Characteristics of Urban Sidewalks/Streets and Objectively Measured Physical Activity

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ABSTRACT *Several studies have found significant relationships between environmental characteristics (e.g., number of destinations, aesthetics) and physical activity. While a few of these studies verified that the physical activities assessed were performed in the environments examined, none have done this in an urban, neighborhood setting. This information will help efforts to inform policy decisions regarding the design of more “physically active” communities. Fourteen environmental characteristics of 60, 305-m-long segments, located in an urban, residential setting, were directly measured using standardized procedures. The number of individuals walking, jogging, and biking in the segments was assessed using an observation technique. The segments were heterogeneous with regards to several of the environmental characteristics. A total of 473 individuals were seen walking, bicycling, or jogging in the segments during 3,600 min of observation (60 min/segment). Of the 473 seen, 315 were walking, 116 bicycling, and 42 jogging. A greater number of individuals were seen walking in segments with more traffic, sidewalk defects, graffiti, and litter and less desirable property aesthetics. Only one environmental characteristic was associated with bicycling and none were significantly related with jogging. This study provides further evidence that environmental characteristics and walking are related. It also adds new information regarding the importance of scale (e.g., micro, macro) and how some environmental characteristics of urban, residential sidewalks and streets relate to physical activity.*

KEYWORDS *Cross-sectional study, Environment, Exercise.*

INTRODUCTION

Obesity is a major risk for chronic diseases such as hypertension, dyslipidemia, coronary heart disease, non-insulin-dependent diabetes, and various forms of cancer.¹⁻⁴ Globally, there are over one billion overweight adults, at least 300 million of them obese.⁵ This translates into substantial health care costs. For example, obesity-attributable medical expenditures in the USA are estimated at \$75 billion in 2003 dollars.⁶ Similar findings have been reported for other countries including Canada (direct cost of obesity: 1.1 to 4.6% of total health care expenditures in 1997)

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and Germany (cost of illness: 2,572 euros per obese individual vs. 848 for nonobese individuals).^{7,8}

Several authors propose the obesity epidemic is partially the result of drastic environmental transformations that have negatively impacted physical activity.^{9,10} Researchers have found significant associations between physical activity and access to attractive physical activity opportunities, proximity of retail businesses, neighborhood aesthetics, crime, heavy traffic, and auto-orientated neighborhood planning schemes.^{11–18} Although studies in this area have employed a number of methodological procedures (direct vs. indirect environmental measures, subjective and/or objective assessments), none of the studies provide evidence as to whether the physical activities assessed were performed in the environments being examined. For instance, physical activity data from self-report surveys is often correlated with environmental data obtained from predefined geographical areas (e.g., 400 m) around a survey respondent's home.¹⁴ In addition, measures of physical activity were sometimes correlated with environmental characteristics in areas (e.g., neighborhoods) defined by the survey respondents.^{13,15,16} Whether these approaches are problematic is not known; however, it is reasonable to assume that if any portion of physical activity assessed were performed in places other than where the environmental characteristics were measured, the magnitudes of the relationships would be affected. This could be a reason why the correlations between environmental characteristics and physical activity tend to be low and inconsistent across studies.¹⁹

To obtain information on physical activities in specific behavioral settings where environmental characteristics can also be assessed, some authors have proposed the use of observational methods.^{20–22} Observational methods allow researchers to classify free-living physical activity behaviors into distinct categories that can be quantified and analyzed in greater detail and identify the type of activity seen, as well as when, where, and with whom it occurs.²⁰ Adapting observational methods for use in studies of environment–physical activity relationships would be applicable to diverse groups, administratively feasible, and unobtrusive (not disturbing physical activity patterns).²³

An observation method [block walk method (BWM)] was recently developed to count the number of individuals walking, bicycling, and jogging on residential sidewalks and streets.²⁴ The BWM was found to be reliable for determining the type of physical activity being performed, the number of individuals performing the physical activity, and the geographical location (street address) where the physical activity was performed. To date, the BWM has not been used to assess relationships between environmental characteristics of sidewalk and street settings and physical activities occurring in these settings. Therefore, this study utilized the BWM to describe relationships between the number of individuals walking, bicycling, and jogging on urban, residential sidewalks and streets and the environmental characteristics of the same sidewalks and streets.

