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Inequities in Intimate Partner Homicide: Social Determinants of Health Mediate Racial/Ethnic Disparities

Adam Rowh, MD^{1,2}, Xinjian Zhang, PhD², Brenda Nguyen, PhD², Shane Jack, PhD²

¹Epidemic Intelligence Service, National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia

²National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia

Abstract

Introduction: Intimate partner violence accounts for up to one half of all homicides of women in the U.S. Rates of intimate partner homicide are associated with both race/ethnicity and social determinants of health, but their relative contribution is incompletely understood.

Methods: The authors used negative binomial regression to model the relationship between counties' racial/ethnic composition and their rates of intimate partner homicide of women, controlling for urbanicity, median income, gender pay gap, unemployment, school funding, and violent crime rate. Data from 49 states and the District of Columbia between 2016 and 2021 were used. Analyses were conducted in 2024.

Results: In unadjusted analysis, counties with a lower proportion of White residents experienced higher rates of intimate partner homicide (incidence rate ratios [IRR]=1.11; 95% CIs=1.08, 1.13). When controlling for social determinants of health, this association was not observed (IRR=1.01; 95% CI=0.97, 1.04). Median income, school funding, and violent crime rate were independent predictors of intimate partner homicide in the multivariate model.

Conclusions: Racial/ethnic composition of a population does not independently predict its rate of intimate partner homicide when controlling for social determinants of health. Racial/ethnic inequities in intimate partner homicide are largely attributable to structural factors, which may be modifiable through policy changes.

Address correspondence to: Adam Rowh, MD, 1600 Clifton Rd NE, Atlanta GA 30333. arowh@cdc.gov.

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CREDIT AUTHOR STATEMENT

Adam Rowh: conceptualization, methodology, formal analysis, writing – original draft, writing – review & editing, visualization
Xinjian Zhang: formal analysis, validation
Brenda Nguyen: writing – review & editing
Shane Jack: conceptualization, resources, data curation, writing – review & editing, supervision.

SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at <https://doi.org/10.1016/j.amepre.2024.11.021>.

INTRODUCTION

Intimate partner violence (IPV), which includes abuse and aggression that occur in an intimate relationship, affects an estimated 27% of women worldwide at some point during their lifetime.¹ In the U.S., about 41% of women have experienced IPV during their lifetime with one or more violence-related impacts (e.g., injuries, PTSD).² Fatal incidents of IPV, or intimate partner homicide (IPH), account for between one third and one-half of all homicides of women in the U.S.^{3,4}

Racial and ethnic inequities have been well documented in the incidence of both homicides of women and IPV. For example, the rates of homicide overall are higher among Black women than among White women,^{3,5,6} as are the rates of nonfatal IPV.^{7,8} Data is scarcer in other racial/ethnic groups, but higher overall homicide rates—regardless of whether the homicide involved IPV—have been observed among American Indian/Alaska Native women and lower rates have been observed among Asian/Pacific Islander women and Hispanic women.⁹ However, racial inequities in homicide rates observed in the U.S. are not consistent throughout the country,⁵ suggesting that the observed racial and ethnic inequities are likely mediated by other factors.¹⁰

Social determinants of health (SDOH) are the social and economic conditions in which individuals live, learn, work, and play. SDOH include a variety of structural factors, such as economic policies, political systems, and social norms; they influence a broad range of risks and outcomes in both health and quality of life.¹¹ Various adverse health outcomes have been associated with a range of external factors ranging from subjective personal experiences of racism¹² to institutional policies such as enforced residential segregation.¹⁰ SDOH associated with risk of IPV victimization include neighborhood violence, high rates of poverty, and limited educational and economic opportunities.^{8,13-16} The influence of these structural inequities on IPV suggests that racial/ethnic differences in IPV may be explained by the conditions in which individuals live. In addition, although financial hardship is a well-known risk factor for IPV,¹⁶ poverty is more than twice as common among Black and Hispanic people than White and Asian people in the U.S.,¹⁷ and racial inequities in IPV are not observed when household income is controlled for.⁸ Nevertheless, previous research on IPV has tended to study the effects of either individual factors (e.g., race and ethnicity) or material conditions (e.g., housing and employment); research on combined effects is less common.^{8,10,13,14}

