A Global Study on the Influence of Neighborhood Contextual Factors on Adolescent Health

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Abstract

Purpose—This study uses data collected as part of the Well-Being of Adolescents in Vulnerable Environments (WAVE) study to: 1) compare the perceptions of neighborhood-level factors among adolescents across five different urban sites; 2) examine the associations between factors within the physical and social environments; and 3) examine the influence of neighborhood-level factors on two different health outcomes -- violence victimization in the past 12 months and ever smoked.

Methods—Across five urban sites (Baltimore, New Delhi, Johannesburg, Ibadan, and Shanghai), 2320 adolescents aged 15-19 years completed a survey using ACASI technology. To recruit adolescents, each site used a respondent-driven sampling method, which consisted of selecting adolescents as 'seeds' to serve as the initial contacts for recruiting the entire adolescent sample. All analyses were conducted with Stata 13.1 statistical software, using complex survey design procedures. To examine associations between neighborhood-level factors, as well as among our two outcomes, violence victimization and ever smoked, bivariate and multivariate analyses were conducted.

Results—Across sites, there was great variability in how adolescents perceived their neighborhoods. Overall, adolescents from Ibadan and Shanghai held the most positive perceptions about their neighborhoods, while adolescents from Baltimore and Johannesburg held the poorest. In New Delhi, despite females having positive perceptions about their safety and sense of social cohesion, they had the highest sense of fear, as well as the poorest perceptions about their physical environment. The study also found that one of the most consistent neighborhood-level factors across sites and outcomes was witnessing community violence, which was significantly associated with smoking among adolescents in New Delhi and Johannesburg, and with violence victimization

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across nearly every site except Baltimore. No other neighborhood-level factor exerted greater influence.

Conclusions—This study confirms the important associations between perceptions of a neighborhood and adolescent health. At the same time, it demonstrates that not all neighborhood-level factors are associated with adolescent health outcomes in the same way across different urban contexts. Further longitudinal research is needed to examine the direction of causation between adolescent health neighborhood contexts and health outcomes, and the reasons for why different urban contexts may exert varying levels of influence on the health of adolescents.

Keywords

neighborhood effects; urban health; physical environment; adolescents

Introduction

In the United States, urban health researchers have long recognized the powerful influence of the neighborhood context on the heath of its residents. Research dating back more than a century has found that residents living in neighborhoods characterized by greater physical disorder – trash, graffiti, unkempt vegetation, and deteriorating housing – are more likely to be exposed to crime and suffer greater health problems compared to those who live in less disorderly neighborhoods[1-4]. Specifically, researchers have referred to the 'physical environment', which includes the built structures, the air and water, the indoor and outdoor noise, and the parkland inside and surrounding the city[5], as one of the key drivers for many health disparities, including mental health status[6], obesity[7], and risky sexual behaviors[8].

In addition to the physical environment of a neighborhood, the social environment of a neighborhood has also been studied in relation to the health of residents. For adolescents, this research supports the notion that they are not only socialized by their parents, but also by the various adults and peers they interact with regularly at school and in the neighborhood[9, 10]. Two factors within the social environment have been extensively studied in the United States in relation to adolescent health: social capital and social cohesion. Social capital, or the resources that are innate in people's relationships, has been examined as a mechanism behind the relationship between neighborhood poverty and a variety of poor health outcomes[11]. Social cohesion, a form of social capital, refers to the degree to which neighbors share instrumental and emotional support with one another[12]. Studies have found that when adolescents have lower levels of social cohesion, they report poorer mental health status[13], higher crime and homicide[14], and increased sexual risk behaviors[15].

Not surprising, these two environments – the social and the physical – are intertwined such that features of the physical environment influence not only individual social interactions but also resident perceptions of the social environment, and vice versa. There have been two theories that are frequently referenced to help explain the potential mechanisms by which social capital and the physical environment influence each other. *Social Disorganization Theory* postulated that neighborhood structural characteristics (which were originally thought of as poverty, ethnic heterogeneity, and residential instability) disrupted neighborhood and family-level controls, which in turn increased the risk of violence and

delinquency among adolescents in the neighborhood[16]. The second theory, developed by Wilson and Kelling, became known as the *Broken Windows Theory,* which argued that unrepaired physical signs of disorder eroded community trust and promoted further behavioral disorders[17]. Wilson and Kelling hypothesized that this erosion of community cohesion encouraged additional disorderly behavior by providing 'cues' to potential offenders that disorder could be tolerated. Both of these theories argue that cues in the physical environment influence either trust or social control among community members (within the social environment), which then influence violence or delinquency. Other scholars, meanwhile, have argued that the reverse can also be plausible: that poor social support and social cohesion might lead to a poorer physical environment as residents take little interest in looking after their common areas.[13]

In addition to these theories, there is also the possibility that the physical signs of disorder have a more indirect effect on social control and support. Ross and Mirowsky, for example, have argued that disorder creates an overarching sense of fear and danger that is then carried into all social interactions, making for weaker relationships within the neighborhood[18]. Given the strong likelihood that there is a dynamic relationship between the social and physical environments, understanding the collective influences of neighborhood influences on health could enhance our ability to understand the distribution of health behaviors and outcomes across urban areas.

