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Changes in Walking Associated with Perceived Neighborhood Safety and Police-Recorded Crime: The Multi-Ethnic Study of Atherosclerosis

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Abstract

Objective—To explore the association of changes in perceived safety and police-recorded crime with changes in transport and leisure walking using longitudinal data from Chicago residents participating in the Multi-Ethnic Study of Atherosclerosis (2000–2012).

Method—Main exposures included perceived safety (self-reported as feeling safe walking in the neighborhood and reporting violence to be a problem in the neighborhood), and one-year counts of police-recorded crime occurring within a one-mile buffer of participants' residencies. Main outcomes included transport and leisure walking (self-reported and calculated as total minutes/week across four study visits). Fixed effects models assessed the association of change in perceived safety and police-recorded crime with changes in transport and leisure walking over a 10-year period for 796 adults.

Results—No associations were found between changes in perceived safety and either changes in transport or leisure walking. Residing in areas with increases in murder was associated with decreases in transport walking. However, no other associations were found with police-recorded crime.

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CONFLICT OF INTEREST

All authors have no conflicts of interest to report.

Conclusion—There continues to be a need to continue exploring the benefits of cultivating safe neighborhoods that enhance resident health and well-being. Research should continue examining how community initiatives may build safe environments and community identity that promote walking.

INTRODUCTION

Walking contributes to the United States (US) physical activity recommendations as the most common source of moderate intensity physical activity for adults.¹ Although report of walking has increased in the past decade, less than half of all adults obtain the recommended amount of weekly physical activity.² In addition, substantial barriers to walking exist, such as perceived lack of safety and crime.^{3–8} As posited by the social-ecological framework,¹² there is a need to focus on perceived and objectively-measured built environment variables alongside individual level factors such as sex and socioeconomic status.

Several reviews^{5, 9–12} summarize the mixed findings regarding the association between physical activity and safety. Reasons for these discordant findings include lack of specificity in the measurement of both physical activity and safety. Physical activity is a broad behavior, encompassing activities such as those related to leisure, occupation, transportation, and household chores. Safety may impact only some of these modes and perhaps only particular activities, such as transport walking or outdoor activities. In addition, there are several relevant aspects of safety related to physical activity, including safety from dogs, traffic, infrastructure condition (e.g., lighting, tripping hazards), and personal safety from crime. Typically, personal safety is assessed with questions about violence in your neighborhood or how safe one feels walking during the day or at night.^{13–19} However, secondary data sources for safety are also utilized, including 911 calls¹⁴ and police-recorded crime.^{13, 15, 17, 19, 20} Agreement between both types of measures is low,^{13, 14, 19} prompting recommendations to incorporate both measures in future research.^{12, 13, 19}

Research has estimated cross-sectional associations of walking with both perceived safety and crime with results ranging from no associations^{14, 19} to lower crime levels and higher levels of perceived safety being associated with more walking.^{13, 15, 17} However, the utilization of cross-sectional data impedes the ability to establish a temporal association between safety and walking. Two longitudinal studies indicated that fear of crime is associated with decreased walking over time^{21, 22}. This study builds upon the current literature by exploring whether changes in perceived safety and police-recorded crime were associated with changes in transport and leisure walking in a cohort of adults.

METHODS

Source population

The Multi-Ethnic Study of Atherosclerosis (MESA) is a cohort study of 6,814 self-identified White, African-American, Hispanic, and Chinese-American adults 45–84 years of age recruited from six US study sites.²³ The study was approved by the Institutional Review Boards at each site. All participants gave written informed consent. Participants were free of clinical cardiovascular disease at baseline and were recruited using a variety of population-

based approaches. Baseline examinations (exam 1) occurred from July 2000–July 2002, with follow-up exams occurring in: July 2002–January 2004 (exam 2); January 2004–September 2005 (exam 3); September 2005–June 2007 (exam 4); and April 2010–February 2012 (exam 5). We restricted the sample to only those who participated in the MESA Neighborhood Ancillary Study and were within the Chicago city limits (n=859 at exam 1) because measures of detailed police-recorded crime were available only from this MESA site. An additional 63 participants were excluded from the analysis due to missing baseline walking data. This left 796 participants for analysis. Data from follow-up exams was excluded if participants moved outside of the Chicago city limits (thus outside of the area with detailed police-recorded crime). For this study, our main outcomes were measures of walking; our main exposures were measures of perceived safety and police-recorded crime.

