Published in final edited form as:
J Phys Act Health. 2008 January ; 5(1): 117–131.

The Association of Perceived and Objectively Measured Crime With Physical Activity: A Cross-Sectional Analysis

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Abstract

Background—Crime is one aspect of the environment that can act as a barrier to physical activity. The goals of this study were to (1) compare measures of perceived crime with observed crime and (2) examine the association between the independent and combined effects of objective and perceived crime on physical activity.

Methods—Perceived crime and physical activity were assessed in 1659 persons via telephone survey. Crime was objectively measured in a subset of 303 survey participants.

Results—For all types of crime, there was low agreement between objective and perceived measures. Both perceived and objectively measured crime were independently associated with leisure activities.

Conclusions—This study suggests that perceptions and objective measures of crime are both important correlates of leisure physical activity. Evaluating both measures is necessary when examining the relationship between crime and physical activity to develop interventions that will most influence leisure physical activity levels.

Keywords

epidemiology; physical activity; crime; objective measures; perceptions

Background

Despite the well-documented health benefits of physical activity,[1] a substantial percentage of US adults are not active enough to meet the current recommendations for physical activity (at least moderate-intensity activity for at least 30 minutes a day on most, preferably all, days of the week or vigorous-intensity activity).[2] It is possible that this lack of adequate physical activity is the result, in part, of the community environment in which one lives.[3] The socio-ecological framework of health behaviors purports that choices in individual behavior are influenced by a myriad of factors, some inherent to the individual and others present in the environment in which the behavior occurs.[3] In fact, the health behavior of physical activity is theorized to be influenced at many levels, including the individual (eg, motivational factors and social support), institutional (eg, work-site physical activity programs), community (eg, high crime rates), and policy levels (eg, zoning regulations).[3] Until more recently, one of the least studied of these levels in physical activity research was the community or physical environment. Crime is one aspect of the community environment that has been proposed as a barrier to physical activity.[4,5]

Although participants in many qualitative studies[6–9] cite crime and safety issues as a barrier to physical activity, few quantitative studies have assessed crime specifically as a self-reported barrier to physical activity.[10,11] In addition, few studies of adults[12–14] included objective measures of crime to examine these associations. To our knowledge, only 1 study has obtained both self-reported and objective measures of crime and examined the interplay of these measures with physical activity in adults.[13] They found no association between perceived or objective crime and transportation or recreational activity in this study; however, crime was objectively measured as the number of crime watch signs, which can be considered a measure of the ability of a neighborhood to come together to fight crime and not of crime itself.

This current study expands on past work by obtaining actual crime locations and examining the independent and combined effects of perceptions and objective measure of crime on physical activity. The goals of this study were to compare measures of perceived crime with actual locations of crime and examine the association between the independent and combined effects of self-reported physical activity with objectively measured crime, perceived neighborhood crime, and the perception of crime as a barrier to physical activity.

Methods

Source Population

From January to July 2003, a random digit dialed phone survey of the noninstitutionalized adult population in 2 distinct geographic locations (Forsyth County, NC, and the city of Jackson, MS) was conducted. A disproportionate sampling strategy was adopted for the Forsyth County, NC, sample frame to ensure representation for areas outside of the Winston-Salem metropolitan area but within the county. The survey was approved by the Institutional Review Board at the University of North Carolina with more detailed information published elsewhere.[15]

Physical Activity

Several domains of self-reported physical activity were obtained through the phone survey and are described briefly here, with more detail on their test–retest reliability elsewhere.[16] Leisure activity was assessed using questions from the Behavioral Risk Factor Surveillance System (BRFSS) module on physical activity used from 1986–2000,[17] and respondents were categorized into 1 of 3 levels based on the 1996 US Surgeon General's Report,[1] American College of Sport Medicine and Centers for Disease Control and Prevention recommendations[2]: (1) meets recommendations, (2) insufficiently active, (3) inactive. Because we were interested in the association between physical activity and the neighborhood environment, we defined an analogous 3-level outdoor leisure-activity variable by taking into account only those leisure activities performed outdoors and near one's home based on responses to questions on whether respondents had places to be physically active (indoors, outdoors, or both) and where these activities were usually performed (near home, work, home and work, or some other place). As such, the outdoor leisure-activity variable is more restrictive in that it does not include those leisure activities generally performed indoors (ie, health club exercise or weightlifting) or outdoors and away from home (ie, mountain climbing or water skiing).

