Journal of Urban Health: Bulletin of the New York Academy of Medicine, Vol. 86, No. 4
doi:10.1007/s11524-009-9345-8
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Neighborhood Violence and its Association with Mothers' Health: Assessing the Relative Importance of Perceived Safety and Exposure to Violence

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ABSTRACT *This paper presents a cross-sectional study examining the influence of neighborhood violence on multiple aspects of mothers' health. While the influence of neighborhood violence on health is important to understand for all populations, mothers are especially important as they play a key role in protecting their children from the consequences of violence. Three hundred and ninety-two Baltimore City mothers of children 5 years and younger completed a self-administered survey that included questions about perceptions of their safety as well as their personal experiences with neighborhood violence. Separate models were run to compare the relationship between each measurement of neighborhood violence and five diverse health-related determinants and outcomes: self-reported health status, smoking, exercise, average hours of sleep a night, and sleep interruption. Controlling for mother's age, child's age, maternal education, and marital status, mothers with high exposure to neighborhood violence were twice as likely to report poorer health, smoking, never exercising, and poor sleep habits. Maternal perception of neighborhood safety was not related to any of the assessed health-related determinants and outcomes. This study emphasizes the importance of measuring exposure to neighborhood violence rather than solely assessing perceived safety. Neighborhood violence was a common experience for mothers in this urban sample, and should be considered by health professionals in trying to understand and intervene to improve the health of mothers and their children.*

KEYWORDS *Neighborhood violence, Women's health, Measurement*

INTRODUCTION

Research measuring the effect of neighborhood violence on health has focused on various outcomes, most frequently the association between neighborhood violence and decreased physical activity.[1–9] Unsafe neighborhoods appear to provide residents with less access to safe recreational places and activities, reducing their opportunities to be physically active. These results have been consistent across studies of children, adolescents, adults, and the elderly.[9–13]

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Neighborhoods with high violence are thought to encourage isolation and therefore inhibit the social support needed to cope with stressful events.[14,15] Adolescents and adults living in violent neighborhoods have a greater risk for mental health disorders.[14,16–18] To cope with stress, individuals may turn to risk-taking behaviors. Exposure to violent neighborhoods has been associated with increased substance abuse, sexual risk-taking behaviors, and smoking as well as risky driving practices.[19,20] Additionally, this chronic stress can increase an individual's vulnerability to disease.[21,22] Exposure to chronic stress has been thought to partially explain the increased prevalence of upper respiratory illness and asthma in neighborhoods with high levels of violence.[23,24] Overall, neighborhood violence has been related to poorer self-report of health in the United States, Australia, and Korea.[25–27]

Importance of Mothers

While the impact of neighborhood violence on all individuals is important, mothers play a critical role in protecting their children from the impact of neighborhood violence. Negative health effects due to neighborhood violence experienced by mothers may hinder their ability to fully protect and care for their children.[28,29] This study assesses the impact of neighborhood violence on mothers' self-reported health status, frequency of exercise, smoking, sleep interruption, and hours of sleep per night. Sleep variables were included in the main study with the hypothesis that tired mothers may be less able to provide the supervision necessary to prevent injury. Injuries remain the leading cause of death to young children.[30,31] A previous study of adolescents showed a relationship between increased community violence exposure and sleep disturbance.[32] To our knowledge, no studies have examined the effect of neighborhood violence on maternal sleep habits.

Measurement of Neighborhood Violence

Studies exploring the impact of neighborhood violence on health traditionally measure violence in one of three ways: perception of neighborhood safety, exposure to neighborhood violence, or actual measures of crime or disorder (police data reports or neighborhood observations). The use of these measures appears to vary by outcome, with studies exploring general health or physical activity tending to focus on perceptions of neighborhood safety, studies investigating mental health measuring exposure to violence, and multi-community studies using actual measures of crimes or disorder.[2,3,6,14,17,23] While the selective use of these measures seems to be reflective of a hypothesized relationship, researchers do not often articulate their reasons for choosing a certain measure of neighborhood violence.

