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Dyadic and Ecological Associations with Intimate Partner Violence (IPV): Using Hierarchical Linear Modeling to Differentiate IPV from Community Crime

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Dyadic and Ecological Associations with Intimate Partner Violence (IPV): Using Hierarchical

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by

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ABSTRACT

Dyadic and Ecological Associations with Intimate Partner Violence (IPV): Using Hierarchical

Linear Modeling to Differentiate IPV from Community Crime

by

Rachel Carpenter

Research on intimate partner violence (IPV) and intimate partner sexual violence (IPSV) has largely focused on individual and dyadic-level risk factors, but recently studies have explored how the surrounding environment is associated with IPV/IPSV. Studies that have explored community-level variables typically only use IPV/IPSV samples and do not first compare indicators of IPV/IPSV to those of general crime in those same communities. To address these gaps, this study was conducted in two parts. Data were retrieved from the Tennessee Bureau of Investigation Reporting System, County Health Rankings and Roadmaps System, the US Census Bureau, and other sources. Study 1 first determined that aspects of gender inequality, specific socioeconomic variables, and health-related factors differentiated IPV/IPSV from community crime. Study 2 utilized multilevel modeling to further investigate the nested effects of IPV/IPSV on individuals within the larger community. Significant individual level variables included younger age, differences among relationship type, and drug use. At the community level, factors related to socioeconomics and children, firearm prevalence, and certain health-related factors (e.g., lack of health insurance) were important when comparing IPV/IPSV. Prevention and intervention efforts should improve healthcare access and medical IPV screening, target younger age groups, provide specific resources to improve socioeconomic status, and reduce excessive drug/alcohol use and firearm use in IPV/IPSV.

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Chapter 1. Introduction

Intimate partner violence (IPV) and intimate partner sexual violence (IPSV), defined as "behaviors between two intimate partners that causes physical, psychological, or sexual harm" (World Health Organization [WHO], 2017) accounts for 15% of all violent crime in the United States (US; National Crime Victimization Survey, 2019). In addition to individual-level factors associated with IPV, it is documented that community-level factors show some association with general crime (Strauss-Hughes et al., 2019; Whiting et al., 2020), but IPV and the characteristics of the surrounding environment are less explored (Voith, 2019). Some researchers argue that IPV is not susceptible to community influences due to the perception that IPV occurs "behind closed doors" (Sampson & Raudenbush, 1999) and is less well-managed or deterred by crime-inhibiting processes such as public monitoring or informal social control (Wright & Benson, 2011). However, structural characteristics such as neighborhood socioeconomics (Ackerson et al., 2008), racial and immigrant diversity (Cunradi et al., 2000), the presence of other crime (Benson et al., 2003; Jain et al., 2010; Lauritsen & Shaum, 2004; Reed et al., 2009; Smith et al., 2014), firearm prevalence (Snyder, 2000), and alcohol outlet density patterns (Cunradi et al., 2012) show some predictive value on community rates of IPV.

These community-level associations have recently been explored using ecological models to explain how different levels of the ecosystem (e.g., individual, community, larger society) interact to potentially maintain and precipitate violence (Voith, 2017). Informed by both social disorganization theory (SDT; Shaw & McKay, 1942) and Bronfenbrenner's ecological model (1989), studies that explore community-level correlates on IPV typically only use IPV samples and do not first compare indicators of IPV to those of general crime in those same communities. There will likely be similarities in community-level correlates on both IPV and non-IPV crime,

but identifying and differentiating specific characteristics that influence IPV may allow for better-tailored IPV prevention and intervention strategies. Additionally, much of the research examining the community-level associations on IPV does not use multilevel modeling (MLM), such as hierarchical linear modeling (HLM), to properly investigate the effects of individual and ecological variables on outcomes like rates of IPV (Rose, 2018). Standard regression techniques may fail to parse apart the correlation between the characteristics of the individual and the larger community, potentially over- or underestimating the actual community effects.

The present study aimed to address both shortcomings. First, a review is provided of the known individual, dyadic, and community-level factors related to IPV and IPSV, and the current theories that differentiate non-IPV crime from partner violence. Both county level non-IPV crime and IPV/IPSV assaults were then compared to determine the community-level associations. Using HLM, community-level, person-level, and dyadic factors were analyzed to better understand which individual and contextual factors were correlated with IPV/IPSV and explore "hot spots" or geographic areas with higher prevalence rates of varying forms of IPV.

Intimate Partner Violence

Individual-Level Factors

Recent lifetime rates indicate that more than one in three women and more than one in four men experience IPV, with the direct costs exceeding \$5.8 billion, including medical, mental health, legal, or housing programs (Center for Disease Control [CDC], 2015). Research investigating how to mitigate these negative outcomes has primarily focused on individual-level IPV risk factors. Most commonly identified variables include perpetrator and survivor gender, younger age, drug or alcohol abuse, lower education, and low socioeconomic status (CDC,

2015). To begin, survivor gender and age may be two of the strongest risk factors for IPV.

Approximately 18.3% of women and 1.4% of men under 35 report IPV annually (CDC, 2011),

and women are more likely to experience severe forms of violence in comparison with men

(Houry et al., 2008). Moreover, research is consistent in showing that risk of IPV decreases with

age (Capaldi et al., 2012), and women aged 18-24 are at the highest risk of IPV, with 70% of

women reporting their first IPV victimization before the age of 24 (Black et al., 2011). Certain

risk factors for young adults include higher rates of substance abuse and illegal activity (National

Institute of Justice, 2018), disrupted peer/parental relationships, poor educational performance,

and early childhood violence (Stöckl et al., 2014), which may explain higher IPV prevalence in

survivors and perpetrators aged 18-24.

Relatedly, the co-occurrence of substance/alcohol use and IPV is well documented

(Cafferky et al., 2018). The exact prevalence of substance use among IPV survivors varies from

18-72% (Soper, 2014), but compared to alcohol use, drug use is strongly associated with

victimization, and problematic, repeated drug use is related to repeated offenses by perpetrators.

Additionally, some evidence indicates that IPV and substance use are bidirectional. Increased or

new substance use may follow IPV, but substance use may also lead to higher incidences of IPV

(Gilbert et al., 2001). Low-income women may be at particular risk for comorbid substance use

and IPV, as there are higher rates of comorbid substance and alcohol use in those who are facing

economic instability (Capaldi et al., 2012).

Similarly, numerous studies have examined the potential links between low

socioeconomic status and IPV (Field & Caetano, 2004; Goodman et al., 2009; Reichel, 2017).

Income level, male unemployment, educational attainment, and levels of education are

moderately associated with IPV in both the perpetrator and survivor (Kishor & Johnson, 2006).

Significant associations exist between unemployment and IPV (Caetano et al., 2008), even after controlling for alcohol and drug abuse, impulsivity, and relationship factors, while in one study annual household income was the most important predictor of IPV (Cunradi et al., 2002). Factors such as housing and food insecurity add additional financial constraints, preventing the abused partner from leaving the abusive relationship and/or causing stress or conflict in the relationship (Breiding et al., 2017). Moreover, a recent review indicated that parents with a lower than high-school education, a proxy variable for socioeconomic status, increased the risk of IPV (Yakubovich et al., 2018).

Dyadic-Level Factors

While individual-level factors are important in understanding IPV, these factors interact with the dyad (i.e., the relationship), which is also influenced by and nested within contextual factors of the surrounding community. A number of dyadic-level factors are known to influence IPV risk and appear both independently and in combination with individual-level factors. Identified factors include the longevity of the partnership and the relationship type (e.g., married, dating, acquaintances), traditional gender norms (Karakurt, & Cumbie, 2012), and higher female educational attainment (Ackerson et al., 2008).

Regarding relationship type, the US Bureau of Justice Statistics (Morgan, & Oudekerk, 2019) indicated that the majority of IPV cases are classified as either friends/acquaintances (36.45%) or intimate (dating or married; 22%). Acquaintances typically demonstrate the highest number of reported IPV assaults, and are more likely to engage in simple assaults, intimidation, and verbal abuse (Bagwell-Gray et al., 2015). Married partners report significantly less frequent, but more aggressive, forms of violence (e.g., assault, rape, and homicide; Krienert & Walsh, 2018). However, IPV within the context of married partners is highly underreported (The

National Center for Victims of Crime, 2017) due to both personal reasons (e.g., aspects of stigma, economic dependence, fear of retaliation) and societal influences (e.g., imbalanced power, community resources; Gracia, 2004).

Other factors, such as notions of traditional gender role attitudes (Baugher & Gazmararian, 2015), are known to increase the likelihood of an abusive partner. Typically studied within non-western contexts, a recent review indicated that male partners who endorsed traditional gender roles, such as "*A woman's most important role is to take care of her home and cook for her family" (*Attitudes Towards Gender Norms Scale; GEM; Pulerwitz, & Barker, 2008), were associated with frequent IPV offenses (McCarthy et al., 2018). The US has documented similar patterns, in which masculine gender role norms significantly increased the likelihood of young men having unprotected sex and perpetrating IPV (Santana et al., 2006).

Similarly, female educational attainment is associated with both increased and decreased IPV prevalence (Friedemann-Sánchez & Lovatón, 2012). Some studies indicate that women with more than a high school diploma avoid socioeconomic risk factors such as food insecurity, report fewer instances of IPV, and experience reduced sexual violence compared to women with no high school diploma (Gibbs et al., 2018). Conversely, women who have attained a higher educational level than their partners are more likely than educationally similar dyads to report recent IPV, but IPV decreases with increased education in the male partner (Bonnes, 2016; Ackerson et al., 2008). In dyads with high female educational attainment, IPV may stem from traditional gender role expectations and aspects of masculinity in which partners compensate with violence for their inability to fulfill their role as a primary provider (Choi & Ting, 2008). These traditional gender role attitudes and female educational attainment are important for the individual dyad but are also largely influenced by the surrounding community and larger society.

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Community-Level Factors

The ecological associations of IPV are informed by various theories that describe the interactions between the broader environment and the individual person. One theory, Social Disorganization Theory (SDT; Shaw & McKay, 1942), argues that individual behaviors, including crime and violence, are influenced by community characteristics. Originally proposed to explain general community violence, SDT has been used as a framework for direct measurement of constructs such as collective efficacy (Browning, 2002; Dekeseredy et al., 2003), social cohesion (Frye et al., 2008), and social or physical disorder (Cunradi, 2007, 2009), and their influence on the occurrence of IPV. Similar to SDT, other conceptual frameworks exist; for example, Heise (1998) proposed that IPV does not only include person-level variables but also situational and sociocultural factors. These ecological theories, largely based on Bronfenbrenner's ecological model (1981), explain how the individual, the dyadic relationship, the community, and the larger society interact to explain IPV, with each level of analysis nested within the broader level (Capaldi et al., 2012; VanderEnde et al., 2012; Voith, 2017). See Figure 1.

