

Putting health inequities on the map: social epidemiology meets medical/health geography—an ecosocial perspective

Nancy Krieger

Published online: 7 February 2009
© Springer Science+Business Media B.V. 2009

Abstract *To put on the map:* according to the Oxford English Dictionary, whatever is so placed occupies “an important or prominent position” and is “of some account or importance.” In this brief commentary, I take the opportunity to reflect on several articles by medical/health geographers and others regarding our *Public Health Disparities Geocoding Project* and my research, as a social epidemiologist, on the myriad ways racism can harm health. In both cases, my work on these topics has been motivated by my desire, starting a quarter of a century ago, to put health inequities on the map: as a topic of public concern, research, and action. The insightful and informative points and questions raised by the geography-oriented articles underscore the importance of bringing the best of our respective disciplinary insights and expertise to illuminate the profound connections between social justice and public health, between our bodily truths and the body politic, so as to further the goal of embodying equity—in an ecologically sustainable world.

Keywords Social epidemiology · Geocoding · Socioeconomic position · Racial discrimination · Public health surveillance · Health inequities

To put on the map: according to the Oxford English Dictionary, whatever is so placed occupies “an important or prominent position” and is “of some account or importance” (Oxford English Dictionary 2008). Indeed, the power of maps—as literal signs of the power and resources of their creators, as visual displays, as modes of organizing ideas and knowledge, and as metaphors and stimuli for theory and thinking—has long been known to geographers, as readers of *GeoJournal* most deeply know. The many meanings and uses of the word “map” (see Textbox 1) attest to the central importance of spatially-construed knowledge and reasoning, whether literal or abstract, for knowledge and action.

Not that my initial training in epidemiology had anything to do with maps, other than the oblique cursory mention of John Snow’s 1854 maps placing the Broad Street pump at the epicenter of one of London’s cholera outbreaks (for a more adequate treatment of the complexity of this story, see: Koch 2005; Monmonier 1997, and Robinson 1982, among others). Instead, my introduction to the multifaceted realm of geographic ideas and methods came about through my desire to put health inequities on the proverbial map—as a topic of public concern, research, and action.

In the usual case of one thing leading to another, my initial use of geographic data in the early 1980s—and the path of research and work that it opened—started with one very particular problem. With all the curiosity and gumption of a master student, I wanted

N. Krieger (✉)
Department of Society, Human Development, and Health,
Harvard School of Public Health, 677 Huntington
Avenue, Kresge 717, Boston, MA 02115, USA
e-mail: nkrieger@hsph.harvard.edu

Textbox 1 The many meanings of “map” (Oxford English Dictionary 2008)

Etymology: [Either <post-classical Latin *mappa* map (from c1120 in British sources; in classical Latin ‘towel, napkin’, a word of Punic origin according to Quintilian), or shortened <MAPPEMONDE *n.* or MAPPA MUNDI *n.* Compare Old French *mape*, *mappe* map of the world (c1160 or later, rare; not recorded in Anglo-Norman), Italian *mappa* (14th cent.), Spanish *mapa* (1582–5), Portuguese *mapa* (16th cent.), and also forms s.v. MAPPEMONDE *n.*

Post-classical Latin *mappa* is attested from the late 4th cent. as a term used by land surveyors, though its exact interpretation is not clear. (The usual word for a surveyor’s map in classical and post-classical Latin is *forma*.) The transition in sense from ‘cloth’ to ‘map’ is probably due to the fact that early maps were sometimes drawn on cloth.

Compare German *Mappe* map (15th cent.; this sense became obsolete in 18th cent.; the modern sense ‘portfolio’ developed from the intermediary 18th-cent. ‘cover for a map’).

In sense 10 probably after classical Latin *mappa* piece of cloth, napkin.]

I. A chart, plan, diagram, etc.

1. a. A drawing or other representation of the earth’s surface or a part of it made on a flat surface, showing the distribution of physical or geographical features (and often also including socio-economic, political, agricultural, meteorological, etc., information), with each point in the representation corresponding to an actual geographical position according to a fixed scale or projection; a similar representation of the positions of stars in the sky, the surface of a planet, or the like. Also: a plan of the form or layout of something, as a route, a building, etc.

b. fig. A tract of country spread out to view like a map. *in map:* within view. Cf. MAP *v.* 1c. *Obs. rare.*

2. A tabulated arrangement of data; = TABLE *n.* 14a. *Obs. rare.*

3. a. A diagram or collection of data showing the spatial distribution of something or the relative positions of its components. Freq. with distinguishing word.

b. Genetics. A representation of the relative order and distance apart of the genes of a chromosome. Also: the nucleotide sequence of all or part of a chromosome or genome.

c. Physiol. Originally: (a representation of) a sensory area of the cerebral cortex in which neighbouring cells respond to stimulation of neighbouring portions of the peripheral sensory epithelium. More generally: within the central nervous system, a representation of sensory or motor information in which some parameter of a stimulus or movement varies systematically with physical location in the brain.

4. Math. A correspondence by which each element of a given set has associated with it one (or occas. more than one) element of a second set; = MAPPING *n.* 2a.

II. Extended uses.

5. fig.

a. A representation in abridged form; a summary or condensed account of a state of things; an epitome, a summation. *Obs.*

b. An embodiment or incarnation of a quality, characteristic, etc.; the very picture or image of something. *Obs.*

6. fig. A conceptualization or mental representation of the structure, extent, or layout of an area of experience, field of study, ideology, etc.

