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# **Intimate Partner Violence Victimization and Cognitive Function in a Mixed-Sex Epidemiological Sample of Urban Adults**

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Intimate partner violence (IPV) victimization is associated with a wide range of mental and physical health problems, but little is known about the effect of IPV on cognitive decline. Previous research suggests an association between IPV victimization and cognitive dysfunction, but the few studies that have examined this phenomenon were cross-sectional in design and focused only on female victims of IPV. This study examined cognitive function over time among a diverse population of both male and female victims of IPV. Regression analyses indicated increased completion time on Trail Making Test (TMT) A for both male and female victims of IPV living below poverty as well as for female victims of IPV without previously depressive symptomatology. Results also indicated increased completion time on TMT B for male victims of IPV. Our findings support an association between IPV victimization and increased cognitive decline that is moderated by poverty status and previous depressive symptomatology.

**Keywords:** cognition; intimate partner violence; domestic violence; executive function; attention

Cognitive performance, the “processes of knowing, including attending, remembering, and reasoning” (American Psychological Association, 2014), shifts and changes over the adult lifespan and is influenced by numerous demographic and health-related factors such as age, sex, socioeconomic status, and mental and physical health. Although there is considerable debate about the mechanisms underlying cognitive change over time (Glisky, 2007), some cognitive decline is considered a “normal” component of aging (Deary et al., 2009). Cognitive deficits are common among individuals with

traumatic brain injuries and neurodegenerative disorders, but less is known about the role of psychiatric and psychological conditions in cognitive performance.

Psychological symptoms such as those associated with depression (McDermott & Ebmeier, 2009) and emotional trauma (Brandes et al., 2002) reduce cognitive performance. Depressive symptoms are associated with cognitive decline, particularly executive function (Elliott et al., 1996; McDermott & Ebmeier, 2009), processing speed (Beats, Sahakian, & Levy, 1996; Elliott et al., 1996; McDermott & Ebmeier, 2009), spatial recognition, and attentional shifting (Beats et al., 1996). Similarly, psychological symptoms associated with exposure to trauma can lead to deficits in attention, memory, learning, and executive function (Brandes et al., 2002; Flaks et al., 2014; Yehuda et al., 2006). It is unclear whether cognitive dysfunction following exposure to a traumatic event is mediated by the emergence of posttraumatic stress disorder (PTSD). Some studies suggest that a decline in cognitive performance following trauma exposure is associated with the development of PTSD (e.g., Flaks et al., 2014); however, other findings suggest that individuals exposed to trauma experience significantly greater cognitive decline over time than unexposed comparisons, regardless of PTSD symptom severity (e.g., Yehuda et al., 2006).

Psychological and cognitive responses to trauma may differ based on sex (Polak, Witteveen, Reitsma, & Olf, 2012; Vrana & Lauterbach, 1994). Although men have higher rates of trauma exposure, women tend to have higher rates of psychological consequences, such as PTSD, following traumatic events (Breslau, 2009). Furthermore, Vrana and Lauterbach (1994) found that men exposed to traumatic events were affected more negatively by events they felt they could not discuss, whereas women were affected more negatively by exposure to violent deaths or injury.

Few studies have examined sex differences in cognitive function following exposure to traumatic events; however, one study (Polak et al., 2012) found that male patients with PTSD performed worse on measures of executive function, whereas female patients with PTSD did not exhibit any signs of executive dysfunction. Although the mechanisms of change are unclear, research suggests that traumatic experiences have a negative impact on cognitive performance. Despite these findings, few studies have examined the association between IPV victimization and cognitive function.

Intimate partner violence (IPV) is a noteworthy source of psychological trauma and a serious public health concern that affects both men and women in all racial and socioeconomic groups (Bonomi et al., 2009). IPV prevalence estimates vary by sample and detection method, particularly with respect to age, income, race, and sex. IPV victimization is more common among younger adults (Bonomi, Anderson, Rivara, & Thompson, 2007; Jones et al., 1999; Thompson et al., 2006) and those with lower household income (Bonomi et al., 2009; Campbell et al., 2002; Coker et al., 2002; Jones et al., 1999; Thompson et al., 2006). Although some studies found no significant differences in rates of IPV victimization with respect to race (Coker, Smith, Bethea, King, & McKeown, 2000; Thompson et al., 2006), other studies have found higher rates of reported IPV among African Americans than European Americans (Campbell et al., 2002; Jones et al., 1999). Racial disparities appear to be largely accounted for by socioeconomic factors (Cazenave & Straus, 1990; Grossman & Lundy, 2007).