Figure 1

Ecological Model of IPV/IPSV
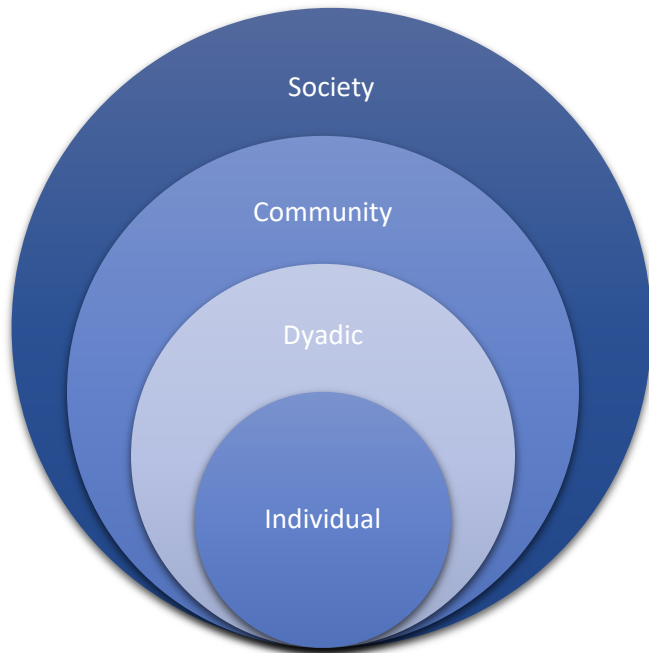
A recent review indicated that out of 36 studies analyzed, 30 reported some evidence that community-level factors are associated with IPV (Beyer et al., 2015). Community-level indicators commonly associated with IPV include community socioeconomic factors such as unemployment rate, rate of poverty, and education levels. Studies have consistently demonstrated this pattern in which the surrounding socioeconomic characteristics are several of the strongest predictors of IPV (Reichel, 2017; Spencer et al., 2019; Voith, & Brondino, 2019). Additional identified community-level factors include violent crime (Herrero et al., 2017), rate of firearm prevalence (Bullock & Cubert, 2002; Garcia et al., 2007; Glass et al., 2008; Roberts, 2009; Shuman, 2008), alcohol outlet density (Cunradi et al., 2011), rurality (Garcia-Moreno et al., 2006), gender-inequitable social norms (Ackerson & Subramanian, 2008; McCarthy et al., 2018), and geographic patterning (Garcia et al., 2014; Jackson, 2016).

To begin, the association between community socioeconomic disadvantage and IPV is so strong that some scholars argue to control for certain socioeconomic characteristics when examining IPV (Pinchevsky, & Wright, 2012). Several studies found that structural disadvantage continues to influence IPV, regardless of cultural norms, social community ties, and even individual factors such as substance use, previous reports of IPV within the dyad, and race. (Cunradi et al., 2000; Spencer et al., 2019; Wright & Benson, 2011).

Another indicator of disadvantage, community violence, is also associated with elevated IPV prevalence (Benson et al., 2003; Lauritsen & Shaum, 2004; Jain et al., 2010; Raghavan et al., 2006). Areas with elevated levels of "street crime," specifically property crime and stranger assaults, demonstrate higher rates of IPV, intimate partner sexual violence, and intimate-partner homicides (Naved & Persson, 2008; Stueve & O'Donnell, 2008). Additionally, communities with high violent crime are typically associated with low socioeconomic status, higher levels of unemployment, and below average median incomes (Smith et al., 2014). In an examination of male-to-female and female-to-male partner violence, couples that resided in impoverished communities with high rates of non-IPV violent crime were two to four times more likely to experience IPV compared to other couples residing in non-impoverished areas (Cunradi et al., 2000).

Relatedly, the presence of a firearm in the home is known to predict increased risk of IPV and possible homicide (Bullock & Cubert, 2002; Garcia et al., 2007; Glass et al., 2008; Roberts, 2009; Shuman, 2008), but research at the community level examining numbers of firearms/permits within the given community and its influence on IPV is infrequent. Internationally, countries with higher gun ownership demonstrate significantly higher rates of homicide ($r = 0.61$), and within the US, states with higher rates of gun ownership show

disproportionately higher community-wide firearm-related homicides (Siegel et al., 2013). Further, of those murdered by a firearm located within their own home, most were killed by an intimate or family partner, and the majority (55%) occurred in the context of an altercation, romantic argument, or a murder-suicide (Kellerman et al., 1993).

Although a link between alcohol use and IPV exists at the individual and dyadic level, indicators of community availability of alcohol or alcohol outlet density has been seldom studied (McKinney et al., 2009; Waller et al., 2012). One study indicated that off-premise alcohol outlets are associated with an approximate 3% increase in crime reports related to IPV (Cunradi et al., 2011). Another study indicated that the proximity of alcohol outlets did not influence the likelihood of IPV, but young women who drank heavily demonstrated a greater likelihood of sexual and physical abuse compared to those who did not drink (Waller et al., 2012).

Research exploring differences in occurrences of IPV in urban versus rural areas produces mixed conclusions. Some studies indicate that rural communities characterized by increased isolation, resource deprivation, and IPV stigma demonstrate higher rates of IPV (Breiding et al., 2009; Peek-Asa et al., 2011), while other studies find no difference by locality (Edwards, 2015). Additionally, one study reported that more severe forms of violence by male partners occurred in rural settings, suggesting that a more traditional and isolated environment may influence the form, severity, or trajectory of IPV (Garcia-Moreno et al., 2006).

Aspects of gender equality, including women's autonomy (Koenig et al., 2003), female education (Boyle et al., 2009), and gender norms (Koenig et al., 2006), are possible factors related to IPV. A high degree of country-level gender equality is not always associated with lower IPV prevalence, with most studies examining countries outside of the US (Ivert et al., 2020). For example, the European Union Agency for Fundamental Rights (FRA) indicated that

the lifetime prevalence of IPV in three EU Nordic countries was higher than the EU average, despite these countries ranking the highest in gender equality. Known as the "Nordic paradox" (Gracia, & Merlo, 2016) these countries are consistently ranked among the most equal in terms of education, economic possibility, and political aims, but also evidence disproportionately high rates of violence against women. This illustrates the need to further investigate the link between macro-level indicators of gender equality and individual factors related to IPV. Additionally, it is unknown how such findings compare to occurrences of IPV within the US.

Similarly, the geographic distribution of IPV may be localized, in that IPV is known to cluster within specific neighborhoods (Frye, 2007; Garcia et al., 2014). Areas with high social disorder, low collective efficacy, and a diminished sense of trust demonstrate significantly higher rates of IPV compared to areas with low social disorder (Jackson, 2016). In addition, some research has identified geographic associations in the incidence of intimate partner homicide (Madkour et al., 2010; Miles-Doan, 1998; Miles-Doan & Kelly, 1997). This clustering of IPV suggests an opportunity to concentrate IPV intervention and prevention efforts to areas that may most need them.

Intimate Partner Sexual Violence (IPSV)

Intimate partner sexual violence is typically subsumed within the broader definition of IPV, but IPSV may have distinctive risk factors compared to general IPV (Jung et al., 2021). Intimate partners (e.g., dating or married) are the most common victims of sexual violence (Smith et al., 2020). One in ten women report sexual assault by an intimate partner (Black et al., 2011), and the rates rise with coexisting physical abuse (28-68 percent%; McFarlane et al., 2005). Similar to general IPV, younger survivors face higher risk (Lopez et al., 2019), with those aged 65 and older being 92% less likely than those 12-24 years old to be a victim of rape or

sexual assault (DOJ, 2019). Additionally, the role of alcohol or drugs at the time of the assault is also known to differ depending on the type of violence, in which many rapes/forced sexual acts are facilitated by alcohol or other drugs. Alcohol and drug use is common by sexual perpetrators (Kilpatrick et al., 2007), as well as survivors who may use substances to cope with the abuse (Ullman et al., 2018) and/or symptoms related to post traumatic stress disorder (PTSD).

While IPSV shares many characteristics of IPV generally (e.g., younger age, typically female survivors, lower socioeconomic status), the individual and dyadic influences may differ depending on the type of abuse. Ecological features of IPSV remain relatively understudied. One examination specific to IPSV found factors related to ethnic heterogeneity reduced the risk of IPSV, while collective efficacy (i.e., mutual trust among community members and willingness to intervene on the behalf of the common good) increased the occurrence of IPSV (Frye et al., 2014). Thus, more research is necessary to understand the influence of community factors in the perpetration of IPSV (Carpenter & Stinson, 2021).

General Violence

Intimate partner violence/IPSV differs from community violence as it often takes place hidden from public view, and community members do not always recognize IPV/IPSV as problematic, resulting in little to no intervention (Browning, 2002). Moffitt et al. (2000) suggested that partner violence and general crime represent moderately related constructs, but they do not share similar motivations. Individual risk factors common to both include early childhood violence, substance abuse, male aggressive behavior, poor behavioral control, and low sense of self-worth (Anderson & Bushmam, 2002; Moffitt et al., 2000; Piquero et al., 2014). Research has identified the individual similarities between IPV/IPSV and non-IPV crime, but only one published study has compared the larger environmental influences (Kiss et al., 2015).

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Comparisons were made between IPV perpetration, male aggression levels, and the prevalence of property crime. Areas evidencing high rates of property crime and unintentional homicides increased the likelihood of IPV by one to two times, but the individual-level partner variables were more significant determinants for the probability of a woman experiencing IPV from her male partner (Kiss et al., 2015). These individual-level variables included the frequency with which the male partner engaged in physical fights with peers, as well as male alcohol use. While Kiss and colleagues (2015) indicated that individual level factors were the strongest IPV associations, other research has identified the importance of examining possible larger IPV community-level associations, specifically socioeconomic disadvantage, firearm prevalence, gender inequality, and rurality.

Current Study

Though a growing body of research explores the influence of community-level factors on occurrences of IPV/IPSV, much of the currently available findings examine only contributions to IPV without also establishing differential impacts of these variables on community crime apart from IPV. Additionally, since the field has transitioned toward investigating the community-level factors, individual and dyadic level factors remain unexplored within the context of the larger ecology. Further, hierarchical linear modeling (HLM) has only seldom been used in IPV/IPSV research, potentially providing biased estimates by not accounting for interdependence of observations.

This study was conducted in two parts. Study 1 aimed to determine which county-level factors influenced county-level occurrences of IPV/IPSV beyond those related to general crime. Study 2 aimed to determine which individual and dyadic variables, in combination with county-

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level predictors, influenced IPV/IPSV. Based on the previous literature review, the research questions are as follows.

Study 1

Research Question 1: Are there county-level variables that are more strongly associated with IPV/IPSV than non-IPV crime?

> *Hypothesis 1:* Socioeconomic characteristics (i.e., rates of unemployment, income inequality, median household income), indicators of gender inequality (i.e., educational attainment by gender, and median income by gender), percentage rurality, and prevalence of firearms will demonstrate the strongest association with IPV versus non-IPV crime.

