J Urban Health (2017) 94:534–541
DOI 10.1007/s11524-017-0170-1

The Relationship between Neighborhood Disorder, Social Networks, and Indoor Cigarette Smoking among Impoverished Inner-City Residents

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Published online: 30 May 2017

Abstract Impoverished urban neighborhoods tend to have higher rates of smoking and higher rates of exposure to secondhand smoke as compared to more affluent neighborhoods. Contextual factors of neighborhood disorder and social network and household composition may have an impact on indoor smoking behaviors. The TIDE study examined psychosocial factors associated with smoking behaviors among impoverished inner-city smokers in Baltimore, Maryland. Among a community-recruited sample of 413 smokers who lived with others, most (73%) reported that they or others smoked in their residence. Cohabitation with children, elderly, and those with asthma and other respiratory condition was not associated with indoor smoking. Neighborhood disorder, the proportion of social network members who smoked with the study participant, and the proportion of household members who smoked were all independently associated with smoking indoors. The study findings suggest the importance of addressing neighborhood and social network factors when developing programs for promoting indoor smoking bans as well as cessation and prevention programs.

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Keywords Neighborhood disorder · Tobacco · Secondhand smoke · Social networks · Poverty · Cigarettes · Urban health

Introduction

Many American inner-city neighborhoods are plagued by poverty, violence, pollution, and poor health. These challenging conditions are a paradise for tobacco companies. In the USA in 2015, smoking prevalence rates among those living below the poverty line were 26.1% compared to 13.9% for those at or above the poverty line [1]. Low-income individuals also have lower quit rates [2]. One study found that the majority of adults in some impoverished urban neighborhoods smoke cigarettes [3]; hence, smoking is the norm in these neighborhoods. Social norms have a strong influence on other behaviors and tend to be self-reinforcing [4]. This dynamic perpetuates smoking and hence provides a perfect market for tobacco companies [5]. In addition to the social factors in impoverished urban communities that promote smoking, the high levels of stress and the perception that smoking reduces stress may also exacerbate smoking levels [6, 7]. Moreover, financial stress is associated with smoking and has been found to impede cessation [8, 9].

Besides the direct health impact of smoking in such environments, there is also the deleterious effects of secondhand smoke, especially to those who are young or in poor health [10, 11]. Secondhand smoke exposure

has resulted in over 7300 lung cancer deaths every year during 2005–2009 among adult nonsmokers in the USA and an estimated 2.5 million deaths of nonsmokers from health problems was caused by exposure to secondhand smoke between 1964 and 2014 [12]. There are also economic disparities in exposure to secondhand smoke. In 2011–2012, almost half (43.2%) of nonsmokers living below the poverty level were exposed to secondhand smoke, which was more than twice the exposure rates of those at or above the poverty level [13]. Smoke-free homes are an effective means to reduce exposure to secondhand smoke. Voluntary policies that make a home smoke-free can further support reduced smoking behaviors among low-income individuals [14].

There has been an increase in the reported proportion of smoke-free homes in the USA; however, the US Tobacco Use Supplement to the Current Population Survey in 2010–2011 found that less than half of the households with at least one adult smoker reported a household smoking ban [15]. A systematic review of children's exposure to secondhand smoke found that in 10 out of 11 studies, parental SES was associated with the level of exposure [16]. In the USA, from 1988 to 2010, the decline in exposure to secondhand smoke was substantially lower among low SES households as compared to higher SES groups [17]. A review of barriers and facilitators of smoke-free homes documented the importance of community norms [18] and local smoke-free public places policy [19], but few studies have examined other neighborhood factors associated with home smoking bans.

In the current study, we examined the psychosocial and neighborhood factors associated with indoor smoking by study participants and other smokers in their household among a sample of impoverished inner-city smokers. Given the high prevalence of smoking in the community, we were interested in examining the household impact of smoking, namely, the types and proportion of household members who were exposed to secondhand smoke in their residence as well as predictors of exposure. We were particularly interested in the exposure to secondhand smoke by youth, elderly, and those who suffered from respiratory conditions.

