations reported in Table 2.

Exposure to community violence.—Relations between exposure to community violence and assessment procedure differed across the TDV types for sexual vs. emotional TDV, $b = -.13$, $SE = 0.05$, $p = .01$, and sexual vs. physical TDV, $b = -0.15$, $SE = 0.07$, $p = .03$, but not for emotional vs. physical TDV, $b = .02$, $SE = .05$, $p = .71$. We thus examined the relations separately by TDV type.

Results indicated a moderating effect of assessment procedure on the relation between TDV and exposure to community violence for sexual TDV, but not for physical TDV or emotional TDV (see Table 3). The association between sexual TDV and exposure to community violence was stronger when measured cumulatively rather than when measured with a single assessment. These findings are consistent with the pattern of correlations reported in Table

2. In fact, our correlational findings indicate no relation between sexual TDV and exposure to community violence when TDV was measured with the single assessment, and a positive relation when TDV was measured cumulatively.

Attitudes about dating.—Results of the three-way interactions indicated that effects of assessment procedure on associations between TDV perpetration and attitudes about dating did not vary by TDV type: sexual vs. emotional TDV, $b = -0.004$, $SE = 0.02$, $p = .78$; sexual vs. physical, $b = 0.02$, $SE = 0.02$, $p = .39$; and emotional vs. physical, $b = -0.02$, $SE = 0.02$, $p = .22$. Thus, we dropped the 3-way interactions and re-computed the analysis. Results indicated that the relation between TDV perpetration and attitudes about dating did not differ by assessment procedure (see Table 3). This result is consistent with the fact that the correlations between attitudes about dating and each type of TDV were almost identical across assessment procedure.

Sensitivity and Exploratory Analyses

We recomputed analyses utilizing the mean of the obtained assessments on each TDV subscale as the cumulative score for TDV (this is equivalent to mean imputation; Baraldi & Enders, 2010). That is, we calculated a mean score (from the obtained assessments for each participant) on each TDV subscale, which, when divided by 2, represented the average TDV score per week. To calculate a similar “average score per week” from the single 3-month assessment, we divided the sum score (over the last 3 months) by 12 weeks. Missing single 3-month assessments were not imputed, resulting in a total sample of 127 in this analysis. We reran all analyses with this new “average per week” dataset.

Results indicated greater prevalence of physical and emotional TDV when TDV was measured cumulatively rather than with a single assessment; however, prevalence of sexual TDV did not differ by assessment procedure. Similarly, results indicated greater frequency for all TDV types using the cumulative assessment procedure compared to the single assessment.

Results for the relation between the “mean TDV” subscales and the precursor variables (hypothesis 2) were analyzed using models that were similar to the MGLMM models used above to test hypothesis 2. However, since “mean TDV” scores were not whole numbers, we could not use the negative binomial parameterization of MGLMM model above as negative binomial models are for “count” distributions, which require whole numbers (Heck, Thomas, & Tabata, 2012). Instead, we used a normal distribution with an identity linking function, and robust standard errors (robust to violation of multivariate normality). Results for the mean scores were similar to those reported above for the imputed scores. In particular, assessment procedure moderated the relation between externalizing problems and all three TDV subscales (see Table 3), such that the relation between TDV and externalizing problems was stronger when TDV was measured with the cumulative assessments rather than a single assessment. Assessment procedure also moderated the relation between exposure to community violence and both sexual TDV and emotional TDV, but not physical TDV. That is, the relation between sexual TDV and exposure to community violence, and the relation between emotional TDV and exposure to community violence,

was significantly stronger for the cumulative method compared to the single assessment. Assessment procedure also moderated the relations between attitudes about dating and both sexual TDV and emotional TDV, but not physical TDV, such that the relation between sexual and emotional TDV and attitudes about dating was stronger when TDV was measured cumulatively rather than with a single assessment

In addition to replicating the original analyses, we also examined whether these associations differed by the number of cumulative assessments participants completed. For instance, it may be that participants who completed most or all of the cumulative assessments reported higher rates of TDV and a greater moderator effect due to assessment procedure. To examine this, we included number of completed assessments in the original analyses and the mean imputation analyses, and included a three-way interaction between assessment procedure, TDV precursor, and number of assessments (as well as all subcomponents of this interaction). Results of the original analysis demonstrate that the moderating effect of assessment procedure did not differ by number of completed assessments for externalizing problems, $b = -0.001$, $SE = 0.004$, $p = .79$, exposure to community violence, $b = -0.01$, $SE = 0.01$, $p = .56$, or attitudes about dating, $b = 0.00$, $SE = 0.004$, $p = .94$. Results of the sensitivity analyses also demonstrated that the moderating effect of assessment procedure did not differ by number of completed assessments for externalizing problems, $b = 0.00$, $SE = 0.001$, $p = .77$, exposure to community violence, $b = 0.001$, $SE = 0.004$, $p = .16$, or attitudes about dating, $b = 0.002$, $SE = 0.001$, $p = .06$.