MATERIALS AND METHODS

Geographical Study Areas

A total of 12 U.S. Census block groups in a large, midwestern city were selected for observation. The block groups were located in an urban area with a high population density (>8 residential dwelling per residential acre) and a grid pattern street design.²⁵ The total length of streets in residential areas of the block groups ranged from 2,306

to 2,808 m (mean ± standard deviation, 2,583±168.0 m). Residential housing units constituted over 98% of the structures along the streets. The total population for the 12 block groups was 9,066 (49.9% men), who where primarily Caucasian (92.1%) and educated (36.0% with a bachelors degree or higher). Detailed block group characteristics from the U.S. Census 2000 are presented in Table 1.²⁶

Procedures

Segments Five 305-m-long segments per block group were randomly selected from residential areas of the block groups (*n*=60 segments). The segments followed streets and included streets, sidewalks (both sides of the streets), the facades of structures along the segment, and the area between the facades and the sidewalks (e.g., front yards). The widths of streets intersecting a given segment were not included as part of the segment length. On average, the segments represented 68.2% of the total length of streets in the block groups. All lengths were directly measured using a Stanley Dual Measuring Wheel (model–MW20).

Observations of Physical Activity in Segments using the BWM The same methods used by Suminski et al.²⁴ to train observers and conduct the BWM were used in this study. Briefly, each segment was observed for 10 min on six different days (weekdays and weekends) during summer months. During an observation, a trained observer traversed a segment at a pace of 30.5 m/min (paced by a metronome) and recorded the number of individuals walking, bicycling, and jogging in the segment. Individuals were counted only if they crossed a parallel plane of motion with the observer. For example, individuals walking down the sidewalk towards the observer (from ahead or from behind the observer) were counted if they continued to walk past the observer. An individual was counted only once during a given 10-min observation period. The number of individuals walking, bicycling, and jogging per segment was calculated by summing the number seen during the six 10-min segment observations (e.g., number seen walking per segment per 60 min of observation).

Environmental Characteristics of the Segment The conceptual work of Pikora et al.²⁷ was referenced to develop a list of environmental characteristics pertaining to the functional and safety aspects of the sidewalks and streets in the segments, as well as the aesthetic appeal of the segments. The environmental characteristics measured are provided in the [Appendix](#) along with definitions of the characteristics, descriptions

TABLE 1 Characteristics of the 12 U.S. block groups

	Mean	SD	Minimum–maximum
Median household income (1999 U.S. \$)	39,900	8,345	29,236–53,056
Median home value (1999 U.S. \$)	118,767	29,135	78,000–161,900
Housing units	383.0	91.1	288.0–557.0
Total population	755.5	208.0	572.0–1,123.0
% in labor force	79.8	5.7	68.0–88.0
% with a BS degree or higher	36.0	9.8	20.4–56.6
% walking or biking to work	5.7	3.9	0.0–11.4

SD = standard deviation

of the techniques used to measure the characteristics, and the outcome variables for the characteristics.

Two trained members of the research team measured the environmental characteristics of each segment in June and July. Both research team members simultaneously assessed the first 20 segments to examine interrater reliability. Agreement between observers was considered to be good to excellent (intraclass correlation coefficients >0.85 for all measures).²⁸ The Stanley Dual Measuring Wheel was used to assess distances (e.g., property widths) and a metal tape was used to make length, width, depth, and height measurements. All observations and measures were made from the sidewalk (note: physical activity and environmental data were obtained during times void of participation).