7. A shape or pattern resembling a map in form or outline.

8. In various *fig.* phrases. (Now occas. with premodifying adjective or noun.)

a. off the map: out of existence; obsolete or of no account; in or into a remote or insignificant position. Freq. *to wipe* (also *knock*, etc.) *off the map*.

b. on the map: (a) in or into existence; (b) (the usual sense) in an important or prominent position, in vogue; of some account or importance. Chiefly in *to put (back) on the map*.

c. Chiefly *N. Amer.* *all over the map:* widely distributed, in many different places; (also) varying widely and erratically.

9. colloq. A person’s face.

to measure the contribution of racial/ethnic socio-economic inequality to racial/ethnic inequities in breast cancer survival. Specifically, I wanted to test—and refute—the conventional hypothesis which held that “race,” understood as an allegedly innate biological characteristic, was the reason US black women were burdened by poorer breast cancer

survival compared to white women. To me, my alternative hypothesis seemed eminently logical and obvious: I had entered public health, after all, with a worldview already deeply informed by my activism about issues of social justice—and I wanted to do work that would help elucidate the reasons for social inequalities in health.

What I quickly discovered was that it was far from obvious how to answer my breast cancer survival question using available cancer registry data. This was because US cancer registries, like most US public health surveillance systems, contained data on “race” but had no data on socioeconomic position. This glaring data gap was unacceptable to me. Not content to accept “can’t be done” for an answer, I sought a way to get the data to test my hypothesis and answer my question. Through a combination of conversations with other colleagues and intensively researching the literature, it became clear that one possible solution to the problem of missing socioeconomic data would be to: (a) identify the residential address of each breast cancer case, and (b) characterize the socioeconomic position of each case in relation to the kind of neighborhood she lived in, using US census data; by extension, I also realized that, for computation of rates, it would be possible to obtain the corresponding denominator data the same way, by determining how many women, of the same race/ethnicity and age, lived in a given neighborhood, thereby enabling their socioeconomic position to be categorized using the same neighborhood socioeconomic measure as employed for the cases. I note that at this time, all this was easier said than done: there existed no pre-packed geocoding software. Instead, I had to borrow a thick printout listing each street, street address range, and corresponding census tract code that had been prepared by a member of the university’s geography department—and I then manually geocoded each and every one of the over 1,500 breast cancer cases included in the study. Working on this project with my colleague Dr. Mary Bassett, we were able to demonstrate, in our population-based study that: (1) “In a Cox regression model, after adjustment for Black-White differences in age, stage, and histology, Black mortality was 1.35 times that of Whites (95% CI = 1.05–1.72);” (2) “Following additional adjustment for social class, as measured by a variety of block group characteristics, Black mortality was only 1.10 times that of Whites (95% CI = 0.83–1.46);” and (3) “In both Blacks and Whites, poorer social class was a powerful determinant of shortened survival.” (Table 1) (Bassett and Krieger 1986).

And so was born my abiding interest in using geocoding and area-based socioeconomic measures in my empirical social epidemiologic research—and

also my enduring commitment to improving the kinds of data collected in public health surveillance systems and studies so that they reveal, not obscure, the societal determinants of health and health inequities. I soon followed up with two methodological studies, comparing the magnitude of socioeconomic disparities in health measured with individual-level versus area-based socioeconomic measures (ABSMs) (Krieger 1991, 1992) and continued to use ABSMs in various research projects (e.g., from Krieger 1990a on up to Krieger et al. 2008a). At the same time, I also pursued my other research interests, both etiologic investigations of health inequities (including substantive and methodologic research on how racism harms health) and theoretical work critiquing past and present conceptual frameworks guiding epidemiologic research (see, for selected references: <http://www.hsph.harvard.edu/faculty/nancy-krieger/>). Among these efforts has been my work on developing the ecosocial theory of disease distribution, which I first proposed in 1994 and have elaborated since, and which is concerned with how societal determinants of health, at multiple levels and spatiotemporal scales, become embodied across the lifecourse, thereby producing population patterns of health, disease, and well-being (Krieger 1994, 2001, 2008).

Recognizing the still pressing need, however, for methodologic research to improve monitoring of health inequities, in 1998 I launched the *Public Health Disparities Geocoding Project*, designed “to ascertain which ABSMs, at which geographic level (census block group [BG], census tract [CT], or ZIP Code [ZC]), would be suitable for monitoring US socioeconomic inequalities in the health” (Krieger et al. 2008b). It is the work of this *Project*—work which would not have been possible without the expertise and dedication of our *Project*’s longstanding team members Pamela D. Waterman and Jarvis T. Chen and also the contributions of our other colleagues who co-authored our many studies (Table 2)—that led Daniel Sui, Editor-in-Chief of *GeoJournal*, to organize this special issue, whose articles were invited to discuss the impact of what he termed our “ground-breaking” and “cross-disciplinary” research “on medical/health geography and social epidemiology” (personal correspondence: email from Sui, 1/4/08).

