Moving Beyond Self-Report: Neighborhood Disorder, Safety and Physical Activity

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Brief Abstract (<= 150 words)

Lack of neighborhood safety may inhibit physical activity. Stronger associations with activity have been observed using self-reported safety than using independently recorded measures such as crime rates. This may reflect relevance of between-individual differences in perceptions of safety for physical activity, or same-source bias (correlated errors), or an environmental characteristic such as physical disorder undermining both perceived safety and physical activity. We combined self-reported measures of neighborhood safety and physical activity from 509 adult residents of New York City, accelerometer measures of physical activity, and a neighborhood disorder measure developed from systematic observations of Google Street View imagery. Neighborhood disorder was not associated with self-reported or accelerometer-measured physical activity. Perceived lack of safety was associated with 33% greater odds (95% CI: 1.11-1.59) of reporting no physical activity but not with lower levels of objectively measured physical activity. Perceived lack of safety's association with less reported activity may reflect same-source bias.

Extended Abstract

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Background

Physical activity has substantial benefits to both physical and mental health [1], yet only about a third of American adults reported meeting Healthy People 2010 physical activity recommendations [2]. It has been suggested that lack of neighborhood safety may be an impediment to walking, and thus to overall physical activity. Findings from studies linking neighborhood safety to physical activity have been inconsistent, however, which may reflect differences in how neighborhood safety has been measured and analyzed [3].

Neighborhood safety can be measured through independent data sources, such as reported crime rates or systematically observed neighborhood disorder. However, crime rates capture only *reported* crimes and also fail to account for between-subject variation in probability of crime victimization. Neighborhood disorder is also problematic, as it may affect activity levels not only by stimulating criminal activity or fear of crime victimization [4] but also more directly due to the discomfort and aesthetic displeasure of experiencing a chaotic environment [5].

An alternate method to assess neighborhood safety is to ask each subject if his or her neighborhood is safe. However, self-reported measures are subject to errors in reporting, and when analyzed with respect to other self-reported measures such as self-reported physical activity may be subject to 'same-source bias' as well [6]. For example, if a subject's awareness of having reported no physical activity increases the subject's likelihood of reporting the neighborhood to be unsafe as a justification for the lack of activity, then these correlated errors can lead to substantial overestimates of the association between neighborhood safety and activity [7].

Comparing self-reported and accelerometer-derived measures of physical activity can help to distinguish whether self-reported measures or independent measures of neighborhood safety should be preferred. If perceived safety is more salient for physical activity than independently observed measures of safety, then perceived safety should be associated with *both* self-reported and accelerometer-measured physical activity. By contrast, if the link between perceived safety and physical activity is an artifact of same-source bias, then it should be more strongly associated with self-reported than accelerometer-measured physical activity. The role played by neighborhood disorder can be assessed similarly: if disorder affects activity solely by decreasing perceived safety, then disorder should be associated with perceived safety and physical activity but the association between perceived safety and physical activity should not be attenuated after adjusting for neighborhood disorder. If disorder affects both perceived safety and activity directly, then adjusting for disorder should attenuate the association between perceived safety and both self-report and accelerometer-measured activity.

However, to the best of our knowledge, no previous study has investigated the association between neighborhood safety and physical activity using objective measures of both neighborhood safety and physical activity or compared those results to the association of study-subject self-reported neighborhood safety and self-reported physical activity. In this study, we examined the socio-demographic correlates of neighborhood disorder and reported crime in a cross-sectional sample representing the adult population of New York City. We investigated the relationship of disorder and

crime to perceived safety, and further compared both objective disorder and perceived safety to both self-reported physical activity and objectively measured physical activity.

Methods

The New York City Physical Activity and Transit (PAT) survey was a multi-wave random-digit dial cross-sectional study of adult residents of New York City [8]. In wave 2 of this study, conducted in 2011, 2,488 adults who completed the survey were invited to wear a Global Positioning System (GPS) device (US GlobalSat DG-100 GPS logger) and an accelerometer (ActiGraph GT3x triaxial accelerometer) for seven consecutive days. Of those invited, 1,134 (42.5%) subjects agreed to participate, and 803 (70.8% of those who agreed) returned the monitors with any GPS monitoring data. Following the protocol originated for the National Health and Nutrition Examination Study (NHANES) [9], accelerometer cases were considered valid if accelerometers contained 4 or more 10 hours days. Additionally, this study required at least 4 days with any GPS data. Of the 803 participants, 679 had valid accelerometer data; of these 603 had any GPS data and 509 had 4 or more days. These 509 comprised our final sample. Sample selection and race/ethnicity, age, and sex totals from the 2010 US Census were used to compute weights using constrained raking such that weighted analyses reflected the population of New York City as a whole.

Each subject reported race/ethnicity, education, age, gender, relation of household income to poverty level, self-rated health, children in household, and whether he/she felt safe going on a walk in his/her neighborhood during the day because of crime. Self-reported physical activity was assessed using the World Health Organization Global Physical Activity Questionnaire (GPAQ) [10].

Accelerometer data was processed to compute daily average moderate-equivalent minutes of activity following the protocol developed for the 2003-2006 NHANES [8,9].