Measures of walking

Measures of walking were obtained from exams 1, 2, 3, and 5 from an interviewer- or self-administered questionnaire adapted from the Cross-Cultural Activity Participation Study.^{24, 25} Measures of (1) transport walking, such as walking to get to places such as bus, car, work, or store; and (2) leisure walking, such as walking for leisure, pleasure, social reasons, during work breaks, and with a dog, were recorded as total minutes/week.

Perceived safety measure

Perceived safety was collected from a questionnaire given at exam 2 or 3, and exam 5. Participants responded on a five-point scale, ranging from “strongly agree” to “strongly disagree,” to two items regarding “feeling safe walking in their neighborhood day or night” and “violence being a problem in their neighborhood.” Neighborhood was defined as the area within about a 20-minute walk (or about a mile) from home. Questions similar to these had acceptable test-retest reliability in other urban populations.^{26, 27} The mean of these responses (with the former statement’s responses reverse-coded) generated our perceived safety measure, ranging from 1 (lowest safety) to 5 (highest safety).

Police-recorded crime measure

Police-recorded crime data for years 2001–2012 were from the “City of Chicago Data Portal,” which houses crime data that occurred within the Chicago city limits,²⁶ which included location geocoded to 100th block centerlines, date, time, and type of crime. For years 1999–2000, police-recorded crime was obtained from the Chicago Police Department similar to that available from the data portal. Crimes were excluded from analyses if they were missing any of this information. Types of crime were categorized as: assault and battery, criminal offenses, incivilities, and murder (see http://www.unc.edu/~kevenson/_MESA_ChicagoCrime_Type.pdf for further information on how crimes were coded into each of the six crime categories). Crimes were coded as indoor and outdoor based on the location of the crime (see http://www.unc.edu/~kevenson/_MESA_ChicagoCrime_Location.pdf for further information on how crimes were coded as indoor/outdoor). Locations with missing location information, or listed as ATM, coin operated machine, and other, were not coded as either indoor or outdoor. However, they were included in the “total” number of crimes for each category. Crimes occurring at an

airport or in an airplane were excluded. These were determined to not affect neighborhood facilities usage or health outcomes.

Measures for the total number of incidents within each crime category for one-mile buffers around the participants' addresses were created using ArcGIS. We then created population normalized one-year rates of crime per 1,000 persons. The numerator for the normalized one-year crime rate was the sum of counts of crime within the buffer over the previous one-year period prior to the exam date. For example, an exam occurring in January 2002 would utilize the sum of counts of crime occurring from January 2001 to December 2001. The denominator for the normalized one-year crime rate was the total population within the buffer, which was calculated based on census block-level population. Each block was weighted by the percent of the area that fell with the participant buffer. The total population within that block was then multiplied by this weight and the weighted populations were summed together for the total population within the buffer. For dates prior to January 2006 (midpoint between 2000 and 2010), population counts originated from the 2000 Census. For dates on and after January 2006, population counts originated from the 2010 Census. These rates were created for total crime, assault and battery, criminal offenses, incivilities, and murder. We also created rates that were restricted to outdoor crimes.

Covariate measures

Information on covariates was obtained through self-report or measurement at one or more exams. Time-invariant covariates included age at baseline, sex, race/ethnicity, education, and work status (Table 1). Time-varying covariates included household income, arthritis status, move status, and measured height/weight to compute body mass index (BMI).

