A multilevel approach to modeling health inequalities at the intersection of multiple social identities

Clare R. Evans[a],[*], David R. Williams[b], Jukka-Pekka Onnela[c], S.V. Subramanian[b]

[a] Department of Sociology, University of Oregon, Eugene, OR, United States
[b] Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, Boston, MA, United States
[c] Department of Biostatistics, Harvard T.H. Chan School of Public Health, Boston, MA, United States

ARTICLE INFO

ABSTRACT

Rationale: Examining interactions between numerous interlocking social identities and the systems of oppression and privilege that shape them is central to health inequalities research. Multilevel models are an alternative and novel approach to examining health inequalities at the intersection of multiple social identities. This approach draws attention to the heterogeneity within and between intersectional social strata by partitioning the total variance across two levels.

Method: Utilizing a familiar empirical example from social epidemiology—body mass index among U.S. adults ($N = 32,788$)—we compare the application of multilevel models to the conventional fixed effects approach to studying high-dimension interactions. Researchers are often confronted with the need to explore numerous interactions of identities and social processes. We explore the interactions of five dimensions of social identity and position—gender, race/ethnicity, income, education, and age—for a total of 384 unique intersectional social strata.

Results: We find that the multilevel approach provides advantages over conventional models, including scalability for higher dimensions, adjustment for sample size of social strata, model parsimony, and ease of interpretation.

Conclusion: Considerable variation is attributable to the within-strata level, indicating the low discriminatory accuracy of these intersectional identities and the high within-strata heterogeneity of risk that remains unexplained. Multilevel modeling is an innovative and valuable tool for evaluating the intersectionality of health inequalities.

1. Introduction

Intersectionality is a theoretical framework that is increasingly used to study the patterning of health inequalities because of its focus on the multidimensional, multiplicative nature of disadvantage (Bowleg, 2012; Farmer and Ferraro, 2005; Schulz and Mullings, 2006; Veenstra, 2011; Warner and Brown, 2011), which corresponds with discipline-specific theories such as fundamental causes (Link and Phelan, 1995) and ecosocial theory (Krieger, 2011). Intersectionality theorists posit that inequalities are generated by numerous interlocking systems of privilege and oppression such as racism, classism, sexism, and ageism (Collins, 1990; Crenshaw, 1989; McCall, 2005), and push back against the "additive approach," which treats the advantages or disadvantages conferred through simultaneous occupation of multiple social positions as simply accumulated. Care must be taken in the adoption of intersectionality by public health researchers, however, to ensure that it is

properly framed within the context of ongoing debates in epidemiology—namely between the so-called "risk factor" epidemiology and "eco-epidemiology" (Susser and Susser, 1996). Conventional approaches to quantitative intersectionality analysis have also presented several methodological limitations, including issues of scalability, model parsimony, small sample size, and interpretability of results.

In this study, we explore an alternative analytic approach (Evans, 2015; Green et al., 2017; Jones et al., 2016) that resolves some of the key theoretical and methodological tensions inherent to this research. This approach involves applying hierarchical, multilevel models to study large numbers of interactions and intersectional identities while partitioning the total variance between two levels—the *between-strata* (or between category) level and the *within-strata* (or within category) level. This analytic approach is a valuable tool for *exploring* multiple interactions simultaneously and the patterning of inequalities across society. We apply and compare this new approach with the

---

conventional, fixed effects approach to interaction models. To demonstrate its potential application in health research, we explore an empirical example that will be familiar to many social epidemiologists—body mass index among U.S. adults.

1.1. Risk factor epidemiology and eco-epidemiology—Framing intersectionality

McCall (2005) has identified three distinct orientations within the current intersectional literature—the *intercategorical*, the *intracategorical* and the *anti-categorical*. The anti-categorical approach involves the critique and deconstruction of analytic categories. The intracategorical approach tends to "focus on particular social groups at neglected points of intersection … in order to reveal the complexity of lived experiences within such groups" (p.1774). The approach to intersectionality most often adopted in social epidemiology is the intercategorical approach because of its natural fit with quantitative analyses of inequalities. The intercategorical approach involves the provisional adoption of analytic categories to document inequalities among groups and explore the interactions between different dimensions of identity, position, and social processes. The conventional intercategorical approach to studying interactions, which we will refer to as the *fixed effects* approach, involves fitting a single-level regression model with a full complement of parameters to account for all points of interaction. This can be accomplished either by using a full set of dummy variables (one representing each possible combination of social identity and position, e.g., young college educated high income black woman) or by including main effects and a saturation of interaction terms. Mathematically these approaches are equivalent, and so we refer primarily to the version with interaction parameters.