Understanding the relationship between race/ethnicity and structural factors in the incidence of IPV could facilitate effective and efficient uses of resources toward prevention. Furthermore, distinguishing factors that are potentially modifiable (e.g., poverty) from those that are not (e.g., race/ethnicity) could also counteract the stigmatization of non-White victims of violence¹⁸ and challenge inaccurate and counterproductive stereotypes about what constitutes risk.¹⁹ This study sought to examine the relationship between county-level racial composition and rates of IPH while adjusting for the potential confounding effects of SDOH.

METHODS

Population

Several data sources were linked to analyze the study population. Data from the U.S. Census Bureau²⁰ was used to calculate the primary predictor variable (i.e., racial composition) and the denominator of the outcome variable (i.e., total population of women aged 15 and over) by county. Annual county-wide population values for each study year were available stratified by sex, race, and ethnicity in 5-year age groups; this data allowed calculation of total population at risk and the racial composition of each county.

Data from the Centers for Disease Control and Prevention (CDC) National Violent Death Reporting System (NVDRS) was used to identify cases of IPH, the numerator for the calculation of the outcome variable. NVDRS is an active surveillance system that captures data on violent deaths,²¹ combining information from law enforcement, coroner/medical examiner reports, and death certificates to describe the nature and circumstances of each incident and the individuals involved. This includes the relationship between the homicide victim and perpetrator, which allows for identification of IPV-related homicides. The most recent available data was used, which covered 49 states (all except Florida) and the District of Columbia during 2016–2021. All calculations, including population denominators, were adjusted to account for changes in the underlying jurisdictions submitting data to NVDRS during the study period (Appendix Table 1). IPH was defined as a homicide in which the victim and suspect had an intimate relationship (i.e., current or former spouse, current or former girl/boyfriend, and girl/boyfriend of undetermined current status), based on information documented in the three types of source documents (law enforcement, coroner/medical examiner reports, and death certificates). Female victims aged 15 years and over were included; this age threshold was chosen in accordance with previous research showing that IPV among adolescents becomes more common as adolescents start dating in greater numbers.¹

SDOH indicators for each county served as variables in the regression model. Data on county urbanicity was obtained from the National Center for Health Statistics Urban-Rural Classification Scheme for Counties²²; data on other SDOH variables was obtained from the publicly available County Health Rankings published by the University of Wisconsin Population Health Institute.²³ The County Health Rankings aggregate multiple sources of data (e.g., Bureau of Labor Statistics, American Community Survey, Federal Bureau of Investigation) into a single dataset at the county level. The 2022 dataset²³ was used for this analysis because the years of source data therein best reflected the study period.

Measures

Seventeen candidate SDOH variables for this study were identified based on scientific precedent (e.g., urbanicity¹⁶ and poverty²⁴) and the plausibility of a causal link to IPV (e.g., gender discrimination¹⁵ and exposure to other crime²⁵). Exploratory data analysis using correlation matrices revealed high levels of collinearity among multiple pairs of variables representing similar domains (e.g., child poverty and median income; school funding and educational attainment). Through an iterative process of dimension reduction, and with

the use of directed acyclic graphs to guide decision-making, variables were chosen that parsimoniously represented aspects of SDOH plausibly associated with IPV (Appendix 2). Covariates selected for the final model were: urbanicity, median household income, unemployment rate, gender pay gap (the ratio of women's median earnings to men's median earnings), school funding (the average gap, in dollars, between actual and required spending per pupil), and violent crime rate (violent crime offenses per 100,000 population). Continuous variables were transformed to facilitate interpretation of the results: non-White population was reported in increments of 10%, median income in increments of \$10,000, school funding in increments of \$3,000, violent crime rate in increments of 100, gender pay gap in increments of 5%, urbanicity in increments of 1 level, and unemployment rate in increments of 1% (approximately 0.5 standard deviations of each). Because not all of the underlying data for these variables is updated annually,²³ a single value of each (the most recent) was used to represent all years of the study. To assess the suitability of this approach, coefficients of variation for each variable were calculated when multiple years of data were available. These coefficients of variation were higher across counties than within counties across years (data not shown), supporting the decision that a single value would be adequately representative of the time range.