Research Question 2: Which counties demonstrate geographic patterning, or areas where IPV occurrences are the highest?

> *Hypothesis 1:* Areas with a high concentration of rurality will demonstrate increased IPV prevalence and severity.

Study 2

Research Question 1: Which individual (e.g., perpetrator gender, victim gender, victim age, drug related, and race/ethnicity), dyadic (e.g., relationship type), and county-level variables (retrieved from Study 1) are most associated with reported cases of IPV and IPSV?

> *Hypothesis 1:* Those in acquaintance relationships and younger cohorts will demonstrate the highest prevalence of and strongest association with IPV.

> *Hypothesis 2:* Those in spousal and dating relationships will demonstrate the highest prevalence of and strongest association with IPSV (Carpenter & Stinson, 2021).

Chapter 2. Method

Procedures

Study 1

Participants. County-level cases of intimate partner violence and intimate partner sexual violence (IPV/IPSV; $N = 107,264$) and non-IPV ($N = 1,542,920$) crimes from 2018-2019 were retrieved from the Tennessee Bureau of Investigation's online incident-based reporting system (TIBRS) for purposes of secondary data analysis. The TIBRS reports crime information from all 95 Tennessee counties and once reviewed for accuracy by the TBI, data are made available to the public and can be downloaded for research purposes.

Within the TIBRS data, cases are classified as either IPV, IPSV, or non-IPV. County level rates of non-IPV crime included property crime (e.g., burglary, larceny, theft, motor vehicle theft, arson, shoplifting, and vandalism), simple assault, aggravated assault, homicide, and non-IPV sexual assaults (e.g., forcible rape, sexual assault with an object, forcible fondling, forcible sodomy). County level IPV included homicide, simple assault, intimidation, stalking, kidnapping/abduction, aggravated assault, and IPSV (forcible rape, sexual assault with an object, forcible fondling, forcible sodomy).

Continuous independent predictor variables describing geographic characteristics were retrieved from the online County Health Rankings and Roadmaps System (CHRRS) and were retrieved as Z scores (i.e., the number of standard deviations a given data point lies above or below the mean; University of Wisconsin Population Health Institute, 2019). In addition to the variables retrieved from the CHRRS, the number of handgun permits per county were collected from the US Department of Safety and Homeland Security (2019). The county-level population weighted distance (PWD) from on-premise alcohol outlets was retrieved from Lu et al. (2018),

who created a similar measure of alcohol outlet density. Additionally, based on previous research

(Ackerson & Subramanian, 2008), median income by gender, median income by female or male

headed households, and median education by gender were included as a measure of gender

inequality and are part of the Gender Inequality Index formula (US Census Bureau, 2018-2020;

Gaye et al., 2010). Please see Tables 1 and 2 for additional details related to how variables were

calculated and relevant descriptive information.

Table 1

County-Level Independent Continuous Variables (Study 1 and 2)

Variable	Retrieved from:	Calculated By:	Level Examined
Health Related Factors			
Excessive Drinking	CHRRS	Percentage of a county's adult population that reports binge or heavy drinking in the past 30 days.	Community
PWD Alcohol Outlets	Lu, Zhang, Holt, Kanny, & Croft (2018)	Authors	Community
Rate of Sexually Transmitted Infections	CHRRS	Number of newly diagnosed chlamydia cases per 100,000 population	Community
Lack of Health Insurance	CHRRS	Percentage of the population under age 65 without health insurance coverage.	Community
Drug Overdose Deaths	CHRRS	Number of drug poisoning deaths per 100,000 population.	Community
Poor Mental Health Days	CHRRS	Average number of mentally unhealthy days reported in past 30 days.	Community
Primary Care Physicians	CHRRS	Ratio of the population to primary care physicians.	Community
Poor or Fair Health	CHRRS	Percentage of adults in a county who consider themselves to be in poor or fair health.	Community
Poor Physical Health Days	CHRRS	Average number of days a county's adult respondents report that their physical health was not good on the Behavioral Risk Factor Surveillance System (BRFSS)	Community
Socioeconomic Factors			
High School Graduate	CHRRS	Percentage of the population ages 25 and over that received at least a high school diploma or equivalent.	Community
Food Environment Index	CHRRS	Ranges from a scale of 0 (worst) to 10 (best) and equally weights food insecurity and limited access to healthy foods	Community
Rate of Unemployment	CHRRS	Percentage of the county's civilian labor force, ages 16 and older, that is unemployed but seeking work.	Community
Income Inequality	CHRRS	Ratio of household income at the 80th percentile to that at the 20th percentile,	Community

Severe Housing Problems	CHRRS	Percentage of households with one or more of the following housing problems: Housing unit lacks complete kitchen facilities; lacks complete plumbing facilities; overcrowded; or severely cost burdened	Community
Children in Poverty	CHRRS	Percentage of people under age 18 living in poverty.	Community
Children in Single Parent Households	CHRRS	Percentage of children (less than 18 years of age) living in family households that are headed by a single parent.	Community
Violence Related Factors			
Number of Handgun Permits per County	Titan Business Unit	Total number of handgun permits divided by rate of population multiplied by 100,000	Community
Violent Crime	CHRRS	Total number of violent crimes reported per 100,000 population	Community
Rate of Firearm Fatalities	CHRRS	Total number of firearm fatalities reported per 100,000 population	Community
Racial Factors			
Residential Segregation (Black/White)	CHRRS	The residential segregation index ranges from 0 (complete integration) to 100 (complete segregation). The index score can be interpreted as the percentage of either Black or White residents that would have to move to different geographic areas to produce a distribution that matches that of the larger area.	Community
Structural Factors			
Percentage Female	CHRRS	Percentage of the population that is female.	Community
Percentage Rurality	CHRRS	Percentage of population living in a rural area.	Community
Gender Inequality Factors			
Median Income by Gender	US Census Bureau	Male and female headed households (children and no children) divided to create average across households. Male and female divided to create overall median income rate.	Macro-Level
Educational Attainment by Gender	US Census Bureau	Rate of those aged 25-34 with high school diploma or higher.	Macro-Level
Male/Female Income (Poverty Indicator)	US Census Bureau	Males and females with and without children under 10,000. Divided male and female for overall rate.	Macro-Level
Rates of IPV and Property Crime			
Total Rate of IPV Incidents (2018 & 2019)	TIBRS	Number of county level IPV cases divided by population of county multiplied by 100,000.	
Total Rate of Property Crime Incidents (2018 & 2019)	TIBRS	Number of county-level non-IPV crime cases divided by population of county multiplied by 100,000.	
Z Score Linear Combinations	TIBRS	Added Z score together for total Z score (e.g., -1.60 + 1 = .60). Obtains average Z score across years.	

Note: CHRRS = County Health Rankings and Roadmaps System; TIBRS = Tennessee Incident Based Reporting System

Table 2

Study 1 Descriptive Data (2018 and 2019)

Variable	Minimum	Maximum	Mean	SD
Total Normed IPV Rate (N = 107,264)	92.19	107,724.94	2,244.27	1,0936.62
Total Normed Non-IPV (N = 1,542,920)	3,860.25	1,756,426.63	36,592.22	17,7953.21
Excessive Drinking	-1.134	4.205	1.311	1.008
STDs	-2.581	5.931	-.016	1.897

Poor Mental Health	-7.163	4.910	.000	2.000
Primary Care Physicians	-8.300	2.625	.000	1.952
High School Graduation	-3.177	5.697	.000	1.836
Unemployment	-3.985	4.075	.000	1.983
Children in Poverty	-6.408	6.000	-.011	1.935
Income Inequality	-4.140	5.565	-.005	1.908
Children in Single Parent Homes	-5.504	6.413	.000	1.960
Violent Crime	-2.813	9.077	-.003	1.961
Severe Housing Problems	-3.815	6.296	.000	1.941
Poor or Fair Health	-6.245	4.572	.000	2.000
Poor Physical Health	-7.242	4.282	. 000	2.000
Food Environment Index	-4.721	7.223	.000	1.984
Uninsured	-7.389	5.302	.000	1.940
Rate of Handgun Permits	.031	.377	.112	.044
PWD Distance	1.555	18.139	6.802	3.078
Pwd Euclidian	.984	11.064	4.561	1.981
M/F Educational Attainment	.733	2.038	1.018	.208
M/F Income	.000	1.623	.23963	.237
Median Income by Gender	.353	3.495	1.30372	.437
% Female	.366	.544	.503	.023
% Rurality	.028	1.000	.664	.270
Residential Segregation	0	80.000	35.870	21.775
Drug Overdose Deaths	0	571.00	48.021	97.871

Study 2

Participants. Data now included the individual cases of IPV ($N = 105,885$) and IPSV ($N = 1, 374$). For IPV, the majority of assaults were simple assaults ($n = 72,388$; 68.4%) survivors were mainly White ($n = 56,056$; 52.9%), aged 25-44 ($n = 62,376$; 58.9%), in intimate relationships ($n = 72,109$; 68.1%) and female ($n = 79, 684$; 75.3%). For IPSV, the majority of assaults were forcible rapes ($n = 789$; 57.4), survivors were mainly White ($n = 928$; 67.5%), aged under 18-24 ($n = 736$; 53.6%), in intimate relationships ($n = 1, 066$; 77.6%) and female ($n = 1,320$; 96.1%). See Tables 3 and 4 for further demographic information.