Neighborhood disorder was measured by virtual street audit using the Computer Aided Neighborhood Visual Assessment System (CANVAS) [11]. Nine audit items, assessing (1) litter, (2) empty alcohol bottles, (3) graffiti, (4) burned out buildings, (5) abandoned buildings, (6) abandoned cars, (7) poor building maintenance, (8) vacant lots, and (9) bars on windows, were assessed on a sample of Google Street View imagery from 532 street segments across New York City. Imagery dated from 2007-2011. Items were combined to estimate a latent level of physical disorder, and a raster surface estimating disorder across the city was constructed using kriging [12,13].

Subject reported addresses were geocoded from self-reported street address and verified by ensuring that a high proportion of GPS points clustered near the geocoded location. Next, by geographically intersecting a 1km radial buffer around the subject's geocoded reported address with the disorder surface, we estimated an objective neighborhood disorder level for each subject.

Preliminary Results: Neighborhood Disorder and Self-Reported Measures

As expected, neighborhood disorder was generally higher for more disadvantaged subjects (Table 1, next page). However, neighborhood disorder was not significantly associated with accelerometer-measured moderate-equivalent minutes of physical activity or with self-reported physical activity, either in analyses adjusting only for total hours worn or after adjusting for age group, household income, race/ethnicity or presence of one or more children in the household (data not shown).

Perceived safety was inversely related to disorder, but the relationship was not statistically significant after adjusting for individual characteristics. In unadjusted analysis, a one Z-score unit increase in

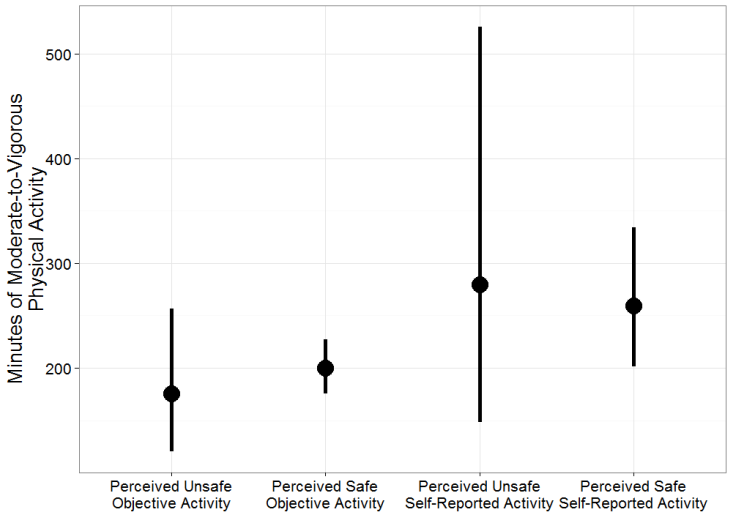
neighborhood disorder was positively associated with 62% higher odds of reporting that it was unsafe to walk during the day owing to crime (95% CI: 1.03, 2.57), but the elevation in odds dropped to 33% and became non-significant after adjusting for individual-level covariates (95% CI: 0.69, 2.59).

Subjects who reported that it was unsafe to walk in their neighborhood during the day had 25% lower odds (95% CI: 0.63, 0.90) of reporting any physical activity compared with those who reported safe neighborhoods. However, accelerometers worn by subjects who reported unsafe neighborhoods recorded approximately the same amount of physical activity as for subjects who reported safe neighborhoods: the geometric mean of moderate-equivalent physical activity for subjects reporting safe neighborhoods was 200 (95% CI: 176, 227) minutes/week as opposed to 176 (95% CI: 120, 256) minutes/week for subjects reporting unsafe neighborhoods. Figure 1 displays objective and self-reported measures of physical activity as related to perceived neighborhood safety.

Table 1: Selected demographic characteristics of study subjects and mean disorder levels

	N	Neighborhood Disorder (mean)	P-value
Education			
< High School	52	0.087	REF
High School	123	-0.026	0.012
Some College	144	-0.071	<0.001
College	119	-0.108	<0.001
Graduate School	130	-0.140	<0.001
Ratio of Household Income to Poverty Level			
<100%	81	0.034	REF
100-199%	96	0.008	0.652
200-399%	104	-0.051	0.068
400-599%	101	-0.081	0.021
600+%	139	-0.201	<0.001
Don't know or refused	48	-0.039	0.178
Self-rated health			
Excellent	129	-0.085	REF
Very good	194	-0.097	0.717
Good	160	-0.014	0.068
Fair or Poor	86	0.017	0.009
Neighborhood Perceived as Unsafe			
Yes	60	0.034	REF
No	507	-0.065	0.007

Figure 1: Objective and self-reported physical activity as related to percieved neighborhood safety



Preliminary Conclusions

Based on preliminary results, it appears that perceived safety was not associated with objectively measured activity levels but was associated with reporting any physical activity. This result is consistent with the association between neighborhood safety and physical activity representing same-source bias, wherein error in self-reported neighborhood conditions is correlated with error in self-reported physical activity [14,15]. Neighborhood disorder does not appear to affect physical activity directly or through perceived safety.

Further Analyses

Future analyses will incorporate

neighborhood reported crime as a predictor of physical activity and compare neighborhood disorder to reported crime.

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