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## Increase of perceived frequency of neighborhood domestic violence is associated with increase of women's depression symptoms in a nationally representative longitudinal study in South Africa

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### Abstract

Studies that examine the effects of neighborhood characteristics on mental health show that perceptions of general neighborhood violence are associated with depression across diverse populations (Clark et al., 2008; Velez-Gomez et al., 2013; Wilson-Genderson & Pruchno, 2013). However, to our knowledge, none have examined the specific effect of perceived frequency of neighborhood domestic violence (PFNDV) on residents' mental health, despite knowledge that domestic violence is a potent predictor of depression at the level of the individual. This study investigates the impact of PFNDV on mental health using the South African National Income Dynamics Study (SA-NIDS). NIDS Waves 2 and 3 measure the perceived frequency of six neighborhood violence subtypes through the NIDS household respondent questionnaire and depression through a questionnaire administered to all NIDS participants. Linear regression was used to model the relationship between change in depression symptoms and change in violence subtypes between Waves 2 and 3. We found that two-year increase in PFNDV was significantly correlated with increase of depression symptoms over the same time period for women, independently of individual, household and neighborhood level characteristics, including five other types of neighborhood violence. No other type of violence was associated with increased depression in women in the fully adjusted model. Research and policy implications are discussed.

## Keywords

Depression; Domestic violence; Women's mental health; Longitudinal; Neighborhood violence; Mental health; South Africa; National income dynamics study

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## 1. Introduction

Studies that examine the effects of neighborhood characteristics on mental health show that perceptions of general neighborhood violence are associated with depression across diverse populations (Clark et al., 2008; Velez-Gomez et al., 2013; Wilson-Genderson and Pruchno, 2013). However, the specific effect of perceived frequency of neighborhood domestic violence (PFNDV) on residents' mental health has not been examined.

Objective measures of neighborhood violence (e.g., neighborhood violent crime statistics) and residents' perceptions of neighborhood violence are both associated with poor mental health among residents, and the impact of objective measures is thought to be mediated by subjective perceptions of neighborhood violence (Weden et al., 2008). Researchers have examined potential pathways for how residents' perceptions of neighborhood violence might affect their mental health. Although risk of personal victimization is slightly higher if resident's report high perceived neighborhood violence, studies suggest that the dominant mediators of personal mental health impact on residents living in neighborhoods with high perceived violence are not actual victimization, but threat-related feelings of mistrust and powerlessness (Ross and Mirowsky, 2009). The rapidly growing research of social-cognitive neuroscience is consistent with such observations. Investigations of “intersubjectivity” or the psychological relationship between people, have found that neuroscientific processes for producing an understanding of one's self are tightly related to processes governing our understandings of others—which may partly explain why perceiving one's neighborhood as threatening to others could translate into feelings of being personally threatened, with related impact on personal mental health (Marchetti and Koster, 2014; Murray et al., 2014; Weden et al., 2008).

At the level of the individual, the relationship between personal domestic violence victimization and depression among survivors is well-established in the field of mental health research. Exposure to domestic violence leads to high levels of depression, typically doubling the odds of incident depression among survivors (Devries et al., 2013). The epidemic proportions of domestic violence against women is also well known—the WHO estimates that 35% of women worldwide have experienced violence in their lifetime (WHO| Violence against women, 2013). Despite the knowledge that (1) domestic violence is one of the most potent violence subtypes for individual mental health damage; (2) it is a widespread global problem and; (3) it has the potential to affect the health of whole populations via pathways identified through neighborhood violence research, no studies have examined the impact of perceived neighborhood domestic violence on community mental health.

Our goal is to advance knowledge in this area using the South African National Income Dynamics Study (SA-NIDS). The NIDS measures neighborhood domestic violence by

asking household respondents to report their perception of the frequency of domestic violence in their neighborhood. NIDS is the first national household longitudinal study in South Africa and is implemented by the Southern Africa Labour and Development Research Unit (SALDRU) at the University of Cape Town's School of Economics (NIDS|SALDRU Research|South African Income Surveys, 2014). The NIDS includes a household questionnaire that is administered to the oldest woman in the family or another family member who is knowledgeable about the living arrangements, and a separate, adult questionnaire that is administered to everyone living in the household who is over the age of 15 years. The household respondent is asked to report the PFNDV. Depression is measured through the individual questionnaire, using the Center for Epidemiologic Studies-Depression (CES-D) scale, which is administered to all NIDS participants, including household respondents. The NIDS provides a rare opportunity to examine the effects of PFNDV on depression symptoms among household residents. This design allows for assessment of the impact of domestic violence at a population-level, which may be distinct from that related to individual exposure, and may have the potential to inform public health efforts, prevention strategies, and policies regarding law enforcement and safety in low resource settings.

We conducted an analysis of NIDS data to examine relationships between PFNDV and depression symptoms in the 2008, 2010 and 2012 data Waves, controlling for individual, household and neighborhood level variables. We hypothesized that a higher reported PFNDV by household respondents would correlate with higher depression symptoms amongst individual residents and that increase of PFNDV would be associated with increase of depression over the same time period.

## 2. Materials and methods

### 2.1. Study population

NIDS began in 2008 with a nationally representative sample which included approximately 16,800 adults in 7296 households (7296 household respondents). Four hundred Primary Sampling Units (PSUs) were selected for NIDS Wave 1 to represent independent households in South Africa's nine provinces. Using a multistage sampling design, PSUs were drawn randomly from the 3000 PSUs of the 2003 South African Labour Force and General Household surveys, District Council strata. NIDS has been repeated with the same households every two years. Currently, data from Waves 1, 2 and 3 are publically available (2008, 2010, and 2012). NIDS is a multi-dimensional study that uses matched household and individual measures to collect data on demographics, depression, social capital, household income, household events and sub-types of perceived neighborhood violence, including PFNDV, gangs, theft/burglary, murder, drugs/alcohol and violence between different households. In 2008, the individual questionnaire non-response rate was 6.7% and household non-response rate was 31% (Woolard et al., 2010). Non-response, differences from national population and attrition were taken into account in the weighting process (design, calibrated and panel weights) and in survey methodology for 2010 and 2012 Waves. See Leibbrandt and colleagues for details of weighting methods (Leibbrandt et al., 2009). Data from all available Waves of the NIDS were used to examine the relationship between depression and perceived frequency of neighborhood violence (all types) for this study.