Statistical analyses

For exams where perceived safety was unavailable, scores were imputed from the exam closest in date where data was available. Results sans imputation were not meaningfully different and thus not shown. Spearman correlation coefficients assessed overall agreement between perceived safety and police-recorded crime.

We used econometric fixed effects models to assess the association of safety and police-recorded crime with walking. Fixed effects models estimated associations between safety/crime and walking utilizing only within person variability. These models allowed examination of how within person change in the exposure was related to within person change in the outcome after tightly controlling for person-specific characteristics.²⁸ Perceived safety scores and crime levels were centered at the baseline mean value. Given previous research,^{13, 17} we also considered interactions of time with age, sex, and race/ethnicity. However, these interactions were dropped from models as they were not significant.

Perceived safety scores and police-recorded crime were examined separately in their continuous forms for each walking outcome. Following this, we modeled perceived safety and police-recorded measures simultaneously. All models utilized the same time-varying covariates to control for potential confounders: BMI, income, arthritis status, move status, and season (Table 1). Because BMI may be a mediator and not a confounder, we also

explored models without BMI; however, exclusion of BMI did not affect results and thus is not presented separately.

All analyses were conducted using SAS version 9.3 (Cary, NC), with an a priori p-value of 0.05. To satisfy assumptions, models originally utilized transformed outcome variables. However, these transformations did not change the direction or the significance of effect estimates. Thus, effect estimates from models with untransformed outcome variables are reported.

RESULTS

At exam 1, most participants were White (56.5%), followed by African-American (31.0%) and Chinese-American (12.4%) (Table 2). Participants were an average 62.7 years of age (SD=9.9; Range=45–84). Compared to participants that dropped out of the study (n=198), participants with data at all exams (n=598) were more likely to be younger at baseline and have at least a bachelor's degree ($P<0.001$).

On average, participants reported more time on transport walking than leisure walking. A majority of participants strongly agreed or agreed that it was safe to walk in their neighborhoods (exams 2/3: 64.5%; exam 5: 60.8%), and strongly disagreed or disagreed that violence was a problem in their neighborhoods (exams 2/3: 57.9%; exam 5: 57.4%). Overall, the perceived safety scores showed some change with 67.9% of participants having the same perceived safety score across exams.

In participants' neighborhoods, assault and battery occurred most often, followed by incivilities and criminal offenses (Table 3). A higher average proportion of incivilities and murders occurred outdoors (incivilities: 64.2%; murder: 58.6%) than assault and battery (39.3%) and criminal offenses (35.4%). With the exception of criminal offenses, crime decreased over time both within the MESA participants' neighborhoods (Table 3) and for the city of Chicago as a whole (data not shown).

Correlations within each visit indicated that as total police-recorded crime were higher, perceived safety scores were lower ($r=-0.18$). Correlations among specific police-recorded crime categories ranged from -0.27 for murder to -0.16 for incivilities. No meaningful differences in correlations were found when comparing perceived safety's association with total crimes to that with outdoor crimes (data not shown).

Association of perceived safety with walking

No associations were found between perceived safety and either transport or leisure walking (Table 4 – Model 1).

Association of police-recorded crime with walking

Associations between any type of police-recorded crime and transport walking were limited (Table 4 – Model 2a–2d). The exception was the association between murder and transport walking (Model 2e). Residing in areas with increases in murder was associated with decreases in transport walking (in minutes/week) [$\beta = -330.0$; 95% confidence interval (CI):

–541.7, –118.3]. This finding was similar when data was restricted to outdoor murders (β = –273.3; 95% CI: –520.7, –25.9). No associations were found between police-recorded crime and leisure walking. In addition, findings did not differ when adding perceived safety to the models with police-recorded crime (Table 5).