The challenge for adolescent health researchers is that the majority of studies that have examined both the physical and social environments have been undertaken primarily in the United States. Even within the body of work produced in the United States, the studies among adolescents have only focused on examining the neighborhood effects on a relatively small number of health and behavioral outcomes with no clear consensus about which neighborhood contextual factors may be more relevant. An increasing focus on the health inequalities and the social determinants of health has also highlighted the potentially powerful role of neighborhood/community context in influencing adolescent health and development[19].

Meanwhile, dramatic trends in urbanization across the globe and the enormous growth of urban slum settlements make it imperative that we better understand the extent to which neighborhoods, and the specific factors within the neighborhood, influence the health of adolescents[20]. To date, however, we have limited understanding about how factors within this context operate and affect the health and wellbeing of adolescents living in different urban contexts around the globe.

To address these knowledge gaps, this paper utilizes data collected as part of the Well Being of Adolescents in Vulnerable Environments (WAVE) study, a global study conducted among adolescents aged 15-19 years old from five urban sites: Baltimore (USA), Ibadan (Nigeria), Johannesburg (South Africa), New Delhi (India, and Shanghai (China). The specific objectives for the present analysis are: 1) to compare the perceptions of neighborhood-level factors among adolescents across sites; 2) to examine the associations between the physical environment and factors within the social environment across sites; and 3) to examine the influence of these neighborhood-level factors on violence

victimization and smoking among adolescents living in disadvantaged urban neighborhoods, as previous US research has suggested relationships between the neighborhood and each of these outcomes [21-25].

Methods

The WAVE study

The WAVE study is the first of its kind to focus on very disadvantaged urban adolescents and their health globally. While there has been substantial research conducted among more accessible adolescents (e.g., school or household samples), to date there is limited data available on young people who do not necessarily go to school or live in a typical home environment – characteristics not uncommon to those living in distressed urban locations. The first phase of the study, the formative phase, was launched in June of 2011 to: 1) explore adolescents' perceived health and their top health challenges and; 2) describe the factors within their urban communities which were perceived to be related to their health and health seeking behaviors. Data were collected using identical research protocols across the five study sites: key informant interviews among representatives from schools, places of worship, and youth-serving organizations; in-depth interviews among adolescents; community mapping and focus groups among adolescents; and a Photovoice exercise among adolescents[26]. Findings from this formative phase, interestingly, showed that adolescents perceived that factors within the physical and social environments to be the most influential to their health. To examine these factors more extensively, a survey using ACASI technology was conducted in the spring and summer of 2013 among adolescents in the same five urban sites. The analysis for this paper is based on data collected from the surveys across all five sites.

Study sites

In each of the five cities (Baltimore, New Delhi, Johannesburg, Ibadan, and Shanghai), the local research team selected a specific geographical area within the city as the study site, based primarily on high poverty. Table 1 summarizes the main characteristics of each study site, which was characterized by each of the local research teams.

Sample and Recruitment

To recruit adolescents for the survey, each site used a respondent-driven sampling methodology, which consisted of selecting adolescents as "seeds" to serve as the initial contacts for recruitment (see Decker et. al. in the current volume for detailed description of sample recruitment methods). Additionally, see Marshall et al in this volume for a description of the study sample and the differences in the sample characteristics across sites.

Survey Measures

At a neighborhood level, several measures were identified that captured both the physical and social environments. The *physical environment* measure consisted of an eight-item scale that asked about certain aspects of a neighborhood, such as whether there are abandoned buildings, rats, trash, and recreational facilities in the neighborhood. The selection of the items was driven by a similar type of physical environment scale, called the *Extent of*

Neighborhood Problems Scale[21], and items identified as important from the formative research phase. Scale scores ranged from 0-24, with Chronbach's alphas ranging from 0.78 (in New Delhi) to 0.88 (in Shanghai). The higher the score, the better the perception was of the physical environment.

