Using Google Street View to measure neighborhood physical disorder

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Introduction

Racial, ethnic, and economic characteristics of neighborhoods have long been viewed by sociologists as determinants of socioeconomic attainment and social outcomes (most notably, crime and delinquency). More recently, interest has shifted to the role of neighborhood environments in shaping health and health behaviors, including and health disparities, following mounting evidence that poor health outcomes tend to cluster spatially. While social attributes of neighborhoods, such as social cohesion, collective efficacy, and demographic composition, can be measured using survey questions or existing censuses, in most cases measuring physical aspects of neighborhoods, including physical disorder and the built environment, requires some form of systematic field observation. The high costs and logistical constraints of field observation have greatly limited the inclusion of measures of neighborhood physical characteristics in analyses of health, with most such studies focusing on single cities and often on selected neighborhoods within cities. The Street View project assesses the feasibility, reliability, and validity of using new technology, freely available online via Google, to measure neighborhood physical disorder and built environment features at a fraction of the cost of field studies.

In this paper, we compare the psychometric properties and predictive power of physical disorder subscales that can be captured via Google technology to original physical disorder scales, previously used in analyses of the Los Angeles Family and Neighborhood Study (LA FANS) and the Project on Human Development in Chicago Neighborhoods (PHDCN).

Background

Physical disorder generally refers to physical signs of neglect or deterioration such as litter, graffiti, or boarded-up buildings. It is distinct from *social disorder*, which connotes human activity such as public drunkenness or illegal activity such as drug dealing, and which cannot be measured using Google Street View. Physical disorder is generally regarded as aesthetically unattractive, thus deterring recreational walking or other outdoor activities for which environmental aesthetics tend to be more important. In addition, physical disorder may create stress or deter walking and other outdoor activity by creating the perception of a dangerous environment, sometimes leading parents to keep their children indoors. This perception may be heightened by social signifiers such as graffiti or by vacant or boarded-up buildings, which provide venues for illegal activity or reduce resident surveillance. Physical disorder may also be a source of chronic stress, with detrimental effects on health; in fact Glass and colleagues suggest that stress caused by neighborhood disorder may be one pathway through which disorder affects obesity rates. Measures of physical disorder, most commonly boarded up buildings, broken glass, litter or graffiti, have been associated with all-cause premature mortality and with mortality from cardiovascular disease and homicide, self-rated health, walking and other forms of physical activity, obesity, lower-body functional limitations, and symptoms of depression, anxiety, and conduct disorders. Physical disorder, particularly vacant or dilapidated buildings, may also be associated with asthma. There is also an extensive literature in criminology linking physical disorder to crime and violence. Aspects of physical disorder most commonly measured include deteriorated or boarded-up buildings, vacant lots, broken glass, conditions of sidewalks, graffiti, litter, and trash. A number of scales of physical disorder have been developed, and their component items are included in large neighborhood studies, including the LA FANS study and the PHDCN study. What is unknown is whether associations such as those described above are apparent when using subscales of neighborhood disorder that exclude items too small to view using Street View.

Data and Methods

Google Street View is a component of Google Maps that allows users to see panoramic street-level views of city streets, pan 360 degrees, rotate the camera vertically 290 degrees, and zoom in and out. Analyses conducted during the summer of 2009, assessing inter-rater reliability and comparing Street View-coded block faces with in-person field observations of the same blocks, revealed that Street View can produce very reliable data on some aspects of neighborhoods and not on others. For example, inter-rater agreements for garbage on the sidewalk was 85%. It was 79% for sidewalk disrepair and 68% for broken windows. Generally, Street View proved to be very reliable for measuring elements of urban design and street infrastructure. Street View had low levels of inter-rater agreement on small items such as discarded drug paraphernalia, bottles, and

cigarette butts. Similarly, when the Street View coded data were compared to the field observers' data for 37 blocks, the items that scored high on inter-rater reliability also scored high on between mode agreement. Agreement between Street view and in person field rater scores was 81% for sidewalk disrepair, 75% for broken windows, 71% for building disrepair, and 68% for graffiti, garbage on the sidewalk, and abandoned buildings.

We will create subscales based on the high reliability/high validity items from the LAFANS and PHDCN study. Then, based on LAFANS and PHDCN data, we will then assess the extent to which the street View-able subscales correlate with the full neighborhood disorder scales. And we will compare associations between measures of neighborhood disorder and other aspects of neighborhoods (including social and demographic compositional characteristics) and between neighborhood disorder and individual level health and behavioral outcomes data, using the full and sub scales.

Ascertaining the value of Street View-able subscales of physical disorder inventories will establish the potential for Google Street View to replace field studies as a way of contextualizing survey data, at a fraction of the cost of sending people into the field.