Table 3

Study 2 Descriptive Data (IPV; N = 105,885)

Variable	N	Percent
IPV (DV): Other Assaults	33,497	31.6
Simple Assault	72,388	68.4
Level One Predictors		
Race (White)	56,056	52.9

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Other	49,829	47.1		
Victim Age (Under 18-24)	25,316	23.9		
25-44	62,376	58.9		
45-65+	18,193	17.2		
VOR (Acquaintance/Other)	7,660	7.2		
Intimate	72,109	68.1		
Spousal	26,116	24.7		
Drug Related (Yes)	397	.40		
No	105,488	99.6		
Perpetrator Gender (Male)	78,173	73.8		
Female	27,712	26.2		
Victim Gender (Male)	26,201	24.7		
Female	79,684	75.3		
Level Two Predictors	**Min**	**Max**	**Mean**	**SD**
Excessive Drinking	-0.68	1.83	0.00	1.00
Rate of Handgun Permits	-2.40	9.60	0.00	1.00
% Female	-14.37	5.96	0.00	1.00
% Rurality	-0.76	3.78	0.00	1.00
Residential Segregation	-3.41	2.04	0.00	1.00
Drug Overdose Deaths	-1.23	1.29	0.00	1.00
STDs	-1.38	3.03	1.20	1.23
Poor Mental Health Days	-3.58	2.46	-0.92	0.87
Primary Care Physicians	-4.18	1.38	-0.94	1.03
High School Graduation	-1.82	3.13	1.12	1.55
Unemployment	-2.01	2.55	-0.73	0.84
Children In Poverty	-3.27	3.00	-0.28	1.04
Income Inequality	-2.28	3.00	0.26	1.21
Single Parent Households	-2.85	3.33	0.80	1.31
Violent Crime	-1.59	4.60	1.92	1.98
Severe Housing Problems	-2.17	3.17	1.19	1.42
Poor or Fair Health	-3.12	2.29	-0.65	0.80
Poor Physical Health Days	-3.62	2.14	-0.95	0.84
Food Environment Index	-2.37	3.66	0.88	1.26
Uninsured	-3.76	2.77	-0.07	1.05
PWD Distance	1.55	18.14	3.40	2.09
M/F Educational Att.	0.68	2.20	0.94	0.09
M/F Income	0.00	2.53	0.19	0.14
Median Income by Gender	0.00	4.20	1.16	0.26
SES	-12.71	18.67	5.88	8.88
Health	-10.33	6.83	-2.51	2.35

Table 4

Study 2 Descriptive Data (IPSV; N = 1,374)

Variable	N	Percent
IPSV (DV): Other Assaults	585	42.6
Forcible Rape	789	57.4
Level One Predictors		
Race (White)	928	67.5
Other	446	32.5
Victim Age (Under 18-24)	736	53.6
25-65+	638	46.4

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	85	6.2		
VOR (Acquaintance/Other)	85	6.2		
Intimate	1,066	77.6		
Spousal	223	16.2		
Drug Related (Yes)	13	.9		
No	1,361	99.1		
Perpetrator Gender (Male)	1,329	96.7		
Female	45	3.3		
Victim Gender (Male)	54	3.9		
Female	1,320	96.1		
Level Two Predictors	**Mean**	**Max**	**Mean**	**SD**
STDs	-1.38	3.03	1.08	1.19
Poor Mental Health Days	-3.58	2.46	-0.87	0.83
Primary Care Physicians	-4.18	1.32	-1.08	1.08
High School Graduation	-1.76	3.13	1.07	1.52
Unemployment	-2.01	2.55	-0.85	0.83
Children In Poverty	-3.27	3.00	-0.42	0.96
Income Inequality	-2.28	3.00	0.16	1.10
Single Parent Households	-2.85	3.33	0.61	1.23
Violent Crime	-1.47	4.60	1.73	1.89
Severe Housing Problems	-1.99	3.17	0.97	1.35
Poor or Fair Health	-3.12	2.29	-0.74	0.80
Poor Physical Health Days	-3.62	2.14	-0.93	0.82
Food Environment Index	-2.37	3.66	0.73	1.14
Uninsured	-3.76	2.77	-0.10	1.08
PWD_Distance	1.55	18.14	3.38	2.10
M/F Educational Attainment	0.68	1.98	0.95	0.09
M/F Income	0.00	2.53	0.18	0.16
Median Income by Gender	0.00	3.18	1.15	0.25
Excessive Drinking	-0.67	1.86	0.00	1.00
Rate of Handgun Permits	-1.78	9.69	0.00	1.00
% Female	-12.87	5.89	0.00	1.00
% Rurality	-0.79	3.93	0.00	1.00
Residential Segregation	-3.53	2.20	0.00	1.00
Drug Overdose Deaths	-1.23	1.32	0.00	1.00
Health	-7.71	5.96	-0.59	1.92
Children	-6.12	5.79	0.19	2.08
SHP_FEI	-3.85	5.92	1.70	2.36

Taking an ecological perspective, survivors and perpetrators are embedded in overlapping groups that stem from interconnected systems of the individual, families, neighborhood, and communities (Rose, 2018). Due to the inherent grouping of cases or "clustering," standard logistic regression analysis can lead to biased standard error values (Raudenbush & Bryk, 2002). When using regression techniques individuals may not be randomly distributed, and the tests of the null hypothesis are based on the reported cases or

individuals within the sample without examining the aggregates (i.e., nested cases within the county). Hierarchical linear modeling (HLM) is a structured approach to determine variance between the individual and the group (county), which allows for grouping effects to emerge, yielding more accurate parameter estimates (Voith & Brondino, 2017).

Level-One, Level-Two, and Outcome Variables. HLM identifies the relationship between the predictor and outcome variables by taking multiple levels of clustering into account. In this case, the lowest order, or level-one variables, included information pertaining to the individual cases of IPV/IPSV retrieved from the TIBRS data set (e.g., perpetrator gender, victim gender, victim age, relationship type, drug related, and race/ethnicity). The higher order, or level-two variables, were informed by the relevant county-level variables from Study 1 (e.g., health/socioeconomic related factors). Finally, the dichotomous outcome variables were cases of IPV and IPSV (see analytic plan for further information).

Analytic Plan

Study 1

Separated by year (2018-2019), the data included both county level IPV/IPSV and non-IPV cases and the additional continuous county-level/ecological predictors. These were first retrieved from their various sources and cleaned using Kuku Tools for Excel, Version 25. To determine if there were specific ecological factors that influenced rates of IPV/IPSV more so than property crime over two years (2018-2019) the normed IPV rates for 2018 and 2019 were totaled to create an overall IPV rate (see Table 1 for calculations). Linear combinations (Chignell et al., 2015) were conducted on the Z score ecological variables to create total Z scores for 2018 and 2019 (see Table 1 for calculations), and the county-level rates of IPV and non-IPV crime were population normed to control for county population size. Several of the ecological variables

required further calculations including data from the US Census Bureau and Titan Business Unit (rate of handgun permits; see Table 1). A linear regression and variance inflation factors (VIF) indicated acceptable levels of multicollinearity (<10; Tay, 2017) for the continuous county-level predictor variables.

Following, using SPSS Version 27, a series of two-tailed bivariate correlations examined the correlations between the normed non-IPV and IPV/IPSV reported incidents (2018-2019 combined) and the continuous ecological level predictors. Following, a series of backwards stepwise linear regressions explored which specific ecological factors were associated with IPV more so than non-IPV crime for both years (2018-2019) collectively and then separately. Due to the similarities between predictors this stepwise approach was employed to reduce the number of predictors and avoid model overfitting. Across all analyses, non-IPV was added to the regression models to control for the high correlation between IPV and non-IPV ($r = .96$).

Study 2

Analyses were conducted using the statistical analysis software, R (R Core Team, 2021). Given the dichotomous nature of the outcome variable, the default error distribution (e.g., Gaussian) in typical HLM is not appropriate. Thus, goodness-of-fit tests were conducted using the *mcvd* package (Wood, 2016) to determine the distribution of the dependent variable and obtain the appropriate estimation method. Results indicated a binomial distribution, which called for a unique implementation of HLM: a binomial generalized linear mixed-effects model (GLMM; Bates, 2019). The *glmer* package (Bates, 2019) was used, which implements an inverse link function to estimate fixed and random effects as well as a non-Gaussian error distribution. This allows for non-biased parameter estimates of dichotomous outcome variables.

Due to unequal sample sizes, two data sets were created that separated cases by IPV and

IPSV and a principal components analysis (PCA) was conducted to reduce multicollinearity

(Table 5).

Table 5

Factor Loadings for Oblimin Rotation for IPV Ecological Factors (Study 2)

Factor	Component Factor Loading 1: SES	Component Factor Loading 2: Health
Poor Mental Health Days	-.176	**.933**
High School Graduation	**.896**	-.282
Unemployment	.314	**.763**
Children In Poverty	**.785**	.447
Income Inequality	**.833**	.235
Children in SPH	**.954**	.024
Severe Housing Problems	**.958**	-.195
Poor or Fair Health	.215	**.894**
Poor physical health days	-.208	**.951**
Food Environment Index	**.928**	.064

For each data set, maximum likelihood estimation was used to estimate an unconditional

model (i.e., model only including the intercept; Model 1) on the dichotomous IPV/IPSV outcome

variables. Following, the intraclass correlation coefficient (ICC) was calculated

following Snijders and Bosker's (1999) formula for binary outcomes (IPV/IPSV = 0.03). Any

relationship with an ICC of 0% or greater suggests the possible evidence of level-two effects

(Pituch & Stevens, 2015), so GLMM was employed. After retrieving the unconditional model,

each level-one factor (e.g., victim gender, perpetrator gender, relationship type, victim age, drug

related, race/ethnicity) was added and tested as both fixed (i.e., slopes remain constant) and

random effects (i.e., slopes can vary) to model the influence of level-one factors on IPV/IPSV

offenses (Model 2). Significant variables were retained, and the random intercept or the fixed

model were compared to determine which model best explained the relationship between the

level-one predictors and IPV/IPSV outcomes. Following level-one variables, this process was repeated with the significant level-two variables from Study 1 (i.e., county-level predictors) to explore the influence of both level-one and level-two variables on IPV/IPSV (Model 3). Subsequent models also explored all ecological variables to ensure no significant variables were missed.

To guide the determination of the most accurate models, model fit tests (e.g., Akaike Information Criterion [AIC]) were used to estimate the quality of each fixed or random model. This test aided with determining which level-one and level-two variables to include, and which model most accurately explained the relationship between the level-one, level-two, and outcome variables (Voith & Brondino, 2017).

Chapter 3. Results

Study 1

2018 and 2019 Analyses

A series of bivariate correlations were conducted to determine the correlations between the county level normed non-IPV and IPV rates and county level predictors. Percent rurality was not significantly associated with the normed IPV rate, but moderately correlated variables (> .3) included rate of property crime, population ratio of primary care physicians, rate of sexually transmitted diseases, percentage of children in single parent homes, rate of violent crime, percentage of severe housing problems, alcohol outlet density, rate of handgun permits, and food environment index. Following, additional bivariate correlations examined the 10 counties with the highest rates of IPV (see Figure 2). Hypothesis 1 was not confirmed in that rurality was not significantly correlated with these 10 counties. Only two variables, including the population ratio of primary care physicians and rate of handgun permits were significant (Table 6).