Within the social environment, several neighborhood-level measures were identified that captured both social cohesion to the neighborhood, as well as safety, fear, and violence at a community level, to align with those variables important to theories such as Social Disorganization Theory and Broken Windows Theory. Additionally, given the dominant findings from the qualitative phase of this study in regards to the perceptions of safety and violence affecting adolescent health[26], we included several measures that tapped into these constructs. *Social cohesion* was measured as a continuous variable by summing nine items in a scale, many of which were borrowed from the social cohesion scale first developed by Sampson, Raudenbush, and Earls (1997) [27]. Examples of items included statements such as "people in this neighborhood can be trusted", "people in this neighborhood do not share the same values", and "most people in this neighborhood know each other." Chronbach's alphas ranged from 0.74 (in New Delhi) to 0.84 in both Baltimore and Johannesburg. Similar to the physical environment, as the score increased, so did the perception of social cohesion. *Perceived safety* was a binary variable based on the question: "In terms of violence, how safe do you consider the community you live in?" Responses were collapsed into very safe/ safe and very unsafe/unsafe categories. We also included two measures of fear in the neighborhood. One measure, which we called *perceived fear*, consisted of six items that asked respondents about how afraid they are of being robbed and attacked in various locations in the neighborhood. Chronbach's alphas for this measure ranged from 0.77 (in Johannesburg) to 0.87 (in Baltimore). The other measure, which we have named *fear behaviors*, consisted of four items that asked respondents within the past 12 months how often they limited the places or the times they went out because they were afraid. Chronbach's alphas ranged from 0.64 (in New Delhi) to 0.77 (in Ibadan). For the final neighborhood-level measure, *witnessing community violence*, nine items were summed that each asked respondents about how often they saw various violent acts in their neighborhood within the past 12 months. Examples of violent acts included seeing drug deals in the neighborhood, hearing guns shot, seeing gangs in the neighborhood, and seeing someone getting arrested, or pulling a gun, knife or other weapon on another person. Alphas for this measure ranged from 0.69 (in Shanghai) to 0.87 (in Baltimore) across sites.

To confirm that multicollinearity was not an issue, we conducted correlation tests among the neighborhood-level factors. Since no correlation coefficient was above 0.44, we included each neighborhood variable described above in our analyses.

For our outcomes, smoking was measured as a binary variable that asked respondents about ever use of cigarettes, while victimization was measured by asking respondents how often they were pushed or shoved, hurt in a fight, verbally threatened, threatened with a weapon, and hurt with a weapon within the last 12 months. Response categories were never, once, more than once, which were then collapsed into a binary variable that captured a "never/ ever" measure of any of the experiences of victimization.

Analysis

All analyses were conducted using Stata 13.1 statistical software using complex survey design procedures to accommodate the non-independence of observations, i.e., the potential for intercluster correlation within recruitment chains was adjusted for[28] and weights were generated via the RDSII estimator[29].

Given differences in the age distribution across sites, a post-stratification age weight was developed and harmonized with the RDSII weight for all of the demographic tables. The post-stratification age weight was not used in regression analyses because age was included as a covariate in all regression models.

To account for missing variables in the scales a two-step process was conducted. First, variables were created to count the number of missing items per scale. Second, if a respondent was missing fewer than 33% of the items on a scale, those items were replaced with the mean of that particular item. All scales used in our analyses were also re-scaled and standardized to account for different maximum values. Specifically variables were re-scaled into z-scores with a mean of 0 and a standard deviation of 1. This did not affect the levels of significance, but instead, allowed for a more accurate interpretation of the coefficients (and a one-unit increase) in our analyses.

Covariates used in all the multivariate regression models were selected based on theory. To control for factors we believed would be related to the independent and dependent variables, all regression models were adjusted for demographic variables, which included age, gender, perceived economic status, in-school status, and housing stability. Since the qualitative phase of the study revealed large gender differences, t-tests between gender and our two outcome variables were conducted (data not shown). Based on significant differences observed for violence victimization, we stratified the regression analyses by gender (see Tables 6a and b).

Results

What are the perceptions of neighborhood-level factors among adolescents across sites?

Weighted means of the neighborhood level factors across sites, stratified by gender, are displayed in Table 2. Among both males and females, those who perceived their physical environment most favorably were from Ibadan (mean 9.9 for males; 11.1 for females) and Shanghai (9.5 for males; 10.0 for females). In contrast, among males, those living in Johannesburg (mean 7.8) and New Delhi (mean 7.5) had the poorest perception of their physical environments, and among females, the poorest perceptions were observed among those from Baltimore (mean 9.2) and, again, New Delhi (mean 7.1). In general, males and females from both Baltimore and Johannesburg had the lowest social cohesion scores (ranging from 9.3 to 10.1), whereas male and female adolescents from New Delhi and Ibadan held the highest scores on a scale from 0 to 18 (11.9 to 12.4). These findings echo the prevalence and averages observed for both perceived safety and witnessing community violence among males and females as well. Baltimore and Johannesburg had the lowest proportion of adolescents who felt safe in their communities (percentages ranged from 43.9% among males in Johannesburg to 66.1% of females in Baltimore) and had the highest

means for witnessing community violence (8.9 for males and 7.0 among females in Johannesburg; 7.0 among males and 6.3 among females in Baltimore). In Baltimore, however, these findings did not directly map onto adolescents' sense of fear in their communities. This is particularly the case for males in Baltimore, who had one of the lowest perceived fear scores. In contrast, females in New Delhi had the highest sense of fear, with a mean of 6.7, followed by females in Johannesburg with a mean of 6.5. Adolescents with the lowest sense of fear were both males and females in Shanghai, with means of 1.4 for males and 3.0 for females. The scale that measured fear behaviors followed this same pattern, with females from New Delhi and Johannesburg having the highest score (6.4 for females in New Delhi and 4.8 for females in Johannesburg), and males and females from Shanghai having the lowest (0.7 among males and 1.5 among females).