Walking was assessed using questions from the 2001 optional BRFSS module on physical activity, and respondents were categorized into 3 activity categories based on the aforementioned recommendations. Transportation activity was assessed by asking how much time was spent walking or bicycling for transportation in a usual week. Participants were categorized as having engaged in any transportation activity if they walked or bicycled for transportation purposes for at least 10 minutes in a usual week.

Perceived Measures of Crime

A 6-item measure developed by Saelens et al[18] was used to assess perception of crime in the neighborhood. Each of the 6 questions was answered on a 4-point Likert scale, from which a crime-safety index was calculated by adding the 6 items together and taking the mean, such that the range of the score was from 1 (lower crime) to 4 (more crime). Results from the reliability survey performed on a subset of survey participants[19] indicated that this crime-safety index had substantial reliability (intraclass correlation coefficient = .68; 95% CI, .57–.77), consistent with the reliability found by Saelens et al.[18] In addition, respondents were asked if crime, or fear for personal safety, was a barrier to being physically active (yes/no), and this perceived measure also had substantial reliability (kappa = .79; 95% CI, .65–.93).

Other Survey Measures

Self-reported socio-demographic information collected from the survey included age, gender, marital status, work activity, number of children in the household, education, race/ethnicity, household income, and availability of a motor vehicle for personal use. Other questions asked of the respondents included general health and presence of health problems or disability that limit physical activity. All of these measures were considered as potential confounders based on a review of the literature. In order to account for differential reporting of crime between low and high socioeconomic neighborhoods, we also considered neighborhood socioeconomic status (SES) as a potential confounder in all models.

Neighborhood SES was defined as the median household income of the block group that each participant resided in and was obtained from the 2000 US Census.

Objective Measures of Crime

Objective measures of crime were obtained for 303 persons whose home addresses fell within a half mile of the city limits of Winston-Salem, NC. Crime location data were not available for rural Forsyth County, NC, or Jackson, MS. The home addresses of these participants were considered point locations allowing for the definition of participant-specific neighborhoods by drawing a buffer of uniform radius around each point. A 1-mile radius was chosen to define each participant's neighborhood to match the survey definition of the respondent's neighborhood as "a 20-minute walk or 1 mile from (their) home." Smaller radii of a half-mile and an eighth-mile were also evaluated, as it was hypothesized that smaller areas around one's home might be more influential in an individual's choice to be physically active than a 1-mile radius.

Crime was quantified as the number of calls for service, including all emergency and nonemergency citizen-generated calls and any officer-initiated activities, to the Winston-Salem Police Department. The exact address location of all calls for service was classified by 2 independent reviewers by whether or not the crime was likely to affect a person's decision to be active in their neighborhood. All 110,432 crimes hypothesized to have the potential to affect outdoor physical activity that occurred between July 2002 and July 2003 (1-year period preceding the last month telephone surveys were conducted) were used to construct the objective measures of crime (referred to as "total crimes"). Two independent reviewers also categorized these crimes into 3 types: criminal offenses (n = 30,957), incivilities (n = 58,627), and traffic-related offenses (n = 20,848). Traffic-related offenses included all traffic accidents, hit and runs, reckless driving, traffic violations, and driving while under the influence charges. Physical and social incivilities included minor forms of misbehavior (eg, public drunkenness) and attributes of the neighborhood that might create a feeling of disorder (eg, graffiti). The remaining offenses constituted the criminal-offense category and primarily included the crimes listed in the FBI's Crime Index: murder, rape, robbery, aggravated assault, burglary, larceny-theft, motor-vehicle theft, and arson. Other crimes that were included in the criminaloffense category because of the threatening nature of the crime were foot chase, illegal weapons, impersonating an officer, offense against a family member, kidnapping, and missing persons.

Crimes were mapped at the address level by study staff or by a specialized firm, with 94.4% of crimes successfully mapped. Each crime category was then aggregated to the buffer around each participant and normalized by population obtained from the 2000 US Census to produce a crime rate. Analyses were also performed using raw counts of crime (instead of crime normalized by population), producing similar results and thus are not shown here. The raw counts of total crimes for each participant's 1-mile buffer ranged from 215 to 11,211; the total-crime rate ranged from 0.11 to 1.52.