There is a considerable degree of controversy regarding prevalence of IPV with respect to sex. Some theorists argue that IPV is often expressed through mutual physical contact, but women bear the brunt of injury, leading to higher reporting rates in medical and legal contexts (Archer, 2000). Furthermore, a significant amount of research has focused primarily on IPV victimization among women (e.g., Adams, Bybee, Tolman, Sullivan, &

Kennedy, 2013; Bonomi et al., 2007; Thompson et al., 2006). The tendency for researchers to exclude male victims in their analyses may lead to inaccurate perceptions of the prevalence of IPV with respect to sex. Despite these discrepancies, it is important to accurately understand the prevalence of IPV among these specific populations to appropriately address the consequences stemming from this type of abuse.

IPV is associated with a range of psychological and physical health problems. Psychological consequences of IPV include depression, PTSD, suicidality (Golding, 1999), anxiety (e.g., Adams et al., 2013; Bonomi et al., 2009), and substance abuse (e.g., Coker et al., 2002; Coker et al., 2000). These outcomes may be moderated by sex, with women reporting more symptoms related to PTSD (Golding, 1999) and men reporting more depressive symptoms following their abuse (e.g., Reid et al., 2008). Although findings from research examining mental health outcomes of female victims of IPV have linked reported abuse to depression, suicidality, PTSD, substance abuse (e.g., Golding, 1999), and anxiety (Adams et al., 2013), only depression and substance abuse were reported in studies that included male victims of IPV in their sample.

In addition to the psychological consequences associated with IPV, many victims of IPV also suffer from physical health problems associated with their abuse. Direct effects include contusions, soft tissue injuries, sprains, strains, fractures, maxillofacial injuries, and traumatic brain injuries (Mitchell & Anglin, 2009). Men and women with a reported history of IPV victimization tend to report poorer overall health than their nonabused counterparts (Carbone-López, Kruttschnitt, & Macmillan, 2006; Coker et al., 2002). Specifically, findings from research examining physical health outcomes of both male and female victims of IPV have linked reported abuse to chronic disease (e.g., Coker et al., 2002), joint disease, asthma, smoking, activity limitations, heavy drinking (e.g., Breiding, Black, & Ryan, 2008), and physical disability (e.g., Carbone-López et al., 2006). Physical health outcomes associated with IPV may be moderated by sex. One study (Breiding et al., 2008) reported greater risk for heart attacks, strokes, and high cholesterol for women but not for men with a reported history of IPV. Although a considerable amount of research has focused on the mental and physical health outcomes associated with IPV, less literature is available on the cognitive consequences of abuse.

Previous research on the association between IPV victimization and cognitive dysfunction, although limited, suggests that IPV victimization may negatively affect cognitive function, particularly with respect to executive function (Seedat, Videen, Kennedy, & Stein, 2005; Stein, Kennedy, & Twamley, 2002), working memory (Stein et al., 2002), and processing speed (Twamley et al., 2009). For example, one study (Stein et al., 2002) found that female victims of IPV performed worse than nonabused controls on tasks of visuoconstruction, working memory, and executive function. Similarly, Seedat et al. (2005) found that female victims of IPV performed worse than controls on tests of cognitive inhibition and set shifting. Furthermore, Twamley et al. (2009) found that women with PTSD related to IPV victimization performed significantly worse than healthy controls on a measure of processing speed.

The few studies that have examined the association between IPV victimization and cognitive function focused only on female victims of IPV (e.g., Seedat et al., 2005; Stein et al., 2002; Twamley et al., 2009). Furthermore, each of the studies investigating the effects of IPV on cognitive function was cross-sectional. Because of the temporal association between age and neurocognitive decline, it is important to investigate the effects of IPV victimization on cognitive function over time. Although some level of cognitive decline is inevitable with age, it is important to identify risk factors that can lead to an accelerated



rate of decline in cognitive function over time to better understand the mechanisms underlying this type of deterioration.

This study examined the effect of IPV victimization on cognitive function among a mixed-sex sample of economically and racially diverse working-aged adults. Based on high rates of depression among both male and female victims of IPV, our study examined whether this effect is moderated by previous depressive symptomatology. Based on findings from research examining cognitive function following exposure to traumatic events, we expected to find an association between IPV victimization and cognitive decline over time. Although our literature review uncovered no studies that examined the association between IPV victimization and cognitive function among men, research suggests differential health and psychological outcomes for men and women following IPV victimization. Based on these findings, we expected to observe some sex differentials in the association between IPV victimization and cognitive performance. Furthermore, based on findings from research examining the association between depression and cognitive function, we expected worse cognitive performance among individuals with previously depressive symptomatology.