## 2.2. Measures

### 2.2.1. Primary outcome and exposure measures

**2.2.1.1. Depression:** The primary outcome measure was depression on the 10-item version of the CES-D. The original 20 item version of the CES-D was shortened to 10 items to improve clinical utility (Andresen et al., 1994). The CES-D-10 is widely used to screen for depression (Cheng and Chan, 2005; Irwin et al., 1999). The Cronbach's alpha value of the 2008 CES-D-10 in this study is 0.85, similar to the internal consistency observed in prior studies (Björgevinnsson et al., 2013). However, the suggested cutoff score on the CES-D 10-item version has been shown to be sensitive but not specific for psychiatric populations—recommended cutoff scores of 8 and 10 resulted in sensitivity of 0.91 and 0.89 and specificity of 0.35 and 0.47 (Björgevinnsson et al., 2013). The diagnostic specificity of the CES-D for HIV + populations across Sub-Saharan Africa is also low (Tsai, 2014). Given that the prevalence of depression symptoms among South African women is as high as 20% and HIV infection among adults in South Africa is 18–19%, we elected to model the CES-D-10 continuously as a measure of severity of depression symptoms, rather than limiting our assessment to non-specific diagnostic cutoffs. The CES-D-10 assesses depression symptoms in the past week (e.g., “I felt depressed”) which are scored on a 4 point Likert scale: (1) Rarely/none of the time; (2) Some/little of the time; (3) Occasionally/moderate amount of time; (4) all of the time; and summed for a total score ranging from 0 to 30, with higher scores indicating more severe depression. Two of the items are positively worded (e.g., “I was happy”) with reverse scoring. Every NIDS participant was asked to complete the CES-D-10.

**2.2.1.2. Perceived Frequency of Neighborhood Domestic Violence (PFNDV):** In 2010 and 2012, the NIDS asked household respondents to report the neighborhood frequency of “violence between members of the same household” using the following question: “How common is violence between members of the same household in your neighborhood?” Response options were: (1) never happens; (2) very rare; (3) not common; (4) fairly common; or (5) very common, scored accordingly with higher number indicating higher frequency. In keeping with other studies in the field of research investigating the health impact of perceived neighborhood characteristics (Kim et al., 2014; Sampson, 2003), the NIDS does not define the term ‘neighborhood’ for respondents, but allows them to use their own definition.

**2.2.2. Other measures—**Previously identified confounders of the relationship between violence and depression (Curry et al., 2008; Latkin and Curry, 2003; Mair et al., 2008; Schulz et al., 2006) were selected from the available NIDS variables, including socio-demographics, crime/safety, household events and measures of social capital.

**2.2.2.1. Demographic and socioeconomic measures:** These included age, gender, marital status, population group, highest level of education achieved, household income relative to neighborhood (higher number corresponds to lower income) and household income relative to nation (higher number corresponds to higher income).

**2.2.2.2. Crime/safety:** In the first Wave (2008), NIDS assessed perceived frequency of neighborhood togetherness/help, and aggression/thievery. In 2010 and 2012, NIDS collected perceived frequency of six types of neighborhood crime/safety issues: (1) burglary/mugging/theft; (2) violence between members of the same household discussed above (PFNDV); (3) violence between members of different households; (4) gangsterism; (5) murder/shootings/stabbings; (6) drug/alcohol abuse. Each of these was assessed with the question: “How common is/are [crime/safety issue] in your neighborhood?” with response options: (1) never happens; (2) very rare; (3) not common; (4) fairly common; or (5) very common, scored accordingly with higher number indicating higher frequency. A composite score consisting of the sum of all types of violence reported was also created. Only NIDS household respondents were asked to report on crime/safety in the neighborhood.

**2.2.2.3. Household events:** Twelve negative household events in the past 24 months were assessed in each Wave, including death of household residents/friends/relatives, death/disease of livestock or crops, job loss/reduction in work hours, cut-off of remittances/grants, theft/fire/destruction of household property and an open field for specification of other negative household events. Six positive events over the past 24 months were assessed in 2008, including new jobs, remittances, grants, inheritance/gift/winning, retirement funds and scholarships, as well as two open fields for other positive events. Responses were scored as bivariate (yes/no) and summed to create an overall negative/positive household events score which was used as a continuous measure for regression modeling. Tertiles were created to describe 2008 positive and negative household events. Only NIDS household respondents were asked to report on household events.

**2.2.3. Social capital—**In light of prior studies showing that perceived neighborhood social capital is associated with residents' mental health (Almedom, 2005; Bassett and Moore, 2013; Forsman et al., 2012; Patel et al., 2010; Thoits, 2011), we controlled for constructs of structural and cognitive social capital in our depression modeling.

**2.2.3.1. Structural social capital:** A measure of structural social capital in 2008 and 2010 was constructed using NIDS data on membership in sixteen different types of social groups, including an open field for specification of other groups. Bivariate yes/no responses were summed to create a score reflecting the number of groups to which the respondent belonged. Measuring structural social capital as the quantity or frequency of social interaction is consistent with social capital research concepts in common use over the past decade (Almedom, 2005; Forsman et al., 2012; Putnam, 2001). These items were dropped from Wave 3 of NIDS (2012). Low, moderate and high structural social capital were calculated as scores of zero, 1–8 and 9–17, respectively. Each NIDS participant was asked to report structural social capital in 2008 and 2010.

**2.2.3.2. Cognitive social capital:** A measure of cognitive social capital in 2008 was constructed by adding the frequency of neighbors helping one another and doing things together and subtracting a reverse coded item assessing trust in neighbors: “Imagine you lost a wallet or purse that contained R200 [200 South African Rand] and it was found by someone who lives close by. Is it very likely, somewhat likely or not likely at all to be

returned with the money in it?” Conceptualization of cognitive social capital as relating to the quality of social relationships, including time together, assistance and trust, is customary in social capital research (Almedom, 2005; Forsman et al., 2012; Putnam, 2001). The items assessing frequency of spending time with and helping neighbors were dropped from NIDS Waves 2 and 3. Low, moderate and high cognitive social capital were defined as a summation that was negative, zero or positive, respectively. Each NIDS participant was asked to report cognitive social capital in 2008.

### 2.3. Statistical analysis

Table 1 gives descriptive statistics for the unweighted sample of respondents for individual, household and neighborhood level variables, with division of Likert response items for neighborhood characteristics into: “never/very rare,” “notcommon,” or “fairly/very common. Bivariate linear regression was used to evaluate the cross-sectional relationships of depression, as the dependent variable, with individual, household and neighborhood level independent variables. Relationships between depression and perceptions of neighborhood violence were examined through linear regression modeling of change in depression score (dependent) in a multivariate analysis including interval changes in neighborhood violence sub-types. Given that the violence measures of interest were instituted in 2010 and therefore available only for the 2010 and 2012 time-points, we elected to use change score analysis rather than longitudinal modeling. Beta coefficients are reported as the number of points change in the CES-D-10 for a one unit change in the corresponding variable  $r$  of the regression model. Effect sizes are reported as Cohen's  $f^2$  which is the proportion of variance explained divided by the proportion of unexplained variance.