Statistical Analysis

We compared the subsample for whom we have objective measures of crime (n = 303) to the remaining sample by treating the 2 groups as independent samples using chi-square statistics. Agreement between objectively measured crime and perception of (1) neighborhood crime (as measured by the crime-safety index) and (2) crime or fear for personal safety as a barrier to physical activity was calculated using kappa statistics. Kappa statistics were also calculated stratifying by activity level to determine if agreement differed between active and inactive individuals. Agreement was categorized according to Landis and Koch's[20] classification: kappa values between 0 and .2 were considered poor, .2 to .4 fair, .4 to .6 moderate, .6 to .8 substantial, and .8 to 1.0 almost perfect.

Associations between physical activity outcomes and (1) perceived neighborhood crime and (2) perceived crime or fear for personal safety as a barrier to physical activity, (3) objectively measured crime and (4) combinations of perceived measures and objective measures, were examined with either logistic regression modeling (for binary outcomes) or generalized logits modeling (for 3-level outcomes). Stratified analyses were performed to assess gender as an effect modifier of perceived neighborhood crime and perceived crime or fear for personal safety as a barrier to physical activity and tested by modeling statistical interaction terms.

Potential confounders were chosen separately for perceived crime and for objective crime for each outcome using backward single elimination with a 20% change in estimate criteria. In addition, potential confounders were chosen separately for each type of objective crime (total, criminal, incivilities, and traffi-coffense) as the relationship between physical activity and the different exposures might be confounded by different variables. Race/ethnicity, age, and gender were kept in all models, regardless of the percent change in estimate, because of the known influence these variables have on physical activity levels. Prevalence estimates were weighted to account for the probability of selection and adjusted with poststratification weights based on age and sex to reduce the effects of sampling error and nonresponse bias and to make the data more representative of the general population under study. All other analyses were performed on unweighted data because it has been shown that weights have modest effects on associations within a population.[21] Analyses were conducted using SAS Version 8.2 (SAS Institute Inc, Cary, NC.) For these analyses, adjustment for multiple testing was not performed.

Results

Sample Characteristics

In total, 1659 participants agreed to participate in the survey. Most of the total sample was either non-Hispanic White or non-Hispanic Black (Table 1). In general, the weighted sample was highly educated with approximately two-thirds reporting more than a high school diploma. Most of the sample was not partnered or did not have minor children living in their household. Approximately 15% of the population considered themselves to be of poor or fair general health, and one-eighth had a moderate or severe disability that limited physical activity or exercise. Roughly 30% of respondents reported no leisure activity in the past month, approximately one-fifth of respondents reported not walking for any purpose in a usual week, and two-thirds reported no transportation activity in a usual week. The subsample of participants for whom we were able to collect objective data did not differ significantly from the overall sample with regards to socio-demographic and physical activity characteristics (all $P > .05$).

Agreement

Overall agreement between objective measures of total crime and the crime-safety index (weighted kappas [95% CI]: 1-mile, .12 [.04–.20]; half-mile, .18 [.10–.26]; eighth-mile, .22 [.14–.30]) and perception of crime or fear for personal safety as a barrier to physical activity (kappas [95% CI]: 1-mile, .21 [.13–.29]; half-mile, .23 [.16–.31]; eighth-mile, .19 [.11–.27]) was poor across all buffer sizes. When stratified by crime type (ie, criminal offenses, incivilities, and traffic-related offences), similar ranges and patterns in percent agreements were found between objective and perceived crime, except for traffic-related crimes, which tended to have lower agreement, likely a result of the fact that perceived crime measures inquired about crime rates and personal safety, not about traffic safety per se (data not shown). When stratified by activity level for each type of physical activity, there were no clear patterns in the strength of agreement by categories of leisure, outdoor leisure, walking, or transportation activity, indicating no difference in agreement between active and inactive individuals (data not shown).

Association of Perceived Crime and Incivilities With Physical Activity

Perception of neighborhood crime was modeled using quartiles of the crime-safety index as the independent variable using data from all 1659 survey respondents. Respondents perceiving less crime in their neighborhood were more likely to be active than to be inactive for leisure physical activity (Table 2, Model Set 1; outcome = LTPA). When only those leisure activities that are performed outdoors were evaluated, the strength of this association was even greater (Table 2, Model Set 2; outcome = Outdoor LTPA). In general, there were no associations seen between walking or transportation activity and perception of neighborhood crime.