## METHOD

### Participants

Participants were 63 men and women initially between the ages of 30–63 years old who were participants in the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study. HANDLS is an ongoing epidemiological study focusing on health disparities in Baltimore, Maryland. Participants are a fixed cohort of women and men recruited from 12 neighborhoods (contiguous census tracts) in Baltimore City that were predetermined based on the likelihood of yielding representative distributions of Baltimore City residents. The area probability sample was designed to sample a diverse group of participants with respect to a four-way factorial design of age, sex, race, and socioeconomic (SES). Poverty status was coded as a binary variable. Individuals were categorized as living in households with incomes at or below 125% of the federal poverty line or 125% above the federal poverty line based on their annual household income and household size. For example, in 2003, the federal poverty level was \$18,400 for a family of four. Therefore, an individual in our sample in a household earning less than or equal to \$18,400 per year with a household size of four was classified as living below the federal poverty line. Race was defined as African American or White, and participants ranged from 30 to 64 years of age (Evans et al., 2010). Exclusionary criteria for the HANDLS study included a current pregnancy, a history of autoimmune deficiency syndrome (AIDS) or cancer.

Longitudinal data were collected at two time points (Wave 1 and Wave 3) spanning approximately 5 years between each visit for each participant. To investigate the rate of cognitive decline following a new incident of IPV victimization, this study examined HANDLS participants who reported IPV victimization at Wave 3 but reported no history of IPV victimization before their participation in Wave 1. Overall, 38 participants (2.27%) reported IPV victimization since their last HANDLS visit; however, 6 participants were excluded because of their reporting victimization prior to Wave 1, and 8 were excluded because of missing data regarding IPV victimization prior to Wave 1. Of the 24 remaining participants reporting incident IPV victimization, 21 had complete cognitive data.

We created a comparison sample by performing a 2:1 match on education and initial age for participants with no history of IPV. Matching is a way of controlling for certain criterion that removes the variation in that criterion which can then not be used as a comparisons classification. Therefore, we did not match on any variables that were included as covariates in our analyses. Although some studies use years of education as a proxy for SES, years of education and poverty status were not highly correlated in the sample for this study ( $r = .17$ ). Within the effective sample, 54% identified as female and 46% of participants identified as male. Furthermore, 63% of participants identified as African American, and 37% identified as White.

## Measures

Cognitive function was evaluated using several measures, including the Trail Making Test (TMT) Parts A and B and the Animal Naming (AN) test. Although many cognitive measures were administered to HANDLS participants, only the scores from TMT A, TMT B, and the AN test were analyzed for this study because of missing data for the participants in these analyses. These measures were administered to participants during their visits to the mobile research vehicles (MRVs) during Wave 1 and Wave 3.

**Trail Making Test.** The TMT consists of two parts. Part A of the TMT consists of a sheet of paper displaying circles labeled “1” through “25.” This task requires the participant to sequentially connect the 25 circles as quickly and as accurately as possible by drawing straight lines from one circle to the next (e.g., connect circle “1” to circle “2”). Studies suggest that Part A of the TMT is a valid measure of visuoperceptual abilities, attention, and information processing speed (Army Individual Test Battery, 1944; Lezak, 1995; Reitan, 1992).

Part B of the TMT consists of a sheet of paper displaying 25 circles with numbers (“1”–“12”) and letters (“A”–“L”). This portion of the TMT requires participants to connect the 25 circles, switching back and forth between numbers and letters (e.g., connect “1” to “A” and “A” to “2” and “2” to “B”) as quickly and accurately as possible. Part B of the TMT serves as a measure of processing speed and cognitive flexibility. The scores for TMT Parts A and B are derived from the number of seconds it takes the participant to complete each task, with higher scores indicating poorer neurocognitive performance (Army Individual Test Battery, 1944; Lezak, 1995; Reitan, 1992).

**The Animal Naming Test.** The AN test is a measure of categorical verbal fluency that requires participants to recite the names of as many animals that they can in 60 s. Participants receive 1 point for each animal name that they recite. Duplicate and mythical animal names are not counted (Tombaugh, Kozak, & Rees, 1999).