What are the associations between the physical environment and factors within the social environment across sites?

Table 3 displays the multivariate results of the analysis between the physical environment and social factors across sites. For Baltimore, Johannesburg, and Shanghai, perceived safety was strongly and negatively associated with the physical environment ($p<0.001$). Social cohesion, meanwhile, was positively associated with the physical environment only in Ibadan ($p<0.05$). Perceived fear exhibited a negative relationship with the physical environment among adolescents from every site except Ibadan, where the relationship was significant, but positive. In New Delhi, limiting when and where a participant went out due to fear was also significantly associated to a lower perception of the physical environment ($p<0.05$). Similarly, for adolescents in every site except New Delhi, the higher the community violence score, the lower the positive perception about the physical environment was, and these were all statistically significant ($p<0.01$).

What is the prevalence of violence victimization and smoking among adolescents across sites?

In Table 4, we present the prevalence of our two selected health outcomes across all sites. Among males, a substantially high percentage of adolescents from both Johannesburg and Shanghai ever smoked cigarettes (54% from Johannesburg and 58% in Shanghai), with lower proportions smoking in Ibadan and New Delhi (11% in Ibadan and 16% in New Delhi). A somewhat different pattern emerged among females. The highest proportion of females who ever smoked was from Baltimore (35%) and Johannesburg (29%), with very few females who ever smoked from New Delhi (2%) and Ibadan (3%). For violence victimization, another interesting pattern emerged across sites. The highest proportion of those who experienced victimization in the past 12 months were actually males from Johannesburg (67%), followed by females in Johannesburg (48%) and males and females from Ibadan (47% for males and 43% for females). Males and females from Shanghai, meanwhile, reported the lowest rates of personal victimization in the past 12 months (18% for males and 15% for females).

What is the influence of neighborhood-level factors on violence victimization and smoking among adolescents across the sites?

The multivariate results for our two health outcomes, ever smoked and violence victimization in the past 12 months, are displayed in Table 5 (for smoking) and Tables 6a and b (for violence victimization for boys and girls respectively).

Ever Smoked—When we look at the associations between the neighborhood level factors and ever smoked, there is no consistent pattern across sites. For adolescents living in Baltimore and Ibadan, there were no neighborhood-level factors significantly associated with ever smoked. In New Delhi, the only factor found significantly related to ever smoked was witnessing community violence; adolescents who had more exposure to community violence were also more likely to have ever smoked (p<0.01). In Johannesburg, two neighborhood-level factors emerged as being significantly related to ever smoked: perceived fear and witnessing community violence. While the association between witnessing community violence and ever smoked echoed that found in New Delhi, there was a negative association between perceived fear and smoking such that as adolescents' sense of fear increased, their likelihood for ever smoked actually decreased (p<0.01). Finally, in Shanghai adolescents who perceived their neighborhoods to be unsafe were nearly twice as likely to have ever smoked compared to those who felt safe (OR 1.90, p<0.01). However, they were less likely to have ever smoked if they perceived their neighborhoods as more socially cohesive (p<0.01).

Victimization in the past 12 months—Examining both Tables 6a and 6b, overall, we can see that females are much more influenced by neighborhood-level factors in comparison to males across sites. For males, the most notable finding was the positive significant association between witnessing community violence and victimization within the past 12 months across all five sites (p<0.01). No other neighborhood-level factor displayed this consistent correlation across the sites. In fact, the only other neighborhood-level factors that were associated with male victimization in the past 12 months were perceived fear among male adolescents in Baltimore (p<0.001) and the perceived lack of safety among male adolescents in Johannesburg (p<0.05).

Among females, with the exception of perceived fear, each neighborhood-level factor was found to be significantly associated with any form of victimization in the past 12 months in at least one site. The perception of a more positive physical environment was significantly associated with less reported victimization in the last 12 months among females in Ibadan and Johannesburg (p<0.01). Interestingly, perceiving to be unsafe in the community was positively associated with female victimization in Baltimore (p<0.05), but negatively associated to victimization in Johannesburg (p<0.05). Similar to the perception of safety, social cohesion showed different levels of association between sites. In Baltimore, adolescents who perceived more socially cohesive neighborhoods were also more likely to have been victimized (p<0.001). In New Delhi, however, adolescents living in more socially cohesive neighborhoods were less likely to have been victimized (p<0.001). There were positive associations, on the other hand, between fear behaviors, and victimization among females; both in Baltimore (p<0.01) and Johannesburg (p<0.05), adolescents who felt they

had to limit the times and places they went out because of fear were also more likely to have been victimized in the past 12 months. Similar to what was observed among males, in every site except Baltimore, witnessing community violence was positively and significantly associated with female victimization, with female adolescents in New Delhi and Shanghai being more than one and half more times likely to be victimized if they had also witnessed community violence.