Those who perceived crime or fear for personal safety as not being a barrier to physical activity were 40% more likely to meet recommendations and 30% more likely to be insufficiently active than to be inactive during leisure activity than were those who perceived crime or fear for personal safety as being a barrier to physical activity (Table 2, Model Set 2; outcome = LTPA). Similar associations were found for outdoor leisure activity.

The association between perceptions of neighborhood crime or perceived crime or fear for personal safety and physical activity did not differ between men and women in all models from Table 2.

Association of Objectively Measured Crime and Incivilities With Physical Activity

Those participants whose 1-mile buffers were categorized as having low objectively measured total crime (Table 3, Model Set 3, outcome = LTPA) were about two and a half times more likely to meet recommendations for leisure activity than to be inactive compared with those who resided in higher crime-rate areas. When exploring by crime type, this positive association was stronger for criminal offenses (Table 3, Model Set 4, outcome = LTPA) and attenuated for incivilities (Table 3, Model Set 5, outcome = LTPA) and traffic-related offenses (Table 3, Model Set 6, outcome = LTPA). Similar findings were found for outdoor leisure activity. These analyses, however, were limited to the 303 participants for whom objective measures were obtained; thus, any results must be interpreted with caution because the point estimates derived from these models were imprecise.

The associations between physical activity and crime differed between the smallest (eighth-mile) and largest (1-mile) buffer sizes (data not shown). For example, there were significant associations for transportation activity in the smallest buffer size, and these associations were attenuated as the buffer size increased, (total crimes: eighth-mile OR = 0.5, 95% CI, 0.3–0.9; half-mile OR = 0.6, 95% CI, 0.4–1.1; 1-mile OR = 1.2, 95% CI, 0.7–2.1) suggesting that the area right around one's home is more influential for transportation activity. Alternatively, the largest buffer size produced the strongest point estimates for leisure activities (total crimes: eighth-mile OR = 1.5, 95% CI, 0.7–3.2; half-mile OR = 1.1, 95% CI, 0.5–2.6; 1-mile OR = 2.6, 95% CI, 1.2–5.9), perhaps indicating a larger area around one's home is more influential in these activities. More research is needed to determine the optimal buffer size to consider when exploring such associations.[22]

Combined Associations of Perceived and Objectively Measured Crime/Incivilities With Physical Activity

Because of the associations found between perceived crime or fear for personal safety as a barrier to physical activity (Table 2, Model Set 2) and objectively measured crime on physical activity levels (total crimes—Table 3, Model Set 3 and criminal offense—Table 3, Model Set 4), we evaluated the combined association of perceived crime or fear for personal safety as a barrier to physical and objectively measured crime (Table 4, Model Set 7) with the different types of physical activity. Because of the small sample size, point estimates are imprecise; however, in general, for the outcomes of leisure and outdoor leisure activity, the perceived measures were somewhat attenuated after controlling for objective measures of crime, whereas the objective measures of crime were not changed. For the outcomes of walking and transportation activity, having both perceived and objective measures of crime in the same model did not affect the point estimates substantially. We also assessed the model fit of the independent and combined models using likelihood ratio tests. For the outcomes of leisure and outdoor leisure activity, the models with both objective and perceived variables were a significantly better fit than those with perceived measures alone, and there was no significant difference in model fit between the models with both objective and perceived variables and the models with objective variables alone. The opposite was observed for the outcomes of walking and transportation activity; the models with both objective and perceived variables had a significantly better fit than the models with objective measures alone, and there was no difference in model fit between the models with both objective and perceived variables and the model with perceived variables alone. These results might be suggesting that objective measures play a larger role in leisure activity, whereas perceptions play a larger role in utilitarian (walking and transportation) activity.