A vast body of literature exists attempting to understand the relationship between perceptions of safety and experiences of violence. This literature presents a complex relationship influenced by gender, race, age, education, feelings of vulnerability and helplessness, and neighborhood level factors.[33–36] However, this literature does not attempt to link measures of neighborhood violence with health outcomes.

The current study aims to assess the relative contribution of perceived safety and exposure to violence, both subjective measures of the environment, on multiple health determinants and outcomes for mothers of young children. This study does not aim to elicit a mechanism by which neighborhood violence impacts health, but instead seeks to compare the use of two individual-level measures of neighborhood violence.

METHODS

This study took place in Baltimore City, Maryland. Baltimore is a city of over 630,000 residents.[37] Twenty percent of Baltimore City's residents' have an annual income below the federal poverty level and 30% have not graduated from high school.[38] These indices are both well below the national average, but similar to other urban populations.[38] Similar to other inner-city environments, violence is a major problem in Baltimore City.[39] In 2005, there were 269 murders, 3,910 robberies, and 6,907 aggravated assaults in Baltimore City.[40]

Study Design

The data for this paper come from baseline data collected from the control group of a randomized trial conducted in the emergency department (ED) of a level 1 pediatric trauma center from September 2004 to December 2005. The trial aimed to test the effectiveness of a computer kiosk that generated tailored safety reports for parents on smoke alarm use, poison storage, and child safety seat use.[41,42] The study was approved by the Johns Hopkins Committee for Human Research.

Parents or guardians with a child between 4 and 66 months of age who were visiting the ED for either an injury or medical complaint were invited to participate in the study. Eligibility criteria included being an English-speaking parent or guardian residing in Baltimore City, and living with the child "at least some of the time". After receiving written consent, baseline data was collected using a computer-kiosk located in a private area of the ED waiting room. Participants were paid $10 for completion of the instrument.

Of the 1,410 parents or guardians selected as potential participants for the study, 239 (17%) were ineligible, 201(14%) refused to participate, and 69 (5%) were missed by recruiters. The remaining 901 participants were randomized into a control and intervention group for a participation rate of 77%. Further specifics about the recruitment process can be found in Gielen et al.[41]

Data for this analysis comes from the 453 individuals randomized into the control group. As the sample recruited were primarily mothers (90%), and considering the intent of the study, the decision was made to limit the analysis to only mothers. Therefore, 45 participants who did not classify their relationship with the child as mother or step-mother were excluded.

An additional 16 participants were excluded as they were missing information on key variables. *T*-test comparisons showed that those excluded from the study did not differ statistically either in their perception of neighborhood safety and exposure to neighborhood violence or in their demographic information. This analysis is therefore based on 392 participants.

Measures

Neighborhood Violence Mothers were asked two types of questions pertaining to their experience of neighborhood violence in the past 12 months. The first type were the Perceived Safety items that assessed frequency of feelings of safety walking in their neighborhood during the day and at night. The second type were the Exposure to Violence items that assessed frequency of exposure to events associated with neighborhood violence. Exposure questions were modified from the Richters and Martinez' "Children's Exposure to Violence" scale.[43] This scale was originally created to examine relationships between neighborhood violence (assessing sights and sounds

in children's neighborhoods and homes) and children's psychological well-being. Modified versions of this scale have been used in other studies investigating the effects of exposure to neighborhood violence on health.[17,23] For both types of questions participants responded by answering never, once or twice, a few times, or many times. Due to the nature of the primary study, an additional question was included which asked mothers how safe they felt allowing their children to play outside.