All analyses were conducted using Stata (Ver 12, StataCorp, College Station, TX) and accommodated the complex sample survey aspects of NIDS (primary sampling units and sample weights). We calculated standard errors using the Taylor Linearization method, which uses a form of robust standard errors to accommodate arbitrary correlations within primary sampling units (and therefore within households and/or within individuals).

### 2.4. Role of the funding source

The NIDS SALDRU reviewed the proposal for this NIDS sub-study and granted access to the data. NIDS SALDRU requested no changes to the proposed study and had no role in study design, data analysis, data interpretation, or writing of the manuscript. The NIDS is a publically available database of de-identified data and as such, does not meet the UCSF definition of human subjects' research and was not required to undergo ethics review. NIDS was granted ethical clearance by the University of Cape Town Commerce Faculty Ethics Committee.

## 3. Results

We used the first Wave (2008) to ascertain demographic information on study participants (Table 1), most of whom were re-interviewed in Wave 2 (2010) and Wave 3 (2012). The continuing sample member non-response rate was 19% in 2010 and 16% in 2012 (De Villiers et al., 2013). In 2008, the largest age category for NIDS adult participants was 15–



30 years (41.4%). The majority of Wave 1 respondents were women, African, never married and educated at less than a high school level (Table 1). More than one-third (35.6%) reported a depression symptom score at or above 10 on the CES-D-10 in 2008. Between 2008 and 2010, changes in depression scores ranged from -26 to +29 between 2008 with a decrease in depression symptoms in approximately 54% of participants, no change in 7% and an increase of symptoms in 39% of participants. Between 2010 and 2012, changes in depression scores ranged from -27 to +27 with a decrease in depression symptoms for approximately 46% of participants, no change for 9% and an increase for 45% of participants.

Individual variables significantly associated with higher depression symptoms in cross-sectional analysis across all three Waves included female gender, African population group and being widowed. Prior depression symptoms were significantly associated with higher depression scores in 2010 and 2012 Waves. Male gender, white population group and higher education were consistently associated with lower levels of depression symptoms (Table 2). At the household level, lower national household income and lower income relative to neighborhood were each significantly associated with increased depression, while positive household events (available only in 2008) were associated with decreased depression symptoms (higher number on national income scale indicates higher income, while higher number on household income scale indicates lower income). At the neighborhood level, the composite measure of perceived neighborhood violence had significant cross-sectional associations with depression symptoms for both available Waves (2010, 2012). Evaluation of component neighborhood violence metrics found that PFNDV, inter-household violence and gangsterism were all significantly associated with increased depression symptoms in both 2010 and 2012. Overall, cross-sectional effect sizes were small, as judged by the Cohen's  $f^2$  (proportion of explained to unexplained variance), ranging from 0.0004 to 0.099 (Table 3).

Cognitive social capital items (available only in 2008) and structural social capital (2008, 2010) were not significantly associated with depression symptoms in cross-sectional, bivariate analysis. Cognitive and structural social capital were also assessed for their relationship with depression symptoms in subsequent NIDS Waves. Neither cognitive nor structural social capital had significant associations with depression symptoms.

The effect of change in violence sub-types (see methods, measures, section) on change in depression symptoms was modeled with change in depression symptoms (2008–2010, 2010–2012) as the dependent variable and change in violence sub-types as covariates, while controlling for baseline individual, household and other neighborhood co-variates. Between 2008 and 2010, 39% of household respondents stated neighborhood frequency of theft decreased, 23% reported that it stayed the same and 39% stated that it increased. Between 2010 and 2012, approximately 30–39% of household respondents reported that neighborhood frequency of theft, PFNDV, inter-household violence, gangsterism and murder decreased, 24% reported that it stayed the same and 36–46% reported that it increased (76% stated that it changed). Twenty-four percent of household respondents stated that drug and alcohol use decreased from 2010 to 2012, 32% stated that it remained the same and 44% reported that it increased (68% stated that it changed). None of the individual or



neighborhood level variables, including gender, race and social capital, were significantly associated with increase of depression symptoms between 2008 and 2010 (Table S1). Increase of depression symptoms between 2010 and 2012 was associated with increased PFNDV between 2010 and 2012 (Table S1).

Although there is continued controversy over whether men or women experience a higher prevalence of domestic violence victimization, many studies show that women experience more negative mental health consequences as a result of exposure to domestic violence, relative to men (Carbone-López et al., 2006; Cho, 2012; Devries et al., 2013; Ulloa and Hammett, 2014). We therefore repeated the regression analysis, stratifying by gender. In stratified analyses, the PFNDV effect was somewhat stronger in females (0.35, 95% CI 0.11–0.58) than in males (0.24, 95% CI 0.05–0.53) though the difference in the PFNDV effects between females and males was not statistically significant.

We conducted several sensitivity analyses to further examine our finding that increased PFNDV was associated with increased depression between 2010 and 2012. To partially address the possibility of reverse causation, whereby depression might cause increased PFNDV by the household respondents, we repeated our analysis using only the household resident subpopulation of the NIDS, which contains individuals who report their own depression symptoms but do not report PFNDV. We achieved similar results to the larger model using all NIDS participants – the only significant ( $p = 0.004$ ) correlate of increased depression symptoms between 2010 and 2012 was increase in PFNDV over the same time period (Table S3). When stratified by gender, the effect of PFNDV on depression remained significant for women ( $p = 0.004$ ) and decreased in significance for men ( $p = 0.050$ ) (Tables S4 and S5). We also repeated our analysis of 2010–2012 change in depression with the household resident subpopulation using the cumulative measures of neighborhood violence and omitting the subtypes. In this analysis, there were no significant correlates of increased depression (Table S6).

#### 4. Discussion

In a nationally representative study of South Africa, this study finds that increased depression symptoms among women are associated with an increase in the perceived frequency of neighborhood domestic violence (PFNDV) by the household respondent. These findings are consistent with prior research on the mental health effects of neighborhood violence.

Studies show a consistent link between perceived neighborhood conditions and mental health (Clark et al., 2008; Mair et al., 2010; Wilson-Genderson and Pruchno, 2013). Studies that evaluate mental health as well as both objective neighborhood characteristics and subjective neighborhood perceptions, find that objective and subjective neighborhood characteristics correlate well with one another and that both correlate with the mental health of residents (Curry et al., 2008; Frohlich et al., 2007). Researchers hypothesize that the mental health impact of objective neighborhood characteristics is mediated by perceptions of one's neighborhood, which is supported by path analysis (Curry et al., 2008; Cutrona et al., 2005).

In this study, we find that increase in the PFNDV reported by the household respondent is associated with increase of depression for all the female residents of the household, whether we evaluate the total sample, or the sub-population of household residents who do not report PFNDV. While report of high PFNDV in the neighborhood may correlate with risk of victimization in the respondent's household (not measured), it is important to note that, in the majority of cases, the respondent characterizing neighborhood violence (household questionnaire) is not the same respondent as the one reporting on depression symptoms (adult questionnaire), making the victimization hypothesis less likely. Furthermore, our sensitivity analyses with household residents who do not report PFNDV generated results similar to the pooled model.