Discussion

Results of this study imply that perception of crime in the neighborhood is a detriment to leisure and outdoor leisure activity. These results are corroborated by studies, such as one conducted by the CDC, in which data from the BRFSS in 5 states found that adults with higher levels of perceived neighborhood safety had higher levels of leisure activity even after controlling for other factors,[23] and one conducted by Huston et al,[24] which found a positive, nonsignificant relationship between neighborhood safety and leisure activity in a population-based sample from 6 counties in North Carolina. It is surprising that few epidemiologic studies have assessed whether the perceived safety of one's physical environment was a personal barrier to physical activity behavior, and those that have, asked about the lack of a safe place to exercise as a barrier to physical activity rather than a high crime rate or fear for personal safety being a barrier to physical activity. In the current study we found that those who perceived that crime or fear for personal safety was not a barrier to physical activity were more likely to be active than to be inactive. These findings are not surprising given the congruent results of many focus groups that indicate that personal safety and fear of crime are a barrier to physical activity.[6–9]

In addition to perception of crime, we were also able to evaluate objectively measured crime, albeit for a small sample of the study population. We found, for the most part, that respondents whose 1-mile radius around their home was categorized as a low-crime area, based on objective measures, were more likely to be active during leisure time than those whose 1-mile radius was categorized as a high-crime area. Furthermore, the importance of measuring both perceived and objective crime was confirmed by the results of the models combining objective and perceived crime measures. Although point estimates from all the models with perceived and objective variables were imprecise, objective crimes were related to leisure activity, but adding perceived crimes did not improve model fit. By contrast, perceived crimes were related to walking and transportation activity, but adding objective crimes did not improve model fit. Additional studies should examine further whether our preliminary findings hold in other populations.

One explanation for our results is that our objective and perceived measures of crime did not substantially agree, suggesting that the 2 measures might be assessing different dimensions of one's physical environment. Findings from Kirtland et al,[12] with an overall kappa of .22 for perceived safety compared with objective crime for a half-mile neighborhood, support this conjecture. The lack of agreement between objective measures of criminal activity and perceived measures of criminal activity might be the result, at least partially, of measurement error. We mapped all calls for service in a geographical area, but calls for service might be an underrepresentation of actual crime because not all crimes are reported to the police. For example, incivilities might be present in an area, such as loiterers or unattended dogs, but the police are never called. Even criminal offenses are not always reported because of embarrassment of the victim or fear of retaliation. There is also the potential for differential reporting between high and low socioeconomic neighborhoods with higher SES neighborhoods reporting offenses more often than lower SES neighborhoods. For such reasons, we attempted to account for this by considering neighborhood income obtained from the census as a potential confounder in all models.

This study is one of the first to date to examine the association of perceived crime and objectively measured crime in relation to levels of physical activity among adults. There were several limiting factors, however. We included only 2 geographical areas to investigate these associations, and the survey respondents tended to be highly educated in these areas. Thus, results of these analyses might not be generalizable to other populations. In addition, we were able to obtain objective measures of crime only for a small subsample of participants. Despite the limited statistical power, this study helps provide insight into important potential determinants of physical activity and the role that the neighborhood environment might play in determining physical activity behavior. Future research should examine objective measures of crime for larger study areas and assess interactions with SES and between perceived and objective measures of crime, because there might be a synergistic effect of the 2 measures of crime. For example, if crime is perceived as high and crime is actually high, the synergy of the 2 might make it more likely that one is not active.

Another limitation, which might affect the results of this study, is the propensity for individuals to go outside of their immediate neighborhood to exercise. This can occur for at least 2 reasons. First, it might be more convenient for individuals to exercise near work as opposed to near their home. Although we did not collect work addresses, we do have information on where leisure activities were performed (near their home, near their workplace, or neither). Thus, in addition to analyzing the data using all leisure activities, we also performed the analyses using only those activities performed outdoors near the home (ie, outdoor leisure activity). Second, individuals who reside in areas that are not conducive to activity might go elsewhere to engage in physical activity. In an effort to evaluate this limitation, participants were asked if they have places to be physically active (indoor, outdoor, both, or neither) in their neighborhood. Most of the respondents (>87%) indicated that they had places outdoors to be physically active. A further limitation of this study is the inability to control for variables that might affect the choice an individual makes about where to live. If individuals choose to live somewhere because of the characteristics of those areas (ie, an individual moves to a neighborhood because it is a safer neighborhood to walk, or because it has a pattern of streets amenable to walking), it becomes difficult to separate the direction of causality between individual values, the environment, and that individual's physical activity behavior. Thus, any interpretation of the data will need to take into account the cross-sectional nature of the data. Last, in this study we tested many associations but chose not to adjust for multiple testing because we considered this study exploratory. Therefore, significance should be interpreted with caution, and replication of results is needed.