**The Center for Epidemiological Studies Depression Scale.** Depression was assessed during Wave 1 using the Center for Epidemiological Studies Depression (CES-D) scale. The CES-D scale is a 20-item questionnaire used to assess the presence and frequency of depressive symptoms in the general population. Participants are asked to rate their depressive symptoms within the past week using a 4-point Likert scale ranging from “0” (*rarely or none of the time*) to “3” (*most or all of the time*). Scores for this measure range from 0 to 60. Scores greater than 16 are suggestive of significant depressive symptomatology (Radloff, 1977). The CES-D scale variable was dichotomized based on the cutoff level for clinical significance.

**Intimate Partner Violence.** Incident IPV victimization was assessed by participants’ reports of sexual or physical abuse by a partner in Wave 3, but no such abuse before

Wave 1. IPV in Wave 1 was evaluated during each participant's medical history interview. As part of a semistructured interview, participants were asked whether or not they had ever been physically or sexually abused by an intimate partner in their lifetime. Participants' responses were coded as "Yes" or "No." IPV in Wave 3 was evaluated using audio computer-assisted self-interview (ACASI) software composed of various psychological measures. Participants' reports of abuse were based on a response of "Yes" or "No" to either of the following questions: "Since your last HANDLS examination, have you been hit, slapped, kicked, or otherwise physically hurt by (a partner)?" or "Since your last HANDLS examination, has anyone (partner) forced you to have an unwanted sexual act?"

## Procedure

Participants provided written informed consent before participating in the study. The study is approved by the Institutional Review Board of the National Institute of Environmental Health Sciences, National Institutes of Health. Demographic information was obtained from each HANDLS participant during an interview conducted in the participant's home. On a separate occasion, participants were administered various medical and psychological tests during an all-day appointment on mobile research vehicles parked in their neighborhoods including a detailed medical history at the initial visit and an interim medical history at the follow-up visit approximately 5 years later. Although several measures were administered, only the data from the measures related to IPV and cognitive function were analyzed. Participants received monetary compensation as well as comprehensive physical examinations and clinical reports after they participated in the study. Detailed information regarding the procedure for the HANDLS study has been described previously (Evans et al., 2010).

## Analyses

All statistical analyses were performed using the statistical software "R" (R Development Core Team, 2013).

**Matching.** Forty-two participants who did not meet the criteria for the IPV group were matched to the 21 participants who did meet the criteria for the IPV group. Participants were matched on years of education and age at baseline. The 2:1 matching procedure was performed using the "MatchIt" package (Ho, Imai, King, & Stuart, 2011) in R. Pearson's chi-squared test with Yates' continuity correction was used to test differences in sex and race between the IPV group and matched controls. A Welch two-sample *t* test was used to test differences in age at baseline and years of education between the IPV group and matched controls. No differences were found for sex,  $\chi^2 = 0.008$ ,  $p = .929$ ; race,  $\chi^2 = 0$ ,  $p = 1$ ; years of education,  $t(41.8) = 0.665$ ,  $p = .510$ ; or age,  $t(46.67) = -0.486$ ,  $p = .629$ , between the IPV group and matched controls.

**Regression Models.** The longitudinal relationship between IPV victimization and cognitive function was examined with mixed-effects regression analyses (Singer & Willett, 2003) using unstructured correlation matrices. Mixed-effects regression analyses account for the correlation of repeated measurements over time among participants. Furthermore, this technique is not affected by missing data and can adequately handle varying measurement intervals within and across participants. Backward elimination was used in each regression model. Backward elimination is a technique commonly used with mixed model regression analyses in which unnecessary and nonsignificant fixed-effects are removed from the regression analysis. The model begins with all candidate variables and

nonsignificant variables are then removed in a stepwise fashion. However, if a fixed-effect corresponds to a significant interaction term or random effect, then it is not removed from the analysis. The benefits of backward elimination with linear mixed-effect models are well-documented (e.g., Morrell, Pearson, & Brant, 1997).

Three separate regression analyses were performed for each outcome variable (i.e., TMT Part A, TMT Part B, AN test) using the “lme4” (Bates, Maechler, Bolker, & Walker, 2014) and “lmerTest” (Kuznetsova, Brockhoff, & Christensen, 2013) packages in R. The lme4 package is used to fit linear and generalized linear mixed-effects regression models. The lmerTest package calls on functions within the lme4 package to perform *F* tests for fixed effects, likelihood ratio tests for random effects, and backward elimination of non-significant fixed effects. Models were adjusted for age at baseline and years of education using a matching procedure. Poverty status, depression, and sex were treated as dichotomous covariates. Age at Wave 1 and Wave 3 was modeled as a random effect to serve as an index of time. This technique is recommended for studies involving multiple waves of data collection (McArdle & Bell, 2000).