DISCUSSION

This study is one of the first to examine the longitudinal association between levels of walking and safety. It builds upon previous longitudinal studies^{21,22} by focusing on transport and leisure walking in a large cohort of individuals 45–84 years of age. Perceived safety was assessed twice and walking was assessed four times during the 12-year study period. In addition, we obtained Chicago crime data occurring within participant neighborhoods at three time points.

We found that changes in perceived safety and police-reported crime were generally not associated with transport and leisure walking. The sole exception was that those individuals residing in areas with increases in murder had larger declines in transport walking. Possibly, only the most serious crimes, such as murder, would consequentially affect transport walking. Knowledge of crime in one's neighborhood may also not affect one's decision to walk as transportation, particularly if alternative means (e.g., car, bus) are not available. The lack of associations for either perceived or police-recorded crime with leisure walking may also be attributable to the age of our sample, some of whom may be maintaining, as opposed to increasing, their walking. However, age was not found to modify the association between safety and walking. In addition, unlike previous studies,^{13, 17} race/ethnicity and sex were not modifiers, although this may be attributable to low statistical power.

Caution must be taken when interpreting findings related to perceived safety. Our measure of perceived safety was derived from two dimensions: feeling safe when walking in one's neighborhood, and being concerned about neighborhood violence. Although these dimensions are typically utilized in research,^{13–19} they have been operationalized in various manners. Our study utilized two items from a questionnaire given to MESA participants at exam 2 or 3, and exam 5. The cross-sectional study utilizing MESA data¹³ utilized slightly different items from the baseline assessment at exam 1. Other studies have utilized multi-item measures^{14, 19} or other single-item assessments,^{16, 18} some of which focused on fear of walking at night.^{16, 17} At the same time, our fixed effects models relied upon variation in the exposure. Self-reported measures, such as perceived safety, may not be as time-varying as the police-recorded crime data and thus may limit the ability to detect changes in walking. As a result, variations in findings may be contingent upon how perceived safety was measured.

Furthermore, other levels of influence that affect perceptions of safety and crime could be explored. Foster and Giles-Corti¹² outlined a social-ecological framework that considered multiple levels of influence that pertained to the individual (e.g., sex, socioeconomic status, and victim of crime), social environment (e.g., neighborhood bonds), and built environment (e.g., walkability, lighting). In our models, we considered numerous individual-level covariates such as sex, household income, and education. However, to better ascertain

estimates related to walking, future research must explore factors within the socio-ecological framework that target the social and built environments, as well as individual-level factors.

Compared to the previous study utilizing baseline data from MESA,¹³ our study utilized a slightly different measure of police-recorded crime in which crime counts within one-mile buffers of participants' residencies were utilized, as opposed to counts from their census block groups. Although census block groups are small geographic areas, they may not appropriately represent the neighborhoods in which participants reside and potentially engage in walking. Police-recorded crime was weakly correlated with perceived safety, as seen in previous studies.^{6, 13, 14, 17, 19} Because objective and self-reported measures of safety may be separate constructs, we agree with previous recommendations to capture both to fully understand safety's association with physical activity.^{13–15,20}

Limitations

While this study makes important contributions, it has several limitations. First, walking measures relied on self-report data and may be prone to bias. Second, data captured after individuals moved outside of Chicago city limits was not considered. These individuals may have moved because of high levels of crime and/or low levels of perceived safety in their neighborhoods. Last, data may only be generalizable to certain areas within Chicago. The MESA participants were concentrated on the north side of Chicago, which has lower police-reported crime compared to the south and west sides of Chicago.

Conclusions

The findings suggest that among adults, perceived safety was not longitudinally associated with changes in transport or leisure walking. However, increases in murder levels were associated with declines in transport walking. There continues to be a need to continue exploring the benefits of cultivating safe neighborhoods that enhance resident health and well-being.