Conclusions

The evaluation of crime as a correlate of physical activity can lead to a clearer understanding of whether it is unsafe environments with high criminal activity, unfounded fear, or a combination of the 2 that affects physical activity. This article lends support to the idea that both objective and perceived measures of crime have important, cross-sectional, independent associations with levels of leisure and outdoor leisure activity. To help alleviate perception of crime, or unfounded fear, health-promotion campaigns that encourage the benefits of leisure physical activity and emphasize the safety of the neighborhood, as well as the many benefits of exercising with others, should be implemented. Although perceived and objectively measured crime were shown to have small effects on levels of leisure physical activity, small changes in the environment, such as a neighborhood watch program, might result in large population-level changes in physical activity.

Acknowledgments

This study was funded by a grant from the American Heart Association. The lead author was also funded, in part, by NIH, NHLBI, NRSA Training Grant No. 5-T32-HL007055.

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Table 1

Prevalence of Socio-Demographics, General Health, and Physical Activity of Survey Respondents

	Weighted % (n)		
	Jackson, MS, N = 774	**Forsyth County, NC, N = 884**	**Winston-Salem, NC,[a] N = 303**
Gender			
male	45.6 (263)	46.6 (295)	45.5 (96)
female	54.4 (511)	53.4 (590)	54.5 (207)
Age			
18–29	26.8 (150)	22.0 (126)	27.2 (50)
30–44	30.4 (229)	31.6 (250)	31.5 (85)
45–64	27.6 (250)	29.6 (343)	24.4 (102)
≥65	15.2 (145)	16.8 (166)	16.9 (66)
Education			
<high school	9.4 (79)	8.6 (66)	8.5 (20)
high school equivalency	22.0 (172)	22.9 (217)	21.9 (70)
some college	24.6 (190)	24.5 (215)	21.6 (66)
college graduate	44.0 (331)	44.0 (386)	48.1 (146)
Marital status			
unpartnered	72.2 (484)	50.0 (359)	60.4 (154)
partnered	27.8 (287)	50.0 (526)	39.6 (149)
Race/Ethnicity			
White, non-Hispanic	34.8 (276)	74.5 (702)	58.8 (196)
Black, non-Hispanic	59.5 (457)	20.1 (139)	36.9 (94)
other	5.7 (41)	4.9 (42)	4.4 (12)
Annual household income			
<$25,000	38.8 (292)	23.6 (172)	29.6 (73)
$25,000–$50,000	30.2 (233)	30.6 (266)	29.1 (92)
≥$50,000	24.8 (198)	39.9 (380)	36.4 (115)
Number of children			
none	65.7 (485)	62.8 (558)	63.6 (194)
1	14.8 (134)	18.6 (169)	20.5 (62)
2 or more	19.5 (153)	18.6 (158)	16.0 (47)
General health			
excellent/very good	50.6 (375)	60.6 (528)	62.7 (181)
good	31.0 (247)	28.0 (246)	24.3 (74)
fair/poor	18.4 (150)	11.4 (110)	13.0 (47)
Disability			
none/mild	87.4 (667)	87.7 (762)	87.7 (258)
moderate/severe	12.6 (99)	12.3 (118)	12.3 (43)
Availability of motor vehicle for personal use			

	Weighted % (n)		
	Jackson, MS, N = 774	**Forsyth County, NC, N = 884**	**Winston-Salem, NC,[a] N = 303**
very often/often	89.6 (693)	94.5 (841)	90.3 (276)
sometimes/never	10.4 (79)	5.5 (42)	9.7 (27)
Work activity			
unemployed	34.5 (285)	35.2 (337)	36.2 (119)
mostly sitting or standing	45.0 (235)	45.3 (378)	40.7 (118)
mostly walking or heavy labor	20.5 (146)	19.6 (161)	23.2 (64)
Leisure-time physical activity			
inactive	31.2 (248)	27.0 (248)	31.4 (102)
insufficiently active	43.3 (330)	45.9 (412)	38.8 (116)
meets recommendations	25.5 (196)	27.1 (224)	29.8 (85)
Outdoor leisure-time physical activity			
inactive	43.9 (340)	41.7 (369)	45.7 (143)
insufficiently active	39.5 (306)	43.8 (387)	37.7 (114)
meets recommendations	16.5 (128)	14.5 (128)	16.6 (46)
Walking activity			
inactive	21.6 (166)	20.8 (178)	23.2 (63)
insufficiently active	41.7 (339)	45.0 (408)	43.8 (142)
meets recommendations	36.7 (269)	34.2 (299)	33.0 (98)
Transportation activity			
none	69.2 (533)	71.0 (629)	68.3 (211)
any	30.8 (226)	29.0 (237)	31.7 (85)

