Social Science & Medicine 168 (2016) 16–29

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Review article

Research on neighborhood effects on health in the United States: A systematic review of study characteristics

Mariana C. Arcaya [a], Reginald D. Tucker-Seeley [b, c], Rockli Kim [b], Alina Schnake-Mahl [b], Marvin So [b], S.V. Subramanian [b, *]

[a] Massachusetts Institute of Technology, USA
[b] Harvard Chan School of Public Health, USA
[c] Dana-Farber Cancer Institute, USA

ARTICLE INFO

Article history:
Received 9 May 2016
Received in revised form
17 August 2016
Accepted 27 August 2016
Available online 28 August 2016

Keywords:
Neighborhoods
Study design
Multi-level
Social epidemiology
USA

ABSTRACT

Neighborhood effects on health research has grown over the past 20 years. While the substantive findings of this literature have been published in systematic reviews, meta-analyses, and commentaries, operational details of the research have been understudied. We identified 7140 multi-level neighborhoods and health papers published on US populations between 1995 and 2014, and present data on the study characteristics of the 256 papers that met our inclusion criteria. Our results reveal rapid growth in neighborhoods and health research in the mid-2000s, illustrate the dominance of observational cross-sectional study designs, and show a heavy reliance on single-level, census-based neighborhood definitions. Socioeconomic indicators were the most commonly analyzed neighborhood variables and body mass was the most commonly studied health outcome. Well-known challenges associated with neighborhood effects research were infrequently acknowledged. We discuss how these results move the agenda forward for neighborhoods and health research.

Interest in "neighborhood effects on health," or the independent effects of neighborhood context on health over and above individual factors, has been growing over the past 20 years (Oakes et al., 2015). This trend has been motivated by epidemiological studies seeking to explain patterns of disease and health across geographic areas and populations, and by the recognition that individual health is influenced by not only individual characteristics, but also by contexts to which individuals belong (Berkman and Kawachi, 2000; Macintyre, 2002). For example, researchers have conceptualized a wide range of neighborhood characteristics, including area-level poverty, walkability, food environment, air pollution, social cohesion, and crime, among others, as drivers of an equally broad range of individual health outcomes (Diez Roux and Mair, 2010). Recognizing that contextual exposures influence health, and can interact with individual-level characteristics and systems at other levels, is a crucial component of social epidemiological theories of disease distribution, particularly ecosocial theory, that have been explicated and refined in the latter part of the 20th century, and have been gaining strength in the past 20 years or so (Krieger, 2011, 1994). Growth in neighborhoods and health research reflects, in part, the influence of these contextualized perspectives on health as an alternative to dominant biomedical and lifestyle models that focus on proximate, individual-level risk factors for disease (Krieger, 2011). Examining neighborhood effects on health has also taken on new practical importance as the public health community increasingly looks to place-based interventions to promote population health and health equity (Frieden, 2010; Marmot et al., 2008).

Attempts to synthesize neighborhoods and health research conducted to date have included summaries of methodological advances in recent neighborhoods and health research (Oakes and Andrade, 2014), and a review and commentary on the contribution that "neighborhood effects" papers have made to our understanding of health since 1990 (Oakes et al., 2015). In addition, we count over 20 systematic reviews of neighborhoods and health studies that focus on various health outcomes or behaviors (Table 1). Previous reviews have found moderate to strong evidence of neighborhood effects on depression (Kim, 2008; Mair et al., 2008), mental health (Truong and Ma, 2006), early child health outcomes (Christian et al., 2015; Sellstrom and Bremberg, 2006), birth outcomes (Vos et al., 2014), intimate partner violence (Beyer

* Corresponding author. Department of Social and Behavioral Sciences, 677 Huntington Avenue, Kresge Building 7th Floor, 716, Boston, MA 02115-6096, USA.
E-mail address: svsubram@hsph.harvard.edu (S.V. Subramanian).

http://dx.doi.org/10.1016/j.socscimed.2016.08.047
0277-9536/

et al., 2015), all-cause mortality (Meijer et al., 2012), and other general health outcomes (Pickett and Pearl, 2001; Yen et al., 2009), over and above individual-level risk factors. However, other work looking at weight-related health behaviors among African Americans (Casagrande et al., 2009) and alcohol use (Jackson et al., 2014) have reported mixed findings. Similarly, reviews on obesity (Black and Macinko, 2008; Corral et al., 2015; Feng et al., 2010) and physical activity (Bancroft et al., 2015; Ding et al., 2011; Foster and Giles-Corti, 2008; Koohsari et al., 2015; Owen et al., 2004) found largely inconsistent results across various neighborhood-level measures and health outcomes.