Model 1 for each of the three outcome variables examined whether a reported history of IPV, sex, poverty status, and their interactions were associated with a change in cognitive performance over time. In Model 2, separate, mixed-effects linear regression analyses added depression as covariate to test its influence of the relationship between IPV, sex, poverty status, and their interactions on each of the outcome variables (TMT A, TMT B, AN). Following a growth model formulation, age served a dual purpose as both the age of the participant and the measure of time. Random effects for both models included age and the subclass assigned to each participant in the matching procedure. Backward elimination was performed for nonsignificant fixed effects (Morrell et al., 1997). The *p* values were calculated for *t* tests based on Satterthwaite’s approximation for denominator degrees of freedom. Random effects were tested using log-likelihood ratio tests with one degree of freedom. Because the data for TMT A and TMT B were skewed, we performed a logarithmic transformation of the scores for these variables.

## RESULTS

### Model 1

There was a significant IPV  $\times$  Sex interaction for TMT Part B,  $b = 1.12$ ,  $t(58.4) = 3.08$ ,  $p = .003$ ,  $g = 0.81$ . For men, a reported history of IPV was associated with a significant increase in completion time (worse performance) on TMT Part B. No significant main effects or interactions were found on TMT Part A or the AN test with respect to IPV. Coefficients and confidence intervals for regression Model 1 are shown in Table 1.

### Model 2

There was a significant Age  $\times$  IPV  $\times$  Poverty Status interaction for TMT Part A,  $b = 0.11$ ,  $t(73.9) = 2.94$ ,  $p = .004$ ,  $g = 0.78$ . Over time, a reported history of IPV, paired with living 125% below the poverty line, was associated with a significant increase in completion time (worse performance) on TMT Part A (Figure 1). There was also a significant Age  $\times$  IPV  $\times$  Sex  $\times$  Depression interaction for TMT Part A,  $b = 0.15$ ,  $t(55.1) = 3.25$ ,  $p = .002$ ,  $g = 0.86$ . Over time, IPV was associated with a significant increase in completion time (worse performance) on TMT Part A for women without a history of depressive symptoms



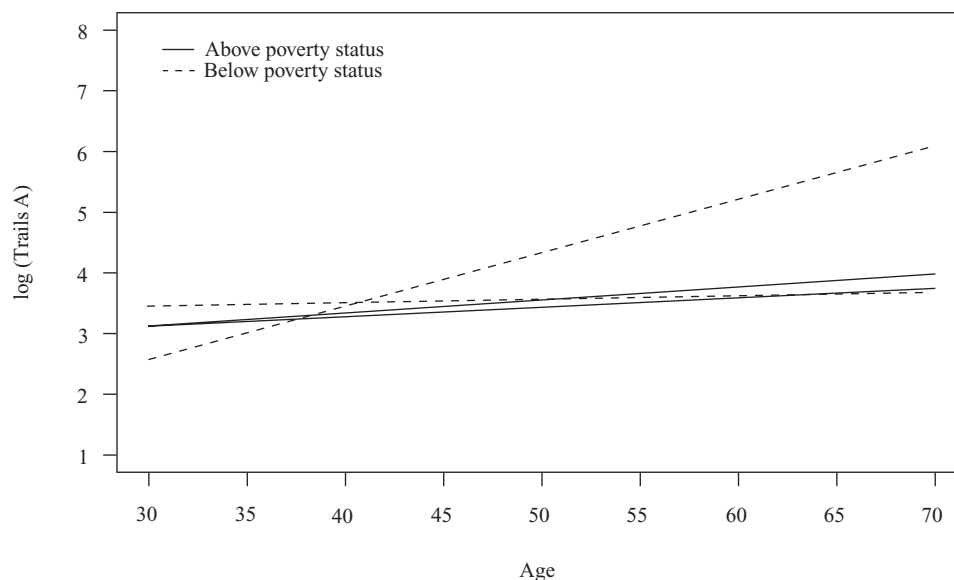
**TABLE 1. Coefficients and Confidence Intervals for Mixed Model Regression of Intimate Partner Violence, Age, Sex, and Poverty Status on Cognitive Performance**