Table 6

Bivariate Correlations of IPV and Non-IPV Crime and Chosen Significant Ecological Variables

	IPV Rate	NON-IPV	Std's	MH	PCP	Unemp	CIP	II	CSPH	VC	SHP	Food Index	Uninsured	Hand-guns	PWD	Rurality
Non-IPV	.943**															
STDs	.402**	.324**														
MH	-0.196	-0.147	-.238*													
PCP	-.359***	-.442**	-0.117	.330**												
Unemp.	-.231*	-.208*	0.040	.652**	.367**											
CIP	-0.139	-0.100	0.023	.739**	.322**	.748**										
II	0.072	0.109	.239*	.400**	-0.132	.470**	.569**									
CSPH	.310**	.224*	.579**	0.182	-0.006	.330**	.412**	.459**								
VC	.566**	.525**	.617**	-0.139	-.275**	-0.110	0.039	.235*	.562**							
SHP	.328**	.295**	.493**	0.096	-0.029	0.027	0.120	.311**	.442**	.599**						
Food Env.	.257*	.252*	.574**	.229*	-0.134	.324**	.409**	.562**	.694**	.561**	.503**					
Uninsured	-0.136	-0.145	-0.162	.521**	.394**	.266**	.494**	0.068	0.159	-0.025	0.195	0.010				
Handguns	-.354***	-.354**	-.278**	0.095	0.147	0.082	-0.089	-0.114	-0.133	-.251*	-0.143	-.221*	0.017			
PWD	-.361**	-.359**	-.293**	.308**	.481**	.232*	.253*	-0.086	-.224*	-.412**	-0.115	-.225*	.317**	.242*		
Rurality	-0.024	0.010	-.281**	.466**	.450**	.461**	.484**	0.112	-0.069	-.393**	-0.195	-0.181	.210*	-0.050	.526**	
Overdoses	.230*	0.200	.348**	-.319**	-.465**	-.367**	-.227*	0.071	0.158	.563**	.330**	.235*	-0.110	-0.199	-.423**	-.584**

Note: MH: Poor mental health days; PCP: Rate of primary care physicians, CIP: Children in poverty; II: Income inequality; CSPH: Children in single parent homes; VC: Violent crime; SHP: Severe housing problems; PWD: Alcohol outlet density. *Sig at $p < .05$; **Sig at $p < .001$; *** = Significant for 10 counties with highest rates of total IPV.

Figure 2

Distribution of Counties with Highest IPV Rates
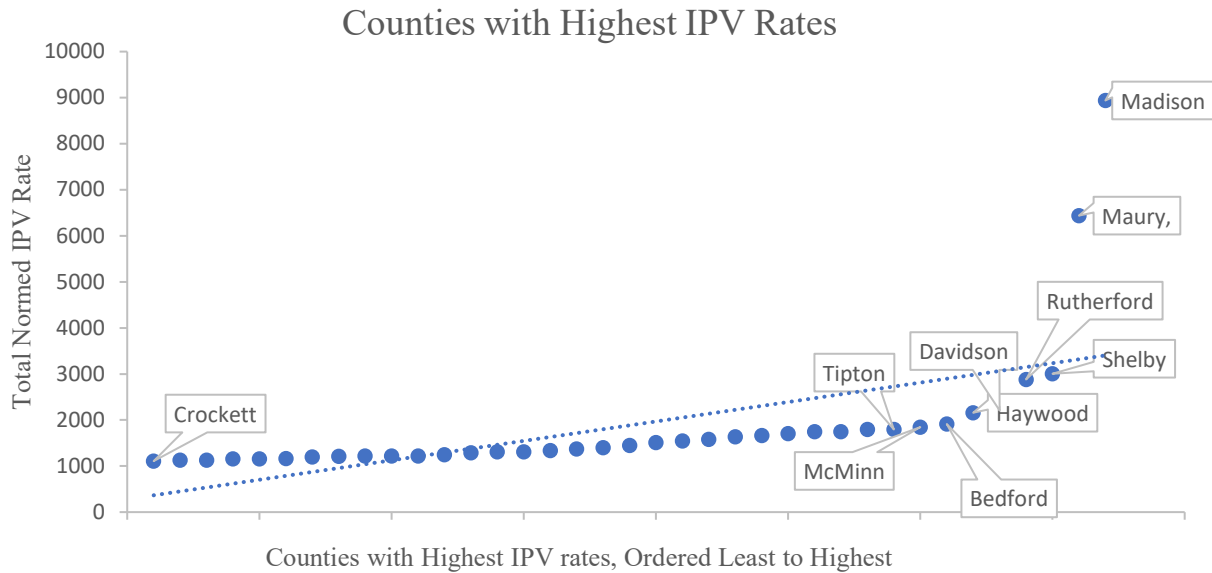
Non-IPV Crime Controlled. Three backwards stepwise linear regressions examined the ecological factors in relation to the normed IPV rate while also controlling for non-IPV crime. Across all years the percentage of poor or fair health remained significant. For 2018 and 2019 combined (Adjusted R^2 = .922, F = 124.718, p < .001), additional variables included within the model were percentage with poor mental health, population ratio of primary care physicians (p = .50), percentage of children in poverty, percentage of children in single parent homes, median income by gender, and rate of drug overdose deaths. For 2018 (Adjusted R^2 = .701, F = 14.232, p < .001), additional variables included income inequality, average number of poor physical health days, and alcohol outlet density. For 2019, (Adjusted R^2 = .931, F = 126.852, p < .001) percentage of poor mental health, poor/fair health, children in poverty, and children in single parent homes were also significant. Please see Table 7 for more information.

Table 7

Significant Independent Variables from Backward Linear Regression. Non-IPV

Crime Controlled

Variable	Std. Error	Std. Beta	t	Sig.	VIF
2018 and 2019					
Poor Mental Health Days	31.897	-.127	-2.241	.028	3.861
PCPs	22.814	.078	1.987	.050	1.882
Children in Poverty	30.178	-.155	-2.991	.004	3.235
Children in SPH	24.688	.146	3.411	.001	2.223
Poor/Fair Health	39.839	.196	2.770	.007	6.023
Median Income	76.078	.067	2.284	.025	1.049
Drug Overdose Deaths	.407	.071	2.016	.047	1.506
2018					
Income Inequality	27.093	-.092	-2.284	.026	1.223
Poor/Fair Health	73.082	.320	3.021	.004	8.523
Poor Physical Health Days	68.572	-.348	-3.415	.001	7.897
PWD_Euclidian	98.382	.495	2.062	.044	43.936
2019					
Poor Mental Health Days	42.662	-.144	-2.131	.037	4.307
Children In Poverty	41.987	-.196	-3.179	.002	3.609
Children in SPH	33.226	.173	3.550	.001	2.248
Poor/Fair Health	45.028	.158	2.253	.028	4.639

Non-IPV Crime Not Controlled. Three backwards stepwise linear regressions examined the ecological factors in relation to the normed IPV without controlling for non-IPV crime. For 2018 and 2019 combined, (Adjusted R^2 = .607, F = 15.539, $p < .001$), several variables were significant predictors, including the rate of STDs, population ratio of primary care physicians, rate of violent crime, alcohol outlet density, male/female educational attainment, and percent rurality. The 2018 model was significant (Adjusted R^2 = .919, F = 100.887, $p < .001$), in which several of these same variables remained significant with the addition of other socioeconomic indicators (e.g., food environment index, rate of high school graduation, rate of uninsured, unemployment rate, income inequality), percentage of poor or fair health, and residential segregation. For 2019, (Adjusted R^2 = .661, F = 16.873, $p < .001$) several of these same variables

remained significant, with the addition of percentage of children in poverty and percent female.

Please see Table 8 for more information.

Table 8

Significant Independent Variables from Backward Linear Regression. Non-IPV

Crime Not Controlled

Variable	Std. Error	Std. Beta	t	Sig.	VIF
2018 and 2019					
STDs	56.412	.295	3.104	.003	2.154
PCPs	49.366	-.313	-3.665	<.001	1.747
Violent Crime	59.274	.526	5.106	<.001	2.542
Pwd Euclidian	48.346	-.235	-2.766	.007	1.727
M/F Edu. Attainment	414.551	-.179	-2.339	.022	1.404
% Rurality	.004	.647	6.636	<.001	2.279
2018					
PCPs	56.261	-.252	-2.879	.006	1.596
High School Graduation	60.730	-.209	-2.476	.017	1.477
Unemployment	81.605	-.253	-2.305	.025	2.505
Income Inequality	67.180	-.233	-2.342	.023	2.050
Violent Crime	65.562	.363	3.679	.001	2.025
Poor/Fair Health	98.207	-.430	-2.949	.005	4.417
Food Env. Index	103.009	.696	4.836	<.001	4.304
Uninsured	61.887	.238	2.402	.020	2.030
M/F Edu. Attainment	458.375	-.257	-3.529	.001	1.105
% Rurality	.002	.731	7.494	<.001	1.976
Residential Segregation	4.260	-.226	-2.816	.007	1.334
2019					
PCPs	54.740	-.287	-3.193	.002	1.553
Children In Poverty	84.869	-.437	-3.498	.001	2.992
Income Inequality	74.495	-.274	-2.502	.015	2.310
Violent Crime	66.621	.466	4.404	<.001	2.148
Food Env. Index	78.116	.355	2.768	.008	3.160
% Female	5147.155	.352	4.038	<.001	1.455
% Rurality	.002	.798	8.294	<.001	1.779

Non-IPV Crime. Three backwards stepwise linear regressions examined the ecological factors in relation to the normed non-IPV rate. Across all years, variables specific to non-IPV crime included population ratio of primary care physicians, percentage of children in poverty, rate of violent crime, percent rurality, and rate of drug overdose deaths. In 2018 and 2019, other variables specific to non-IPV (Adjusted R^2 = .608, F = 19.190, p < .001) included rate of high

school graduation, rate of handgun permits, and alcohol outlet density. In 2018, additional variables specific to non-IPV (Adjusted R^2 = .730, F = 19.612, p < .001) included rate of unemployment, food environment index, rate of those uninsured, and male female educational attainment. For 2019, additional variables specific to non-IPV (Adjusted R^2 = .684, F = 15.102, p < .001) included percentage of severe housing problems and percent female. Please see Table 9 for further information.

Table 9

Significant Independent Variables from Backward Linear Regression Examining Non-IPV

Incidents

Variable	Std. Error	Std. Beta	t	Sig.	VIF
2018 and 2019					
PCPs	591.383	-.403	-5.017	<.001	1.545
High School Graduation	577.880	.157	2.129	.036	1.305
Children in Poverty	605.080	-.319	-3.917	<.001	1.588
Violent Crime	621.816	.646	7.619	<.001	1.723
Handgun Permits	23081.791	-.151	-2.091	.039	1.246
PWD Distance	396.959	-.172	-2.028	.046	1.730
% Rurality	.050	.560	5.632	<.001	2.369
Drug Overdose Deaths	14.395	-.259	-2.648	.010	2.300
2018					
PCPs	656.531	-.346	-4.378	<.001	1.435
Unemployment	1075.117	-.289	-2.584	.013	2.871
Children In Poverty	1272.506	-.386	-2.749	.008	4.518
Violent Crime	903.467	.569	5.406	<.001	2.539
Food Index	1038.424	.453	4.040	<.001	2.888
M/F Edu. Attainment	5732.732	-.187	-2.655	.010	1.141
% Rurality	.032	.657	6.553	<.001	2.304
Drug Overdose Deaths	9.174	-.278	-2.521	.015	2.801
2019					
PCPs	669.230	-.333	-3.825	<.001	1.562
Children In Poverty	1038.645	-.324	-2.674	.010	3.016
Violent Crime	920.944	.455	3.928	<.001	2.762
Food Index	1020.693	.302	2.271	.027	3.631
% Female	61718.274	.337	4.075	<.001	1.408
% Rurality	.031	.621	5.937	<.001	2.252
Drug Overdose Deaths	7.392	-.301	-2.645	.011	2.675

Overall, my hypotheses were partially supported. Across both years, rurality was only significant when non-IPV was not included in the analysis. While the rate of firearm permits was

not a significant contributor within the significant regression model, a variety of socioeconomic and gender inequality variables demonstrated significance when non-IPV was controlled. These included the percentage of children in single parent homes and children in poverty. Additionally, there were several health-related factors that reached significance, including the population ratio of primary care physicians and percentage/average poor/fair physical and mental health, that were not hypothesized to be significant factors related to IPV. For Study 2, the significant variables when non-IPV crime was controlled were used first within model building (See Table 7).