Authors of the reviews commonly criticized the underlying studies for poor measurement of neighborhood environments, a reliance on administrative neighborhood definitions, weak study designs, and underdeveloped or absent conceptual models, all of which may contribute to inconsistent results. Such critiques align with narrative reviews published over the past decade, which reflect on the direction of neighborhoods and health research (e.g., Chaix, 2009; Diez Roux, 2007; Diez Roux and Mair, 2010). These papers have articulated conceptual models describing how multiple aspects of neighborhood environments may affect health, and have offered suggestions for future research directions that emphasize causal inference and a richer theoretical understanding of place. Calls for stronger study designs, more theoretically relevant spatial scales (e.g., Diez Roux and Mair, 2010), and better measures of a broader range of neighborhood-level exposures, mediators and confounders (e.g., Chaix, 2009) highlight the importance of methodological details for understanding the state of the science examining neighborhood effects on health.

However, there is little empirical information on the operational details of recent neighborhoods and health research. While previous reviews, included many of those cited above, provide such details for papers on specific health outcomes or neighborhood characteristics, this is the first systematic review of neighborhood and health literature published over the past 20 years that spans multiple health outcomes and neighborhood factors, and catalogues information on indicators important for assessing the neighborhood health effects literature. To this end, we describe how neighborhoods and health research has been focused and carried out between 1995 and 2014 by summarizing study characteristics of multi-level neighborhoods and health papers published during those years. Multi-level analyses are those that rely on data indexed at more than one level, for example, using data collected on individuals, at level 1, residing in neighborhoods, at level 2. Multi-level models provide estimates of both average relationships between exposures and outcomes, as well as of variation around these averages, at each level. By accounting for statistical dependence in data that is generated by shared contexts, and modeling realistically complex population heterogeneity, multi-level models are methodologically and substantively well-suited for studying neighborhood effects on health (Subramanian, 2004; Subramanian et al., 2003).

The multi-level analysis criterion helped us narrow a broad literature that investigates the health of individuals situated within neighborhoods to those studies whose target of inference was shared neighborhood environment (Subramanian and O'Malley, 2010). Limiting our search to multi-level analyses screened out papers that may have viewed clustering within neighborhoods as a nuisance, and those that conceptualized neighborhood environments as "activity spaces" unique to each individual. As such, studies that used a population average approach to account for shared environments, and those that used spatial buffers to construct individually-varying environmental measures, for example, were deliberately excluded from this review.

We report metrics on the neighborhood definitions used, health outcomes studied, neighborhood attributes measured, study designs employed, and multi-level sample sizes analyzed in papers that met our inclusion criteria. We also examine the extent to which researchers acknowledge common pitfalls in neighborhood effects research, including the fact that different neighborhood boundaries and sizes will produce different estimates. More specifically, we noted whether each study *explicitly* cited the frameworks of Modifiable Area Unit Problem (MAUP) and/or the Uncertain Geographic Problem (UGCoP), which highlight the fact that areal units are usually arbitrarily determined and, therefore, "modifiable" or "uncertain", in the sense that they can be aggregated to form units of different sizes or spatial arrangements leading to different results (Openshaw, 1984).

The goals for this manuscript are twofold. First, we provide new data on the characteristics of a broad set of neighborhoods and health studies over the past 20 years as a resource to better understand the state of the "neighborhood effects on health" science. Primary objectives include characterizing the size, scope, and trajectory of growth in the literature over the past 20 years. Secondly, we reflect on previous agendas to advance neighborhoods and health research, highlighting goals that have not yet been met by the existing literature.

1. Methods

1.1. Search strategy

To identify empirical multi-level studies that examine associations between neighborhood environment and health outcomes published between January 1, 1995 and December 1, 2014, we performed a literature search in four electronic databases: PubMed, Embase, PsycInfo, and Sociological Abstracts. Searches were conducted using the following title, abstract, keyword and Medical Subject Headings (MeSH) terms: multilevel, multi-level, residence characteristics, neighborhood, and built environment. No search terms were included that restricted articles based on specific outcomes (see Appendix 1 for search strategies). The reference lists of previous reviews and meta-analyses on neighborhood effects on specific health outcomes and papers deemed seminal by the investigators were reviewed. We did not perform a meta-analysis on included studies because of the diversity of the health outcomes and incomparable statistical approaches employed across the studies reviewed.

1.2. Inclusion/exclusion criteria

To be included, studies had to be 1) multi-level (i.e., at least two levels of analysis), where at least one of the higher levels was a neighborhood context, and 2) focused on exploring how neighborhoods affect health. We did not restrict how the neighborhood was defined or measured given our explicit interest in exploring this issue. We included studies with diverse outcomes related to health and health behaviors, ranging from mental health, anthropometric measures, cancer and cardiovascular health, physical activity, and diet, for example, but excluded outcomes that measured well-being, such as quality of life and happiness. We also excluded papers focused on natural environmental exposures (e.g., particulate matter, radiation), which are generally, although not always, conceptualized as individual-level risks for which the neighborhood is not the theoretically appropriate level of measurement. We limited our search to English language articles with US study populations due to diverse methodological considerations for administrative units in other countries. Only empirical studies published in peer-reviewed journals were included in the study; abstracts, posters, book chapters, dissertations, methodological