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Proximity to Environmental Hazards: Environmental Justice and Adverse Health Outcomes

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Objectives: The goal of this paper is to explore and answer the question: “Does proximity to environmental hazards result in adverse health outcomes and account for health disparities, and if so, *how* does proximity contribute to disproportionate environmental health impacts? A substantive literature review and critique covering the salient research on these topics during the past two decades, including some earlier seminal works on the subject, was undertaken to answer this question. This paper provides an overview of the connections between proximity to hazards and environmental health justice; reviews and evaluates the range of methodological approaches that have been used to measure and assess the relationship between proximity to hazards and environmental justice; reports on the findings of numerous research studies that examine the relationship between proximity to hazards and adverse health outcomes, such as adverse pregnancy outcomes, cancer (primarily childhood cancer), cardiovascular and respiratory illnesses, end-stage renal disease, and diabetes; discusses limitations of spatial epidemiology; and offers some recommendations as to future research, improvements in methodological approaches, and data needs to achieve more definitive results for guiding policy-making, regulatory changes, and public health decisions.

Relevance: Previous research demonstrates the existence of an uneven geographic distribution of environmental health hazards, and potentially disproportionate exposure to environmental risk in the United States, resulting in racial/ethnic minority and lower income communities bearing the highest burdens which, in turn, might contribute to the health disparities that have been noted extensively by public health officials and medical researchers. That these health and quality-of-life impacts are visited disproportionately on the most vulnerable populations, those least likely to be able to combat them effectively, renders these impacts even more detrimental to the public’s health, and the need for remedy even more urgent.

Summary of Findings: The majority of reviewed studies show that both race/ethnicity and socioeconomic status (SES) predicted a disproportionate spatial distribution of environmental burdens. When these two suites of variables were compared, SES variables pointed to more significant risks of exposure than race; however, race tended to be predictive of disproportion even when controlling for SES. Research on the impacts of proximity to environmental hazards on the health of residential populations shows that there are increased risks for central nervous system defects (including neural tube defects), congenital heart defects, chromosomal anomalies, low birth weight, and small-for-gestational-age for populations that live close to hazardous waste sites. Several studies also noted maternal residence near active sites with chemical emissions to be associated with fetal deaths, infant deaths, low birth weight, central nervous system defects, oral clefts, heart defects, renal dysplasia, and chromosomal anomalies. Residential proximity to pesticide applications or waste sites containing these chemicals was associated with fetal deaths, limb malformations, and neural tube defects. In several studies, women who lived near highways were more likely to have preterm births and low-birth-weight offspring. Studies also found an association between risk of childhood cancer and residential proximity to industrial facilities, highly trafficked roads, nuclear power plants, pesticide applications, and gasoline stations or automobile repair shops, although these positive associations were not consistently found. Results from the studies reviewed suggest that residential proximity to both stationary sources of air pollution (TRIs, NEIs, HAPs,

petroleum refineries, etc.) and, with a few exceptions, heavily trafficked roads, is significantly associated with asthma hospitalizations. In addition, exposure to mobile sources of air pollution increases the occurrence of chronic respiratory symptoms by exacerbating asthma. The studies reviewed also suggest that there is a significant association between residential exposure to combined sources of air pollution and stroke mortality. Although there is some evidence linking residential proximity to hazardous waste sites and PCB toxicity, end-stage renal disease, and diabetes, the dearth of literature on these health outcomes makes definitive conclusions difficult. Only a few studies examined whether disproportionate risks of adverse health outcomes with respect to proximity to environmental hazards were present by race/ethnicity or SES, and findings of these studies tended to be inconsistent.

Recommendations: Based on our review of existing research and our analysis of the evidence for disparities by race/ethnicity and income in relation to proximity to environmental hazards, the adverse health outcomes for populations in close proximity to environmental hazards, and acknowledging the health disparities generally experienced by communities of color and lower income communities, we recommend the following: that these factors be given serious consideration in the decision-making process by governmental environmental and health agencies regarding the siting of environmentally burdensome facilities and land uses, in regulatory and enforcement efforts concerning pollution, and in the active promotion of environmental health justice and environmental health protection. We also offer several technical recommendations regarding improvements in analytical methods, data, and research emphasis to more definitively connect proximity to environmental hazards, exposure of vulnerable populations, and adverse health outcomes.