Study 2

One data set included IPV as the dependent variable (simple assault = 1, homicide, simple assault, intimidation, stalking, simple assault, and kidnapping/abduction, aggravated assault = 0), and the other included the individual cases of IPSV (forcible rape = 1, sexual assault with an object, forcible fondling, forcible sodomy, statutory rape = 0). Due to unequal sample sizes within the predictor variables, they were recoded as follows: race: White = 1, Hispanic, Asian, Black/African American, American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, Unknown = 0; victim age: under 18 and 18-24 = 1, 25-44 = 2, 45-65+ = 3; victim perpetrator relationship: *acquaintance relationship* (neighbor, otherwise known, stranger, friend, employee, employer) = 1, *intimate relationships* (boyfriend/girlfriend, ex-boyfriend/girlfriend, LGBTQ+) = 2 , and *spousal relationships* (spouse, ex-spouse, common-law spouse) = 3. Within the IPSV data set, victim age was recoded into those under 18-24 = 0 and those aged 25-65+ = 1. All individual level predictor variables with more than two levels were dummy coded (e.g., 0 and 1), and continuous variables were mean centered to aid with scaling and interpretation. Please see Tables 3 and 4 for descriptive information.

IPV. Before examining the main study hypotheses, frequency statistics for each predictor and outcome variable and descriptive information for the ecological variables are provided in Table 3. A linear regression examined all potential ecological variables considered in Study 1 with IPV as the outcome to test for multicollinearity. Several variables demonstrated VIF's over the medium thresholds (e.g., > 10; Tay, 2017). To properly recode, the factorability of these items was examined. The variables correlated at least .3 with at least one other item, the Kaiser-Meyer-Olkin measure of sampling adequacy was .798, above recommended value of .6 (Kaiser, 1970), and Bartlett's test of sphericity was significant ($\chi 2$ (45) = 1474909.128, $p < .05$), suggesting reasonable factorability. Examination of the eigenvalues above 1.0 and a scree plot indicated a two-factor solution. A principal components analysis (PCA) using oblimin rotation indicated two factors explaining 49% of the variance, and all items demonstrated primary loadings over .6. The first factor, *health*, was comprised of four indicators: rate of physically unhealthy days, poor mental health days, poor or fair health, and unemployment. The second factor included variables related to *socioeconomic status* and included children in single parent homes, children in poverty, rate of high school graduation, income inequality, food environment index, and severe housing problems. The variables were collapsed, and two new composite variables were created: *health* and *SES*. See Table 5. VIF's were reexamined after the creation of the new composite variables, and two variables were removed from the regression analysis (e.g., percentage rurality and rate of STDs) to further reduce multicollinearity.

After recoding for multicollinearity, all assumptions for GLMM were met: a) the dependent variable was binary or ordinal, b) observations were relatively independent of each other, c) there was little multicollinearity among the independent variables and, d) there was a

large enough sample size (i.e., a minimum of 10 cases with the least frequent outcome for each independent variable; Finch et al., 2019).

   Model Results. Following the unconditional model (Model 1), victim gender, perpetrator gender, race, victim age, and relationship type were entered into the model individually as fixed effects and then subsequently as random effects. The fixed effect model was significant for several individual-level variables, although the variance of the random slope (i.e., random effect) was not significant for any variables. Thus, the random intercept model was considered the best model. Victim gender (Odds ratio [OR] = 6.23, $p \leq .001$), drug related crimes (OR = 5.15, $p \leq .001$), and acquaintance relationships (OR = 11.12, $p \leq .001$) were significant predictors of simple assault, while race (OR = -5.88, $p \leq .001$) and victims under 18-24 (OR = -8.80, $p \leq .001$) were significant predictors for the other forms of assault (reference category: homicide, simple assault, intimidation, stalking, simple assault, and kidnapping/abduction, aggravated assault), all of which were retained in the model for subsequent Model 3 building.

   The level two predictors, (i.e., county-level predictors) were entered into the model following the level-one predictors. In Model 3, the individual predictors remained significant, and rates of handgun permits (OR = 2.05, $p = .04$) and community lack of health insurance (OR = 2.86, $p \leq .001$) were significant predictors of simple assault. Excessive drinking (OR = -2.11, $p = .01$) and drug overdose deaths (OR = -2.02, $p = 0.03$) were significant predictors for the other forms of IPV.

   Our composite factor, *health*, was not significant in the final model but improved model fit (AIC), so it was retained. Several hypothesized variables including *SES* and median income by gender were also examined but removed from the final model due to poor model fit or model failure. For example, *SES* was added to the model but it failed to converge, so singularity,

gradient calculators, and optimizers (e.g., NelderMead) were modified, but the model continued to fail with this predictor included.

Overall, my hypothesis was supported in that acquaintance relationships and being under 18 and 18-24 years of age were significant predictors in both Model 2 and Model 3. The results of the unconditional model (Model 1), the random intercept model with only level-one predictors (Model 2), and the random intercept model with both level-one and level-two variables (Model 3) are presented in Table 10.

Table 10

Random Intercept Model Predicting Categorical Outcome IPV (N = 105,885)

	Model 1		Model 2				Model 3			
	B	SE	B	SE	OR	CI	B	SE	OR	CI
Intercept	-0.88	0.04	-0.87	0.04***	-17.9	[-0.96-0.77]	-1.12	0.10		
Level One										
Under 18-24 (Ref: 45-65+)			-0.20	0.02***	-8.8	[-0.24 - -0.15]	-0.18	0.02***	-11.3	[-0.21- -0.15]
Race: White (Ref: Other)			-0.10	0.02***	-5.88	[-0.13- -0.10]	-0.10	0.02***	-5.92	[-0.13- -0.70]
Acquaintance (Ref: Spousal)			0.33	0.03***	11.2	[0.27-0.39]	0.34	0.03***	12.7	[0.29-0.39]
Victim Gender (Ref: Male)			0.14	0.02***	6.23	[0.10-0.19]	0.14	0.02***	9.17	[0.11-0.18]
Drug Related Ref(No)			0.53	0.10***	5.15	[0.33-0.73]	0.53	0.10***	5.22	[0.33-0.73]
Level Two										
Uninsured							0.08	0.03***	2.86	[0.02-0.14]
Excessive Drinking							-0.04	0.01***	-2.11	[0.07-.01]
Drug Overdoses							-0.17	0.08**	-2.02	[-0.33- -0.01]
Handgun Permits							0.05	0.02**	2.05	[0.00-0.10]
Health							-0.02	0.02		
ICC -2LL	0.03		0.03				0.03			
AIC	129,715.06		129,366.99				129,354.97			

Note: Model 1 = Unconditional Model; Model 2 = Random Intercept Model, Level-1 Predictors Included; Model 3 = Random Intercept Model, Level-1 and Level-2 Predictors Included.
DV = simple assault = 1; aggravated assault, homicide, kidnapping/abduction, intimidation, stalking = 0.
*$p < .10$, **$p < .05$, ***$p < .001$.

IPSV. Frequency statistics for the predictor and outcome variables and descriptive information for the ecological variables are provided in Table 4. A linear regression (IPSV as

outcome) examined multicollinearity among all ecological variables. Several variables demonstrated VIF's over the medium thresholds (e.g., >10; Tay, 2017) and were combined based on an examination of a correlation matrix. Three composite variables were created which included *health*: poor/fair health, and rate of physically unhealthy days; *child SES*: children in poverty, children in single parent homes; and *environment*: food environment index, severe housing problems, and drug overdose deaths (see Table 11). After recoding for multicollinearity and removing two non-significant variables from Study 1 (e.g., violent crime, STD's), all included variables demonstrated appropriate VIF's and all assumptions for HLM were met.

Model Results. Following the unconditional model each individual-level predictor was entered into the model as fixed effects and then as random effects. Similar to the analysis for IPV, the random intercept model was evaluated to be the best model. In Model 2, victim gender (OR = -4.63, $p \leq .001$) and intimate relationships (OR = -2.31, $p = .03$) were significant predictors of other forms of IPSV (reference category: statutory rape, forcible sodomy, forcible fondling, sexual assault w/object), while victims aged under 18-24 (OR = 6.65, $p \leq .001$) were significant predictors of forcible rape. All of these were retained in the model for subsequent Model 3 building. In Model 3, the individual predictors remained significant and rates of residential segregation (OR = 2.59, $p = .01$), *health* (OR = 2.11, $p = .03$), and income inequality (OR = 2.34 $p = .02$) were significant predictors of forcible rape, whereas *child SES* (OR = - 2.14, $p = .03$) and *environment* (OR = -2.19, p = .03) were significant predictors for other forms of IPSV in the final model. Similar to the IPV analyses, several hypothesized variables (e.g., other factors pertaining to SES and median income by gender) were also examined but removed from the final model due to poor model fit or model failure. Similarly, alternative models

including all ecological variables were evaluated though none demonstrated significance or proper model fit.

Overall, my hypothesis was partially supported in that victims aged under 18 and 18-24, and intimate and spousal partnerships (reference category), were significant in both Model 2 and Model 3. The results of the unconditional model (Model 1), the random intercept model with only level-one predictors (Model 2), and the random intercept model with both level-one and level-two variables (Model 3) are presented in Table 11.

Table 11

Random Intercept Model Predicting Categorical Outcome IPSV (N = 1,374)

	Model 1		Model 2				Model 3			
	B	SE	B	SE	OR	CI	B	SE	OR	CIs
Intercept	0.35	0.08	1.33	1.13***			.60	0.14***		
Level One										
Victim Age (Ref: 25 +)			2.31	0.30***	6.65	[1.81-2.96]	2.35	0.12***	7.14	[1.86-2.97]
Intimate (Ref: Spousal)			0.66	0.12**	-2.31	[0.47-0.94]	0.73	0.15**	-2.14	[0.54-0.97]
Victim Gender (Ref: Female)			0.11	0.05***	-4.63	[0.04-0.27]	0.11	0.44***	-5.07	[0.48-0.25]
Level Two										
Children SES							0.89	0.05**	-2.14	[0.80-0.99]
Health							1.11	0.04**	2.11	[1.01-1.20]
Environment							.99	0.00**	-2.19	[.99-1.00]
Segregation							1.20	.07***	2.59	[1.05-1.39]
Income Inequality							1.20	0.08**	2.34	[0.80-.99]
ICC-2LL	0.03		0.03				0.00			
AIC	1,863.95		1,756.91				1,749.09			

Note: Model 1 = Unconditional Model; Model 2 = Random Intercept Model, Level-1 Predictors Included; Model 3 = Random Intercept Model, Level-1 and Level-2 Predictors Included.
DV = forcible rape =1; statutory rape, sexual assault w/object, forcible fondling, forcible sodomy = 0.
*p < .10, **p < .05, ***p < .001.