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HIGHLIGHTS

- No longitudinal associations were found between perceived safety and walking
- Increases in murder levels were associated with decreases in transport walking
- Perceived safety and police-recorded crime were not associated with leisure walking

Table 1

Time-varying covariates included in analysis of the association of walking with police-recorded crime and perception of safety: The Multi-ethnic Study of Atherosclerosis (2000–2012)

Covariate	Operationalization
Arthritis status	Having an arthritis flare-up in the past two weeks: Yes; No
Body mass index	Calculated from height and weight, and categorized according to the World Health Organization ^a : Underweight and Normal (<25.00); Overweight (25.00 to <30.00); Obese (30.00 to <40.00); Morbidly Obese (≥40.00)
Household income	<\$35,000; \$35,000-<\$75,000; \$75,000-<\$100,000; ≥\$100,000
Move status	Participant moved since last exam: Yes; No
Season	Time at which the exam was conducted: Winter (January-March); Spring (April-June); Summer (July-September); Fall (October-December)
Work status ^b	Working at least part-time: Yes; No
Years since baseline exam	Number of years since Exam 1 occurred

^a http://apps.who.int/bmi/index.jsp?introPage=intro_3.html.

^b For work status, retirees not working at least part-time were coded as “No”

Descriptive characteristics of the study population within the city of Chicago: The Multi-ethnic Study of Atherosclerosis

Table 2

	Exam 1 (n=796)		Exam 2 (n=770)		Exam 3 (n=749)		Exam 5 (n=598)	
	n	%	n	%	n	%	n	%
Age group								
45–54	211	26.5%	205	26.7%	201	26.8%	177	29.6%
55–64	222	27.9%	216	28.1%	209	27.9%	171	28.6%
65–74	249	31.3%	239	31.0%	236	31.5%	188	31.4%
75–84	114	14.3%	110	14.3%	103	13.8%	62	10.4%
Gender								
Female	359	45.1%	348	45.2%	336	44.9%	267	44.7%
Male	437	54.9%	422	54.8%	413	55.1%	331	55.4%
Race								
White	450	56.5%	438	56.9%	421	56.2%	341	57.0%
African-American	247	31.0%	239	31.0%	237	31.6%	180	30.1%
Chinese-American	99	12.4%	93	12.1%	91	12.2%	77	12.9%
Body mass index ^a								
Underweight and Normal	306	38.4%	303	39.4%	297	39.7%	223	37.4%
Overweight	304	38.2%	283	36.8%	283	37.8%	238	39.9%
Obese	167	21.0%	158	20.6%	147	19.6%	122	20.4%
Severely/Morbidly obese	19	2.4%	25	3.3%	22	2.9%	14	2.4%
Missing	0		1		0		1	
Education								
Less than high school	59	7.4%	57	7.4%	53	7.1%	38	6.4%
High school/GED	247	31.0%	237	30.8%	234	31.2%	171	28.6%
Bachelor's degree	191	24.0%	186	24.2%	177	23.6%	150	25.1%
Graduate school degree	299	37.6%	290	37.7%	285	38.1%	239	40.0%
Income								
< 35k	199	25.5%	191	25.3%	178	24.3%	137	23.9%
35k – <75k	211	27.0%	211	28.0%	216	29.5%	159	27.8%

	Exam 1 (n=796)		Exam 2 (n=770)		Exam 3 (n=749)		Exam 5 (n=598)	
	n	%	n	%	n	%	n	%
75k – <100k	102	13.1%	88	11.7%	98	13.4%	75	13.1%
>=100k	269	34.4%	265	35.1%	241	32.9%	202	35.3%
Missing	15		15		16		25	
Employed at least part time ^b								
Yes	481	60.4%	434	56.4%	440	58.8%	323	54.8%
No	315	39.6%	336	43.6%	308	41.2%	266	45.2%
Missing	0		0		1		9	
Arthritis flare-up in past two weeks								
Yes	117	14.9%	100	13.0%	119	15.9%	125	21.1%
No	666	85.1%	667	87.0%	629	84.1%	468	78.9%
Missing	13		3		1		5	
Participant moved since last exam								
Yes	0	0.0%	48	6.2%	81	10.8%	99	16.6%
No	796	100.0%	722	93.8%	668	89.2%	499	83.4%
Time between exams (in years)	n/a		1.6 (0.5)		1.4 (0.5)		6.3 (0.6)	
Perceived safety, Mean (SD) ^c	3.6 (0.9)		3.6 (0.9)		3.6 (0.9)		3.6 (0.9)	
Walking (in minutes/week), Mean (SD)								
Transport walking	368.9 (389.1)		348.4 (368.6)		360.6 (411.9)		377.1 (383.1)	
Leisure walking	238.1 (382.5)		213.1 (304.3)		237.4 (346.9)		262.1 (346.1)	