Low-income urban neighborhoods often suffer from high rates of physical and social disorder, including high rates of crime and gangs; abandoned, vacant, and dilapidated buildings; rodent infestations; litter; and graffiti [20, 21]. Neighborhood disorder can contribute to fear of crime and psychological distress [22–24]. Neighborhood disorder has also been found to be associated with unsuccessful quit attempts [25]. In neighborhoods with high levels of disorder, residents may be more likely to smoke inside due to fear of crime and physical environmental factors making it dangerous or unpleasant to smoke outside.

In addition to neighborhood characteristics, smoking behaviors may be influenced by social network factors. The frequently cited Framingham study presents impressive data on the association between tobacco use and social network factors among adults [26] though the analytic techniques used to analyze the Framingham social network data have been called into question [27]. However, the National Longitudinal Study of Adolescent Health (Add Health) included a well-designed social network substudy. In an analysis of these data, Pollard and colleagues found that the level of smoking within peer networks was predictive of smoking. There is also evidence of differential affiliation with smokers choosing other smokers as friends [28]. Research with a low income, predominantly African-American population also found visitors' smoking as a barrier to preventing secondhand smoke exposure at home [29]. In a study with a large Hispanic population in California, participants reported reluctance to ask others not to smoke, especially if the smokers were guests in their homes, community elders, or attending special events [30].

In a qualitative study of Baltimore Head Start caregivers who smoked, which assessed barriers to household smoking bans [31], major themes that emerged as barriers to secondhand smoke reduction were living with extended family members who smoked and having smokers in their social networks. In the current study, we examined whether network members may influence the secondhand smoking behavior of study participants and other household members. As the smoking patterns of other household members are also likely to influence smoking indoors, we examined both the proportion of smokers in the household and the proportion of smokers in the social network and their relationship to indoor smoking.

In January 2017, the US Department of Housing and Urban Development (HUD) finalized the policy for smoke-free public housing regulations, mandating that within 18 months all public housing units develop policies to ban indoor smoking. These policies will impact many impoverished urban smokers living in public housing. Consequently, assessing factors that are

associated with indoor smoking may help to facilitate the implementation of this ban and identify barriers to implementation.

Methods

Data for the analyses were from the Tobacco Use in Drug Environment (TIDE) study conducted in Baltimore, MD. Data was collected from September 2013 to May 2015 among study participants recruited through street outreach, posted advertisements, and word of mouth. Participants, who were prescreened by telephone or face-to-face, were eligible to participate if they were 18 years or older and a current smoker, defined as smoking more than 100 cigarettes in a lifetime and smoking in the prior week. Eligible participants provided written informed consent. A trained staff member administered a face-to-face interview, and sensitive information was collected via audio computer-assisted self-interviewing (ACASI). NicCheck® I Test Strips were used to test for nicotine and verify self-reports of tobacco use [32]. The participants were not penalized for not providing a urine sample. The study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

Indoor smoking exposure The measure of household exposure to secondhand smoke was determined by the question "How often does anyone, including yourself, smoke inside the place where you live? The response categories were "never", "sometimes", and "often." To assess secondhand smoke exposure, the categories of often and sometimes were collapsed and compared to never.

Household Composition The participants were asked if they lived with (1) children under the age of 13, (2) children ages 13 to 17, (3) adults 65 years and older, (4) a person with asthma, and (5) a person with respiratory or lung problems. To assess the number of smokers in the household, the participants were asked "Not including yourself, how many of the people who live with you currently smoke cigarettes?" To determine the household size, the participants were asked "Including children, how many people live with you there?" The proportion of household members who smoked was determined by dividing the number of tobacco smokers in the household by the household size.

Social Network Factors A network inventory was used to collect social network data. The participants provided the first name and first letter of the last name of individuals named in response to a set of name-generating questions such as "During the last six months, who could you talk to about things that were personal and private or who could you get advice from?" and "During the last six months, who actually loaned or gave you some money over $25?" The question "During the last six months, who are the people you smoked cigarettes with?" assessed the size of the cigarette smoking network. The proportion of network members who smoke was computed by dividing the size of the cigarette smoking network by the size of the total social network.