Statistical Analysis

The primary outcome variable was the rate of IPH by county (i.e., IPH incidents per 100,000 women aged 15 years and over). The primary predictor variable was the racial composition of each county's population, defined as the non-White percentage (i.e., total population minus White non-Hispanic population). White women were defined as the reference category because they were the largest subgroup. Other racial/ethnic subgroups included American Indian/Alaska Native, Asian/Pacific Islander, Black non-Hispanic (Black), Hispanic, and multiracial (2 or more races/ethnicities).

To quantify racial inequities, crude rates of IPH were calculated for each race/ethnicity subgroup aggregated across the entire study population. A Chi-square test and row-wise z-tests of proportions were used to evaluate observed differences between crude rates of IPH among race/ethnicity subgroups. To evaluate the SDOH-adjusted relationship between race/ethnicity and IPH rates, negative binomial regression was conducted using counties as the unit of analysis with racial composition (non-White population percent) as the predictor and IPH rate as the outcome. Negative binomial distribution was used based on the observed distribution of the outcome (i.e., counts of IPH) and validated against the Poisson distribution. Crude and adjusted incidence rate ratios (IRR) and 95% CIS were calculated for each covariate. Variance inflation factors were calculated for all variables in the final model; all were less than 3, indicating that the model is free of significant multicollinearity. Selection of covariates to include in the final model was conducted a priori; post-hoc analysis of the Akaike information criterion for various models supported the selection of the final model as described above. Counties with missing SDOH data were excluded listwise from the final analysis; the validity of this approach was tested using multiple stochastic regression imputation of the missing values. Sensitivity analyses were conducted to evaluate the impact of the exclusion of missing data, the inclusion of outliers (defined as

values greater than 3 standard deviations from the mean), and the dichotomization of county racial composition.

All analyses and data visualizations were performed using R statistical software (version 4.4.0, R Foundation for Statistical Computing, Vienna, Austria). This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy (e.g., 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq).

RESULTS

Data on IPH was available for 2,814 counties during 2016–2021, of which 2,564 counties with complete data for all SDOH variables (91.1%) were included in the analysis. Characteristics of these counties are presented in Table 1.

When aggregated across all counties, there were 5,356 IPH during 2016–2021, resulting in an overall rate of 0.91 per 100,000 women (Figure 1). The median age of victims was 38 years (IQR: 29–50) (data not shown). Over half (51.8%) of victims were White non-Hispanic (White), 29.0% were Black non-Hispanic (Black), 13.3% were Hispanic, 2.8% were Asian/Pacific Islander, 1.7% were American Indian/Alaska Native, 1.0% were multiracial, and 0.4% were of other or unknown race or ethnicity. The rates of IPH were not equal among race/ethnicity subgroups (overall Chi-squared, $p<0.001$; Figure 1). The subgroup rate was higher than the overall rate among Black women (2.04 per 100,000, $p<0.001$) and American Indian/Alaska Native women (1.94 per 100,000, $p<0.001$). The subgroup rate was lower than the overall rate among White women (0.72 per 100,000, $p<0.001$), multiracial women (0.52 per 100,000, $p<0.001$), and Asian/Pacific Islander women (0.43 per 100,000, $p<0.001$).

Unadjusted negative binomial regression modeling demonstrated a significant positive association between higher non-White population percent and the rate of IPH (IRR=1.11; 95% CI=1.08, 1.13) (Table 2). After adjustment for SDOH, this association was not observed (IRR=1.01; 95% CI=0.97, 1.04) (Table 2, Figure 2). SDOH covariates in the multivariate model that predicted IPH rates were median income (IRR=0.87; 95% CI=0.84, 0.90), school funding (IRR=0.90; 95% CI=0.87, 0.93), and violent crime rate (IRR=1.06; 95% CI=1.04, 1.09).