To be honest, the request from Dr. Sui was surprising. Although we certainly had intended our

Table 1 Results of the first epidemiologic study in which I used geocoding and area-based socioeconomic measures: Bassett M, Krieger N. Social class and black-white differences

in breast cancer survival. *American Journal of Public Health* 1986; 76:1400–1403

TABLE 2—Relative Risk of Mortality during the First 11 Years following Diagnosis of Breast Cancer (Cox regression estimates)

Risk Factor	Adjusted for:**	Relative Risk	95% Confidence Interval
Race	—	1.31	1.03–1.67
Race	age, stage, histology	1.35	1.05–1.72
Race	age, stage, histology, social class	1.10	0.83–1.46
Working Class	race, age, stage, histology	1.52	1.28–1.88

**Variables entered into Cox regression model as follows:

Race: 0 Whites
1 Blacks

Age-Stage: 1 Age < 50, Stage < 4
2 Age < 50, Stage = 4
3 Age ≥ 50, Stage < 4
4 Age ≥ 50, Stage = 4

Histology: 1 Ductal
2 Lobular
3 Other

Working class: 0 < 35% working class
1 ≥ 35% working class

Poverty: 0 < 20% below poverty (race-specific)
1 ≥ 20% below poverty (race-specific)

Education: 0 < 15% high school dropouts (race-specific)
1 ≥ 15% high school dropouts (race-specific)

Households on public assistance: 0 < 6% public assistance
1 ≥ 6% public assistance

Note

1) The study population consisted of all Black women listed in the all Western Washington Cancer Surveillance System (CSS)—which at that time identified all incident cases of cancer occurring in 13 counties of northwestern Washington State—who were diagnosed with primary breast cancer (excluding Paget's disease) between January 1973 and December 1983 ($n = 268$), each of whom was matched on the basis of year of diagnosis and county of residence to a random sample of five White women in the CSS also diagnosed with primary breast cancer

2) We used 1980 census block-group data for our census-derived areas-based socioeconomic measures

3) Ours was the second published study to examine the role of social class in black/white disparities in breast cancer survival; the first was: Dayal H, Power RN, Chiu C: Race and Socioeconomic status in survival for breast cancer. *J Chronic Dis* 1982; 35:675-683

Reprinted with permission of the *American Journal of Public Health*

Project to have an impact on public health surveillance and public health research, and of course drew on insights and methods from many disciplines, we did not consider medical/health geographers to be an audience who would find our *Project* to be especially novel or interesting. This is because our work, until recently (Subramanian et al. 2005; Chen et al. 2006; Chen et al. 2008), has chiefly used geographically-linked data (i.e., the ABSMs) without deeply

engaging with the underlying spatial relationships or spatial processes at play. Instead, we consciously chose to keep the focus on the central objective of our *Project*: how to expand use of geocoding and ABSMs in US public health surveillance systems. Our explicit intent was to improve monitoring of socioeconomic inequities in health, overall and within racial/ethnic groups, and assess their contribution to racial/ethnic health inequities. Until we felt we had

Table 2 Publications of the *Public Health Disparities Geocoding Project* (freely available at: <http://www.hsph.harvard.edu/thegeocodingproject/webpage/monograph/publications.htm>)*Project monograph*

1) Krieger N, Waterman PD, Chen JT, Rehkopf DH, Subramanian SV. Geocoding and monitoring US socioeconomic inequalities in health: an introduction to using area-based socioeconomic measures—*The Public Health Disparities Geocoding Project* monograph. Boston, MA: Harvard School of Public Health. Available at: <http://www.hsph.harvard.edu/thegeocodingproject/>

Peer-reviewed publications: primary findings

2) Krieger N, Chen JT, Waterman PD, Rehkopf DH, Subramanian SV. Painting a truer picture of US socioeconomic and racial/ethnic health inequalities: the *Public Health Disparities Geocoding Project*. *American Journal of Public Health* 2005; 95:312–323.

3) Krieger N, Chen JT, Waterman PD, Rehkopf DH, Subramanian SV. Race/ethnicity, gender, and monitoring socioeconomic gradients in health: a comparison of area-based socioeconomic measures—*The Public Health Disparities Geocoding Project*. *American Journal of Public Health* 2003; 93:1655–1671.

4) Krieger N, Waterman PD, Chen JT, Soobader MJ, Subramanian S. Monitoring Socioeconomic Inequalities in Sexually Transmitted Infections, Tuberculosis, and Violence: Geocoding and Choice of Area-Based Socioeconomic Measures – *The Public Health Disparities Geocoding Project* (US). *Public Health Rep* 2003; 118:240–260.

5) Krieger N, Chen JT, Waterman PD, Soobader MJ, Subramanian SV, Carson R. Choosing area based socioeconomic measures to monitor social inequalities in low birth weight and childhood lead poisoning: *The Public Health Disparities Geocoding Project* (US). *J Epidemiol Community Health* 2003; 57:186–199.

6) Krieger N, Chen JT, Waterman PD, Soobader MJ, Subramanian SV, Carson R. Geocoding and monitoring of US socioeconomic inequalities in mortality and cancer incidence: does the choice of area-based measure and geographic level matter?: *The Public Health Disparities Geocoding Project*. *Am J Epidemiol* 2002; 156:471–482.

7) Krieger N, Waterman P, Chen JT, Soobader MJ, Subramanian SV, Carson R. Zip code caveat: bias due to spatiotemporal mismatches between zip codes and US census-defined geographic areas—*The Public Health Disparities Geocoding Project*. *American Journal of Public Health* 2002; 92:1100–1102.