NOTE: Exam 1 occurred during July 2000–July 2002; Exam 2 occurred during July 2002–January 2004; Exam 3 occurred during January 2004–September 2005; Exam 5 occurred during April 2010–February 2012.

^aBody mass index classifications based on World Health Organization classifications (http://apps.who.int/bmi/index.jsp?introPage=intro_3.html).

^bFor work status, retirees not working at least part-time were coded as “No”.

^cFor exams where perceived safety was unavailable, scores were imputed from the exam closest in date where data is available. Participants responded on a five-point scale ranging from “Strongly agree” to “Strongly disagree” on how much they agreed with the following statements: (1) I feel safe walking in my neighborhood day or night; and (2) Violence is a problem in my neighborhood. Mean of these responses (with former statement’s responses reverse-coded) generated the perceived safety measure, ranging from 1 to 5, with a higher value indicating higher perceived safety.

Table 3

Normalized one-year rates of crimes within a one-mile buffer of the study population within the city of Chicago: The Multi-ethnic Study of Atherosclerosis

Type of Crime	Normalized crimes ^a							
	Exam 1 (n=796)	Exam 2 (n=770)	Exam 3 (n=749)	Exam 5 (n=598)	Mean	SD	Mean	SD
Total								
Total	94.9	90.6	91.9	70.2	35.4	40.0		
Outdoor	45.8	42.9	43.5	32.5	16.1	16.9		
Assault and battery								
Total	43.9	42.0	40.0	29.2	17.5	16.7		
Outdoor	16.9	16.5	15.9	11.5	6.5	5.7		
Criminal offenses								
Total	15.3	16.9	19.2	16.5	6.3	8.9		
Outdoor	5.5	6.1	6.9	5.5	2.3	2.4		
Incivilities								
Total	35.6	31.5	32.6	24.4	13.5	14.8		
Outdoor	23.3	20.2	20.5	15.4	8.4	9.2		
Murder								
Total	0.2	0.1	0.1	0.1	0.1	0.1		
Outdoor	0.1	0.1	0.1	0.1	0.1	0.1		

NOTE: Exam 1 occurred during July 2000–July 2002; Exam 2 occurred during July 2002–January 2004; Exam 3 occurred during January 2004–September 2005; Exam 5 occurred during April 2010–February 2012..

SD=standard deviation.

^aNormalized crimes are defined as the number of crimes per 1000 population within a one-mile buffer.

Table 4

Adjusted^a mean differences in walking associated with safety and crime: The Multi-ethnic Study of Atherosclerosis

	Beta (Standard Error)			
Models	Transport walking ^b		Leisure walking ^b	
Model 1: Perception of safety ^c	−1.9 (19.2)		24.3 (17.7)	
	Beta (Standard Error)			
	Total crime		Outdoor crime only	
Model 2: Police-recorded crime ^d	Transport walking ^b	Leisure walking ^b	Transport walking ^b	Leisure walking ^b
Model 2a: Total crime	−0.4 (0.5)	−0.2 (0.4)	−0.4 (0.8)	−0.2 (0.8)
Model 2b: Assault and battery	−2.0 (1.3)	−1.3 (1.2)	−3.3 (2.9)	−3.3 (2.6)
Model 2c: Criminal offenses	−1.8 (1.9)	−1.1 (1.8)	−1.8 (5.2)	−1.6 (4.7)
Model 2d: Incivilities	−0.0 (0.9)	0.3 (0.9)	−0.0 (1.2)	0.3 (1.1)
Model 2e: Murder	−330.0 (108.0) *	−95.6 (98.9)	−273.3 (126.2) *	−124.8 (115.4)