[a]Those respondents whose home address fell within a half-mile of the city limits of Winston-Salem, NC.

Table 2

Weighted Prevalence and Adjusted Odds Ratios[a] With 95% Confidence Intervals for Perception of Neighborhood Crime and Perception of Crime as a Barrier to Physical Activity (n = 1659)

		Physical activity outcomes						
		Leisure-time physical activity		Outdoor leisure-time physical activity		Walking activity		Transportation activity
Main exposure	**Weighted prevalence (n)**	**Meets recommendations vs. inactive**	**Insufficient vs. inactive**	**Meets recommendations vs. inactive**	**Insufficient vs. inactive**	**Meets recommendations vs. inactive**	**Insufficient vs. inactive**	**Any activity vs. no activity**
Model Set 1: perception of neighborhood crime (crime safety index)								
quartile 1 (low crime)	26.9 (433)	1.4 (1.0–2.0)[b]	1.3 (1.0–1.9)[b]	1.5 (1.0–2.2)[b]	1.5 (1.1–2.0)[b]	1.3 (0.9–1.9)	1.2 (0.8–1.7)	0.9 (0.7–1.2)
quartile 2	26.4 (423)	1.1 (0.8–1.6)	1.4 (1.0–1.9)[b]	1.3 (0.8–1.9)	1.5 (1.1–2.1)[b]	1.3 (0.8–1.9)	1.8 (1.2–2.6)[b]	1.2 (0.9–1.6)
quartile 3	22.0 (378)	1.0 (0.7–1.4)	1.3 (1.0–1.8)[b]	1.0 (0.6–1.5)	1.2 (0.8–1.6)	0.9 (0.6–1.3)	1.1 (0.8–1.6)	1.1 (0.8–1.5)
quartile 4 (high crime)	24.8 (424)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Model Set 2: perception of crime as a barrier to physical activity (crime or fear for personal safety is a barrier)								
yes	18.3 (336)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
no	81.7 (1311)	1.4 (1.0–2.0)b	1.3 (0.9–1.7)	1.3 (0.9–1.9)	1.2 (0.9–1.6)	1.3 (0.9–1.9)	1.1 (0.8–1.5)	1.0 (0.7–1.3)

[a]All models are adjusted for age, race/ethnicity, gender, and study area (Rural Forsyth County, NC; Urban Forsyth County, NC; and Jackson, MS). Further adjustment for marital status, work activity, number of children in the household, education, household income, availability of motor vehicle for personal use, general health, disability that limits physical activity, or census level income did not change the results.

[b]$P < .05$, confidence limits of 1.0 might be the result of truncation.

Table 3

Weighted Prevalence and Adjusted Odds (95% CI) for Objectively Measured Crime With Physical Activity for the 1-Mile Buffer Surrounding Each Respondent's Home Address (n = 303)