8) Krieger N, Waterman P, Lemieux K, Zierler S, Hogan JW. On the wrong side of the tracts? Evaluating the accuracy of geocoding in public health research. *American Journal of Public Health* 2001; 91:1114–1116.

Book chapters

9) Krieger N, Zierler S, Hogan JW, Waterman P, Chen J, Lemieux K, Gjelsvik A. Geocoding and measurement of neighborhood socioeconomic position. In: Kawachi I, Berkman LF (eds). *Neighborhoods and Health*. New York: Oxford University Press, 2003; 147–178.

10) Krieger N, Waterman PD, Chen JT, Subramanian SV, Rehkopf DH. Monitoring socioeconomic determinants for healthcare disparities: Tools from the *Public Health Disparities Geocoding Project*. In: Williams RA (ed). *Eliminating Healthcare Disparities in America: Beyond the IOM Report*. Totowa, NJ: Humana Press, 2007; 259–306.

Peer-reviewed publications: related analyses (above and beyond initial specific aims)

11) Subramanian SV, Chen JT, Rehkopf DH, Waterman PD, Krieger N. Racial disparities in context: A multilevel analysis of neighborhood variations in poverty and excess mortality among black populations in Massachusetts. *American Journal of Public Health* 2005; 95: 260–265.

12) Krieger N. A century of census tracts: health and the body politic (1906–2006). *J Urban Health* 2006; 83:355–361.

13) Subramanian S V, Chen JT, Rehkopf DR, Waterman PD, Krieger N. Comparing individual and area-based socioeconomic measures for the surveillance of health disparities: a multilevel analysis of Massachusetts (US) births, 1988–92. *Am J Epidemiol* 2006; 164:832–834.

14) Subramanian SV, Chen JT, Rehkopf DR, Waterman PD, Krieger N. Subramanian et al. respond to: “Think Conceptually, Act Cautiously”. *Am J Epidemiol* 2006; 164:841–844.

15) Rehkopf DH, Haughton L, Chen JT, Waterman PD, Subramanian SV, Krieger N. Monitoring socioeconomic disparities in death: comparing individual-level education and area-based socioeconomic measures. *American Journal of Public Health* 2006; 96:2135–2138 (erratum: *AJPH* 2007; 97:1543).

16) Chen JT, Rehkopf DH, Waterman PD, Subramanian SV, Coull BA, Cohen B, Ostrem M, Krieger N. Mapping and measuring social disparities in premature mortality: the impact of census tract poverty within and across Boston neighborhoods, 1999–2001. *J Urban Health* 2006; 83:1063–1084.

17) Chen JT, Coull BA, Waterman PD, Schwartz J, Krieger N. Methodological implications of social inequalities for analyzing health disparities in large spatiotemporal datasets: an example using breast cancer incidence data (Northern and Southern California, 1988–2002). *Stat Med* 2008; 27:3957–3983.

Table 2 continued

Invited commentaries (non-peer reviewed) drawing on the Project's findings

18) Krieger N. Place, space, and health: GIS and epidemiology. *Epidemiology* 2003; 15:384–385.

19) Krieger N. Why epidemiologists cannot afford to ignore poverty. *Epidemiology* 2007; 18:658–663.

addressed our *Project's* objective in a satisfactory manner, we could not let ourselves be tempted by the many fascinating possibilities we glimpsed, in the many spatially-oriented articles we read to inform our work, regarding much more nuanced and complex uses of spatially-referenced data to advance research and action on societal determinants of population health and health inequities.

It therefore is very gratifying to read and learn from the articles included in this special issue of *Geo Journal* by the bona fide medical/health geographers Tom Koch (Koch 2009), Sara McLafferty and Ranjana Chakrabarti (McLafferty and Chakrabarti 2009), Ellen Cromley (Cromley 2009), and Robin Kearns, Helen Moewaka-Barnes, and Tim McCreanor (Kearns et al. 2009). I will not attempt to summarize all that they say; their articles speak for themselves. What I will do, however, is underscore key points and questions that they raise, so as to flag useful avenues for much needed work—in both medical/health geography and other fields—to address gaps in our knowledge relevant for understanding and eliminating health inequities.

I begin with Koch's article on "Social epidemiology as medical geography: back to the future" (Koch 2009). I am heartened by his emphasis on the importance of tracing the historical lineages of the many disciplines involved in population health research. His article makes an important contribution to reviewing the longstanding and deep connections—sometimes severed, sometimes ignored, but nevertheless intrinsically present (Numbers 2000; Valencius 2000)—between epidemiology and medical geography. I likewise appreciate Koch's grounding of the history of these fields in their social, political, economic, and ecologic contexts, an approach that helps explain not only the growing post-18th c CE emphasis on political and administrative (and not just ostensibly "natural") boundaries, but also periods of greater and lesser concern about health inequities in both epidemiology and medical geography.