While this cross-sectional change analysis is not capable of determining causality—only an association—between increased frequency of PFNDV and increased depression among female residents, our findings resonate with those performed at the level of the individual, where exposure to domestic violence has been determined to play a causal role in mental health. Overall, this study and its sensitivity analyses suggest that the demonstrated association between increased depression and increased PFNDV for South African women is independent of age, race, marital status, education, income and other household and neighborhood characteristics, including five other types of perceived neighborhood violence.

While a one-point increase in the PFNDV corresponded to a modest, one-quarter point increase of depression symptoms on the CES-D-10, our findings suggest that the relationship between PFNDV and mental health have a long reach, extending beyond direct victims. Thus, while the individual increase in depression symptoms may be relatively small, when multiplied across a population, the magnitude of the increased depression burden becomes large. These findings are particularly salient for a setting such as South Africa, which has a very high rate of violence against women. In 2009, the rate of female homicide in South Africa, an extreme consequence of violence against women, was five times the global rate and more than double the rate in the U.S. (Abrahams et al., 2013).

#### **4.1. Potential implications for intervention and policy**

As noted above, there currently exist only two NIDS waves which measure perceived frequency of neighborhood domestic violence. Therefore, it is not possible to determine the direction of the effect between increase of depression symptoms and increase of perceived frequency of neighborhood domestic violence. With this caveat in mind, we suggest that interventions to reduce domestic violence at the neighborhood level and the associated mental health sequelae among residents could positively impact other dimensions of population and economic health, including health care costs, economic productivity and the attainment of Millennium Development Goals involving gender equity (Goal 3) (Day et al., 2005; United Nations, 2013). Female survivors of intimate partner violence have substantial health care costs across high income and developing countries (Roldós and Corso, 2013; Varcoe et al., 2011). Likewise, studies of women following discontinuation of intimate partner violence (independently or with programmatic help), show decreases in health care costs and improvements in economic productivity (Fishman et al., 2010; Jan et al., 2011; Kim et al., 2007).

In regards to secondary prevention, not only does mental health treatment alleviate suffering among domestic violence survivors and reduce their downstream health care needs and costs, but recent studies suggest that mental health treatment itself may reduce domestic violence. Encouraging data indicates that mental health treatment for survivors of domestic violence reduces both their mental health symptoms and their risk of future violent victimization, even if they do not leave their violent partners (Iverson et al., 2011; Jiang et al., 2014).

Finally, it is important to note that male perpetrators of domestic violence have a high prevalence of mental disorders, particularly alcohol use disorders, depression and anxiety disorders including Posttraumatic Stress Disorder (PTSD) (Shorey et al., 2012). While the search for effective mental health care strategies to reduce recidivism among perpetrators is ongoing, treatment of alcohol use disorders may be emerging as a method of reducing male perpetration (Kraanen et al., 2013; Stuart et al., 2013).

#### 4.2. Limitations

In the context of this study, determining the relationship between PFNDV and depression among women is limited by the fact that the “exposure” is not randomly assigned, but “observed” in its natural setting, meaning that the exposure could be influenced by many non-random and confounding variables. However, the NIDS dataset is distinguished by a broad array of variables that impinge on mental health, allowing researchers to adjust for many potential confounders. Specifically, the NIDS contains a wealth of social and economic factors known to influence mental health, making it informative for population level interventions.

#### 5. Conclusions

As global mental health treatment efforts unfold, LMICs must seek cost effective interventions to both prevent and treat mental illness. This analysis of depression in the context of a population health study identifies PFNDV as a key correlate of women's depression in South Africa. Given that PFNDV is currently repeated in only two consecutive NIDS waves, this study can only be conducted using cross-sectional change analysis, which does not allow for prediction of the direction of causal effect. While research on individual exposure to domestic violence and mental disorders have established causality at the level of the individual, the same mechanism cannot be assumed to operate at a population level with the current NIDS data. As subsequent waves of NIDS are collected, longitudinal investigations to strengthen inferences about causality will be possible. Given that mental health treatment of survivors of domestic violence reduces their risk of re-victimization, it is possible that focusing treatment efforts on survivors of domestic violence may address both primary and secondary prevention goals. In recent years, effective models for feasible and acceptable mental health treatment in low resource settings have developed that use paraprofessionals and trained community therapists to deliver established psychotherapies adapted for the local setting (Bass et al., 2013; Bolton et al., 2003; Meffert et al., 2009; Mutamba et al., 2013; Neuner et al., 2008; Patel et al., 2008; Schauer et al., 2005; Van

Ginneken et al., 2013). Taking these treatments to scale in a clinically and economically effective manner is one of the next steps.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.socscimed.2015.03.008>.

## References

- Abrahams N, Mathews S, Martin LJ, Lombard C, Jewkes R. Intimate partner femicide in South Africa in 1999 and 2009. *PLoS Med.* 2013; 10(4):e1001412. <http://dx.doi.org/10.1371/journal.pmed.1001412>. [PubMed: 23565064]
- Almedom AM. Social capital and mental health: an interdisciplinary review of primary evidence. *Soc. Sci. Med.* 2005; 61(5):943–964. (1982) <http://dx.doi.org/10.1016/j.socscimed.2004.12.025>. [PubMed: 15955397]
- Andresen EM, Malmgren JA, Carter WB, Patrick DL. Screening for depression in well older adults: evaluation of a short form of the CES-D (Center for Epidemiologic Studies Depression Scale). *Am. J. Prev. Med.* 1994; 10(2):77–84. [PubMed: 8037935]
- Bassett E, Moore S. Social capital and depressive symptoms: the association of psychosocial and network dimensions of social capital with depressive symptoms in Montreal, Canada. *Soc. Sci. Med.* 2013; 86:96–102. (1982) <http://dx.doi.org/10.1016/j.socscimed.2013.03.005>. [PubMed: 23608098]
- Bass JK, Annan J, McIvor Murray S, Kaysen D, Griffiths S, Cetinoglu T, et al. Controlled trial of psychotherapy for Congolese survivors of sexual violence. *N. Engl. J. Med.* 2013; 368(23):2182–2191. <http://dx.doi.org/10.1056/NEJMoa1211853>. [PubMed: 23738545]
- Björgvinsson T, Kertz SJ, Bigda-Peyton JS, McCoy KL, Aderka IM. Psychometric properties of the CES-D-10 in a psychiatric sample. *Assessment.* 2013; 20(4):429–436. <http://dx.doi.org/10.1177/1073191113481998>. [PubMed: 23513010]
- Bolton P, Bass J, Neugebauer R, Verdelli H, Clougherty KF, Wickramaratne P, et al. Group interpersonal psychotherapy for depression in rural Uganda: a randomized controlled trial. *JAMA. J. Am. Med. Assoc.* 2003; 289(23):3117–3124. <http://dx.doi.org/10.1001/jama.289.23.3117>.
- Carbone-López K, Kruttschnitt C, Macmillan R. Patterns of intimate partner violence and their associations with physical health, psychological distress, and substance use. *Public Health Reports Wash. D.C.* 2006; 121(4):382–392. 1974).
- Cheng S-T, Chan ACM. The Center for Epidemiologic Studies Depression Scale in older Chinese: thresholds for long and short forms. *Int. J. Geriatr. Psychiatr.* 2005; 20(5):465–470. <http://dx.doi.org/10.1002/gps.1314>.
- Cho H. Examining gender differences in the nature and context of intimate partner violence. *J. Interpers. Viol.* 2012; 27(13):2665–2684. <http://dx.doi.org/10.1177/0886260512436391>.