Factor analysis was performed to ensure that the neighborhood violence questions were in fact representative of perceived safety and exposure to neighborhood violence. A principal components analysis suggested that the questions were best represented by a two-factor solution. An exploratory factor analysis using maximum likelihood estimation was completed, stipulating a two-factor solution. In order to make the results more interpretable, the solution was rotated using orthogonal varimax rotation. All items except one, fear of allowing children to play outside, had factor loadings of greater than 0.5 on one of the two factors. Perceptions of safety walking during the day and night loaded on one factor. All six questions pertaining to direct experiences with neighborhood violence loaded on the other factor (Cronbach's $\alpha=0.857$). As fear of letting children play outside does not represent an experience, it was grouped with the other perception variables (Cronbach's $\alpha=0.630$). While this alpha is lower than desired, it should be noted that it is only based on three questions.

A summation score for both Perceived Safety and Exposure to Violence was created by assigning the codes 1, 2, 3, and 4 to response categories never, once or twice, a few times, and many times, respectively, for each question.[3,44] The response scoring was reverse coded for the questions asking for frequency of safe feelings walking during the day or at night. A higher score indicated a greater amount of neighborhood violence, i.e., lower Perceived Safety or higher Exposure to Violence. As these numbers were not representative of interval data, scores were categorized by range. The data indicated a three-category classification system. For Exposure to Violence the low violence category averaged a response of never or once or twice on each question; the medium category averaged a response of a few times, and the high category averaged a response of many times for each of the questions. For Perceived Safety the low violence category averaged a response of many times, the medium category averaged a response of a few times; and the high category averaged a response of never or once or twice.[8]

Outcome Measures For outcome variables, mothers were asked questions about their health status, frequency of exercise, smoking status, and sleep patterns. For ease of interpretation, outcome variables were dichotomized based on the distribution of the data. To assess health status mothers were asked "overall, how would you rate your health now" (excellent or very good/good, fair, or poor). This is a standard, widely used measure. Mothers were also asked, "how often do you exercise" (never/occasionally, one to two times a week, three to four times a week, five or more times a week). Mothers were asked to answer yes/no to "do you currently smoke cigarettes". Sleep questions were taken from a National Sleep Foundation Survey.[45] One question asked, "in a typical night, about how many hours do you sleep in total" ($<7/\geq 7$). Another question asked "is your sleep interrupted" (never, rarely or sometimes/usually or always).

Outcome variables were reverse coded as needed so that a negative environment (higher violence exposure or feeling less safe) was positively associated with poorer health determinants or outcomes.

Demographic Covariates

Mothers answered demographic questions including their age, the age of their child (in years), their marital status (married vs. other), race (African-American vs. other), highest level of education (less than high school, high school, more than high school), and the level of household crowding (total number of adults and children living in the home).

Statistical Analysis

Chi-square analysis was used to test for bivariate associations between categorical variables. As all covariates were categorical, the first or lowest category was chosen as a reference category for each variable. Binomial logistic regression was used to compare models of Perceived Safety and Exposure to Violence and their relative impact on mothers' health. A chi-square analysis indicated a relationship between Perceived Safety and Exposure to Violence ($p<0.001$). This co-linearity supported the need for separate models. Odds ratios and 95% confidence intervals (CI) are reported. Included in the models as control variables were child's age, mother's age, marital status, race, education, and household crowding. Models were estimated using maximum likelihood estimation. SPSS version 15.0 was used to run all statistical analyses.[46]

RESULTS

Demographic Characteristics

Table 1 shows participant demographics. Mothers were primarily African-American (94%), the majority were between the ages of 20–29 (64%), and had a high school education (73%). Most mothers were not married or living with their partner (73%) and lived in a house with ≥4 occupants (70%).

In the multivariate models mothers' ages 20 and older were at significantly increased odds of reporting poorer health. They were also significantly more likely to report currently smoking as were African-American mothers and mothers without a high school education. Mothers with more than a high school education were significantly less likely to report never exercising. Mothers' ages 20 and older were significantly more likely to report sleeping 7 h or more a night. Not married or cohabitating mothers were significantly less likely to report their sleep interrupted as were mothers with a high school education and those reporting four to five people in their household. The age of the child was not significantly related to any outcome variable.