Discussion

This paper compares neighborhood-level contextual factors across sites and examines the associations between the physical environment and factors within the social environment and the influence of these neighborhood-level factors on selected health outcomes. When we compare the neighborhood-level contextual factors across sites, our findings suggest that adolescents living in the urban communities of Baltimore and Johannesburg appear to share more neighborhood-level characteristics compared to adolescents from other sites in the study. Adolescents from both Baltimore and Johannesburg held poor perceptions about their physical environments, their sense of social cohesion, and their sense of safety within their neighborhoods. Notably, among females in New Delhi, despite having high scores for social cohesion and safety in their communities, they had the highest sense of fear – both in terms of their perceived fear of their neighborhood and their fear behaviors. They also reported the poorest perception of their physical environment. Meanwhile, adolescents from both Ibadan and Shanghai seemed to have the most positive perceptions about their neighborhoods. While adolescents in Ibadan felt the safest and had the highest perception of neighborhood social cohesiveness, adolescents in Shanghai had the lowest sense of fear and exposure to community violence. Adolescents from both of these sites also had the highest perceptions about their physical surroundings.

When we examine the associations between the physical environment and the neighborhood-level social factors, however, no consistent pattern emerges across the five sites. In Baltimore, with the exception of social cohesion, all of the neighborhood-level factors were negatively and significantly associated to the physical environment. In contrast, in New Delhi, only one neighborhood-level social factor was significantly related to the physical environment and that was fear behaviors. If we look at the associations across sites, the most common association observed between the neighborhood-level social factors and the physical environment was witnessing community violence, with four out of the five sites showing a significant association. Perceived safety also demonstrated a significant association with the physical environment in three out of the five sites. Less common across sites was the association between social cohesion and the physical environment, as only one site (Ibadan) observed such a relationship. These findings suggest that across different cultural contexts, the way in which the social and physical environments interact appears to be city-specific. Even within the United States, the studies are mixed as to how these factors interact with each other. While the prevailing theories of social disorganization and broken window theories postulated that it was the physical environmental cues that led to a breakdown in social trust and control[16, 17], more recent studies have pointed out that even among individuals sharing the same neighborhood, there could be vastly different perceptions about the physical environment depending on their stereotypes of certain sub-

groups and prior experience with violence[4, 30,31]. The fact that witnessing community violence was negatively associated with the physical environment in four out of the five sites suggests that, while it is possible that there may be another underlying factor related to both violence exposure and the perception of the physical environment, prior exposure to violence seems to be particularly influential in shaping adolescents' perceptions about their physical environment. In contrast, there was very little evidence that showed an association between the physical environment and social cohesion. Indeed, in the United States, there have been mixed findings about the influence of social cohesion, with some scholars arguing that it is not enough to have strong social ties in the neighborhood, but rather what makes the difference is the capacity to translate those social ties into the specific goals for the common good[32-34].

Similar to the varied ways in which neighborhood level factors interact with each other across sites, there was also variation across sites and outcomes in how they are associated with adolescent health. If we compare the extent to which neighborhood-level factors co-vary with our selected outcomes, it appears that female victimization is the most strongly associated with neighborhood-level factors. In fact, there were at least two neighborhood-level factors related to female victimization in every site except Shanghai, which also had the lowest mean score for female victimization. Notably, the site that had the highest number of neighborhood-level factors associated with female victimization was Johannesburg, with significant associations between the physical environment, perceived lack of safety, fear behaviors, and witnessing community violence. In Baltimore, there were three neighborhood-level factors associated to female victimization: perceived lack of safety, social cohesion, and fear behaviors. When we examine the other two outcomes, male victimization and smoking, there were only two sites where we found more than one neighborhood-level factor associated with the outcome. For smoking, perceived fear and witnessing community violence were the only two significant factors in Johannesburg; in Shanghai, perceived safety and social cohesion seemed to matter. Similarly, for male victimization, there were two sites (Baltimore and Johannesburg) that found more than one association with the neighborhood-level factors. In Baltimore, male victimization was associated with perceived fear and witnessing community violence; in Johannesburg, it was associated with perceived lack of safety and witnessing community violence.