Tobacco Dependence Tobacco dependence was measured with the 9-item scale from the PATH study [33]. The items, such as "I usually want to smoke a cigarette right after I wake up" had a 5-point Likert scale (1–5) that ranged from "Not true of me at all" to "Extremely true of me." One item had substantial missing data (3%), and linear interpolation was used to replace missing values. The Cronbach's alpha was .851.

Neighborhood Disorder Neighborhood disorder was assessed with a 10-item scale from the Block Environmental Inventory [34]. On a 3-point scale (0–3), the participants were asked whether issues such as vandalism, vacant housing, trash in the streets, people fighting and arguing, people getting robbed or beat up on the street, and groups of teenagers hanging out on the street were "not a problem," "somewhat of a problem," or "a big problem" on their block. The scale's Cronbach's alpha was .907.

Demographic measures included age, sex at birth, race/ethnicity, level of education (grade 11 or less versus grade 12 or higher), and current employment status (unemployed versus employed). We also sampled 100 participants to examine the proportion with addresses that corresponded with the location of public housing units in Baltimore.

Analyses We restricted the analyses to those individuals who reported living with at least one other person, which was 70% of the sample (n = 413). Chi-square and t tests were used to examine associations with indoor smoking. The data were also modeled using multiple logistic regression. Variables were selected with p values <.20 in the bivariate analyses. The

demographic variables of age, gender, education, and employment status were also included in the multiple logistic regression models. Tobacco dependence, neighborhood disorder, and proportion of household and social network members who smoke were converted to *z*-scores for ease of interpretation. This model was restricted to 408 participants, as 5 participants had missing data for at least one variable.

Results

The majority of respondents were male (63.4%), African-American (89.3%), and unemployed (82.1%), with 12th-grade education or higher (55.9%). This was a middle age population. The median age was 48, mean 46.2 (SD = 10.1), 5.6% were ages 60 or older, and 10.2% were 30 or younger. About one-third (35.6%) reported living in their own home or apartment and a similar amount reported living in a family member's residence (37.5%). Fewer (17%) lived in "someone else's house or apartment" or "in a rooming, boarding, halfway house, or a shelter." Less than 1% (0.7%) lived in "other" settings. Most reported that they or others smoked inside their residence (72.6%). Smoking inside their residence was reported by 75.2% who had children in their household, 65.6% who lived with household residents aged 65 and older, 72.8% with a resident suffering from asthma, and in 71.4% households that reported someone with respiratory or lung problems. The vast majority (86%) also indicated that at least one social network member was a smoker. Most (69.6%) reported at least one network member they smoked with, and 76.4% stated that they lived with at least one smoker. In the sample of 100 participants, we found that the addresses of 18 participants corresponded with public housing locations.

In the bivariate analyses (Table 1), indoor smoking was not significantly associated with participant gender ($p = .148$), education ($p = .399$), or employment status ($p = .828$). There was also no association found between indoor smoking and the presence of household members most vulnerable to secondhand smoke (i.e. ages 13 and under [$p = .499$], ages 65 and older [$p = .171$], those with asthma [$p = .963$], or those with another respiratory or lung problem [$p = .853$]). However, indoor smoking was marginally associated with age ($p = .096$) and significantly associated with neighborhood disorder ($p < .001$), the proportion of network members who smoked ($p < .001$), and proportion of household members who smoked ($p < .001$) (Table 2).

In the multiple logistic regression model (Table 3), older age ($p = .006$), neighborhood disorder ($p = .002$), proportion of network members who smoked ($p = .033$), and proportion of household members who smoked ($p < .001$) remained significantly associated with indoor smoking at their residence. An increase in one standard deviation in the level of neighborhood disorder was associated with 1.5 times greater odds of reporting smoking occurring inside the participant's residence ($p = .002$). The level of tobacco dependence was not associated with indoor smoking ($p = .672$).