Outcome Measures

Table 2 shows the distribution of variables. Just over 20% of mothers were classified as experiencing the highest category of neighborhood violence. However, only 12% of mothers were classified in the lowest category of perceived neighborhood safety. Mothers tended to perceive their neighborhood to be relatively safe. Table 3 provides a detailed summary of neighborhood violence categories.

A slight majority of mothers reported very good or excellent health (62%). Most mothers did not smoke (70%) and exercised at least occasionally (73%). A total of 39% of mothers reported getting an average of 7 h or more a night. Almost 70% of mothers reported rarely, never, or occasionally getting their sleep interrupted.

TABLE 1 Demographics of sample (*n* = *392*)

	Frequency (%)
Child age	
<1 year old	34 (9)
1–2 years	192 (49)
3–4 years	116 (30)
5 years	50 (13)
Mother age	
14–19 years	65 (17)
20–29 years	252 (64)
>30 years	75 (19)
Marital status	
Married/coupled	111 (28)
Other	281 (72)
Race	
African-American	369 (94)
Other	23 (6)
Education	
Less than high school	46 (12)
High school	287 (73)
More than high school	59 (15)
Household crowding	
3 or fewer members	117 (30)
4–5 members	172 (44)
6 or more members	103 (26)

Columns may not sum to 100% because of rounding off

Neighborhood Violence

Table 3 shows the distribution of violence perceptions and experiences of mothers over the prior 12 months. Of the 392 mothers, 30% reported having been awakened by police sirens or ambulances many times with 18% being awakened by gunshots many times. Almost half of the sample had seen someone get arrested and/or seen drug deals many times. Seven percent said they had seen someone shot many times, and 17% had seen someone being beaten or stabbed many times.

The majority of mothers felt safe walking alone during the day (72%). Fewer mothers felt safe walking alone during the night (42%). A total of 16% of mothers reported being afraid to let their children play outside alone many times in the prior 12 months.

Multivariate Analysis: Exposure to Violence

Table 4 presents the results from the logistic regression analysis, in the form of odds ratios, for the effect of both Perceived Safety and Exposure to Violence on self-reported health status, amount of exercise, smoking status, amount of sleep per night, and extent of sleep interruption.

Mothers with high exposure to neighborhood violence had an increased odds of rating their health as poorer, reporting never exercising, and reporting smoking. A dose response was seen for exposure to moderate neighborhood violence, with mothers more likely to report negative health outcomes. This relationship only reached statistical significance for smoking.

TABLE 2 Frequencies of neighborhood violence and outcome variables ($n = 392$)

	Frequency (%)
Exposure to neighborhood violence	
Low	157 (40)
Medium	150 (38)
High	85 (22)
Perception of neighborhood safety	
High	103 (26)
Medium	241 (61)
Low	48 (12)
Health	
Excellent or very good	241 (61)
Good, fair, or poor	151 (39)
Currently smoke	
No	272 (70)
Yes	119 (30)
Exercise	
Occasionally or at least 1 time per week	287 (73)
Never	105 (27)
Amount of sleep per night	
7 h or more	151 (39)
Less than 7 h	241 (61)
Extent of sleep interruption	
Rarely, never, or occasionally	270 (69)
Usually or always	122 (31)

Columns may not sum to 100% because of rounding off

Exposure to neighborhood violence was also associated with poor sleep behaviors in mothers. Those who experienced exposure to high neighborhood violence had greater odds of reporting less than 7 h of sleep per night. These mothers were also more likely to report interrupted sleep. A dose response was seen for exposure to moderate neighborhood violence with mothers reporting poorer sleep behaviors. This relationship did not reach statistical significance.

All associations, with the exception of violence exposure to overall self-reported health, were significant at the $p \leq 0.001$ level.