- Clark C, Ryan L, Kawachi I, Canner MJ, Berkman L, Wright RJ. Witnessing community violence in residential neighborhoods: a mental health hazard for urban women. *J. Urban Health*. 2008; 85(1): 22–38. <http://dx.doi.org/10.1007/s11524-007-9229-8>. [PubMed: 17965940]
- Curry A, Latkin C, Davey-Rothwell M. Pathways to depression: the impact of neighborhood violent crime on inner-city residents in Baltimore, Maryland, USA. *Soc. Sci. Med.* 2008; 67(1):23–30. (1982) <http://dx.doi.org/10.1016/j.socscimed.2008.03.007>. [PubMed: 18396366]
- Cutrona CE, Russell DW, Brown PA, Clark LA, Hessling RM, Gardner KA. Neighborhood context, personality, and stressful life events as predictors of depression among African American women. *J. Abnorm. Psychol.* 2005; 114(1):3–15. <http://dx.doi.org/10.1037/0021-843X.114.1.3>. [PubMed: 15709807]
- Day T, McKenna K, Bowlus A. United Nations Nations Unies the Economic Costs of Violence against Women: an Evaluation of the Literature. United Nations. 2005
- de Villiers, L.; Brown, M.; Woolard, I.; Daniels, R.; Leibbrandt, M. National Income Dynamics Study Wave 3 User Manual. Cape Town: Southern Africa Labour and Development Research Unit; 2013.
- Devries KM, Mak JY, Bacchus LJ, Child JC, Falder G, Petzold M, et al. Intimate partner violence and incident depressive symptoms and suicide attempts: a systematic review of longitudinal studies. *PLoS Med.* 2013a; 10(5):e1001439. <http://dx.doi.org/10.1371/journal.pmed.1001439>. [PubMed: 23671407]
- Fishman PA, Bonomi AE, Anderson ML, Reid RJ, Rivara FP. Changes in health care costs over time following the cessation of intimate partner violence. *J. General Intern. Med.* 2010; 25(9):920–925. <http://dx.doi.org/10.1007/s11606-010-1359-0>.
- Forsman AK, Nyqvist F, Schierenbeck I, Gustafson Y, Wahlbeck K. Structural and cognitive social capital and depression among older adults in two Nordic regions. *Aging Ment. Health.* 2012; 16(6):771–779. <http://dx.doi.org/10.1080/13607863.2012.667784>. [PubMed: 22486561]
- Frohlich KL, Bodnarchuk JL, Château D, Roos L, Forsyth S. What you see is what you get? Questioning the relationship between objective and subjective appraisals of neighbourhood resources in relation to health. *Can. J. Public Health = Revue Can. De Santé Publique.* 2007; 98(4):292–296.
- Irwin M, Artin KH, Oxman MN. Screening for depression in the older adult: criterion validity of the 10-item Center for Epidemiological Studies Depression Scale (CES-D). *Arch. Intern. Med.* 1999; 159(15):1701–1704. [PubMed: 10448771]
- Iverson KM, Gradus JL, Resick PA, Suvak MK, Smith KF, Monson CM. Cognitive-behavioral therapy for PTSD and depression symptoms reduces risk for future intimate partner violence among interpersonal trauma survivors. *J. Consult. Clin. Psychol.* 2011; 79(2):193–202. <http://dx.doi.org/10.1037/a0022512>. [PubMed: 21341889]
- Jan S, Ferrari G, Watts CH, Hargreaves JR, Kim JC, Phetla G, et al. Economic evaluation of a combined microfinance and gender training intervention for the prevention of intimate partner violence in rural South Africa. *Health Policy Plan.* 2011; 26(5):366–372. <http://dx.doi.org/10.1093/heapol/czq071>. [PubMed: 20974751]
- Jiang RF, Tong H, Delucchi KL, Neylan TC, Shi Q, Meffert SM. Interpersonal psychotherapy versus treatment as usual for PTSD and depression among Sichuan earthquake survivors: a randomized clinical trial. *Confl. Health.* 2014; 8(1):14. <http://dx.doi.org/10.1186/1752-1505-8-14>. [PubMed: 25254070]
- Kim JC, Watts CH, Hargreaves JR, Ndhlovu LX, Phetla G, Morison LA, et al. Understanding the impact of a microfinance-based intervention on women's empowerment and the reduction of intimate partner violence in South Africa. *Am. J. Public Health.* 2007; 97(10):1794–1802. <http://dx.doi.org/10.2105/AJPH.2006.095521>. [PubMed: 17761566]
- Kim S-S, Choi J, Park K, Chung Y, Park S, Heo J. Association between district-level perceived safety and self-rated health: a multilevel study in Seoul, South Korea. *BMJ Open.* 2014; 4(7):e004695. <http://dx.doi.org/10.1136/bmjopen-2013-004695>.
- Kraanen FL, Vedel E, Scholing A, Emmelkamp PMG. The comparative effectiveness of integrated treatment for substance abuse and partner violence (I-Stop) and substance abuse treatment alone: a randomized controlled trial. *BMC Psychiatry.* 2013; 13:189. <http://dx.doi.org/10.1186/1471-244X-13-189>. [PubMed: 24059784]