Turning to the significance of the factors across outcomes and sites, witnessing community violence was one of the most consistent neighborhood-level factors across all five sites. This was significantly associated with smoking in New Delhi and Johannesburg; it was associated with female victimization in every site except Baltimore, and for male victimization, it was significant across all five sites. No other neighborhood-level factor showed a similar pattern across all five sites. Indeed, although the influence of witnessing community violence has rarely been studied outside the United States and England, there are a few important points from these studies that might shed a little light about this variable. First, the impact of witnessing violence for an adolescent can have long-lasting repercussions that go beyond just influencing the perceptions about one's neighborhood. In fact, research has shown that witnessing community violence can affect not only adolescent emotional and behavioral disorders, but also academic achievement and adult outcomes[35-38]. For adolescents in New Delhi and Johannesburg, there was a positive association between

smoking and witnessing community violence, which might suggest that smoking is a coping mechanism for adolescents to escape the stressors, such as violence, in their communities. For victimization, the pathway is a little less clear; and, indeed, more longitudinal research is needed to identify the plausible casual pathways between exposure to violence and actual victimization.

The study has a number of important limitations. First, while respondent-driven sampling was a specific technique that was used to recruit adolescents from all diverse social backgrounds, each site's sample is not representative of the general adolescent population in the particular cities. Some of the sites, such as New Delhi and Ibadan, may have also been constrained by the lack of exposure of respondents to computers and specifically ACASI. This may have affected the applicability of the technique to elicit accurate survey responses among the participants. Additionally, all of our measures of neighborhood-level factors are obtained from the same survey respondents that were used to test our outcomes. As a result, same-source bias could have occurred, which can explain why those who smoked or were victimized may have been more likely to report poorer perceptions about their neighborhood. Given this constraint and the fact that this is a cross-sectional survey, causal pathways cannot be determined.

Conclusions

Despite these limitations, this study confirms that the perceptions about the physical and social environments within a neighborhood are important to study among adolescents living in disadvantaged urban communities. It also demonstrates that not all neighborhood-level factors influence adolescent health outcomes in the same way across different urban contexts. Further longitudinal research is needed to examine which adolescent health outcomes and behaviors may be more influenced by perceptions within the neighborhood context, and the reasons why different urban contexts may exert varying levels of influence on the health of adolescents.

Acknowledgements

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Table 1

Selected Characteristics of Study Communities (described from Phase 1 in our study)

City	Selected Community	Characteristics
Baltimore	East Baltimore	High prevalence of low income residents near the Johns Hopkins medical campus; majority of residents are African American
Shanghai	Sub-district	A suburban area located in the northwest of Shanghai, the size is 18.8 square kilometers with about 200,000 inhabitants and over half of inhabitants are migrants.
Johannesburg	Hillbrow	Densely populated inner city area (size is about 1 square kilometer with approximately 100,000 inhabitants); community is characterized by high levels of poverty and crime; made up of local Johannesburg residents and immigrants
Ibadan	Ibadan North Local Government Area, Oyo state	Third largest city in Nigeria; capital of Oyo state – within the city, a poor 'inner city' community was selected; predominant ethnic group was Yoruba
New Delhi	A slum in one of Delhi's four districts (South Delhi) bordering the state of Haryana	Large slum community inhabited by migrant families from different parts of the country, overwhelmingly poor, lacking basic facilities, such as sanitation and water

Table 2

Neighborhood level Factors Across Sites, Stratified by Males and Females

MALES					
Factors	**Baltimore Weighted Mean (weighted SE)**	**New Delhi Weighted Mean (weighted SE)**	**Ibadan Weighted Mean (weighted SE)**	**Johannesburg Weighted Mean (weighted SE)**	**Shanghai Weighted Mean (weighted SE)**
	N=263	**N=250**	**N=220**	**N=272**	**N=222**
Physical environment	8.8 (0.41)	7.5 (0.31)	9.9 (0.26)	7.8 (0.25)	9.5 (0.22)
Social cohesion	9.7 (0.15)	12.4 (0.14)	12.1 (0.27)	10.1 (0.42)	10.5 (0.27)
Perceived safety [*]	55.1 (150)	70.4 (180)	84.8 (193)	43.9 (139)	79.0 (182)
Perceived fear	3.2 (0.18)	4.5 (0.22)	4.2 (0.35)	5.4 (0.33)	1.4 (0.07)
Fear behaviors	3.3 (0.45)	5.6 (0.12)	4.0 (0.33)	5.5 (0.39)	0.72 (0.09)
Witness community violence	7.0 (0.32)	3.9 (0.17)	3.9 (0.28)	8.9 (0.38)	0.59 (0.04)