What is especially refreshing about Koch's analysis is his understanding that the work of describing and altering the population distribution of disease—and

the magnitude of health inequities—is a task requiring interdisciplinary and cross-sectoral efforts, efforts that are carried out by real people in real places, in real time, and at multiple levels. One implication is that population health research and interventions, including on social inequalities in health, are inevitably place-based, time-dependent (involving lifecourse, birth cohort, and period effects), and historically contingent. A second is that this type of work necessitates analyzing people and their environs in societal context. The third corollary concerns the importance of being grounded in—but not confined by—one's own particular discipline and expertise. To do fruitful cross-disciplinary work, it is essential both to acknowledge the scope and limitations of one's expertise and to be open to learning from others. Only by simultaneously respectfully honoring—and respectfully transgressing—disciplinary boundaries can we move forward work that meaningfully critiques and advances scientific knowledge.

Cromley's article, on "Breadth and Depth in Research on Health Disparities" (Cromley 2009) offers an instructive example of how geographic expertise can be deployed to improve the questions, data, methods, and analytic approaches used to understand population health. Reviewing the work of our *Public Health Disparities Geocoding Project* and also some of my publications on ecosocial theory and conceptual frameworks for analyzing health inequities, Cromley makes two key points. The first, with which I fully concur, is that our "use of spatial analytic techniques has primarily been to explore associations between social class, race/ethnicity, education, and gender and health" and "has not primarily emphasized analyzing spatial patterns of health and disease in communities or the processes that give rise to them" (even as she notes that some of our newer work has considered problems of "within-tract variability" and "different approaches to characterizing neighborhoods"). The second is her appraisal that despite the "geographical dimensions" of our work being "narrow," it "nevertheless" has "raised the profile of geographical analysis in

epidemiology and public health and as brought attention to the problem of health disparities.” My only quibble is with the “nevertheless,” since I would argue that it has precisely been our single-minded focus on addressing the specific and urgent problem of non-existent socioeconomic data in public health surveillance systems that has enabled our work to be widely useful to researchers, cancer registries, and health departments throughout the United States and in other countries.

That said, I value the series of helpful geographically-focused suggestions that Cromley offers for improving both public health data and research. In particular, she highlights the need to:

- (a) be critical when using pre-defined administrative boundaries (noting that tracts can vary enormously in spatial and population size and with regard to the criteria by which their boundaries are set);
- (b) consider using boundaries that define more “meaningful neighborhoods”;
- (c) acknowledge that populations can be heterogeneous in whatever areas are defined;
- (d) investigate whether “spatial dependencies or effects” exist across the geographic regions analyzed, since the impact of particular exposure can be place-dependent; and
- (e) consider the sampling design implications of “spatially varying processes” for both public health surveillance systems and “health observation and intervention studies.”

I likewise appreciate Cromley’s heralding of new community-based efforts that she hopes marks the “beginning of a shift in focus from describing health disparities to dealing with them.” I would only caution against an either/or approach: the desire for more nuanced research on the spatially-dependent societal process that generate health inequities and the interventions required to address them would be better framed as a complement to, and not substitute for, the vital routine (and non-sampled) birth, death, and public health surveillance or registry data, collected year-in and year-out, that enable tracking the magnitude of health inequities from the local on up to the national level. After all, it is precisely these descriptive data—of the full-population health situation—that give people the information they need to advocate for their communities and hold accountable

the public and private institutions whose policies and practices shape the public’s health.

A geographic perspective on how approaches to conceptualizing and analyzing health inequities could be improved by taking into account such space-based phenomena as immigration, residential segregation, and access to transportation, is in turn provided by McLafferty and Chakrabarti, in their article on “Locating Diversity: Race, Nativity and Place In Health Disparities Research” (McLafferty and Chakrabarti 2009). Using the work of our *Project* as a springboard, along with my critical writings on, in their words, “race as a social rather than biological construct” and my research on the impacts of racism on health, McLafferty and Chakrabarti make the case that US research on health inequities needs to go beyond the conventional US census racial/ethnic categories (e.g., white, black, Asian, Hispanic), largely because of “the role of immigration in reshaping these social axes of difference.” Noting that my team and I have likewise raised the importance of addressing immigration status in addition to socioeconomic position and race/ethnicity, McLafferty and Chakrabarti offer a concise and useful review of new literature on the complex associations between immigration history, immigration status, and population health. To their review they bring a welcome geographic emphasis regarding the health implications of both settlement patterns and residential segregation, with studies indicating associations may vary by nativity. Like Cromley, McLafferty and Chakrabarti call for use of more “fine-scale area units,” so as to study associations between “ethnic density and health outcomes” and also urge more attention to how “use of local spaces is influenced by class and culture” as well as greater use of mixed-methods (qualitative and quantitative) research strategies.

I completely support McLafferty and Chakrabarti’s recommendations. We do need more refined research on the multiple dimensions of—and pathways producing—health inequities. Understanding how societal context and social injustice are embodied is a central concern of ecosocial theory—and empirical work addressing the spatial aspects of this phenomenon will enormously benefit from the disciplinary insights and methods of medical/health geographers. I again would only caution, per my comment on Cromley’s article, that this more detailed and

spatially-informed type of work be construed as a sorely needed addition to, and not replacement for, the vital work of routinely monitoring health inequities, using routinely available public health surveillance and administrative data. It is essential not to lose sight of the need for valid approaches that can be feasibly used by perennially underfunded and overburdened state and local health departments—and it is because of our attention to these critical practical considerations that several US public health agencies have been able to implement our methods and, for the first time, start to routinely report on socioeconomic as well as racial/ethnic health inequities, separately and combined, using consistent area-based socioeconomic measures (see, for example: Virginia Department of Health 2008; Washington State Department of Health 2004; Singh et al. 2003).