	(log) Trail Making Test A		(log) Trail Making Test B		Animal Naming	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
IPV	—	—	-0.41	[-0.86, 0.03]	—	—
Age	0.02***	[0.01, 0.03]	0.01	[-0.02, 0.02]	-0.22**	[-0.38, -0.07]
Sex	—	—	-0.15	[-0.55, 0.26]	2.45	[-0.26, 5.17]
IPV × Sex	—	—	1.12**	[0.41, 1.82]	—	—
Poverty	0.22	[-0.01, 0.31]	0.55*	[0.06, 1.06]	-1.95	[-4.92, 0.96]

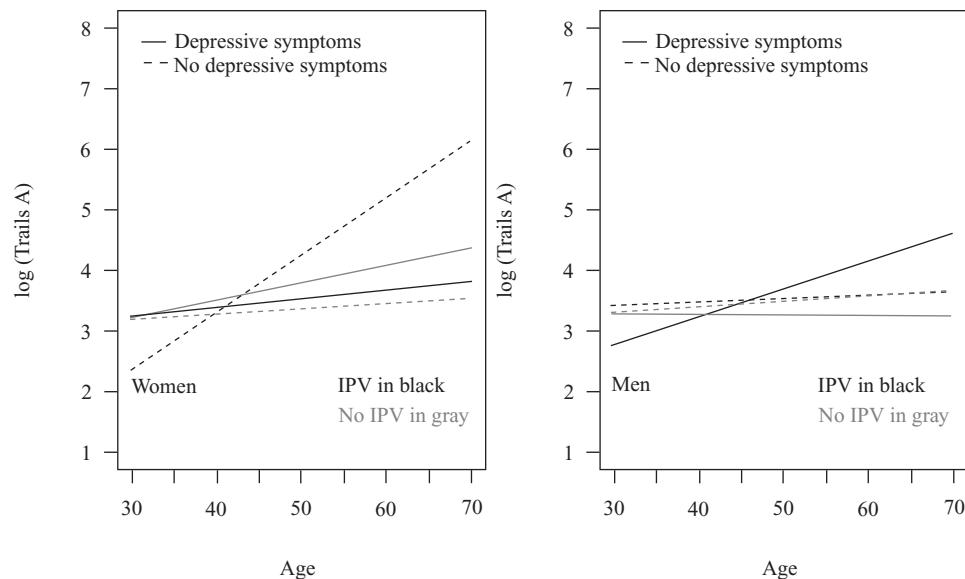
Note.  $N = 63$ . IPV = intimate partner violence; CI = confidence interval.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

(Figure 2). Figure 1 depicts significant IPV × Poverty Status × Age interaction for TMT Part A. Figure 2 depicts significant IPV × Age × Depression × Sex interaction for TMT Part A. Both figures represent age-related change in cognitive performance as a function of IPV using all information in each model. After backward elimination, the final regression models for TMT B and the AN test did not change. Coefficients and confidence intervals for regression Model 2 are shown in Table 2.



**Figure 1.** Longitudinal change in performance on the Trail Making Test Part A as a function of intimate partner violence (IPV) and poverty status.



**Figure 2.** Longitudinal change in performance on the Trail Making Test Part A among men and women as a function of intimate partner violence (IPV) and depression.

## DISCUSSION

In this study, we examined the relationship between a reported history of IPV victimization and change in cognitive function in a mixed-sex sample of African American and White participants between the ages of 30 and 63 years old. We found that IPV victimization was significantly associated with decline in attention, visuo-perceptual ability, and executive function and that this relationship differed by poverty status and previous symptoms of depression. The current findings extend prior research demonstrating associations between IPV victimization and cognitive function by examining change in cognitive functioning over time in both men and women and by examining interactive influences of poverty status, race, and previous depressive symptoms in an epidemiological sample.

IPV victimization was associated with a statistically significant increase in completion time (poorer performance) on TMT Part A over time for men and women living below poverty. These results suggest that poverty status may moderate the effect of IPV victimization on attention and visuo-perceptual ability. These results are consistent with others studies linking poverty to cognitive dysfunction (e.g., Mani, Mullainathan, Shafir, & Zhao, 2013; Turrell et al., 2002). A recent study (Mani et al., 2013) proposed a “cognitive constraint hypothesis” postulating that poverty itself contributes to cognitive decline because the stress of financial difficulty consumes a large majority of an individual’s cognitive resources.