Statistical Analysis

Variables displaying skewed distributions were normalized via log or square root (a value of zero possible) transformations to produce skewness statistics <1.0 . Pearson Product Moment Correlation Coefficients were calculated to examine the bivariate relationships between the environmental characteristics of the segments and the number of individuals observed walking, bicycling, and jogging in the segments. To compare highly walked with non-highly walked segments, the number of individuals observed walking during 60 min of observation for a given segment was dichotomized at the median value creating two groups [highly walked (>5 walkers per 60 min per segment) and non-highly walked (<4 walkers per 60 min per segment)]. Environmental characteristic profiles were constructed for these two groups and contrasted between them using Student *t* test procedures. This same procedure was followed for bicycling and jogging; however, none of the findings were significant (data not presented). All statistical analyses were conducted using SPSS version 15.0, with alpha set a priori at 0.05 and with the segment ($n=60$ segments) as the unit of analysis. No adjustments were made for multiple comparisons because the purpose of this exploratory study was to generate hypotheses and not to test hypotheses. In addition, not making adjustments is the preferred approach for examining relationships between environmental characteristics and physical activity.^{19,29}

RESULTS

Presented in Table 2 are descriptive data for the environmental characteristics of the segments. Traffic volume varied substantially between the segments. On average, 26.1 (standard deviation=35.9) vehicles were counted traveling along a street(s) in the segments during 30 min of observation. This amounts to one vehicle every 1 min and 15 s, with a wide range of from one vehicle every 15 s to one vehicle every 30 min. The number of traffic control efforts and streetlights also varied considerably between the segments. Sidewalk widths were consistent (1.0 to 1.9 m wide), 73.3% of the sidewalks had obstructions, and nearly all (98.3%) had defects. Trees, grass, and landscapable areas were present to some extent in all segments, whereas the segments were heterogeneous with regards to litter and the percentages of properties with graffiti, flowers, and chipped paint. For example, one segment had approximately 577 pieces of litter compared with another void of litter.

Descriptive data concerning the physical activities observed are given in Table 3. A total of 473 individuals were seen walking, bicycling, or jogging during 3,600 min of observation or one individual every 7.6 min. Walking was by far the most frequently observed physical activity, constituting 66.6% of the total number of

TABLE 2 Environmental characteristics of the 60 segments

Environmental characteristics	Mean	SD	Minimum–maximum
Estimated segment population (residents)	29.1	8.0	13.5–47.6
Street			
Traffic volume (vehicles/30 min)	26.1	35.9	1.0–198.0
Number of traffic control efforts	8.6	8.9	0.0–40.0
Number of street lights	7.0	4.0	0.0–20.0
Sidewalk			
Slab incongruence (%)	0.33	0.29	0.0–1.1
Defective (%)	2.4	3.9	0.0–18.0
Obstructed (%)	2.0	3.2	0.0–16.3
Crack growth/overgrowth instances	184.7	70.3	70.0–380.0
Aesthetics			
Grass height (cm)	8.7	2.3	3.6–15.5
Landscapable (%)	89.7	14.3	30.0–100.0
Properties with graffiti (%)	3.1	7.2	0.0–27.8
Pieces of litter	88.2	116.8	0.0–576.7
Properties with chipped paint (%)	22.6	16.5	0.0–63.1
Number of trees	64.3	31.8	6.7–166.7
Properties with flowers (%)	51.5	23.2	0.0–100.0

SD=standard deviation

individuals observed performing physical activities of interest in the segments. One individual was observed walking for each 11.4 min of observation compared with one every 31.0 min for bicycling and one every 86.0 min for jogging. The greatest number of individuals observed along a segment during 60 min of observation was 19 (for walking). During observations in one segment, no individuals were observed walking, jogging, or bicycling.

Correlation coefficients between environmental characteristics of the segments and physical activities observed occurring in the segments are presented in Table 4. Of the 14 environmental characteristics measured, six were significantly related with the physical activities observed. Specifically, more individuals were seen walking in segments with a higher volume of traffic, a greater percentage of defective sidewalks, more litter, less landscapable area, a greater percentage of properties with graffiti, and a lower percentage of properties with flowers. Bicyclists were more likely to be seen in segments with less landscapable area. None of the environmental characteristics were significantly related with jogging.