Discussion

In the present study, we found that the majority of the sample (73%) reported that they or others smoked inside their residence and that neighborhood disorder was strongly associated with participants reporting that they or others smoke inside their residence. This association even held after adjusting for the proportion of household and social network members who smoked. We do not know the mechanism that leads to this association. However, the present findings fit with a qualitative study of smoking ban barriers by Hoehn et al. [31]. They found that in addition to the barriers of living with extended family members who smoked and having smokers in their social networks, weather, neighborhood safety, and fear of police harassment were also barriers to smoking outside.

The issue of barriers to smoking outside among impoverished urban smokers has not been brought to the fore in the tobacco control literature and highlights the need to study and develop tobacco control programs tailored to impoverished communities with high rates of violence and tobacco use. To ensure that HUD's indoor smoking ban is effective with minimal negative consequences, HUD may want to consider implementing the policy in conjunction with facilitating safe outdoor areas. Safe green spaces may also reduce stress, which is linked to smoking and lower levels of cessation. In addition, subsidizing the costs and increasing access for nicotine replacement therapy may also help ensure that the new policy is effective.

The study findings highlight the need to address neighborhood- and individual-level factors, which leads

Table 1 Chi-squared analyses examining the association between indoor smoking and participant and household characteristics among a sample of impoverished smokers in Baltimore, MD ($n = 413$)

	No indoor smoking ($n = 113$) (%)	Indoor smoking ($n = 300$) (%)	Total ($n = 413$) (%)	χ^2	p
Gender					
Male	69.0	61.3	63.4	2.095	.148
Female	31.0	38.7	36.6		
Education					
Grade 11 or less	40.7	45.3	44.1	.712	.399
Grade 12 or higher	59.3	54.7	55.9		
Employment status					
Employed	18.6	17.7	17.9	.047	.828
Unemployed	81.4	82.3	82.1		
Household residents under age 13					
No	77.9	74.7	75.5	.458	.499
Yes	22.1	25.3	24.5		
Household residents age 65 and older					
No	80.5	86.0	84.5	1.875	.171
Yes	19.5	14.0	15.5		
Household residents with asthma					
No	75.2	75.0	75.1	.002	.963
Yes	24.8	25.0	24.9		
Household residents with respiratory or lung problems					
No	89.4	90.0	89.8	.034	.853
Yes	10.6	10.0	10.2		

to all-causes mortality, rather than focusing on addressing one health condition or disease. It is a formidable task to improve neighborhoods and provide pleasurable activities other than tobacco use to individuals with few resources. In tobacco control, as in other health fields that involve consumption of pleasurable behaviors, positive behaviors that are not simply the absence of harmful behaviors need to be promoted.

We also found that having a larger proportion of network members whom the participants smoked with was associated with greater likelihood of someone smoking in their residence. Hitchman et al. [35] reported that lower SES smokers tended to have more smoking friends as compared to moderate and high SES individuals. We also found that 30% of the participants reported that all their household members smoked and 86% had other smokers in their social networks. The strongest association with indoor smoking was the proportion of household members who smoked. With a greater proportion of smokers in the household, there may be

Table 2 Results of independent samples t test examining the association between indoor smoking and participant, household, social network, and neighborhood characteristics among a sample of impoverished smokers in Baltimore, MD ($n = 413$)

	n	No indoor smoking ($n = 113$) Mean (SD)	Indoor smoking ($n = 300$) Mean (SD)	Total ($n = 413$) Mean (SD)	t	p
Age	413	44.80 (10.13)	46.65 (10.07)	46.15 (10.10)	−1.67	.096
Level of tobacco dependence	413	31.23 (8.67)	32.72 (8.43)	32.31 (8.51)	−1.60	.111
Proportion of smokers in household	411	.27 (.35)	.60 (.37)	.51 (.39)	−8.10	<.001
Proportion of smokers in social network	411	.18 (.22)	.30 (.26)	.26 (.25)	−4.20	<.001
Neighborhood disorder	412	3.11 (4.01)	5.00 (4.42)	4.49 (4.39)	−4.15	<.001