FEMALES					
Factors	**Baltimore Weighted Mean (weighted SE)**	**New Delhi Weighted Mean (weighted SE)**	**Ibadan Weighted Mean (weighted SE)**	**Johannesburg Weighted Mean (weighted SE)**	**Shanghai Weighted Mean (weighted SE)**
	N=193	**N=250**	**N=229**	**N=224**	**N=216**
Physical environment	9.2 (9.0, 0.25)	7.1 (7.5, 0.11)	11.1 (11.1, 0.12)	9.6 (9.4, 0.19)	10.0 (9.7, 0.53)
Social cohesion	9.3 (9.6, 0.15)	11.9 (12.0, 0.14)	12.1 (12.4, 0.07)	9.6 (9.6, 0.31)	10.1 (10.0, .10)
Perceived safety [*]	66.1 (118, 61.1)	73.0 (194, 77.6)	86.6 (199, 86.9)	53.2 (113, 50.5)	87.5 (181, 83.8)
Perceived fear	5.5 (5.1. 0.4)	6.7 (6.4, 0.16)	4.9 (4.7, 0.39)	6.5 (6.6, 0.09)	3.0 (3.5, 0.34)
Fear behaviors	3.0 (3.2, 0.1)	6.4 (6.1, 0.29)	3.4 (3.3, 0.33)	4.8 (5.3, 0.25)	1.5 (2.3, 0.15)
Witness community violence	6.3 (7.0, 0.37)	2.6 (2.8, 0.18)	3.2 (3.2, 0.56)	7.0 (6.8, 0.23)	0.42 (0.51, 0.07)

[*] **For this variable, weighted percentages and Ns are displayed instead of means because it is a binary variable**

Table 3

Neighborhood Factors Associated with the Perception of the Physical Environment Among Males and Females (95%CI in parentheses)

Neighborhood Factors	Baltimore Adjusted reg coefficience (aCIs) N=439	Delhi Adjusted reg coefficience (aCIs) N=496	Ibadan Adjusted reg coefficience (aCIs) N=435	Johannesburg Adjusted reg coefficience (aCIs) N=491	Shanghai Adjusted reg coefficience (aCIs) N=433
Perceived Safety	−0.45 ***	−0.14	0.11	−0.23 ***	−0.46 **
	(−0.55 - −0.34)	(−0.61 - 0.33)	(−0.16 - 0.38)	(−0.32 - −0.14)	(−0.72 - −0.2)
Social Cohesion	−0.05	0.03	0.14 *	0.04	0.06
	(−0.18 - 0.09)	(−0.03 - 0.08)	(0.03 - 0.25)	(−0.01 - 0.09)	(−0.00 - 0.13)
Perceived Fear	−0.14 ***	−0.12	0.09 *	−0.01	−0.10
	(−0.2 - −0.09)	(−0.24 - 0.00)	(0.03 - 0.16)	(−0.07 - 0.05)	(−0.33 - 0.12)
Fear Behaviors	−0.10 *	0.09 *	−0.03	0.02	−0.07
	(−0.18 - −0.03)	(0.03 - 0.16)	(−0.09 - 0.04)	(−0.02 - 0.07)	(−0.16 - 0.01)
Witnessing Community Violence	−0.09 *	−0.12	−0.23 **	−0.23 ***	−0.06 ***
	(−0.19 - −0.00)	(−0.27 - 0.03)	(−0.34 - −0.12)	(−0.29 - −0.18)	(−0.08 - −0.04)

Table 4

Prevalence of Health Outcomes Across Sites, Stratified by Males and Females

MALES

Health outcomes	BALTIMORE W% (N)	NEW DELHI W% (N)	IBADAN W% (N)	JOHANNESBURG W% (N)	SHANGHAI W% (N)
Ever smoked a cigarette	38.5 (88)	15.6 (39)	10.7 (22)	53.9 (160)	58.4 (139)
Violence victimization in past 12 months (binary)	27.6 (86)	33.3 (89)	47.2 (100)	67.2 (184)	18.0 (48)
Alpha	0.84	0.75	0.70	0.84	0.62

FEMALES

Health outcomes	BALTIMORE W% (N)	NEW DELHI W% (N)	IBADAN W% (N)	JOHANNESBURG W% (N)	SHANGHAI W% (N)
Ever smoked a cigarette	34.9 (40)	2.0 (7)	3.4 (8)	28.9 (62)	19.9 (45)
Violence victimization in past 12 months (binary)	32.0 (62)	28.2 (63)	42.8 (89)	48.3 (106)	15.1 (37)
Alpha	0.86	0.58	0.70	0.8	0.55

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Table 5

Neighborhood Factors Associated with Smoking among Males and Females (95%CI in parenthesis)