- Latkin CA, Curry AD. Stressful neighborhoods and depression: a prospective study of the impact of neighborhood disorder. *J. Health Soc. Behav.* 2003; 44(1):34–44. [PubMed: 12751309]
- Leibbrandt, M.; Woolard, I.; de Villiers, L. NIDS Technical Paper No. 1. Cape Toan: University of Cape Town; 2009.
- Mair C, Diez Roux AV, Galea S. Are neighbourhood characteristics associated with depressive symptoms? A review of evidence. *J. Epidemiol. Community Health.* 2008; 62(11):940–946. <http://dx.doi.org/10.1136/jech.2007.066605>, 8 pp. following 946. [PubMed: 18775943]
- Mair C, Diez Roux AV, Morenoff JD. Neighborhood stressors and social support as predictors of depressive symptoms in the Chicago community adult health study. *Health Place.* 2010; 16(5): 811–819. <http://dx.doi.org/10.1016/j.healthplace.2010.04.006>. [PubMed: 20434941]
- Marchetti I, Koster EHW. Brain and intersubjectivity: a Hegelian hypothesis on the self-other neurodynamics. *Front. Hum. Neurosci.* 2014; 8:11. <http://dx.doi.org/10.3389/fnhum.2014.00011>. [PubMed: 24478677]
- Meffert SM, Abdo AO, Alla OAA, Elmakki YOM, Omer AA, Yousif S, et al. Sudanese refugees in Cairo, Egypt: a randomized controlled trial of interpersonal psychotherapy for trauma, depression and interpersonal violence. *Psychol. Trauma Theory, Res. Pract. Policy.* 2009; 24(11):1835–1848.
- Murray RJ, Debbané M, Fox PT, Bzdok D, Eickhoff SB. Functional connectivity mapping of regions associated with self- and other-processing. *Hum. Brain Mapp.* 2014 <http://dx.doi.org/10.1002/hbm.22703>.
- Mutamba BB, Van Ginneken N, Smith Paintain L, Wandiembe S, Schellenberg D. Roles and effectiveness of lay community health workers in the prevention of mental, neurological and substance use disorders in low and middle income countries: a systematic review. *BMC Health Serv. Res.* 2013; 13:412. <http://dx.doi.org/10.1186/1472-6963-13-412>. [PubMed: 24119375]
- Neuner F, Onyut PL, Ertl V, Odenwald M, Schauer E, Elbert T. Treatment of posttraumatic stress disorder by trained lay counselors in an African refugee settlement: a randomized controlled trial. *J. Consult. Clin. Psychol.* 2008; 76(4):686–694. <http://dx.doi.org/10.1037/0022-006X.76.4.686>. [PubMed: 18665696]
- NIDS|SALDRU Research|South African Income Surveys. 2014 from <http://www.nids.uct.ac.za/about/what-is-nids>.
- Patel VH, Kirkwood BR, Pednekar S, Araya R, King M, Chisholm D, et al. Improving the outcomes of primary care attenders with common mental disorders in developing countries: a cluster randomized controlled trial of a collaborative stepped care intervention in Goa, India. *Trials.* 2008; 9:4. <http://dx.doi.org/10.1186/1745-6215-9-4>. [PubMed: 18221516]
- Patel, V.; Lund, C.; Hatherill, S.; Plagerson, S.; Corrigan, J.; Funk, M.; Flisher, A. Mental disorders: equity and social determinants. In: Blas, E.; Kurup, AS., editors. *Equity, Social Determinants and Public Health Programmes*. Geneva: World Health Organization; 2010. p. 115-134.
- Putnam, DR. *Bowling Alone: The Collapse and Revival of American Community*. London: Simon & Schuster; 2001.
- Roldós MI, Corso P. The economic burden of intimate partner violence in Ecuador: setting the agenda for future research and violence prevention policies. *West. J. Emerg. Med.* 2013; 14(4):347–353. <http://dx.doi.org/10.5811/westjem.2013.2.15697>.
- Ross CE, Mirowsky J. Neighborhood disorder, subjective alienation, and distress. *J. Health Soc. Behav.* 2009; 50(1):49–64. [PubMed: 19413134]
- Sampson RJ. The neighborhood context of well-being. *Perspect. Biol. Med.* 2003; 46 Suppl. 1(3):S53–S64. [PubMed: 14563074]
- Schauer, M.; Neuner, F.; Elbert, T. *Narrative Exposure Therapy: A Short-term Intervention for Traumatic Stress Disorders after War, Terror, or Torture*. Cambridge, MA: Hogrefe & Huber Publishers; 2005.
- Schulz AJ, Israel BA, Zenk SN, Parker EA, Lichtenstein R, Shellman-Weir S, Klem ABL. Psychosocial stress and social support as mediators of relationships between income, length of residence and depressive symptoms among African American women on Detroit's eastside. *Soc. Sci. Med.* 2006; 62(2):510–522. (1982) <http://dx.doi.org/10.1016/j.socscimed.2005.06.028>. [PubMed: 16081196]



- Shorey RC, Febres J, Brasfield H, Stuart GL. The prevalence of mental health problems in men arrested for domestic violence. *J. Fam. Violence*. 2012; 27(8):741–748. <http://dx.doi.org/10.1007/s10896-012-9463-z>. [PubMed: 23284227]
- Stuart GL, Shorey RC, Moore TM, Ramsey SE, Kahler CW, O'Farrell TJ, et al. Randomized clinical trial examining the incremental efficacy of a 90-minute motivational alcohol intervention as an adjunct to standard batterer intervention for men. *Addict. (Abingdon, Engl.* 2013; 108(8):1376–1384. <http://dx.doi.org/10.1111/add.12142>.
- Thoits PA. Mechanisms linking social ties and support to physical and mental health. *J. Health Soc. Behav.* 2011; 52(2):145–161. <http://dx.doi.org/10.1177/0022146510395592>. [PubMed: 21673143]
- Tsai AC. Reliability and validity of depression assessment among persons with HIV in sub-Saharan Africa: systematic review and meta-analysis. *J. Acquir. Immune Defic. Syndr.* 2014; 66(5):503–511. (1999) <http://dx.doi.org/10.1097/QAI.0000000000000210>. [PubMed: 24853307]
- Ulloa EC, Hammett JF. The effect of gender and perpetrator-victim role on mental health outcomes and risk behaviors associated with intimate partner violence. *J. Interpers. Violence*. 2014 <http://dx.doi.org/10.1177/0886260514564163>.
- United Nations. United Nations Millennium Development Goals: 2013. United Nations. 2013 Retrieved from. <http://www.un.org/millenniumgoals/>.
- Van Ginneken N, Tharyan P, Lewin S, Rao GN, Meera S, Pian J, et al. Non-specialist health worker interventions for the care of mental, neurological and substance-abuse disorders in low- and middle-income countries. *Cochrane Database Syst. Rev.* 2013; 11:CD009149. <http://dx.doi.org/10.1002/14651858.CD009149.pub2>. [PubMed: 24249541]
- Varcoe C, Hankivsky O, Ford-Gilboe M, Wuest J, Wilk P, Hammerton J, Campbell J. Attributing selected costs to intimate partner violence in a sample of women who have left abusive partners: a social determinants of health approach. *Can. Public Policy. Anal. De Polit.* 2011; 37(3):359–380.
- Velez-Gomez P, Restrepo-Ochoa DA, Berbesi-Fernandez D, Trejos-Castillo E. Depression and neighborhood violence among children and early adolescents in Medellin, Colombia. *Span. J. Psychol.* 2013; 16:E64. <http://dx.doi.org/10.1017/sjp.2013.71>. [PubMed: 24230927]
- Weden MM, Carpiano RM, Robert SA. Subjective and objective neighborhood characteristics and adult health. *Soc. Sci. Med.* 2008; 66(6):1256–1270. <http://dx.doi.org/10.1016/j.socscimed.2007.11.041>. [PubMed: 18248865]
- WHO|Violence against women. [Retrieved June 16, 2014] 2013. from <http://www.who.int/mediacentre/factsheets/fs239/en/>.
- Wilson-Genderson M, Pruchno R. Effects of neighborhood violence and perceptions of neighborhood safety on depressive symptoms of older adults. *Soc. Sci. Med.* 2013; 85:43–49. (1982) <http://dx.doi.org/10.1016/j.socscimed.2013.02.028>. [PubMed: 23540365]
- Woolard I, Leibbrandt M, de Villiers L. Sabinet – the south african national income dynamics study: design and methodological issues. *Stud. Econ. Econ.* 2010; 34(3):7–24.