Outliers were observed in county rates of IPH. The 26 counties with IPH rates greater than the 99th percentile were generally small (median population=7,845) compared to the other counties (median population=56,126) but had greater than 0 IPH incidents (median=1), yielding unusually high IPH rates (median=15.9). A sensitivity analysis was conducted by recalculating the model after removing these outliers; results did not change (data not shown). In addition, 250 (8.9%) counties were missing SDOH data; multiple stochastic regression imputation of data for these counties yielded no significant change to the results, and they were excluded from the final analysis. To evaluate the suitability of collapsing all non-White population groups into a dichotomous racial composition variable, additional models were constructed incorporating terms reflecting each county's proportion of every

racial/ethnic group. This model yielded equivalent results: the same relationships were observed for every SDOH variable, and no race/ethnicity variable (or interaction term) demonstrated a significant association with the outcome variable. The dichotomous racial composition variable was retained.

DISCUSSION

Inequities were observed in the racial/ethnic distribution of IPH victims when aggregated across the entire sample, with higher rates compared to the overall population observed among non-Hispanic Black and American Indian/Alaska Native women and lower rates observed among Asian/Pacific Islander, multiracial, and non-Hispanic White women. Furthermore, county-level racial composition was associated with IPH rates in unadjusted regression analysis. However, when controlling for structural factors (i.e., SDOH), the racial composition of a county no longer predicted its IPH rate. This suggests that the observation of racial/ethnic inequities in IPH are likely attributable to racial/ethnic inequities in structural factors such as the SDOH studied in this analysis, rather than an intrinsic contribution of race/ethnicity. Three SDOH factors were associated with IPH rates in the adjusted analysis: counties with higher median income and higher school funding had lower rates, and counties with higher violent crime had higher rates.

A clear relationship exists in previous studies between IPV and SDOH, especially poverty.^{7,13,14} Furthermore, financial stability and its related outcomes (e.g., educational attainment) in the U.S. demonstrate clear racial/ethnic patterns¹⁷ that result from generations of intentionally discriminatory practices.^{10,26} This suggests that correlations with race/ethnicity observed in the past are the result of confounding by longstanding social and financial segregation.²⁷ The current study confirms previous observations that no association is observed between race/ethnicity and IPV when controlling for poverty⁸; it also expands on previous findings to include SDOH using a robust quantitative methodology that is well-suited to replication.

One of the primary limitations of existing research on IPV is the reliance on passive case-finding, which is subject to biases in help-seeking behavior^{28,29} and other contributors to underreporting. These issues may lead to the inconsistent results seen previously.³⁰ In contrast, NVDRS captures all deaths involving violence within the catchment areas, yielding high completeness, and the abstraction methodology yields high precision in identifying IPH. In addition, NVDRS data provides valuable opportunities for future research on the interactions between SDOH and IPH incident characteristics.

Limitations

This work is subject to 5 main limitations. First, the NVDRS captures fatal incidents of IPV (i.e., IPH) but excludes nonfatal incidents. Conclusions from this analysis of IPH may not be generalizable to nonfatal IPV. Second, because this is a novel approach, the selection of SDOH variables may not include the best explanatory variables. However, the variable selection process incorporated both conceptual reasoning and scientific precedent, and sensitivity analyses confirmed the internal validity of the final model. Furthermore, the use of high-quality, publicly available SDOH data will facilitate replication and contribute to

external validity. Third, these data are not nationally representative. Despite this, the current analysis is one of the few that achieve such broad representation of women along the urban–rural continuum.^{31,32} Fourth, IPH rates and measures of SDOH variables were aggregated over the entire study period, obscuring time-dependent variation from this analysis (e.g., the influence of the COVID-19 pandemic). However, this aggregation was necessary to allow for comparison across SDOH variables, and analysis suggested that the potential impact of within-county temporal variation in SDOH was less than between-county differences. Finally, the racial/ethnic composition of the included counties was analyzed as a single proportion that combined all non-White racial/ethnic groups. This precludes a detailed analysis of distinctions that may exist among counties of varying compositions, and it could contribute to reinforcing the erroneous oversimplification inherent in concepts such as “minority.” Further research, with larger samples, could contribute to a more nuanced understanding of these complex relationships.