NOTE: Data originates from four of five exams from the study population within the city of Chicago (Exam 1: July 2000–July 2002; Exam 2: July 2002–January 2004; Exam 3: January 2004–September 2005; Exam 5: April 2010–February 2012; Measures of walking not obtained during Exam 4)..

^a All adjusted fixed effects models control for years since baseline exam, BMI category (Normal, Overweight, Obese, Morbidly Obese), income (<35k, 35k–<75k, 75k–<100k, >=100k), season, arthritis status (flare-up in the past two weeks), move status (did or did not move since last exam), work status (employed at least part time)..

^b Reported in minutes/week.

^c Beta represents one-point increase in perception of safety score.

^d Normalized crimes are defined as the number of crimes per 1000 population within a 1 mile buffer over a one year period. Betas represent change in walking level per one additional crime.

P-values:

* <0.05

Table 5

Adjusted^a mean differences in walking associated with crime and perception of safety, combined: The Multi-ethnic Study of Atherosclerosis

Models	Beta (Standard Error)			
	Total crime		Outdoor crime only	
	Transport walking ^b	Leisure walking ^b	Transport walking ^b	Leisure walking ^b
Model 3a				
Total crime ^c	−0.3 (0.5)	−0.2 (0.4)	−0.2 (0.8)	−0.2 (0.8)
Perception of safety ^d	−2.9 (19.3)	23.8 (17.7)	−2.2 (19.3)	24.0 (17.7)
Model 3b				
Assault and battery ^c	−1.4 (1.3)	−1.3 (1.2)	−2.1 (2.9)	−3.3 (2.7)
Perception of safety ^d	−3.1 (19.3)	23.3 (17.7)	−2.6 (19.3)	23.9 (17.7)
Model 3c				
Criminal offenses ^c	−1.6 (2.0)	−0.9 (1.8)	−1.0 (5.2)	−1.3 (4.8)
Perception of safety ^d	−3.3 (19.3)	23.5 (17.7)	−2.2 (19.3)	23.6 (17.7)
Model 3d				
Incivilities ^c	0.0 (0.9)	0.3 (0.9)	0.1 (1.2)	0.3 (1.1)
Perception of safety ^d	−1.9 (19.3)	24.7 (17.7)	−1.8 (19.3)	24.6 (17.7)
Model 3e				
Murder ^c	−323.8 (108.8) *	−89.2 (100.0)	−280.4 (126.8) *	−123.9 (116.4)
Perception of safety ^d	−3.8 (19.2)	23.8 (17.7)	−2.6 (19.2)	24.0 (17.7)

NOTE: Data originates from four of five exams from the study population within the city of Chicago (Exam 1: July 2000–July 2002; Exam 2: July 2002–January 2004; Exam 3: January 2004–September 2005; Exam 5: April 2010–February 2012; Measures of walking not obtained during Exam 4)..

^a All adjusted fixed effects models control for years since baseline exam, BMI category (Normal, Overweight, Obese, Morbidly Obese), income (<35k, 35k-<75k, 75k-<100k, >=100k), season, arthritis status (flare-up in the past two weeks), move status (did or did not move since last exam), work status (employed at least part time)..

^b Reported in minutes/week.

^c Normalized crimes are defined as the number of crimes per 1000 population within a 1 mile buffer over a one year period. Betas represent change in walking level per one additional crime..

^d Beta represents one-point increase in perception of safety score..

P-values:

* <0.05