Discussion

This study evaluated the potential utility of a cumulative assessment procedure for measuring TDV perpetration, compared to a single report over the same reference period. The cumulative assessment procedure yielded higher prevalence rates for physical, emotional, and sexual TDV compared to the single assessment. In addition, the frequency of all three types of TDV was greater when assessed using the cumulative procedure—almost five times greater for physical TDV, three times greater for sexual TDV, and six times greater for emotional TDV. All three types of TDV perpetration were more strongly related to externalizing problems when TDV was measured cumulatively rather than with a single report, and sexual TDV perpetration was more strongly related to exposure to community violence when measured cumulatively. Most of the results were replicated in sensitivity analyses. These results are generally consistent with findings examining the utility of cumulative assessment procedures for mental health assessment (Copeland et al., 2011; Costello et al., 2003; Jaffee et al., 2005; Kim-Cohen et al., 2003; Moffitt et al., 2010) and TDV victimization (Jouriles et al., 2005).

These findings imply that cumulative assessment procedures may provide a more sensitive assessment of TDV perpetration than single assessments; that is, cumulative assessment procedures may be more likely to indicate when TDV actually occurred. The increased sensitivity of the cumulative assessment procedure is especially important for determining whether prevention programming and clinical interventions are successful in reducing TDV perpetration. Indeed, there is little evidence thus far that significant reductions can occur in the perpetration of partner violence as a result of clinical interventions or

prevention programming directed at violent males (Babcock, Green, & Robie, 2004). In fact, many argue that the field does not yet have effective psychosocial interventions or prevention programs for reducing males' perpetration of intimate partner violence (Aaron & Beaulaurier, 2016). However, these failures to find intervention effects may be due, in part, to measurement methods which are not sensitive enough to detect differences in perpetration of intimate partner violence.

Across analytic approaches, TDV measured cumulatively demonstrated a stronger association with externalizing problems and exposure to community violence compared to the single assessment. Conversely, results involving attitudes about dating were inconsistent across analytic methods. This may be due, in part, to our measure on attitudes about dating. Although a previous study found a relation between attitudes about dating and TDV (Olsen et al., 2010), this relation was between attitudes about *aggression* in dating relationships and TDV. The measure used in the current study was not specific to the role of aggression in dating relationships.

Limitations

One limitation of this research is that all participants completed the cumulative assessment procedure prior to the single assessment procedure. One could argue that because the cumulative assessment procedure always preceded the single assessment, participant responses on the single assessment were affected by the cumulative assessment procedure. Specifically, the cumulative assessments may have primed participants to notice instances of relationship violence during the 3-month period that they might otherwise not recognize. Another possible order effect is that participation in the cumulative assessments caused participants to re-evaluate their behavior in a more positive light, and therefore fail to endorse instances of relationship violence that they perpetrated. Unfortunately, we did not include other measures that might lend insight into how the cumulative assessments affected participants' perceptions of TDV. Future research could minimize these order effects by randomly assigning participants to complete either the cumulative assessments or the single assessment, as opposed to having the same participants complete both assessment procedures.

It may also be argued that the current findings are not due to the different assessment procedures, but to other aspects of the assessments. For example, the cumulative assessments were conducted via phone interview, while the single assessments were conducted as an in-person interview. It could be reasoned that adolescents are more likely to divulge socially undesirable information during a phone interview rather than in person. However, previous research demonstrates that participants respond similarly to phone and in-person interviews (Bidarra, Lessard, & Dumont, 2016; Dansky, Saladin, Brady, Kilpatrick, & Resnick, 1995).

Missing data are common in repeated assessment procedures, and especially when implementing intensive longitudinal data collections (Silvia et al., 2014). In the current study, approximately 30% of the data across the 3-month period in which the cumulative assessments were conducted was missing, which is comparable to that seen in similar studies where data are collected in intensive longitudinal designs (e.g., Karahalios, Baglietto,

Carlin, English, & Simpson, 2012; Ohly, Sonnentag, Niessen, & Zapf, 2010). Although we employed a well-established imputation method appropriate for our data, best practice for handling missing data is to limit missingness as much as possible during data collection (Newman, 2014).

We utilized a commonly used measure of TDV perpetration for both the cumulative assessment procedure and the single assessment. Although we found evidence for the utility of the cumulative assessment procedure, it is unclear if our results would generalize to other measures of TDV perpetration that employ different items and response scales. Relatedly, we only examined three precursors of TDV perpetration, and it is unclear if our results would generalize to other precursors. In addition, the current study utilized a sample of court-referred adolescents. Our prevalence and frequency rates are similar to previously published rates of comparable samples (Coker et al., 2014; Niolon et al., 2015); however, it is unclear if our findings would replicate across other samples. For instance, different samples of youth may have different variables biasing their motivation to report TDV perpetration.