TABLE 3 Physical activities observed in the 60 segments

	Mean ^a	SD	Minimum–maximum ^b	Total ^c
Walking	5.3	4.1	0–19.0	315.0
Bicycling	1.9	1.8	0–8.0	116.0
Jogging	0.7	1.5	0–10.0	42.0

SD = standard deviations

^aMeans and standard deviations (SD) represent the number of individuals observed performing a given physical activity per segment (total observed ÷ 60 segments)

^bMinimum and maximum values represent the minimum and maximum number of individuals observed performing a given physical activity during one 60-min observation of a segment

^cTotal represents the total number of individuals observed during 3,600 min of observation

TABLE 4 Relationships between environmental characteristics and the number of individuals observed walking, bicycling, and jogging in the segments

	Walking	Bicycling	Jogging
Street			
Traffic volume (vehicles/30 min)	0.26*	0.01	−0.04
Number of traffic control efforts	−0.11	0.17	−0.07
Number of street lights	0.05	−0.19	−0.03
Sidewalk			
Slab incongruence (%)	−0.09	0.11	0.07
Defective (%)	0.39**	0.01	−0.01
Obstructed (%)	0.09	−0.09	0.08
Crack growth/overgrowth instances	0.16	−0.19	−0.02
Aesthetics			
Grass height (cm)	−0.10	−0.16	0.06
Landscapable (%)	−0.27*	−0.28*	0.12
Properties with graffiti (%)	0.30*	0.04	−0.37
Pieces of litter	0.43***	−0.22	0.03
Properties with chipped paint (%)	0.19	−0.14	0.05
Number of trees	−0.15	−0.14	0.12
Properties with flowers (%)	−0.26*	−0.20	0.10

ns = correlation coefficient (*r*) was not significant
p*<.05; *p*<0.005; ****p*<0.001

Provided in Table 5 are environmental characteristics for highly (*n*=30 segments; 244 walkers/1,800 min of observation) and non-highly (*n*=30 segments; 71 walkers/1,800 min of observation) walked segments. As can be seen, all but two of the environmental characteristics do not coincide with what would intuitively be expected.

TABLE 5 Environmental profile of highly and non-highly walked segments

	Highly walked		Non-highly walked	
	Mean	SD	Mean	SD
Street				
Traffic volume (vehicles/30 min)	33.8*	39.9	18.6	30.4
Number of traffic control efforts	7.4	8.4	9.7	1.7
Number of street lights	6.9	3.4	7.2	4.5
Sidewalk				
Slab incongruence (%)	0.25*	0.05	0.40	0.31
Defective (%)	3.4*	5.1	1.4	1.8
Obstructed (%)	2.3	3.6	1.7	2.9
Crack growth/overgrowth instances	197.8	76.8	172.1	61.9
Aesthetics				
Grass height (cm)	8.4	2.8	9.0	1.8
Landscapable (%)	86.5	18.3	92.8	8.0
Properties with graffiti (%)	6.0**	9.3	0.4	2.0
Pieces of liter	135.6**	141.9	42.4	58.7
Properties with chipped paint (%)	27.7*	15.8	17.7	15.9
Number of trees	58.4	36.4	69.9	25.9
Properties with flowers (%)	42.2**	17.4	60.5	24.9

SD = standard deviation
p*<0.05; *p*<0.005

In highly walked, compared with non-highly walked, segments, a greater percentage of the sidewalks were defective ($p < 0.05$), there were more pieces of litter ($p < 0.005$) and greater percentages of properties with graffiti ($p < 0.005$) and chipped paint ($p < 0.05$), and a lower percentage of properties had flowers ($p < 0.005$). The percentage of sidewalks incongruent (slab incongruence) ($p < 0.05$) was the only environmental characteristic in the highly walked segments in the expected direction.