CONCLUSIONS

Although health inequities are often framed in terms of race and ethnicity, the current results support previous findings that health outcomes (including violence) must be contextualized in terms of structural factors (i.e., SDOH).^{10,25,33} In the case of IPH, this analysis found that a community’s racial/ethnic composition was not associated with the rate of IPH when SDOH are accounted for. This has important implications for public health efforts, policymakers, and service providers.

Specifically, a more robust and nuanced understanding of factors that contribute to risk of IPH can improve public health efforts to identify groups at higher risk and design efficient prevention efforts. Several of the SDOH included in this study can be influenced by legislation, implying that a community’s risk of IPH might respond to policy changes.¹⁰ Variation in policy environment has been shown previously to be associated with variation in violence against women³⁴; the current results illustrate that concept. For example, poverty and exposure to violent crime were associated with higher rates of IPH, highlighting potential benefits from addressing these social problems. On the contrary, increased school funding was associated with reduced rates of IPH, suggesting other opportunities for intervention.

Finally, anyone who cares for a victim of violence, whether personally or professionally, can benefit from the compassionate and realistic understanding that modern racial/ethnic inequities, while real, result from generations of structural factors³⁵ and their ongoing influence,²⁶ not the color of one’s skin.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Race/ethnicity	IPH victims (n)	IPH rate ^b	Relative rate ^c	p value ^d
Overall	5 356	0.91	—	—
White, non-Hispanic	2 785	0.72	79.1%	<0.001
Black, non-Hispanic	1 561	2.04	224.7%	<0.001
Hispanic	714	0.94	103.3%	0.39
Asian or Pacific Islander	151	0.43	47.7%	<0.001
American Indian or Alaska Native	93	1.94	213.6%	<0.001
Multiracial	52	0.52	56.9%	<0.001

^a Except Florida. ^b IPH incidents per 100 000 population. ^c Subgroup IPH rate as a proportion of overall IPH rate. Red values are higher than expected; green values are lower than expected. ^d Row-wise chi squared test on inequity.

IPH: Intimate partner homicide

Boldface indicates statistical significance (p<0.05)

Data sources: National Violent Death Reporting System, County Health Rankings, National Center for Health Statistics, US Census Bureau.

Figure 1.

Differences in Intimate Partner Homicide Rates of Women by Race/Ethnicity: 2,814 Counties in 49 States^a and the District of Columbia, 2016–2021.

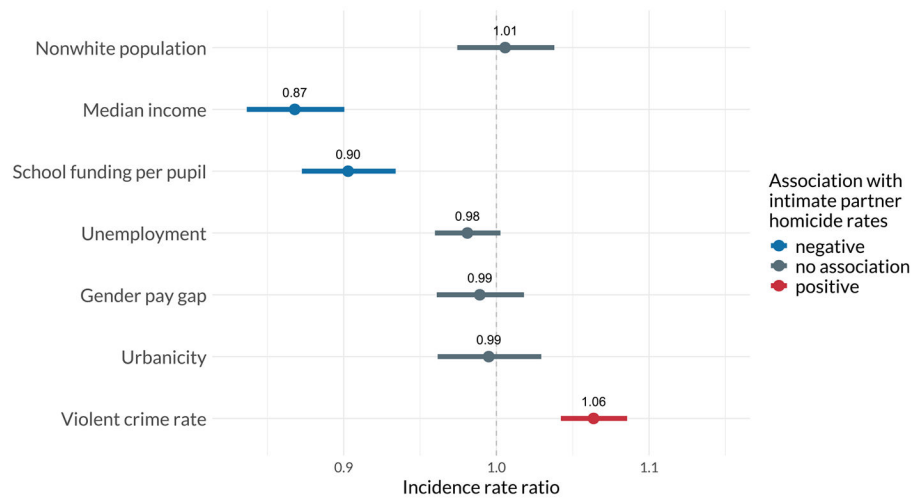


Figure 2.