			Physical activity outcomes						
			Leisure-time physical activity		Outdoor leisure-time physical activity		Walking activity		Transportation activity
Model set[a]	Main exposure	Weighted prevalence (n)	Meets recommendations vs. inactive	Insufficient vs. inactive	Meets recommendations vs. inactive	Insufficient vs. inactive	Meets recommendations vs. inactive	Insufficient vs. inactive	Any activity vs. no activity
3	Low total crime[b]	47.4 (152)	2.6 (1.2–5.9)[cd]	1.2 (0.5–2.5)[d]	2.5 (1.0–6.0)[ce]	1.2 (0.6–2.4)[e]	1.2 (0.6–2.5)[f]	1.1 (0.6–2.2)[f]	1.2 (0.7–2.1)
	High total crime	52.6 (151)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4	Low criminal offenses	47.1 (152)	3.8 (1.5–9.5)[cd]	1.5 (0.6–3.7)[d]	4.6 (1.7–12.4)[cg]	1.8 (0.8–3.8)[g]	0.9 (0.5–1.9)[h]	1.0 (0.5–1.9)[h]	0.9 (0.5–1.7)
	High criminal offenses	52.9 (151)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
5	Low incivilities	48.2 (151)	1.3 (0.6–2.6)[i]	0.9 (0.5–1.9)[i]	1.6 (0.7–3.8)[e]	1.1 (0.6–2.2)[e]	0.9 (0.4–1.8)[f]	1.3 (0.7–2.5)[f]	0.7 (0.4–1.3)
	High incivilities	51.8 (152)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6	Low traffic offenses	46.5 (152)	1.3 (0.7–2.5)[j]	0.9 (0.5–1.6)[j]	1.6 (0.7–3.7)[d]	0.7 (0.4–1.3)[d]	1.4 (0.7–2.9)[f]	1.5 (0.8–2.9)[f]	1.5 (0.9–2.7)
	High traffic offenses	53.5 (151)	1.0	1.0	1.0	1.0	1.0	1.0	1.0

[a] All models adjusted for age, race/ethnicity, and gender.

[b] Total crime is the sum of criminal offenses, incivilities, and traffic offenses.

[c] $P < .05$; confidence limits of 1.0 might be the result of truncation.

[d] Adjusted for household income, body mass index, and census-level income.

[e] Adjusted for household income, number of children in household, availability of motor vehicle, and census-level income.

[f] Adjusted for work activity.

[g] Adjusted for household income, availability of motor vehicle, work activity, and census-level income.

[h] Adjusted for availability of motor vehicle.

[i] Adjusted for household income and body mass index.

[j] Adjusted for household income.

Table 4

Adjusted Odds Ratios (95% CI) for the Combined Associations of Perceived and Objectively Measured Crime for the 1-Mile Buffer Surrounding Each Respondent's Home Address (n = 303)

		Leisure-time physical activity[a]		Outdoor leisure-time physical activity[b]		Walking activity[c]		Transportation activity
	Weighted prevalence (n)	Meets recommendation vs. inactive	Insufficient vs. inactive	Meets recommendation vs. inactive	Insufficient vs. inactive	Meets recommendation vs. inactive	Insufficient vs. inactive	Any activity vs. no activity
Model Set 7[d]: Total crime[e]								
objectively measured total crime								
low	47.4 (152)	2.8 (1.2–6.5) [f]	1.2 (0.5–2.5)	2.8 (1.1–7.0)	1.2 (0.6–2.3)	1.1 (0.5–2.4)	1.1 (0.6–2.2)	1.2 (0.6–2.1)
high	52.6 (151)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
crime of fear for personal safety is a barrier								
yes	13.5 (45)	0.7 (0.2–1.8)	1.1 (0.4–2.7)	0.6 (0.2–1.8)	1.4 (0.6–3.4)	1.2 (0.4–3.5)	1.0 (0.4–2.7)	0.8 (0.4–1.8)
no	86.5 (256)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Model Set 8[d]: Criminal offenses								
objectively measured criminal offenses								
low	47.1 (152)	4.0 (1.6–10.01) [f]	1.5 (0.6–10.0)	5.0 (1.8–13.6) [f]	1.7 (0.8–3.7)	0.9 (0.4–1.8)	1.0 (0.5–2.0)	0.9 (0.5–1.7)
high	52.9 (151)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
crime or fear for personal safety is a barrier								
yes	13.5 (45)	0.7 (0.3–1.9)	1.0 (0.4–2.7)	0.6 (0.2–1.8)	1.4 (0.6–3.7)	1.3 (0.5–3.8)	0.9 (0.4–3.8)	0.9 (0.4–1.9)
no	86.5 (256)	1.0	1.0	1.0	1.0	1.0	1.0	1.0

[a] Adjusted for household income, body mass index, and census-level income.

[b] Adjusted for household income, number of children in household, availability of motor vehicle, and census-level income.

[c] Adjusted for work activity.

[d]All models adjusted for age, race/ethnicity and gender.

[e]Total crime is the sum of criminal offenses, incivilities and traffic offenses.

[f]$P < .05$; confidence limits of 1.0 might be the result of truncation.