**Table 1**

Sample characteristics.

<b>2008: 16,800 adults</b>			
<b>Individual</b>	<b>Category</b>	<b>No. (%)</b>	
Age <i>n</i> = 15,549	15–30	6435 (41.39)	
	30–45	3986 (25.64)	
	45–60	3030 (19.49)	
	60–75	1589 (10.22)	
	75+	509 (3.27)	
Gender <i>n</i> = 15,637	Female	9348 (59.78)	
	Male	6289 (40.22)	
Population Group <i>n</i> = 15,498	African	12,166 (77.80)	
	Coloured/Colored	2202 (14.08)	
	Asian/Indian	223 (1.43)	
	White	907 (5.80)	
Education: Highest grade completed <i>n</i> = 15,542	No school	2194 (14.03)	
	Less than high school	10,031 (64.16)	
	Completed high school	3317 (21.22)	
Marital Status <i>n</i> = 17,606	Married/living with partner	5577 (31.55)	
	Widow/Divorced/Separated	1768 (10.00)	
	Never Married	10,261 (58.04)	
	Depression Symptoms <i>n</i> = 15,358	CES-D < 10	1115 (64.36)
	CES-D ≥ 10	14,243 (35.64)	
<b>Household</b>			
Household income relative to neighbors (self-report) <i>n</i> = 14,571	Below/Much Below	7581 (48.51)	
	Average	5728 (36.65)	
	Above/Much Above	1262 (8.08)	
Household income relative to nation (self-report) ( <i>n</i> = 15,520)	Poor	8345 (53.38)	
	Average	6775 (43.34)	
	Rich	400 (2.56)	
Negative household events <i>n</i> = 12,729	0	2139 (78.97)	
	1	4595 (16.80)	
	2–6	538 (4.22)	
Positive household events <i>n</i> = 12,695	0	10,805 (85.11)	
	1	1701 (13.40)	
	2–4	189 (1.49)	
<hr/>			
<b>Neighborhood</b>	<b>Low: no. (%)</b>	<b>Moderate: no. (%)</b>	<b>High: no. (%)</b>
Trust in neighbors to return money, <i>n</i> = 14,578	10,947 (70.04)	2126 (13.60)	1505 (9.63)
Structural social capital, <i>n</i> = 15,339	9953 (64.93)	5374 (34.99)	12 (0.08)
Cognitive social capital, <i>n</i> = 14,376	845 (5.88)	500 (3.48)	13,031 (90.64)
<hr/>			
<b>2010: 18,571 adults</b>			
<hr/>			

<b>2010 violence parameters</b>	<b>Never/very rare No. (%)</b>	<b>Not common no. (%)</b>	<b>Fairly/very common no. (%)</b>
Frequency of neighborhood theft, <i>n</i> = 18,225	8836 (48.48)	3371 (18.50)	6018 (33.02)
Frequency of domestic violence, <i>n</i> = 18,221	9650 (52.96)	4307 (23.64)	4264 (23.40)
Frequency of inter-household violence, <i>n</i> = 18,197	9346 (51.36)	4428 (24.33)	4423 (24.30)
Frequency of neighborhood gangsterism, <i>n</i> = 18,140	8924 (49.20)	4237 (23.36)	4979 (27.45)
Frequency of neighborhood murder, <i>n</i> = 18,194	8479 (46.60)	4207 (23.12)	5508 (30.28)
Frequency of neighborhood drug/alcohol abuse, <i>n</i> = 18,016	5340 (29.64)	2469 (13.70)	10,207 (56.65)

CES-D = Center for Epidemiologic Studies Depression Scale, 10-item version (CES-D-10).

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**Table 2**  
 Cross-Sectional Bivariate Associations with CES-D: 2008, 2010 and 2012, matched by year.

Individual	2008 $\beta^e$ [95% CI] n = 15,358	Effect size <sup>d</sup>	2010 $\beta^e$ [95% CI] n = 16,392	Effect size <sup>d</sup>	2012 $\beta^e$ [95% CI]	Effect size <sup>d</sup>
Age	-0.00 [-0.00, -0.00]	0.00	-0.00 [-0.00, 0.00]	0.00	-0.00 [-0.00, -0.00]	0.000
Female gender	0.69 [0.44, 0.95]	0.01	0.53 [0.23, 0.83]	0.00	0.39 [0.16, 0.63]	0.00
<i>Population group</i>						
African	2.28 [1.65, 2.91]	0.04	1.24 [0.82, 1.67]	0.02	1.44 [1.06, 1.81]	0.027
Coloured Colored <sup>e</sup>	-0.89 [-1.60, -0.19]	0.00	-1.67 [-2.49, -0.85]	0.01	-0.62 [-1.43, 0.18]	0.00
Asian/Indian	-1.75 [-3.63, 0.13]	0.00	-2.52 [-4.09, -0.94]	0.01	-2.04 [-2.65, -1.42]	0.00
White	-3.03 [-3.75, -2.31]	0.04	-1.26 [-2.07, -0.45]	0.01	-2.49 [-3.07, -1.90]	0.02
Education: highest grade completed	-0.25 [-0.30, -0.21]	0.04	-0.17 [-0.21, -0.12]	0.02	-0.21 [-0.25, -0.17]	0.03
<i>Marital status</i>						
Never married	-0.25 [-0.55, 0.04]	0.00	0.16 [-0.15, 0.48]	0.00	0.01 [-0.31, 0.34]	0.00
Married	-0.68 [-1.03, -0.33]	0.00	-0.66 [-1.03, -0.29]	0.01	0.09 [0.00, 0.17]	0.00
Living together	0.93 [0.41, 1.46]	0.00	0.61 [-0.23, 1.45]	0.00	-0.03 [-0.67, 0.60]	0.00
Divorced/separated	0.36 [-0.60, 1.32]	0.00	0.93 [0.17, 1.69]	0.00	0.77 [-0.16, 1.70]	0.00
Widowed	1.89 [1.38, 2.41]	0.01	1.14 [0.67, 1.62]	0.01	1.69 [1.21, 2.17]	0.01
Depression in prior wave	NA	0.10 [0.07, 0.14]	0.01	0.12 [0.07, 0.17]	0.01	0.01
<b>Household</b>						
Household income rank relative to nation <sup>b</sup>	-0.65 [-0.85, -0.45]	0.04	-0.13 [-0.21, -0.04]	0.03	-0.31 [-0.47, -0.16]	0.03
Household income rank relative to neighborhood <sup>c</sup>	0.18 [0.11, 0.25]	0.01	0.06 [0.00, 0.12]	0.02	0.18 [0.10, 0.26]	0.00
Negative household events	-0.31 [-0.72, 0.10]	0.00	0.14 [-0.30, 0.59]	0.00	NA	0.00
Positive household events	-0.74 [-1.12, -0.37]	0.01	NA	NA	NA	0.00
<b>Neighborhood</b>						
Structural social capital	-0.09 [-0.25, 0.07]	0.00	0.14 [-0.04, 0.32]	0.00	NA	0.00
Cognitive social capital	-0.04 [-0.13, 0.05]	0.00	NA	NA	NA	0.00
<i>Perceived frequency</i>						
All neighborhood violence	NA	0.07 [0.02, 0.12]	0.01	0.04 [0.01, 0.08]	0.00	0.00
Neighborhood theft	NA	0.22 [0.02, 0.42]	0.01	0.06 [-0.07, 0.20]	0.00	0.00
Neighborhood domestic violence	NA	0.35 [0.14, 0.57]	0.01	0.29 [0.12, 0.46]	0.01	0.01