Associations between racial/ethnic composition and intimate partner homicide rate, adjusted for social determinants of health*: 2,564 counties in 49 states[†] and the District of Columbia, 2016–2021. *Non-White population defined as total population minus White non-Hispanic population, reported in increments of 10%, median income in increments of \$10,000, school funding in increments of \$3,000, unemployment in increments of 1%, gender pay gap in increments of 5%, urbanicity in increments of 1 level, and violent crime in increments of 100 incidents. [†]Except Florida. Data sources: National Violent Death Reporting System, County Health Rankings, National Center for Health Statistics, U.S. Census Bureau.

Table 1.

Descriptive Characteristics of Analyzed Counties: 2,814 Counties in 49 States^a and the District of Columbia, 2016–2021

County-level characteristic	Median (range) or n (%)	Counties missing data, n (%)
Population	49,317 (92, 20,973,820)	0 (0%)
Intimate partner homicides	0 (0, 146)	0 (0%)
Intimate partner homicide rate (per 100,000 women)	0.0 (0.0, 40.5)	0 (0%)
Non-White ^b population (%)	12.2 (1.6, 95.6)	0 (0%)
Urbanicity		2 (<0.1%)
Large central metro	60 (2.1%)	
Large fringe metro	330 (12%)	
Medium metro	327 (12%)	
Small metro	323 (11%)	
Metropolitan	585 (21%)	
Non-core (rural)	1,187 (42%)	
Median income (\$)	55,118 (22,901, 160,305)	4 (0.1%)
Unemployment (%)	6.5 (1.7, 22.5)	3 (0.1%)
Gender pay gap (female as % of male)	77.3 (43.4, 157.2)	3 (0.1%)
School funding (\$, excess or deficit)	447 (–22,204, 29,886)	82 (2.9%)
Violent crime rate (per 100,000 people)	194.1 (0.0, 1,819.5)	192 (6.8%)

^aExcept Florida.

^bTotal population minus White non-Hispanic population.

Data sources: National Violent Death Reporting System, County Health Rankings, National Center for Health Statistics (urbanicity), U.S. Census Bureau.

Association Between Racial/Ethnic Composition, Social Determinants of Health, and Intimate Partner Homicide Rate: 2,564 Counties in 49 States^a and the District of Columbia, 2016–2021

Table 2.

Variable	Unadjusted results		Adjusted results	
	Incidence rate ratio (95% CI)		Incidence rate ratio (95% CI)	p-value (adjusted)
Non-White population ^b	1.11 (1.08, 1.13)		1.01 (0.97, 1.04)	0.7
Median income ^c	0.81 (0.79, 0.83)		0.87 (0.84, 0.90)	<0.001
School funding ^d	0.81 (0.79, 0.83)		0.90 (0.87, 0.93)	<0.001
Violent crime ^e	1.13 (1.11, 1.15)		1.06 (1.04, 1.09)	<0.001
Unemployment ^f	1.04 (1.01, 1.07)		0.98 (0.96, 1.00)	0.081
Urbanicity ^g	1.06 (1.03, 1.09)		0.99 (0.96, 1.03)	0.8
Gender pay gap ^h	1.02 (0.99, 1.05)		0.99 (0.96, 1.02)	0.5

^aExcept Florida.

^bTotal population minus White non-Hispanic population in increments of 10%.

^cIncrements of \$10,000.

^dIncrements of \$3,000.

^eIncrements of 100.

^fIncrements of 1%.

^gIncrements of 1 level.

^hIncrements of 5%.

Boldface indicates statistical significance ($p < 0.05$).

Data sources: National Violent Death Reporting System, County Health Rankings, National Center for Health Statistics, U.S. Census Bureau.