When using intercategorical intersectionality in population health research it is critical to correctly situate this framework within existing debates in epidemiology. Rose (1992) famously distinguished between *causes of individual cases* (i.e., why did *this* person get sick with *this* illness at *this* point in time) and *causes of population incidence* (i.e., what caused *this* population to have a higher disease incidence than *that* population). Causes at these distinct levels may or may not resemble each other. Susser and Susser (1996) expanded on this to differentiate *risk factor epidemiology* with its focus on identifying causes of cases from *eco-epidemiology,* which takes a multilevel perspective and considers causal pathways ranging from the societal level to the molecular level. As others have noted (Merlo and Wagner, 2012; Merlo, 2014), this distinction is not always appreciated in modern epidemiology.

The risk factor approach in epidemiology involves the identification of risk factors through the comparison of group averages. In practice the use of variables such as gender, race/ethnicity, and socioeconomic status (SES) in quantitative intersectionality research may make it appear that the mission of intersectionality research corresponds with the risk factor approach, and involves identifying ever-narrower and more specific "risky identities" that are particularly burdened by health inequalities. This is, however, diametrically opposed to a central tenet of intersectionality—namely, that intersectionality does not situate the problems associated with particular identities within individuals or the identities themselves, but within the structural power hierarchies, social processes, and social determinants that shape the social experiences of individuals with those intersectional identities. While categorical variables (gender, race, class) may be used in regression models, care should always be taken to recognize that these may be intended as proxies for the interactions of systems of oppression (sexism, racism, classism) and other social processes in producing population-level incidence (Bauer, 2014).

In ecosocial theory, Krieger (2011) theorizes health inequalities between populations as resulting from numerous interacting *pathways of embodiment* across the life course, through which we come to "literally incorporate, biologically … the material and social world in which we live" (p. 214). Ecosocial theory encourages a broad vision for

the determinants of health inequalities—including both the interlocking systems of oppression and privilege (sexism, racism, classism) implicated by intersectionality and *other* social processes. For instance, Krieger points to issues of social and economic deprivation, environmental hazards, and the targeted marketing of harmful commodities to low income populations as key pathways of embodiment, which may not readily be classified as forms of intersectional "classism" per se.

Eco-epidemiologists have argued strongly against the "tyranny" (Merlo and Wagner, 2012) of comparing group averages, both because it risks framing inequalities as individual-level issues resolvable by individuals (resulting in "blaming the victim") and because such averages obscure the relatively low predictive power of these labels to distinguish between cases and non-cases. In other words, risk factors typically are unable to discriminate between individuals who will become sick and those who will not (Merlo, 2014), which should caution all of us to frame intercategorical intersectionality research in the health inequalities domain as explicitly eco-epidemiologic.

Paradoxically, as Merlo (2014) has noted, many existing eco-epidemiologic studies continue to utilize a framework reliant on comparing group averages—though admittedly these new risk factors are situated at higher contextual levels, such as comparing neighborhood averages. Eco-epidemiologic approaches should balance consideration of group averages with what Merlo (2014) has called a "multilevel analysis of individual heterogeneity"—or a multilevel examination of variation within and between groups. The approach presented here is explicitly framed with this intention and allows for consideration of both group averages and multilevel variation within and between groups.

As a brief aside, we will henceforth refer to these points of intersection as "social strata" rather than as categories or groups. The intersectionality literature has encouraged us all to become more skeptical of the reification of categorical labels, and therefore we feel that the term "strata"—which alludes to stratified analyses—implies *provisional* acceptance of labels for the purposes of studying inequalities, while remaining aware of the inherent danger in treating social labels as monolithic, unchanging, and inflexible. Similarly, we sometimes use the word "identity" as a shorthand to refer to dimensions of identity, position, and resources. We do not mean to imply that income, for instance, is best understood as a social identity.

1.2. Theoretical and empirical motivation

The conventional fixed effects approach to operationalize intercategorical intersectionality is open to two related theoretical criticisms and poses additional empirical concerns. First, including interaction terms encourages us to only study the intersectionality of *marginalization*. For instance, in a comparative quantitative intersectional analysis where white males are the reference group, we might include main effects for "black" and "female" and an interaction term for "black *and* female." Following current standards, finding this interaction term to be statistically significant would be interpreted as support for the interaction of racism and sexism. However, this setup enables us to only evaluate the interaction effect experienced by black women, while those experiencing multiple privileges (e.g., white men) or mixes of privilege and disadvantage (e.g., white women and black men) are treated as having no observable interaction effect. Theorists have voiced this concern and called for consideration of the points of intersection that mix privilege and marginalization (Bauer, 2014; Choo and Ferree, 2010; Hancock, 2007; Nash, 2008). While studying intersectionality of privilege could be accomplished by switching the reference group to "low SES black females" or by constructing alternative post hoc analyses, ideally, we would be able to determine simultaneously whether *all* intersectional identities exhibit evidence of an interaction (or intersectional) effect above and beyond the contributions of the additive main effects.

In other words, to examine whether a given social stratum shows