Multivariate Analysis: Perception of Neighborhood Safety

Mothers' rating of perceived neighborhood safety was not statistically related to overall health status, smoking, exercising, number of hours of sleep per night, or sleep interruption. This was true for both mothers with perceptions of moderate and low neighborhood safety.

DISCUSSION

Mothers in this study were exposed to a high level of neighborhood violence in the prior year. While this study classified mothers into groups based on the summation of their exposure, the importance of each experience should not be overlooked. Nearly 30% of mothers had witnessed someone shot in the last year. Just over half had witnessed someone beaten or stabbed in the past year. Even more had witnessed someone arrested

TABLE 3 Prevalence of perceived and experienced neighborhood violence

Categorization	Neighborhood violence question	Frequency (%) ($n=392$)
Perceived neighborhood violence	Felt safe walking alone during the day	
	Never	27 (7)
	Once or twice	13 (3)
	A few times	70 (18)
	Many times	282 (72)
	Felt safe moving alone during the night	
	Never	68 (17)
	Once or twice	47 (12)
	A few times	114 (29)
	Many times	163 (42)
	Afraid to let children play outside	
	Never	158 (40)
	Once or twice	75 (19)
	A few times	95 (24)
	Many times	64 (16)
Experienced neighborhood violence	Awakened to the noise of police or ambulance	
	Never	65 (17)
	Once or twice	93 (24)
	A few times	117 (30)
	Many times	117 (30)
	Awakened to the noise of gunshots	
	Never	133 (34)
	Once or twice	104 (27)
	A few times	84 (22)
	Many times	71 (18)
	Seen somebody get arrested	
	Never	49 (13)
	Once or twice	86 (22)
	A few times	90 (23)
	Many times	167 (43)
	Seen drug deals	
	Never	94 (24)
	Once or twice	62 (16)
	A few times	75 (19)
	Many times	161 (41)
	Seen someone beaten or stabbed	
	Never	189 (48)
	Once or twice	68 (17)
	A few times	67 (17)
	Many times	68 (17)
	Seen somebody get shot	
	Never	282 (72)
	Once or twice	56 (14)
	A few times	25 (6)
	Many times	29 (7)

Columns may not sum to 100% because of rounding off

TABLE 4 Neighborhood violence and its effect on mothers' health, health behaviors, and sleep

	Health	Smoking	Exercise	Amount of sleep per night	Extent of sleep interruption
Exposure to violence[a]					
Low	1.0	1.0	1.0	1.0	1.0
Medium	1.32 (.83–1.81)	2.53 (1.97–3.09)**	1.52 (0.96–2.08)	1.30 (0.80–1.80)	1.40 (0.87–1.93)
High	1.87 (1.31–2.43)*	3.08 (2.44–3.72)**	2.41 (1.78–3.04)**	2.06 (1.50–2.62)**	2.38 (1.46–2.66)**
Perceptions of safety[a]					
High	1.0	1.0	1.0	1.0	1.0
Medium	0.72 (0.23–1.21)	1.04 (0.50–1.58)	1.43 (0.87–1.99)	0.80 (0.30–1.30)	0.74 (0.22–1.26)
Low	1.48 (0.77–2.19)	1.42 (0.66–2.18)	1.61 (0.82–2.40)	1.28 (0.57–1.99)	1.25 (0.51–1.99)

Health odds of reporting fair, poor or good health, *smoking* odds of reporting smoking, *Exercise* odds of reporting never exercising, *amount of sleep per night* odds of reporting less than 7 h of sleep per night, *extent of sleep interruption* odds of reporting sleep usually and always interrupted

*$p \leq 0.05$; **$p \leq 0.001$

[a]Controlled for child age, mother age, marital status, race, education, and household crowding

and witnessed drug deals (76% and 87%, respectively). The majority had awakened to the noise of gunshots or police and ambulances at least once in the past year.

For mothers in our study, exposure to neighborhood violence was negatively associated with five diverse health determinants or outcomes: self-reported health, smoking, exercise, amount of sleep, and sleep interruption. While the impact of exposure to neighborhood violence on one of these variables is important, mothers in neighborhoods with high exposure to violence have a greater odds of reporting all five poor health-related outcomes.