Still another vantage is offered by Kearns et al. in their compelling article on “Placing racism in public health: a perspective from Aotearoa/New Zealand” (Kearns et al. 2009). Appropriately politicizing the notion of “immigration,” they highlight the significance of understanding the complex and multi-generational health consequences of colonialism, racism, and the entwined realities of geographic and cultural expropriation on the health of the Māori, the indigenous New Zealand population forcefully relegated to political minority status in the 19th c CE by European (predominantly British) colonizers. Highlighting my work on the naming and analysis of racism as an understudied yet extremely important determinant of health inequities, Kearns et al. underscore the importance of “*claiming* the issue as a public health concern.” As they cogently observe, rigorous research on racism and health offers “encouragement, evidence and arguments to the many of those engaged in the broad project of pursuing public health in the quest for equitable outcomes.” Drawing in turn on their place-based expertise, Kearns et al. insightfully augment the five major pathways I have delineated regarding how racism can harm health (which they summarize as “economic and social deprivation; toxic substances & hazardous conditions; socially inflicted trauma; targeted marketing of harmful products; inadequate or degrading medical care”) with a sixth: “the systematic alienation of indigenous lands and subsequent degradation of ecosystems that undermine or destroy traditional economies.” I believe this is a valuable

addition, one consonant with ecosocial theory and its concerns about not only political economy but also political ecology, in historical, cultural, and social context.

Among the types of place-informed research relevant to racism and health in New Zealand that Kearns et al. describe, two stand out. One concerns the “recursive relationship” they delineate “between locational experience and ‘place-in-the-world’ and which they state “is implicated in social status and identity.” As an example, Kearns et al. describe a project in which members of “one particular iwi (tribe)” used GIS to “record and map ... the sites, resources, features and locations of social, spiritual, economic and political importance,” thereby generating evidence useful for “the protection and development of iwi resources in the face of non-Māori development, actions, or aspirations (e.g., through resource consent hearings under the Resource Management Act).” The second addresses how Māori health cannot be meaningfully understood apart from “Māori struggles for sovereignty, land and resources.” In research exploring the “understanding of place as a health-enhancing reality,” Kearns et al. found that not only was “place” more significant to the Māori compared to the Paheka (European settlers and their descendents), but also that the “mundane cultural practices and material infrastructures that constitute social cohesion and healthy social relations” that were a struggle for Māori to obtain and sustain were by contrast more “built into the neighborhood for Paheka.” In the US, analogous research has begun to explore the adverse health consequences of place-based aspects of expropriation and alienation on members of the diverse American Indian nations and tribes (Walters and Simoni 2002). The similarity between the empirical evidence generated in our different country contexts, combined with what Kearns et al. describe as the “convergence” between my thinking and research and that of Māori scholars, powerfully attests to the simultaneously “universal” yet historically-contingent pathways by which, in their words, racism’s “entrenched and naturalized structural, discursive and interpersonal mechanisms of exclusion, marginalization and inequality” wreak their health-damaging effects.

I leave for last the oddly ill-informed and out-of-place article by Eugenia Conde and Dennis M.

Gorman, titled “Krieger’s Conceptualization and Measurement of Discrimination and Internalized Oppression in the Studies of Adverse Health Outcomes” (Conde and Gorman 2009). Written by authors whose publications indicate no prior experience with research on racism and health (per Koch, expertise does matter), the article myopically focuses only on studies I have done and fails to locate this work among—or refer to any of—the extant and fast-growing research on racism and health (as noted below). Had the authors taken the time to consult this literature, they would have found that, contrary to their assertion, it offers a sound basis for positing that self-reported experiences of racial discrimination might be differently associated with psychological distress, health behaviors, and somatic outcomes, with these latter associations modified by etiologic period. Similarly unmoored from extant research, Conde and Gorman dismiss as both “ad hoc” and “post hoc” the hypothesis that I and others have raised that internalized oppression might harm health, declaring instead that our hypothesis is an “unscientific” and “unfalsifiable” idea that “shields the discrimination theory from refutation.”

Highlighting the problematic nature of Conde and Gorman’s sloppy critique, I first note that I first raised the issue of internalized oppression in my earliest conceptual writings on racial discrimination and health (see, for example, Krieger and Bassett 1986, and Krieger 1987), published before my first empirical research on the topic (Krieger 1990b)—so much for “post-hoc”—and I also discussed it at length in other writings (see Krieger et al. 1993) likewise published before my 1996 study (Krieger and Sidney 1996) whose findings Conde and Gorman dispute (albeit without bothering to offer any contrary empirical evidence). I would further flag that other recent studies (see, for example, Huebner and Davis 2007) have replicated my 1996 finding that, within groups historically subjected to discrimination, among persons with the most power and resources, a linear relationship existed between self-reported experiences of discrimination and somatic health (more discrimination, worse somatic health), whereas among persons with the least power and socioeconomic resources, the relationship was more J-shaped (meaning that although the worst somatic health occurred among persons reporting the most discrimination, the somatic health of those reporting “no”