	Baltimore aOR (aCIs) n=435	Delhi aOR (aCIs) n=496	Ibadan aOR (aCIs) n=432	Johannesburg aOR (aCIs) n=490	Shanghai aOR (aCIs) n=431
Neighborhood Factors					
Physical Environment	0.81	1.28	0.80	0.87	1.09
	(0.64 - 1.01)	(0.72 - 2.29)	(0.47 - 1.37)	(0.73 - 1.05)	(0.73 - 1.62)
Perceived Lack of Safety	1.03	1.39	1.40	1.14	1.90 **
	(0.73 - 1.45)	(0.86 - 2.24)	(0.62 - 3.14)	(0.82 - 1.57)	(1.31 - 2.75)
Social Cohesion	0.91	0.84	0.66	0.77	0.69 **
	(0.81 - 1.03)	(0.66 - 1.07)	(0.34 - 1.29)	(0.56 - 1.06)	(0.59 - 0.82)
Perceived Fear	1.01	0.71	1.31	0.69 ***	1.09
	(0.82 - 1.25)	(0.45 - 1.11)	(0.84 - 2.06)	(0.59 - 0.81)	(0.85 - 1.4)
Fear Behaviors	1.57	0.90	1.01	1.05	0.86
	(0.94 - 2.62)	(0.48 - 1.7)	(0.8 - 1.27)	(0.89 - 1.24)	(0.73 - 1.03)
Witnessing Community Violence	1.16	1.73 **	1.20	1.76 **	1.18
	(0.87 - 1.56)	(1.3 - 2.32)	(0.81 - 1.77)	(1.18 - 2.64)	(0.73 - 1.9)

*p<0.05

^Adjusted for age, gender, relative wealth, education, family structure, and whether respondents were unstably housed

***p<0.001

**p<0.01

Table 6a

Neigborhood Factors Associated with Victimization among Boys (95%CI in parenthesis)

	Baltimore aOR (aCIs) n=252	Delhi aOR (aCIs) n=244	Ibadan aOR (aCIs) n=216	Johannesburg aOR (aCIs) n=269	Shanghai aOR (aCIs) n=216
Neigborhood Factors					
Physical Environment	0.94	1.08	0.87	0.86	0.66
	(0.72 - 1.22)	(0.69 - 1.69)	(0.69 - 1.08)	(0.6 - 1.25)	(0.38 - 1.16)
Perceived Lack of Safety	1.28	0.88	0.75	1.68 *	0.58
	(0.61 - 2.69)	(0.42 - 1.85)	(0.41 - 1.36)	(1.07 - 2.65)	(0.07 - 4.7)
Social Cohesion	1.04	1.21	1.13	1.16	0.84
	(0.81 - 1.34)	(0.89 - 1.66)	(0.74 - 1.72)	(1.0 - 1.36)	(0.26 - 2.73)
Perceived Fear	1.65 ***	0.95	1.62	1.07	0.92
	(1.42 - 1.91)	(0.64 - 1.42)	(0.97 - 2.72)	(0.91 - 1.25)	(0.57 - 1.48)
Fear Behaviors	1.00	1.31	1.08	1.66 **	1.46
	(0.93 - 1.07)	(0.92 - 1.89)	(0.75 - 1.55)	(1.23 - 2.24)	(0.34 - 6.29)
Witnessing Community Violence	2.33 ***	3.20 ***	2.86 ***	3.01 ***	1.68 **
	(1.69 - 3.2)	(2.1 - 4.86)	(2.08 - 3.95)	(2.01 - 4.52)	(1.37 - 2.07)

^ Adjusted for age, gender, relative wealth, education, family structure, and whether respondents were unstably housed

*** p<0.001

** p<0.01

* p<0.05

Table 6b

Neighborhood Factors Associated with Victimization among Girls (95%CI in parenthesis)

Neighborhood Factors	Baltimore aOR (aCIs) n=187	Delhi aOR (aCIs) n=248	Ibadan aOR (aCIs) n=219	Johannesburg aOR (aCIs) n=222	Shanghai aOR (aCIs) n=213
Physical Environment	0.81	0.84	0.65 **	0.55 ***	0.73
	(0.65 - 1.02)	(0.07 - 1.02)	(0.53 - 0.8)	(0.45 - 0.67)	(0.49 - 1.1)
Perceived Lack of Safety	2.68 *	0.94	0.54	0.47 ***	1.26
	(1.39 - 5.17)	(0.74 - 1.19)	(0.06 - 5.07)	(0.28 - 0.81)	(0.29 - 5.48)
Social Cohesion	1.80 ***	0.74	0.81	1.09	0.74
	(1.49 - 2.17)	(0.69 - 0.8)	(0.58 - 1.13)	(0.93 - 1.27)	(0.28 - 1.97)
Perceived Fear	0.95	1.19	1.47	1.37	1.01
	(0.652 - 1.39)	(0.97 - 1.46)	(0.99 - 2.18)	(0.87 - 2.16)	(0.37 - 2.79)
Fear Behaviors	1.83 **	1.13	1.09	1.41 *	1.40
	(1.36 - 2.46)	(0.88 - 1.45)	(0.78 - 1.54)	(1.1 - 1.81)	(0.74 - 2.67)
Witnessing Community Violence	1.07	3.57 ***	2.16 ***	1.24 *	2.04 **
	(0.86 - 1.34)	(3.0 - 4.25)	(1.77 - 2.63)	(1.01 - 1.52)	(1.52 - 2.74)

^Adjusted for age, gender, relative wealth, education, family structure, and whether respondents were unstably housed

*** p<0.001

** p<0.01

* p<0.05