Interestingly, this association was not present when analyzing mothers' perception of neighborhood safety. While mothers' ratings of neighborhood safety and their experiences were correlated, mothers tended to have a better perception of their neighborhoods than one might expect from the level of violence reported. Previous studies have found that individuals' perceptions of neighborhood safety are determined by more than just specific experiences of violence.[33–36] For example women are more likely to perceive threats to their safety than men, with women over the age of 30 perceiving their neighborhood as less safe than younger women.[34] Additionally, mothers may report higher ratings of neighborhood safety to self-validate their decision to remain in a violent neighborhood, perhaps in part due to their inability to move to a new neighborhood.[47]

This study demonstrates that measuring exposure to violence-related experiences using discrete measures may be a better method for assessing the influence of neighborhood violence on health than perceptions of safety alone. Participants' ratings of neighborhood safety may not capture the full health consequences of living in a violent neighborhood. As the experience of violence does relate to participants' perceptions of safety, experienced violence measures may still capture aspects of perceived safety. While this study did not support perceived safety as a mediator between the relationships of neighborhood violence exposure and health (due to the lack of association with the outcome variables), this possibility should be investigated further.[48] Additionally, while this study did not attempt to compare exposure to violence with actual levels of crime and disorder, these more objective measures may mask certain areas or population subgroups with extreme exposure to violence. More research should be undertaken to understand the interrelationships between various types of measures of neighborhood violence.

Strengths and Weaknesses

This study was a large cross-sectional survey. As with any cross-sectional research the connections made are simply associations, without the ability to determine causation between violence exposure and health determinants or outcomes. When measuring neighborhood effects, it is difficult to separate out the effects of the neighborhood versus the effects of other associated variables. This study attempted to control for these factors by including education, marital status, race, and household size in the model. However, this study did not control for the duration of exposure, personal, or family victimization.

Participants in this study included mothers living in Baltimore City in a specific geographic locale. Additionally, the $10 paid to participants for completion of the study instrument may have resulted in selection bias with those most disadvantaged participating in the study. While this limits the generalizability of our findings, it does allow for more equal comparisons, as mothers are more likely to be similar for any unmeasured factors. As this geographic area is in a violent area of Baltimore City, neighborhood violence categories were probably skewed to the high end of

violence exposure and the low end of neighborhood safety.[49] This may have actually resulted in an underestimation of neighborhood violence effects as the reference categories were set at a higher than "normal" level. While this sample's social conditions may be considered extreme, they are unfortunately reflective of the experiences of many poor, minority, urban city residents.[39]

This study has several strengths. The findings are based on a large sample of African-American mothers living in the inner-city. Data were collected by a computer-kiosk enhancing confidentiality and perhaps limiting self-report bias of neighborhood violence. Statistical methods were used to ensure that neighborhood violence questions were indeed representative of perceived safety and exposure to violence, with exposure to neighborhood violence questions based on previously validated measures. Additionally, efforts were made to control for many factors that may have independently impacted our health-related outcomes.

CONCLUSIONS

This study contributes to the literature by demonstrating differences in the relationship between two methods of measuring neighborhood violence with health-related outcomes. Studies using only mothers' perceptions of neighborhood safety may potentially miss an association with maternal health. As we have shown, a more robust measure of neighborhood violence includes the assessment of exposure to violence-related experiences. Due to our findings of the disruption to maternal sleep patterns, our study suggests that neighborhood violence may negatively impact a mother's ability to provide optimal care for her children. This study also points to the importance of understanding the lived experiences of individuals residing in high-violence neighborhoods when assessing mothers and implementing maternal and child health interventions.

ACKNOWLEDGEMENTS

This research was funded by grant 5RO1 HD042777-03 to Johns Hopkins University from the National Institute of Child Health and Human Development.

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