Individual	2008 $\beta^e$ [95% CI] n = 15,358	Effect size <sup>d</sup>	2010 $\beta^e$ [95% CI] n = 16,392	Effect size <sup>d</sup>	2012 $\beta^e$ [95% CI]	Effect size <sup>d</sup>
Neighborhood inter-household violence	NA	<b>0.40</b> [0.20, 0.61]	0.02	<b>0.21</b> [0.03, 0.40]	0.00	
Neighborhood gangsterism	NA	<b>0.36</b> [0.16, 0.56]	0.01	<b>0.24</b> [0.07, 0.41]	0.01	
Neighborhood murder	NA	<b>0.31</b> [0.08, 0.54]	0.10	0.16 [-0.01, 0.33]	0.00	
Neighborhood drug/alcohol abuse	NA	0.07 [-0.02, 0.17]	0.00	0.05 [-0.11, 0.21]	0.00	

**Bold** print indicates  $p < 0.05$ ; CES-D = Center for Epidemiologic Studies Depression Scale, 10-item version (CES-D-10).

<sup>a</sup> Population group categories defined by NIDS, “colored” refers to individuals of mixed ethnic descent.

<sup>b</sup> Higher income corresponds to higher number.

<sup>c</sup> Higher income corresponds to lower number.

<sup>d</sup>  $f^2 = R^2 / (1 - R^2)$ .

<sup>e</sup> Beta coefficients are reported as the number of points change in the CES-D-10 for a one unit change in the corresponding variable; NA = measure not available for that NIDS wave.

**Table 3**

Multivariate linear regression modeling change in Women's depression symptoms with change in neighborhood violence.

Model covariates	2008–2010 CES-D [2008 covariates]	2010–2012 CES-D [2010 covariates]
<b>Individual</b>	<b><math>\beta^d</math>[95% CI]</b>	<b><math>\beta^d</math>[95% CI]</b>
	<b>R<sup>2</sup> = 0.02 n = 5001</b>	<b>R<sup>2</sup> = 0.03 n = 4669</b>
Age	0.00 [−0.00, 0.00]	0.00 [−0.00, 0.00]
<i>Population group</i>		
African	−1.37 [−2.90, 0.15]	−0.43 [−4.51, 3.65]
Coloured <sup>a</sup>	−1.79 [−3.55, 0.03]	−0.51 [−4.71, 3.68]
Asian/Indian	−1.94 [−5.79, 1.90]	−0.08 [−4.16, 4.01]
White	0.54 [−1.52, 2.60]	−2.20 [−6.36, 1.97]
Education: highest grade completed	0.05 [−0.04, 0.13]	−0.01 [−0.08, 0.04]
<i>Marital status at baseline</i>		
Never married	1.77 [−2.62, 6.15]	−1.22 [−2.37, 0.07]
Married	1.21 [−3.20, 5.63]	−1.18 [−2.28, 0.09]
Living together	0.86 [−3.61, 5.34]	−2.02 [−3.54, 0.50]
Divorced/separated	2.20 [−2.44, 6.84]	−1.99 [−3.56, 0.43]
Widowed	0.85 [−3.66, 5.36]	−0.82 [−1.95, 0.31]
<b>Household</b>		
Household income rank relative to nation <sup>b</sup>	0.23 [−0.09, 0.55]	0.10 [−0.28, 0.49]
Household income rank relative to neighborhood <sup>c</sup>	−0.10 [−0.32, 0.13]	−0.04 [−0.39, 0.31]
Negative household events	−0.18 [−0.68, 0.31]	0.49 [−1.22, 0.24]
Positive household events	−0.23 [−0.85, 0.40]	NA
<b>Neighborhood</b>		
Structural social capital	0.05 [−0.16, 0.27]	−0.09 [−0.34, 0.17]
Cognitive social capital	−0.00 [−0.12, 0.23]	NA
<i>Change in perceived frequency of neighborhood violence</i>		
Aggression (2008–2010)	NA	NA
Theft, burglaries, muggings	0.06 [−0.12, 0.23]	−0.13 [−0.33, 0.08]
Domestic violence (2010–2012)	NA	0.35 [0.11, 0.58]
Inter-household violence (2010–2012)	NA	0.05 [−0.19, 0.28]
Gangsterism (2010–2012)	NA	0.08 [−0.14, 0.30]
Murder (2010–2012)	NA	−0.11 [−0.30, 0.09]
Drug or alcohol abuse (2010–2012)	NA	−0.10 [−0.24, 0.03]

**Bold** print indicates  $p < 0.05$ ; CES-D = Center for Epidemiologic Studies Depression Scale, 10-item version (CES-D-10).

<sup>a</sup>Population group categories defined by NIDS, “coloured” refers to Population group categories defined by NIDS, “coloured” refers to individuals of mixed ethnic descent.

<sup>b</sup>Higher income corresponds to higher number.

<sup>c</sup>Higher income corresponds to lower number.

<sup>d</sup> Beta coefficients are reported as the number of points change in the CES-D-10 for a one unit change in the corresponding predictor of the regression model; NA = measure not available for that NIDS Wave.

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