discrimination was somewhat worse than those reporting “moderate” discrimination). Because it is not appropriate, in this brief commentary, either to offer a lengthy dissection of the serious flaws in Conde and Gorman’s article or to provide a compensatory in-depth and comprehensive review of current research on racism and health, I would instead urge interested readers of *GeoJournal* to consult recent relevant reviews on the complexities of measuring racial discrimination and its impact on health (e.g., Krieger 1999; Williams et al. 2003; Blank et al. 2004; Paradies 2006; Mays et al. 2007; Williams and Mohammed 2009). Moreover, as part of my own continued engagement with the science of studying racism and health (Krieger 2005), I will soon be publishing research, drawing on new methods in social psychology, that scientifically tests hypotheses about internalized oppression and health, and does so without relying on what Conde and Gorman dismiss as “expert” judgment about the operation of unconscious processes”—i.e., exactly the kind of research they predict cannot be done. It is perhaps fittingly ironic that their views express the same complacent “can’t be done” attitude that first propelled my work on area-based socioeconomic measures and our *Public Health Disparities Geocoding Project*.

In closing, I am appreciative of *GeoJournal* for providing this opportunity to expand the dialogue among socially- and spatially-oriented population health researchers genuinely interested in doing the hard work required to document, analyze, and redress the myriad ways that social inequality becomes embodied, thereby harming health and producing entangled social and spatial health inequities. In the brief quarter-century in which I have been engaged in doing public health research, from the mid-1980s to now, one major advance is that we can now safely say that the topic of health inequities is squarely “on the map”—not only figuratively but literally (see for example, the Worldmapper project (Dorling et al. 2008)). At a time when the just-issued final report of the World Health Organization’s Commission on the Social Determinants of Health (WHO CSDH) has had the honesty and courage (Davey-Smith and Krieger 2008) to declare that “social injustice is killing people on a grand scale” (WHO CSDH 2008), it behooves us all to bring the best of our respective disciplinary insights and expertise to illuminate the profound connections between social justice and

public health, between our bodily truths and the body politic, so as to further the goal of embodying equity—in an ecologically sustainable world.

References

- Bassett, M., & Krieger, N. (1986). Social class and black-white differences in breast cancer survival. *American Journal of Public Health, 76*, 1400–1403.
- Blank, R. M., Dabady, M., & Citro, C. F. (Eds.). (2004). *Measuring racial discrimination*. Washington, DC: National Academies Press.
- Chen, J. T., Coull, B. A., Waterman, P. D., Schwartz, J., & Krieger, N. (2008). Methodological implications of social inequalities for analyzing health disparities in large spatiotemporal datasets: An example using breast cancer incidence data (Northern and Southern California, 1988–2002). *Statistics in Medicine, 27*, 3957–3983.
- Chen, J. T., Rehkopf, D. H., Waterman, P. D., Subramanian, S. V., Coull, B. A., Cohen, B., et al. (2006). Mapping and measuring social disparities in premature mortality: The impact of census tract poverty within and across Boston neighborhoods, 1999–2001. *Journal of Urban Health, 83*, 1063–1084.
- Conde, E., & Gorman, D. M. (2009). Krieger's conceptualization and measurement of discrimination and internalized oppression in studies of adverse health outcomes. *GeoJournal*. doi:10.1007/s10708-009-9262-0.
- Cromley, E. K. (2009). Breadth and depth in research on health disparities: Commentary on the work of Nancy Krieger. *GeoJournal*. doi:10.1007/s10708-009-9264-y.
- Davey-Smith, G., & Krieger, N. (2008). Tackling health inequities. *British Medical Journal, 337*, a1526. doi:10.1136/bmj.a1526.
- Dorling, D., Newman, M., Allsopp, G., Barford, A., Wheeler, B. & Pritchard. (2008). *J. Worldmapper: The World As You've Never Seen it Before*. Retrieved December 3, 2008 from <http://www.worldmapper.org/index.html>.
- Huebner, D. M., & Davis, M. C. (2007). Perceived antigay discrimination and physical health outcomes. *Health Psychology, 26*, 627–634.
- Kearns, R., Moewaka-Barnes, H., & McCreanor, T. (2009). Placing racism in public health: A perspective from Aotearoa/New Zealand. *GeoJournal*. doi:10.1007/s10708-009-9261-1.
- Koch, T. (2005). *Cartographies of Disease: Maps, mapping, and medicine*. Redlands, CA: ESRI Press.
- Koch, T. (2009). Social epidemiology as medical geography: Back to the future. *GeoJournal*. doi:10.1007/s10708-009-9266-9.
- Krieger, N. (1987). Shades of difference: Theoretical underpinnings of the medical controversy on black-white differences, 1830–1870. *International Journal of Health Services, 17*, 258–279.
- Krieger, N. (1990a). Social class and the black/white crossover in age-specific incidence of breast cancer: A study linking census-derived data to population-based registry records. *American Journal of Epidemiology, 131*, 804–814.
- Krieger, N. (1990b). Racial and gender discrimination: Risk factors for high blood pressure? *Social Science & Medicine, 30*, 1273–1281.
- Krieger, N. (1991). Women and social class: a methodological study comparing individual, household, and census measures as predictors of black/white differences in reproductive history. *Journal of Epidemiology and Community Health, 45*, 35–42.
- Krieger, N. (1992). Overcoming the absence of socioeconomic data in medical records: Validation and application of a census-based methodology. *American Journal of Public Health, 82*, 703–710.
- Krieger, N. (1994). Epidemiology and the web of causation: Has anyone seen the spider? *Social Science & Medicine, 39*, 887–903.
- Krieger, N. (1999). Embodying inequality: A review of concepts, measures, and methods for studying health consequences of discrimination. *Int J Health Services, 29*, 295–352. (Republished and updated as: Krieger, N. (2000). Discrimination and health. In: Berkman L, Kawachi I (eds). *Social Epidemiology*. Oxford: Oxford University Press, 36–75.
- Krieger, N. (2001). Theories for social epidemiology in the 21st century: An ecosocial perspective. *International Journal of Epidemiology, 30*, 668–677.
- Krieger, N. (2005). Stormy weather: “Race”, gene expression, and the science of health disparities. *American Journal of Public Health, 95*, 2155–2160.
- Krieger, N. (2008). Proximal, distal, and the politics of causation: What's level got to do with it? *American Journal of Public Health, 98*, 221–230.
- Krieger, N., & Bassett, M. (1986). The health of black folk: Disease, class and ideology in science. *Monthly Review, 38*, 74–85.
- Krieger, N., Chen, J. T., Ware, J. H., & Kaddour, A. (2008a). Race/ethnicity and breast cancer estrogen receptor status: Impact of class, missing data, & modeling assumptions. *Cancer Causes Control, 19*, 1305–1318.
- Krieger, N., Rowley, D. L., Herman, A. A., Avery, B., & Phillips, M. T. (1993). Racism, sexism, and social class: Implications for studies of health, disease, and well-being. *American Journal of Preventive Medicine, 9*(Suppl), 82–122.
- Krieger, N., & Sidney, S. (1996). Racial discrimination and blood pressure: The CARDIA study of young black and white adults. *American Journal of Public Health, 86*, 1370–1378.
- Krieger, N., Waterman, P.D., Chen, J.T., Rehkopf, D.H. & Subramanian, S.V. (2008b). Geocoding and monitoring US socioeconomic inequalities in health: An introduction to using area-based socioeconomic measures—The Public Health Disparities Geocoding Project monograph. Boston, MA: Harvard School of Public Health. Retrieved December 2, 2008 from <http://www.hsph.harvard.edu/thegeocodingproject/>.
- Mays, V. M., Cochran, S. D., & Barnes, N. W. (2007). Race, race-based discrimination, and health outcomes among African Americans. *Annual Review of Psychology, 58*, 201–225.
- McLafferty, S., & Chakrabarti, R. (2009). Locating diversity: Race, nativity and place in health disparities research. *GeoJournal*. doi:10.1007/s10708-009-9263-z.