Chapter 4. Discussion

Often conceptualized as a private form of violence, most IPV and IPSV research has focused on individual-level risk factors. Emerging research has begun to examine the surrounding community and societal influences on IPV and IPSV (Beyer et al., 2015; Carpenter, & Stinson, 2021; Reichel, 2017; Spencer et al., 2019; Vest et al., 2002; Voith, & Brondino, 2017), but only one study has explored the differential impacts of the environment on community crime apart from IPV (Kiss et al., 2015). Additionally, IPSV is typically subsumed under the broader definition of IPV, but IPSV may have specific individual and macro-level risk factors (Bagwell-Gray, 2015; Carpenter & Stinson, 2021). The current study aimed to address these shortcomings by employing multilevel modeling to account for the potential nested effects of IPV/IPSV at both the individual and county level.

Study 1 determined that several factors related to health, socioeconomics, and gender inequality were important when comparing IPV/IPSV to general crime, and some remained significant when also examining the individual-level factors in Study 2. While socioeconomics (Reichel et al., 2017) and measures of gender inequality (Gaye et al., 2010) have shown direct links to IPV/IPSV, certain health-related factors such as lack of health insurance were not originally hypothesized to demonstrate an effect on IPV/IPSV. Additionally, not all variables were significant from Study 1 to Study 2, suggesting that while the community factors likely play a role in partner violence, individual-level factors remain a significant part of the interactive system that correlated with violence. Each study's results will be discussed in turn.

Study 1

Significant variables common across 2018-2019 included socioeconomic factors (e.g., percentage of children in poverty and in single parent homes, rate of income inequality), health

related factors (e.g., poor mental health days, rate of primary care physicians, number of drug overdose deaths) and one indicator of gender inequality (e.g., median income by gender). These results are not consistent with the only known study that compared IPV to general crime. Kiss and colleagues (2015) determined that areas evidencing high rates of property crime and unintentional homicides increased the likelihood of IPV (Kiss et al., 2015), but the individual-level partner variables were stronger determinants for IPV. The current results showed larger community associations specifically pertaining to socioeconomics and healthcare access with little effect of violent crime. Similar to their analysis (Kiss et al., 2015), I found several significant level-one predictors that influenced both IPV and IPSV, confirming that when the larger community is examined, individual level risk remains crucial in evaluating IPV/IPSV.

Study 2

Individual-Level Predictors

For both IPV and IPSV, those aged under 18 through 24 demonstrated the highest likelihood of experiencing violence. This pattern is consistent with decades of research confirming that the majority of IPV occurs within this age range (Capaldi et al., 2012; CDC, 2011, 2015), and women typically report their first IPV victimization before the age of 24 (Black et al., 2011).

Regarding relationship type, acquaintances demonstrated the highest risk for IPV, but for IPSV, intimate partners (e.g., married partners) were most at risk. This pattern is also consistent with previous research where the majority of IPV cases are classified as friends/acquaintances (36.45%; Morgan, & Oudekerk, 2019) and these partnerships typically evidence simple assaults, intimidation, and verbal abuse (Bagwell-Gray et al., 2015). Conversely, married and dating partners typically report more severe forms of violence, including aggravated assault, rape, and

homicide (Krienert & Walsh, 2018). Severe violence may be influenced by proximity, where repeated sexual, physical, and/or homicide is associated with cohabitation (Brownride, 2004). Besides cohabitation, violence typically progresses after a single instance, potentially explaining why intimate partners face sexual violence at higher rates than further distanced partnerships. Feld and Straus (1989) indicated that minor assaults predicted an increased likelihood of more severe physical and sexual assaults in the future, and Laycock (2001) labeled IPV "the quintessential repeat crime" (p. 67). For many survivors, fully terminating the relationship may take upwards of seven attempts (Stein et al., 2016). Survivors may lack adequate financial resources, may miss "red flags" early on, and if they do terminate the relationship may later find themselves in another abusive partnership (Bybee & Sullivan, 2002; Stein et al., 2016). This repeated pattern of violence is typically seen in partners who face financial instability and who have experienced high rates of adverse childhood experiences (ACEs) – specifically physical, psychological, or sexual abuse, and/or those who have witnessed domestic violence during childhood (Stein et al., 2016).

Use of substances at the time of the assault was also a significant IPV predictor. It is striking that this remained a predictor when the majority of TIBRS reports did not indicate substance use at the time of the report. Partner violence is commonly associated with increased substance use dependence, a greater frequency of use, and may influence risk of overdose and intimate partner homicide (Cafferky et al., 2018; El-Bassell et al., 2019; Soper, 2014). Perpetrators may perceive victims as vulnerable if using substances, drug use may heighten relationship conflict, and a pattern of use may decrease the survivor's financial resources to leave violent partners (Testa et al, 2003).

Community Level Factors: IPV

In the multi-level examination, several factors remained significant predictors from Study 1 (e.g., income inequality, children in poverty and in single parent homes, several health-related factors, and drug overdose deaths) and there were distinctions between IPV and IPSV analyses. For IPV, predictors included rates of excessive drinking, drug overdose deaths, handgun permits, and lack of health insurance.

The presence of substances was a significant predictor at the individual level for IPV, so it is reasonable that excessive drinking and rates of drug overdoses would also be important environmental factors. This was interesting because these factors were more likely to influence more severe forms of violence (e.g., aggravated assault, homicide, kidnapping/abduction, intimidation, stalking) as compared to simple assault. There is a clear link between excessive drinking and IPV at the individual level (Foran & O'Leary, 2008), but most county-level research explores this association by evaluating access (e.g., alcohol outlet density and state laws that limit available times for purchase; Lira et al., 2021), and not necessarily elevated rates of alcohol use within the community. In the current study, excessive drinking may have remained a significant predictor due to more survivors and perpetrators engaging in drinking that elevated their risk for IPV.

Since the onset of the opioid crisis, counties with higher amounts of circulating opioid pills experience higher levels of IPV arrests and opioid-related deaths (Pryor et al., 2021). While the mechanisms linking drug use, drug overdoses, and IPV are likely based on a complex interplay of individual and contextual factors, a meta-analysis by Stone and Rothman (2019) concluded that 36-94% of women with a substance use disorder were IPV survivors and that more than 50% of male IPV perpetrators engaged in opioid use. Further,

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(2011) indicated that fathers with an opiate use disorder engaged in more violent and aggressive behaviors, a potential side effect of prolonged opioid use, which may be exacerbated in an already-violent relationship.

Relatedly, rate of handgun permits was also significantly associated with IPV. Partners are more likely to face intimate partner homicide if there is a firearm present in the home (Bullock & Cubert, 2002; Garcia et al., 2007; Glass et al., 2008; Roberts, 2009; Shuman, 2008), and firearm ownership often includes physically abusive and controlling behaviors (e.g., being held at gunpoint, flashing the firearm as means of control; Kafka et al., 2021). Little research has explored firearm permits at the county level, but international findings indicate that countries with higher gun ownership demonstrate significantly higher rates of homicide, and higher rates of firearm permit possession are associated with increased rates of homicide (Siegel et al., 2013).

Community Level Factors: IPSV

Significant IPSV predictors included factors associated with child socioeconomic status, health (i.e., rate of poor/fair health, rate of physically unhealthy days), residential segregation, and income inequality. To begin, percentage of children in single parent homes and children living in poverty were some of the few predictors that were significant across both Study 1 and 2 and are consistent with other multilevel analyses (Vest et al., 2002). For those facing economic hardship, women with dependent children are more likely than women without to be repeat victims of sexual violence (Harrell & Smith, 1996). Children not only serve as a trigger for conflict and additional stress between the survivor and the perpetrator, but also may influence the victim's decision to reconcile with the offender. Survivors who are their children's sole provider may have just recently left an abusive partnership, which is the most dangerous time for a victim

(Black et al., 2011) and may escalate when living in areas with high rates of neighborhood deprivation and burdensome cost of housing.

Residential segregation, related to neighborhood deprivation and structural inequities (Massey et al., 1999), is largely attributable to discriminatory housing practices (e.g., "redlining/" gentrification; Conley, 1999). In one study, women housed in areas highly segregated based on race were unable to meet their basic needs, faced continued barriers to re-housing, and were dependent on an abusive partner (Holliday et al., 2021). It is unclear why this factor was only significant for IPSV, but it is possible survivors have been in these partnerships for longer periods (i.e., a risk factor for IPSV) making their ability to leave the partnership and find alternative housing particularly challenging.

Income inequality was also one of the few predictors that was significant across both studies. It is estimated that 40.6 million Americans (13.4%) live in poverty, and women only make $.80 to the male-dollar (Aizer, 2010). The National Intimate Partner and Sexual Violence Survey (2012) indicated that three out of four victims remained with their perpetrators for economic reasons, and many victims who returned to their abusers reportedly did so due to insufficient financial resources needed to maintain an independent household as a precipitant of their return. Reducing the substantial pay gap may improve survivors' ability to not only leave the relationship but also to obtain health insurance, which would enhance opportunities for screening and provision of IPV resources.

Across both studies and the IPV and IPSV analyses, several health-related factors were significant. Even though our composite *health* variable was not a significant predictor in the IPV analyses, absence of health insurance was, as were rates of poor/fair health and physically unhealthy days for IPSV. Lack of health insurance and poor self-rated health may be bridged by

lack of healthcare access. Survivors demonstrate higher comorbid health conditions (Plitcha, 2007) compared to the general population, but for those lacking health insurance, they may not have the opportunity for routine screening for preventative medical care within a range of clinics, including primary care, internal medicine, or obstetrics. For those that do obtain care, rates of IPV/IPSV reported within primary care settings are higher than the national average, perhaps because a primary care visit may be the first time a survivor is screened and/or able to communicate their experiences of abuse (Perone et al., 2022). Generally, individuals who experience IPV/IPSV are more likely to utilize crisis centers and emergency rooms to obtain care (Davidov et al., 2015), and one study noted that women murdered by an intimate partner had at least one emergency room visit two years prior to their death, and that visit was not always IPV related (Crandall et al., 2004).