DISCUSSION

The purpose of this investigation was to describe how directly measured environmental characteristics of urban, residential sidewalks and streets relate to the number of individuals observed using them for the purpose of walking, bicycling, and jogging. Most studies in this area did not attempt to verify if the physical activities examined actually occurred in the environments measured.^{11–18} Some researchers, though, have directly observed physical activities in the context of the environments in which they were performed.^{20–23,30–33} For example, Sallis et al.³⁰ found that environmental characteristics of school areas explained 51% of the variance in the proportion of girls and boys seen being physically active in these areas. Observation methods also have revealed significant relationships between home equipment (e.g., toys) and physical activity in children, public open space characteristics and usage, and environments around stairs and opting to take the stairs.^{21,31–33} We found environmental characteristics of urban, residential sidewalks and streets were related with walking, but not bicycling or jogging, on those sidewalks and streets; however, the relationships were not in the expected directions.

Our results are in contrast with those of others who have examined relationships between characteristics of sidewalks and streets and physical activity. First, perceptions of safety from motor vehicles have been associated with bicycling in school children and college students.^{34,35} In the present study, higher traffic and less traffic control efforts were not significantly correlated with the number of bicyclists observed. Second, level sidewalks, sidewalks of good quality, accessible sidewalks, and attractive neighborhood aesthetics have been linked with higher levels of walking.^{14,36–39} We observed a greater number of walkers using more defective sidewalks in less aesthetically pleasing neighborhoods with high volumes of vehicular traffic.

The major differences between our study and previous ones in this area are the methods used to measure both physical activity and environmental characteristics. We directly measured the environmental characteristics of sidewalks/streets and observed their usage for physical activity. Studies reporting dissimilar findings used surveys to measure environmental characteristics and physical activity, and none of them verified if the physical activities assessed actually occurred in the environments examined.^{11–18,36–39} In two of the studies that did directly measure sidewalk and street characteristics, a self-report questionnaire was used to assess recreation and transportation physical activity.^{14,38} Therefore, the relationships reported in these previous studies could be reasoned suspect if one considers that self-report data on physical activity and environmental characteristics does not accurately reflect objective data on these outcomes.^{12,40–42} Furthermore, it is not known if there are adverse consequences (e.g., inaccurate results) to correlating environmental data from an area with physical activities performed elsewhere.

Alternatively, our examination of environmental characteristics located solely along the segments may have been overly focused. We did not include information on characteristics representing the larger-scale aspects of the environment (e.g., street

connectivity, land-use mix). Such aspects have been consistently found to be related with physical activity especially when combined to reflect an area's "walkability."^{39,43,44} Residents of high-walkability neighborhoods tend to accumulate more minutes of physical activity and walk more for recreation and transport and are more likely to meet physical activity recommendations than residents of low-walkability neighborhoods.^{39,43,44} Information of this nature could have provided greater insight into our findings.

The preceding discussion alludes to the complexity of interpreting relationships between physical activity and environmental characteristics. Our findings indicate that, while walking on sidewalks and streets was associated with their environmental characteristics, they probably did not influence walking. It is unlikely that walking in these settings was promoted by their adverse conditions. Rather, the purpose of the walk may have dictated whether a particular segment was used. For example, walking for transport is positively associated with the presence of destinations, whereas walking for recreation is not.³⁹ Although we cannot discern the reason for walking, segments with higher walking utilization rates may have been nearer or more connected to areas that attract pedestrians (e.g., business districts, shopping centers). Also, the issue of reverse causality must be considered. Pedestrians almost certainly contributed to the litter seen along the segments. Likewise, graffiti is often expressed in areas where it is most likely to be seen by humans. This may especially be the case now that so much graffiti has become a platform for advertising various social and political points of view.⁴⁵

Our results are consistent with others who have demonstrated that the relationships between environmental characteristics and physical activity vary as a function of physical activity mode, reason for doing a physical activity, and/or the intensity level at which a physical activity is performed.^{15,39,43,46} For example, Humpel et al.⁴⁶ found that aesthetics and accessibility were associated with walking in one's neighborhood but not with walking to get to and from places. Similarly, moderate, but not vigorous, physical activity has been shown to be related with the walkability of a neighborhood.⁴³ These findings have important implications not only for planning research paradigms in this area but also for efforts to alter environmental characteristics for the purpose of promoting physical activity. Comprehensive approaches of study more consistent with explanations of behavior, such as the social cognitive theory and ecological models, are highly recommended and should provide further insight into how physical activity is influenced by environmental characteristics.⁴⁷⁻⁴⁹ Likewise, urban planning schemes built on the realization that physical activity behavior is extremely dynamic may be more successful at promoting sustained increases in physical activity. Changes affecting multiple levels and facets of the built environment could ultimately prove to induce the most widespread effect on physical activity levels.