- Monmonier, M. (1997). *Cartographies of danger: Mapping hazards in America*. Chicago: University of Chicago Press.
- Numbers, R. L. (2000). Medical science before scientific medicine: Reflections on the history of medical geography. *Medical History*, 20, 217–220.
- Oxford English Dictionary* (2008). Retrieved December 2, 2008 from <http://dictionary.oed.com.ezpl.harvard.edu>.
- Paradies, Y. (2006). A systematic review of empirical research on self-reported racism and health. *International Journal of Epidemiology*, 35, 888–901.
- Robinson, A. H. (1982). *Early thematic mapping in the history of cartography*. Chicago: University of Chicago Press.
- Singh, G.K., Miller, B.A., Hankey, B.F., Edwards, B.K. (2003). Area socioeconomic variations in U.S. cancer incidence, mortality, stage, treatment, and survival, 1975–1999. NCI Cancer Surveillance Monograph Series, Number 4, NIH Pub No. 03–5417, Bethesda, MD: National Cancer Institute.
- Subramanian, S. V., Chen, J. T., Rehkopf, D. H., Waterman, P. D., & Krieger, N. (2005). Racial disparities in context: A multilevel analysis of neighborhood variations in poverty and excess mortality among black populations in Massachusetts. *American Journal of Public Health*, 95, 260–265.
- Valencius, C. B. (2000). Histories of medical geography. *Medical History*, 20, 3–28.
- Virginia Department of Health. (2008) *The 2008 Virginia Health Equity Report*. Retrieved December 3, 2008 from <http://www.vdh.state.va.us/healthpolicy/2008report.htm>.
- Walters, K. L., & Simoni, J. M. (2002). Reconceptualizing native women's health: An "indigenist" stress-coping model. *American Journal of Public Health*, 92, 520–524.
- Washington State Department of Health. *The Health of Washington State Supplement: A statewide assessment addressing health disparities by race, ethnic group, poverty and education*. September 2004. Retrieved December 3, 2008 from <http://www.doh.wa.gov/HWS>.
- Williams, D. R., Neighbors, H. W., & Jackson, J. S. (2003). Racial/ethnic discrimination and health: Findings from community studies. *American Journal of Public Health*, 93, 200–208.
- Williams, D. R., & Mohammed, S. A. (2009). Discrimination and health: Evidence and needed research. *Journal of Behavioral Medicine*, 32, 20–47.
- World Health Organization Commission on Social Determinants of Health. (2008) *Closing the gap in a generation: Health equity through action on the social determinants of health. Final report of the Commission on Social Determinants of Health*. Geneva: WHO, 2008. Retrieved December 3, 2008 from www.who.int/social_determinants/final_report/en/index.html.