Several community-level factors that were empirically supported within the previous literature did not emerge as significant in the current study. Though various indicators of socioeconomics have been suggested as important predictors of IPV (Ackerson et al., 2008; Reichel et al., 2017), only income inequality and factors related to children were significant across models. I also hypothesized that rurality would be a significant predictor, but this was true in neither Study 1 nor 2. This is consistent with some empirical indications that geographic location based on population density has little to no effect on IPV (Brieding et al., 2009). Further, gender inequality factors were also not significant in Study 2 (e.g., median income by gender). This is inconsistent with a recent study that found the Gender Inequality Index to be positively correlated with the prevalence of any form of IPV in the US (Willie, & Kershaw, 2019). My findings may differ because I only used three indicators of the gender inequality index formula and could not capture the full range of gender disparities. Further, this study only

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examined IPV/IPSV cases within the state of Tennessee, and these ecological variables may differ depending on the state examined. For example, rates of insurance access (i.e., proxy variable for SES and employment) may vary depending on state requirements and allocated funding.

It is also interesting that not all the variables that achieved significance in Study 1 were significant in Study 2. It is possible that these variables are strong correlates of violence at the individual level only and potentially outweigh the influence of some of the surrounding ecological variables. Nevertheless, significant variables across the two studies, such as children in single parent homes, children in poverty, drug overdose deaths, income inequality, and certain health related factors, potentially provide valuable information for intervention and prevention.

Recommendations and Future Directions

Access to healthcare is vital when attempting aid and intervention for survivors. For survivors who lack health insurance, programs like *Futures Without Violence* work with advocates and healthcare providers to increase access to healthcare coverage through Medicaid and marketplace enrollment support (Meier, 2016). For survivors who do have coverage, the United States Preventive Services Task Force (USPSTF) recommends routine medical IPV screening for reproductive-aged women (Moyer, 2013), but actual implementation has stalled. A recent primary care study indicated that IPV screening happened at a far lower frequency than anxiety/depression screening, and 64.7 percent of interactions resulted in patients refusing to be screened (Perone et al., 2022). Additionally, there is no national standardized screening practice, and methods vary across settings. Alvarez and colleagues (2018) examined 17 healthcare providers and found that their screening practices varied by provider preferences. When IPV was disclosed, it was often during an assessment for a related medical or mental health presenting

problem, and most commonly a provider would refer a positive screen to a social worker, where women were given information about available resources such as hotlines and safe houses, but with limited follow-up. Nationally, it would be beneficial to implement universal screening in medical and emergency clinics (i.e., for those uninsured) such as the IPV Screen and Assessment Tier (IPV-SAT; Todahl et al., 2020), a relatively easy and efficient decision-making protocol. Additional screening for domestic violence (e.g., violence within the home that may affect children) may reduce intergenerational trauma transmission and children engaging in violent partnerships as adults.

Further, while IPV is highly stigmatized and underreported, this may be more so in medical clinics (McCall-Hosenfeld et al., 2014). Some patients feel ambivalent about potential screening and worry about provider judgement, ultimately decreasing their willingness to communicate the abuse (Portnoy et al., 2020). For survivors who do visit their primary care provider, one study indicated that only 31% of survivors safety-planned with their providers, and the remaining providers simply advocated for the patient to leave the relationship (Morse et al., 2012). Building a relationship that is accepting and non-judgmental of their decision to remain in the partnership may facilitate reporting and eventual termination of the relationship, if needed. Additional provider education may include information pertaining to the difficulties of terminating and its multistep process (Stein et al., 2016), using novel instruments such as the MyPlann app (Glass et al., 2015) for safety plan development, encouraging anonymous online reporting, and acknowledging potential risk factors (e.g., young age).

In this sample, the majority of survivors were between the ages of under 18 to 24. One of the major recommendations posed by the Center of Disease Control (CDC), National Center on Domestic and Sexual Violence, National Coalition Against Domestic Violence and other

governmental agencies is early intervention programs. These programs found in primary, secondary, and collegiate settings should describe the characteristics of healthy partnerships, warning signs, consequences, and potential interventions for abuse (Smith et al., 2018). Additionally, resource allocation may differ for those facing IPSV. These survivors may need distinctive resources compared to friends/acquaintances facing IPV which may include securing protective orders if deciding to leave, financial resources especially if caring for children, and support in obtaining healthcare. Besides additional screening/intervention practices within medical clinics, reducing financial, housing, and economic burdens may be the most effective intervention for intimate partners.

Regarding firearms, several US federal and state policies have attempted to reduce the negative impacts of firearms on IPV (Goodyear et al., 2020), but for many of these restrictions, perpetrators maintain their gun ownership. "Possession" laws prohibit the possession of firearms by these offenders while "relinquishment" laws prohibit firearm possession and require offenders to surrender their firearms (Diez et al., 2017). Although Tennessee demonstrates relinquishment laws, Tennessee is one of the few states that still has very lax dispossession of weapons, meaning officials do not always ensure that the perpetrator has returned their firearm following a known incident of IPV (Black, 2018).

Limitations

The current study, despite a number of intriguing findings, was not without limitations. Due to the nature of using secondary data, I was unable to identify several individual and dyadic factors that are known IPV/IPSV correlates, as these were not recorded within the TIBRS. These included the length of the relationship, previous relationship history (IPV or not), frequency of violence within the relationship, and other individual historical factors (e.g., previous substance

abuse history, employment status, education, number of ACEs, etc.). Additionally, reciprocal

partner violence (Voith & Brondino, 2017) is recently understood to be common within

IPV/IPSV relationships but was not identifiable for the current analyses. This limits my ability to

test and/or replicate previous literature for generalizability purposes. For example, several of the

previously mentioned variables have known interaction effects with the surrounding ecology

(e.g., reciprocal partner violence, educational level, violent crime, and IPV; Voith, & Brondino,

2017) but were not examined. Further, LGBTQ relationships were included within the analyses

but due to a small sample size, were subsumed within *intimate* relationships. Future ecological

research should focus on individuals in LGBTQ relationships, and TIBRS should work towards

inclusivity by ensuring accurate reporting during collection of police reports.

Similarly, the community variables were not measured for the purposes of this study. It

remains unclear how some constructs were defined or coded initially, which may limit our ability

to interpret results. Further, the analyses included several proxy variables (e.g., rates of firearm

permits by county, alcohol outlet density) that provide a sense of the community but not if the

survivor/perpetrator owned a firearm, or if they purchased alcohol. Specifically, the

directionality of firearm permits is unknown, as it might be assumed that gun ownership

increases the potential for violence, though it may also be true that a person would purchase a

firearm for protection because existing rates of violence in a community are high. Similarly,

these ecological variables may reflect broader contextual community factors, but I was unable to

determine how much individuals were impacted within a given community. For example, there

are many different areas within one county (e.g., Nashville [Davidson County]) that may differ

depending on location and survivor characteristics (e.g., if a given victim was living in a wealthy

part of the county, or a more impoverished one). Further, it is possible that the majority of the

socioeconomic variables were not significant due to variability in those within the same county (e.g., wealthiest neighborhood in Memphis vs. poorest).

The sample sizes between the IPV and IPSV data sets were quite different in scale and IPV and IPSV overlap quite frequently (e.g., high rates of co-occurring physical and sexual abuse). Future research should evaluate larger samples of partners who have experienced IPSV while potentially controlling for other forms of abuse. Similarly, this study examined IPV/IPSV reported to law enforcement, and cases of IPV/IPSV that are not reported may evidence differing characteristics than reported incidents. Thus, the current findings and recommendations may not fully encapsulate the complex contributors to unreported IPV/IPSV.

Additionally, while the current study corrected for multicollinearity, several environmental factors not included in the analyses demonstrated high correlations even after correction. Future research using the current environmental data sets may benefit from more extensive data reduction (e.g., principal component or exploratory factor) analyses that construct more accurate composite variables. Finally, as this study's cross-sectional methodology restricts causal conclusions, longitudinal research is key. Most longitudinal IPV research has focused on risk and protective factors that contribute to repeated abuse over time (Yakubovich et al., 2018) or the possible psychological outcomes (Devries et al., 2013), but relatively few studies have followed cohorts of partners after implementing community wide interventions aimed at improving socioeconomics, firearm prevalence, gender inequality, or dependent status.

Conclusion

Whereas previous research has focused either on the individual or macro-level associations of IPV/IPSV, this study utilized multilevel modeling to further investigate the nested effects of IPV/IPSV on individuals within the larger community. By first determining

which environmental factors differentiate IPV/IPSV from community crime, the current study found several significant ecological and individual-level factors pertinent to IPV/IPSV. Several significant individual level variables included younger age, differences among relationship type (e.g., married partners demonstrated higher likelihood of IPSV), and drug use. At the community level, hypothesized factors related to socioeconomics and firearm prevalence were important when comparing IPV/IPSV to general crime, but certain health-related factors such as lack of health insurance were not expected to have an effect on IPV/IPSV. Prevention and intervention efforts should improve healthcare access and IPV screening within medical environments, target younger age groups, provide resources to all partners regardless of their relational distance, and further examine the role of socioeconomics, excessive drug/alcohol use, and firearms in IPV/IPSV.

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APPENDIX: Study 2 Equations

Study 2: IPV

Unconditional Model:
$Y_i = \beta_0 + r_i$

Model 2:
Level 1:
$IPV(\gamma_{00}) = \beta_{oj} + \beta_1(\text{perpetrator gender}) + \beta_2(\text{victim gender}) + \beta_3(\text{race}) + \beta_4(\text{acquaintance/other relationship}) + \beta_5(\text{under 18-24}) + \beta_6(\text{drug related})$

Level 2:
$\beta_0 = \gamma_{00} + \mu_0$
$\beta_1 = \gamma_1\ldots$
$\beta_6 = \gamma_{95}$

Model 3:
$IPV(\gamma_{00}) = \beta_{oj} + \beta_1(\text{perpetrator gender}) + \beta_2(\text{race}) + \beta_3(\text{acquaintance/other}) + \beta_4(\text{Under 18-24}) + \beta_5(\text{drug related}) + \beta_6(\text{uninsured}) + \beta_7(\text{excessive drinking}) + \beta_8(\text{drug overdose deaths}) + \beta_9(\text{rate of handgun permits}) + \beta_{10}(\text{health})$

Study 2: IPSV

Unconditional Model:
$Y_i = \beta_0 + r_i$

Model 2:
Level 1
$IPSV(\gamma_{00}) = \beta_{oj} + \beta_1(\text{victim gender}) + \beta_2(\text{race}) + \beta_3(\text{intimate relationship}) + \beta_4(\text{under 18-24})$

Level 2
$\beta_0 = \gamma_{00} + \mu_0$
$\beta_1 = \gamma_1\ldots$
$\beta_6 = \gamma_{95}$

Model 3:
$IPV(\gamma_{00}) = \beta_{oj} + \beta_1(\text{victim gender}) + \beta_2(\text{race}) + \beta_3(\text{intimate relationship}) + \beta_4(\text{under 18-24}) + \beta_6(\text{chidrenSES}) + \beta_7(\text{health}) + \beta_8(\text{residential segregation}) + \beta_9(\text{income inequality})$

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