Research Implications

Many factors pertaining to optimal use of a cumulative assessment procedure remain unknown. For example, the ideal number and spacing of assessments are virtually unexplored. One could reason that shorter assessment periods, such as those used in daily diary studies, may yield more accurate estimates of TDV perpetration. On the other hand, additional assessments pose additional assessment burden on participants, and may have other effects (e.g., priming, effects of frequent repetition) which could affect the validity of the data obtained. Future research should examine how factors such as number and spacing of assessments impact estimates of TDV perpetration and validity of data.

The optimum format for administering a cumulative assessment procedure is also unknown. Repeated interviews, such as those used in the current research, may require considerably more time and effort than single assessments. However, advances in technology have significantly reduced the burden placed on researchers and participants. For instance, currently available survey programs include automatic survey distribution and tracking via cell phone, tablet, or computer. Additionally, several studies document the feasibility of using remote technology, such as cell phones, to collect intensive longitudinal data (Heinonen, Luoto, Lindfors, & Nygård, 2012; Hensel, Fortenberry, Harezlak, & Craig, 2012). With such advances, there are now several options for administering cumulative assessments with little burden to the researcher and less burden for participants. However, whether certain formats provide higher quality data than others is unknown at this point, and a worthwhile topic for future research.

Prevention, Clinical, and Policy Implications

As noted earlier, our findings suggest that cumulative assessment procedures may provide a more sensitive assessment of TDV perpetration, which may be useful in the evaluation of programs designed to prevent or reduce TDV perpetration. Similarly, a more sensitive

assessment of TDV perpetration may uncover potential precursors that may have been missed in past research, due to the use of less sensitive measurement procedures.

Conclusion

Results of the current study suggest that cumulative assessments yield greater prevalence and frequency rates of TDV perpetration compared to single reports. Additionally, differential associations between TDV perpetration and hypothesized precursors of violence across measurement procedures provide some evidence that estimates obtained via cumulative assessments may be more valid than those obtained via single reports, at least for the purpose of identifying correlates of TDV perpetration. Although further research is needed on the use of cumulative assessments, especially within the field of TDV and partner violence in general, the current study points to the potential utility of cumulative assessment procedures.

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Table 1

Means and standard deviations of frequency of TDV perpetration and prevalence of TDV perpetration by type of TDV

	<i>Single Assessment</i>		<i>Cumulative Assessment</i>	
	<i>Frequency</i>	<i>Prevalence</i>	<i>Frequency</i>	<i>Prevalence</i>
	<i>M (SD)</i>	<i>% (n)</i>	<i>M (SD)</i>	<i>% (n)</i>
Physical TDV	0.56 (2.22)	13.6 (20)	3.127 (8.55)	47.6 (70)
Sexual TDV	0.39 (1.31)	15.0 (22)	1.30 (3.22)	33.3 (49)
Emotional TDV	6.14 (7.42)	78.2 (115)	34.07 (35.39)	98.6 (147)

Note. Prevalence: percent of participants who endorsed any violence perpetration. Frequency: The possible range for physical and sexual TDV scores for the single assessment was 0-16; for emotional TDV the possible range was 0-40. The possible range for physical and sexual TDV scores for the cumulative assessment was 0-96; for emotional TDV the possible range was 0-240.

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Table 2

Correlations of TDV perpetration with precursors of TDV

	Single Assessment			Cumulative Assessment		
	Physical TDV	Sexual TDV	Emotional TDV	Physical TDV	Sexual TDV	Emotional TDV
Externalizing	.27 **	.22 **	.46 **	.39 **	.36 **	.46 **
Community Violence	.25 **	.12	.21 **	.30 **	.32 **	.27 **
Dating Attitudes	.11	.17 *	.19 *	.12	.16	.19 *

Note. All values are Spearman rho correlations.

* $p < .05$.

** $p < .01$.

Table 3

Moderator effects of assessment procedure on the relation between precursors and TDV across analytic approaches

TDV Precursors	Physical TDV			Sexual TDV			Emotional TDV		
	<i>B</i>	<i>SE</i>	<i>OR</i> ^a	<i>B</i>	<i>SE</i>	<i>OR</i>	<i>B</i>	<i>SE</i>	<i>OR</i>
Original Imputation									
Externalizing	0.01**	.01	0.99						
Community Violence	-0.02	.05	0.98	0.12*	.05	1.13	-0.01	.02	1.00
Dating Attitudes	-0.01	.01	1.00						
Mean Imputation									
Externalizing	0.01**	.01	0.01	0.01**	.01	.01	0.10**	.02	0.03
Community Violence	0.04	.02	0.01	0.02**	.01	.01	0.19**	.07	0.02
Dating Attitudes	0.01	.01	0.01	0.01*	.01	.01	0.05**	.02	0.01

Note. Analyses with only physical TDV reported indicate analyses where models did not differ by TDV type. Bolded numbers indicate statistically significant findings

^aThe effect size for the mean imputation models was partial-eta squared.

*
p < .05

**
p < .001