IPV victimization was also associated with a significant decline in performance on TMT A for women without a history of significant depressive symptomatology. These findings suggest that IPV victimization was related to declines in attention and visuo-perceptual ability over time for previously nondepressed women but not for women with a history of significant depressive symptomatology. There are a couple of possible explanations for this phenomenon. First, despite numerous studies citing the relationship between

**TABLE 2. Coefficients and Confidence Intervals for Mixed Model Regression of Intimate Partner Violence, Age, Sex, Depression, and Poverty Status on Cognitive Performance**

	(log) Trail Making Test A		(log) Trail Making Test B		Animal Naming	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
IPV	0.52	[-0.00, 0.04]	-0.41	[-0.86, 0.03]	—	—
Age	0.02	[0.02, 0.96]	0.00	[-0.02, 0.02]	-0.22**	[-0.38, -0.07]
IPV × Age	0.05*	[0.00, 0.09]	—	—	—	—
Sex	0.05	[-0.32, 0.39]	-0.15	[-0.55, 0.26]	2.45	[-0.26, 5.17]
IPV × Sex	-0.51	[-1.47, 0.60]	1.12**	[0.41, 1.82]	—	—
Poverty	0.07	[-0.31, 0.47]	0.55*	[0.06, 1.06]	-1.95	[-4.92, 0.96]
IPV × Poverty	1.12*	[0.40, 1.92]	—	—	—	—
CES	0.56*	[0.19, 0.92]	—	—	—	—
CES × IPV	-1.13**	[-1.74, -0.48]	—	—	—	—
IPV × Age × Sex	-0.06	[-0.13, 0.02]	—	—	—	—
IPV × Age × Poverty	0.11**	[0.05, 0.19]	—	—	—	—
IPV × Age × CES	-0.10**	[-0.15, -0.05]	—	—	—	—
IPV × Sex × Poverty	-1.05	[-2.16, 0.00]	—	—	—	—
IPV × Sex × CES	1.50*	[0.47, 2.50]	—	—	—	—
IPV × Age × Sex × Poverty	-0.09	[-0.19, -0.00]	—	—	—	—
IPV × Age × Sex × CES	0.15**	[0.06, 0.23]	—	—	—	—

Note. *N* = 63. IPV = intimate partner violence. CES = Center for Epidemiological Studies; CI = confidence interval. \**p* < .05. \*\**p* < .01.

cognitive dysfunction and depression, there is some evidence that the neurobiological changes associated with depressive symptoms may improve certain aspects of cognition (Andrews & Thomson, 2009). Andrews and Thomson (2009) proposed an analytical rumination hypothesis, suggesting that there are several adaptive features of depression, including attentional control. Specifically, the left ventrolateral prefrontal cortex (VLPFC) is activated during depressive episodes to facilitate focused attention on the target problem. Research suggests that activation of the left VLPFC can improve an individual's ability to concentrate and withstand distractions (Andrews & Thomson, 2009).

Second, research suggests that women are more likely than men to seek psychological help for depression (e.g., Möller-Leimkühler, 2002), and the skills and insight acquired in therapy can prevent a relapse of depressive episodes (e.g., Bockting, Spinhoven, Wouters, Koeter, & Schene, 2009). Furthermore, women are also more likely to reach out for social support for psychological problems (Tamres, Janicki, & Helgeson, 2002). Women who have suffered previously from depressive symptomatology may be more familiar with available resources and may feel more comfortable reaching out for help following IPV victimization.

The results from TMT A for previously nondepressed women with a reported history of IPV are inconsistent with previous research on IPV victimization and time scores on TMT Part A (Stein et al., 2002; Twamley et al., 2009). However, both studies were cross-sectional in design, and neither study included men in their sample.

IPV victimization was associated with a statistically significant increase in completion time (poorer performance) on TMT B for men, but not for women. These results suggest that IPV victimization may have a significantly greater effect on executive dysfunction in men over time. Previous research suggests differential frontal lobe activation patterns in response to stress between men and women, with greater involvement of the prefrontal regions for men compared to women (Wang et al., 2007). Considering that the frontal lobes are implicated in tasks involving cognitive flexibility and set-shifting (Dulay, Busch, Chapin, Jehi, & Najm, 2013), it is not surprising that male victims of IPV performed worse on a task of executive function.