Although work has been done to develop methods and instruments to audit environmental characteristics of sidewalks and streets, we opted to directly measure environmental characteristics.^{50,51} This was done because existing audits, at times, rely on subjective ratings from auditors.^{50,51} There is no way to substantiate auditor responses to such questions as "Is the path well maintained?" Perhaps direct measures could be used to validate auditor decisions. We also decided to directly observe walking, bicycling, and jogging in the segments as opposed to conducting surveys with individuals residing along the segments. Physical activity surveys are characterized by several inherent problems and they are not at present valid for providing information on where an activity was performed.^{40,41}

The results we found must be interpreted in conjunction with the study's limitations. First, although our selection of the environmental characteristics was based on previous work, we did not collect data on a larger scale (e.g., street connectivity) nor did we obtain segment-level information on other factors that could have influenced our observations (e.g., segment population, segment income levels).²⁷ To better understand how environmental characteristics relate to and affect physical activity, comprehensive assessments of multiple variables at different geographical scales will be necessary. Second, the segments were not constructed in block groups representing a wide range of median household incomes. Because environmental characteristics are somewhat dependent on the socioeconomic status of an area, it is possible that the range of environmental characteristics examined in this study was truncated, thus minimizing our ability to detect significant relationships.^{16,52} Third, as mentioned previously, the observation technique used to measure physical activity does not allow one to determine why a physical activity was performed. The reason for doing a particular physical activity is important for understanding its relationship with environmental conditions.^{39,46} Fourth, the cross-sectional study design does not allow for inferences to be made regarding causal effects. The design does provide a basis for hypothesis formation and rationales for longitudinal studies. Lastly, environmental characteristics and physical activities were not measured simultaneously. Although most of the environmental characteristics examined would be expected to be stable over the period when physical activity observations were made, some could have changed, particularly those associated with aesthetics. Evidence is needed regarding the stability of environmental characteristics, especially at the microlevel.

In conclusion, this study provides further evidence that environmental characteristics are related with walking. It also adds new information regarding the importance of scale (e.g., micro, macro) and how environmental characteristics of sidewalk and street settings relate with physical activities performed in those settings. Future studies in this area would benefit from using comprehensive approaches to assess environmental characteristics and physical activity. Both micro- and macrolevel environmental characteristics should be considered along with the various aspects of physical activity. Determining if a hierarchy of environmental influences exists could prove useful. We believe, as do others, that the next step will be to establish the existence of cause-effect relationships between environmental characteristics and physical activity. This, ultimately, will be essential information for promoting policy changes in favor of more "physically active" environments.

APPENDIX

Measures of Environmental Characteristics

1. Traffic volume: One 10-min observation period was randomly selected from the 5–6 p.m. time period, one from the 6–7 p.m. time period, and one from the 7–8 p.m. time period. During a 10-min observation period, an observer stationed at a randomly selected point in a segment counted the number of motorized vehicles passing by. Outcome variable: *Total number of vehicles per 30 min of observation (multiple observation periods summated) per segment.*
2. Traffic control efforts: Any efforts to reduce the volume and/or speed of motorized traffic. Examples include signs such as "Children at play," speed

limit signs, or speed bumps. Outcome variable: *Total number of traffic control efforts per segment.*