Table 3 Logistic regression examining the association between indoor smoking and participant, social network, household, and neighborhood characteristics among a sample of impoverished smokers in Baltimore, MD ($n = 408$)

	Odds ratio	95% CI	*p*
Age	1.036	(1.010, 1.062)	.006
Gender			
Male	Ref.	–	–
Female	1.049	(0.619, 1.779)	.858
Education			
Grade 11 or less	Ref.	–	–
Grade 12 or higher	0.790	(0.578, 1.079)	.139
Employment status			
Employed	Ref.	–	–
Unemployed	1.686	(0.887, 0.467)	.715
Household residents age 65 and older			
No	Ref.	–	–
Yes	0.914	(0.479, 1.743)	.784
Level of tobacco dependence*	1.054	(0.827, 1.343)	.672
Proportion of smokers in household*	2.380	(1.766, 3.209)	<.001
Proportion of smokers in social network*	1.390	(1.027, 1.881)	.033
Neighborhood disorder*	1.543	(1.167, 2.042)	.002

*z-score

reinforcement for the behavior of indoor smoking, and it may appear normative. These findings suggest that it may be beneficial to intervene with social networks and households of smokers to promote norms to reduce indoor smoking and to train network members to support each other in quit attempts. These data also suggest that both the household and social network, although overlapping, should be targeted for interventions as both the proportion of household members and proportion of network members who smoked were independent predictors of indoor smoking.

The majority of respondents who reported that they resided with children, someone aged 65 and older, who has asthma, or who had respiratory or lung problems also stated that they or others smoked inside their household. We did not find that having household members who were young, old, or had respiratory problems was associated with indoor smoking. It may be that some of those household members who are elderly or have respiratory problems are also smokers. The social and neighborhood influences that facilitate indoor smoking may also be more powerful determinants of smoking behaviors than awareness of vulnerable and ill household members.

One of the limitations of the study was that it was not a random sample. It was a convenience sample comprised of predominately highly impoverished smokers. Although the study is recruited in neighborhoods with high levels of poverty, it is likely that more impoverished individuals (e.g., those who were unemployed) enrolled in the study, as compared to others in the neighborhoods. Regardless, in neighborhoods that have high levels of social disorder and where smoking is normative, indoor smoking in households of smokers also appears to be normative. This is an important public health issue for both smokers and nonsmokers who live in these neighborhoods. Other limitations should be noted. The question about indoor smoking asked whether the participants and other household members smoked inside the household. Consequently, we do not know if the participants or others were the ones smoking indoors. One advantage of this question, however, was that there was less social desirability bias compared to a question that solely focused on the participants' indoor smoking behaviors. The study was also cross-sectional, and hence it is impossible to disentangle if the results are due in part to differential affiliation or social and geographic influences on smoking behaviors. In addition, there may have been other critical neighborhood and social network influences on indoor smoking that we did not assess. We also did not ask the participants whether they lived in federally funded subsidized housing where indoor smoking bans are being phased in. However, in reviewing a sample of addresses, we

estimate that less than 20% reside in federally funded public housing, though some participants may have received vouchers or other subsidies for housing.

The data support the promotion of indoor smoking bans and changing the social norms of indoor smoking. It would be a mistake to refrain from promoting indoor smoking bans in neighborhoods with high levels of social disorder. In addition to reducing exposure to secondhand smoke, indoor bans are associated with increased and successful quit attempts [36]. In impoverished communities, household smoking bans should also consider the feasibility of alternative smoking locations and work in conjunction with economic and neighborhood improvement programs to provide safe environments and alternatives to smoking. More effective smoking cessation programs are also needed for low-income communities [37]. In addition to reducing tobacco-related mortality and morbidity, cessation can reduce psychological stress associated with smoking and economic stress related to the cost of tobacco products.

Acknowledgments This research was supported by the FDA and NIH grant support, Award No. 5R01DA032217-04S1 and research reported in this publication was supported by the NIDA/NIH and FDA Center for Tobacco Products (CTP). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Food and Drug Administration.

Compliance with Ethical Standards The study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board. Eligible participants provided written informed consent.

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