Furthermore, it is possible that this effect persists for men but not for women because of gender stereotypes regarding IPV victimization. Public perception of IPV victimization leans toward the idea that women are the victims and men are the perpetrators (Kimmel, 2002). Beyond men's general reluctance to seek medical attention (Galdas, Cheater, & Marshall, 2005), gender stereotypes may further deter them from seeking help for their abuse and may limit the help provided by police, social services, or health professionals. Research suggests that male victims of IPV are less likely than female victims of IPV to seek psychological help following their abuse (e.g., Tjaden & Thoennes, 2000). Female victims of IPV may be more likely to reach out for help, thus allowing them to better cope with their victimization. Lack of appropriate intervention may lead to more harmful and extended cognitive consequences for male victims of IPV.

Consistent with previous research (Stein et al., 2002), IPV victimization did not significantly influence performance on the AN test, suggesting that categorical fluency is not affected by a history of IPV victimization. Previous research suggests that the hippocampus is negatively impacted by traumatic stress (Bremner, 2006). Given the temporal lobe involvement in semantic fluency tasks (Baldo, Schwartz, Wilkins, & Dronkers, 2006), it is surprising that a measure of semantic fluency would not be impaired among victims of IPV victimization. However, our results were consistent with findings from Stein et al. (2002) in which victims of IPV did not perform worse on a measure of semantic fluency.

These results suggest that cognitive function may be differentially impacted by specific types of trauma exposure, particularly in the domain of semantic fluency.

This study is not without limitations. First, because of stringent inclusion criteria, only a small number of participants were included in the effective sample, thus lending to the possibility of over- or underestimating the results of our analyses. Future research would benefit from a larger sample size. A second limitation of this study involves measuring IPV through participants' self-reports of victimization on a 2-item screening instrument. Although self-report is arguably the best single method for detecting IPV victimization, underreporting may result from discrepancies in interpretation of item content or personal definitions of victimization (e.g., Perry & Fromuth, 2005). Screening instruments similar to items used in this study tend to have good specificity, but lower sensitivity than more comprehensive measures (Nelson, Bougatsos, & Blazina, 2012). In addition, the phrasing of the physical IPV screening item included the term *harm*, which may have reduced endorsement by individuals who experienced physical partner aggression that was not perceived as harmful or injurious. Future research would benefit from implementing more comprehensive measures of IPV that do not rely solely on participants' self-reports of abuse. Other limitations are a small number of cognitive tests over a relatively short interval. We used only a global measure of depressive symptomology, and we did not have repeated measures for anxiety or symptoms of PTSD.

Finally, the incident rate of physical IPV victimization in this study was 2% for women and 1.3% for men. These rates are considerably lower than incident rates of IPV reported among national samples. For example, 4% of women and 4.7% of men reported new cases of IPV victimization in the Centers for Disease Control and Prevention's National Intimate Partner and Sexual Violence Survey (Breiding, Chen, & Black, 2014). However, the sample for the National Intimate Partner and Sexual Violence Survey included individuals 18 years of age and older, whereas the sample for this study included individuals ages 30–64 years. Considering that rates of IPV are typically higher among younger individuals (Breiding et al., 2014), it is possible that the restricted age of the sample in this study contributed to lower reported rates of incident IPV.

Nevertheless, our study has several strengths. We examined a mixed racial and economically diverse area probability sample of urban adults. HANDLS participants are generally forthcoming in discussing health problems, economic problems, and other vicissitudes of life with our staff physician and nurses. It is likely that IPV victimization would have been included had it occurred. Data on cognitive performance were longitudinal more than about 5 years, and we examined only incident IPV. To date, no other study has examined changes in cognitive performance associated with incident IPV victimization.

The results of this study highlight the need for further investigation into the association between IPV victimization and cognitive function and have important implications for future prevention education and treatment for victims of IPV. Identifying health risks associated with IPV victimization may facilitate more honest and comprehensive psychoeducation with victims of IPV. Furthermore, although the issue of help-seeking for IPV victimization is complex, at-risk populations may be more likely to seek psychological intervention following experiences of abuse if they are well-informed of the health risks associated with partner violence victimization. In addition, the results of our study contribute to a growing body of literature supporting prevention efforts aimed at both men and women. The U.S. Preventative Services Task Force (USPSTF) recommends that clinicians screen all women of childbearing age for IPV (Moyer, 2013). Based on the results of this study, it would likely be beneficial for clinicians to screen both male and female patients for IPV and to administer a brief cognitive assessment to patients who disclose abuse.



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