3. Streetlights: Any lamp supported on a lamppost whose purpose was to illuminate a street was counted during daylight hours. Outcome variable: *Total streetlights per segment.*
4. Sidewalk slab displacement (slab incongruence): The length and maximum visible height of unevenness of the spacers between sidewalk slabs. Measurements started with the spacer in front of the first slab of a segment and ended with the final spacer included in that segment. Visible height was used due to coverage of spacers by grass and weeds. Outcome variable: *Percent of sidewalk incongruent per segment* = $[\text{total area of slab incongruence per segment (m}^2\text{)}] \div [\text{total sidewalk area of a segment (length} \times \text{width)}] \times 100$.
5. Defects: The maximum width, length, and depth in meters of all man-made and natural cracks, separations, or holes in sidewalks. Outcome variable: *Percent of sidewalk defective per segment* = $[\text{total volume of defective areas per segment (m}^3\text{)} \div \text{total sidewalk volume of a segment (thickness 0.102 m} \times \text{width} \times \text{total length of sidewalk)}] \times 100$.
6. Obstructions: A man-made or natural item was considered an obstruction if it extended into the sidewalk 0.2 m or more and was ≥ 0.15 m above the sidewalk. The height of an obstruction was measured to a maximum of 2.13 m. The width was measured at the most obtrusive part of the obstruction. The requirement of ≥ 0.15 m was imposed to eliminate the measurement of protruding surface grass, measured as separate variables (crack growth/peripheral overgrowth). The height value was selected to correspond to the maximum height of most humans. Outcome variable: *Percent obstructed per segment* = $[\text{volume of obstructions per segment (width} \times \text{height} \times \text{length)} \div \text{total sidewalk volume of a segment usable for human movement (height 1.98 m} \times \text{sidewalk width} \times \text{total length of sidewalk)}] \times 100$.
7. Crack growth/peripheral overgrowth instances: Crack growth was any plant (dead or alive) growing in the slab cracks including the spacers between slabs with a maximum height of 0.15 m. Peripheral overgrowth was considered any plant form extending into the slab 0.2 m or more on either side of the slab, with a maximum height of 0.15 m. Outcome variable: *Total number of crack growth and peripheral overgrowth instances per segment.*
8. Grass height: The height of grass blades and weeds was determined at the first and last slab of each property in a segment. The measurement was taken at the midpoint of the slab, 50 cm into the property (away from the street). If no grass or weeds were present at this location, a second measurement was made at the quarter point of the slab nearest the end of the section. If no measures could be obtained at this point of the slab, the measurement procedures were conducted at the next slab towards the interior of the property. Outcome variable: *Average property grass height in centimeters per segment.*
9. Landscapable area: Landscapable area was determined by measuring the linear length of properties or empty lots in a segment that were or could be landscaped. Front yards/lots with grass and/or dirt were considered landscapable, whereas driveways, parking lots, and any other areas void of grass and/or dirt (e.g., paved front yards, paved empty lots, etc.) were considered not landscapable. Outcome variable: *Percent of a segment landscapable* =

[linear meters of landscapable area ÷ total linear meters of a segment (both sides of the street: 610 m)] * 100.

10. Graffiti and/or other defacements: Any institutionally illicit, man-made marks anywhere on a property (house facades, street signs, sidewalks, etc.) considered illegal (e.g., vandalism) to the larger society were counted. Outcome variable: *Percent of properties with graffiti per segment* = [Instances of graffiti on a property per segment ÷ number of properties per segment] * 100.
11. Litter: Litter was defined as anything on the sidewalk and in an area 5 ft from the sidewalk into a property that did not perform a function or add to the landscape. Outcome variable: *Total pieces of litter per segment*.
12. Chipped paint: The presence or absence of cracked and/or chipped paint on the facades of properties was noted. Outcome variable: *Percent of properties with chipped/cracked paint per segment* = [Number of properties with chipped/cracked paint ÷ number of properties per segment] * 100.
13. Trees: Trees present in the area extending from the front of building structure to the street were counted. Outcome variable: *Total number of trees per segment*.
14. Flowers: presence of flowers on property (yes or no). Outcome variable: *Percent of properties with flowers per segment* = [Number of properties with flowers per segment ÷ total number of properties per segment] * 100.

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