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Place-based stressors associated with industry and air pollution



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ABSTRACT

Exposure to air pollution and its sources is increasingly viewed as a psychosocial stress, however its nature is not understood. This article explores the role of the concept of place on risk perception and community stress within data collected from eight focus groups in Philadelphia, USA. Discussions focused on air pollution, a nearby oil refinery, health, and a proposal for air monitoring. We present a framework of place-based elements of risk perception that includes place identity, stigma and social control. Our findings indicate that air pollution contributes to physical and psychosocial conditions that act as community-level social stressors. Findings also suggest that programs which seek to change behaviors and gather or spread information on issues such as pollution and other environmental concerns will be challenged unless they directly address: (1) the public's identification with a place or industry, (2) immediate environmental stressors such as abandonment, waste and odors, and (3) public perceptions of lack of social control and fear of displacement.

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1. Introduction

There is an established relationship between air pollution exposure and poor health, including cardiovascular and respiratory disease (Brunekreef and Holgate, 2002; Dockery et al., 1993; Pope et al., 2002). Living or working in close proximity to heavily trafficked roadways or heavy industry has been associated with asthma and respiratory infection (Brauer et al., 2007), lung cancer (Attfield et al., 2012), and low birth weight or pre-term birth (Lin et al., 2001; Yang et al., 2002). Such evidence has been used to inform regulatory strategies on an individual-chemical basis, such as via the United States' Clean Air Act.

There is increasing evidence that communities exposed to higher levels of air pollutants may also be more vulnerable to

the effects of this exposure. Environmental hazards are often co-located with non-chemical social stressors such as poverty and violence. These stressors can influence health by triggering negative emotions (such as fear, anxiety or depression), which affect physiological processes such as endocrine and immune systems and increase risk of disease (Cohen et al., 2007). Social stressors have been shown to affect respiratory disease, asthma, cardiovascular disease, cancer, depression, and HIV/AIDS (Astell-Burt et al., 2013; Cohen et al., 2007).

Exposure (to air pollution and its sources) itself can also be interpreted as a psychosocial stress on individuals (Atari et al., 2011; Atari et al., 2013; Bickerstaff and Walker, 2001; Chen et al., 2008; Clougherty et al., 2007; Cutchin et al., 2008; Gee and Takeuchi, 2004; López-Navarro et al., 2013; Luginaah et al., 2010; Luginaah et al., 2002a; Luginaah et al., 2000, 2002b; Shankardass et al., 2009; Yang and Matthews, 2010). Likewise, perceptions of air pollution have been shown to affect disease-status (Gee and Takeuchi, 2004; Piro et al., 2008). Yet exposure and risk assessment tend to focus on single pollutants, exposure pathways and health outcomes, and neglect to characterize or incorporate stress

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(Sexton, 2012). Many argue that risk assessments and environmental health interventions should be informed by social perceptions and local knowledge regarding pollution and risk (Corburn, 2003; Luginaah et al., 2010).

Risk theory offers a framework by which to understand the socio-cultural nature of air pollution. According to risk theory, Western societies have become increasingly aware and concerned about “modern” technology-based environmental risks (Beck, 1992a; Giddens, 1991). Multiple authors have called for an expansion of this theory to include the ‘spatial organization of risk’ (Beck, 1992b; Bickerstaff and Simmons, 2009; Giddens, 1991; November, 2004), in which environment and culture, people and places (‘context’ and ‘composition’) are viewed as contingent rather than distinct and separate (Cupples, 2009; Macintyre et al., 2002). Place indicates the physical aspects of locations as well as the social and emotional meanings tied to them (Tuan, 1977), and is a meaningful concept for risk studies because it underscores the role of space in the formation of identities (Twigger-Ross and Uzzell, 1996), feelings of belonging, defining of social boundaries or conflicts, and in other emotional processes.

Multiple studies have identified concepts tied to place relating to stress or risk perception. Day (2006) adapted a place-based framework developed by Curtis (2004) to explore the air pollution perceptions. Prior to this work, studies of risk perception and stress relating to air pollution have addressed place-based concepts, but only implicitly. In this study we apply three concepts to analyze the role of place in risk perception: place identity, stigma and social control. Place identity refers to the role of an individual's physical surroundings in their self-identity (Proshansky et al., 1983). Wester-Herber (2004) suggested that place identity is related to risk perception; perceived risks to land and environments will necessarily threaten individuals' perception of self. Others have demonstrated ways that at-risk environments are incorporated in to individuals' identities (Atari et al., 2011; Luginaah et al., 2010). Related to place identity is the concept of displacement, which represents unwillful movement from a place, for example via gentrification, and disrupts well-being, community ties and attachments (Newman and Wyly, 2006).

Stigma is a second place-related concept tied to risk perception (Wester-Herber, 2004). Negative images associated with places can affect individuals' perception of self. Multiple studies have found stigma to play an important role in stress associated with living in proximity to industrial facilities or pollution (Atari et al., 2011; Bush et al., 2001). In addition, we investigate the role of social control in risk perception. Social control represents structural social and political hierarchies, often enacted or reproduced in spaces and places (Lefebvre, 1991; Massey, 1993). In the context of environmental hazards, lack of power and agency can act as determinants of risk perception (Bickerstaff, 2004).

This study questions the role of place in risk perception and community stress within analysis of qualitative data collected from eight focus groups conducted with 47 residents of the Point Breeze and Grays Ferry neighborhoods of Philadelphia, USA. These neighborhoods are adjacent to the Philadelphia Refinery, one of the oldest operating urban refineries in the US. The study is preceded by announcements by local officials of plans to begin a local air monitoring effort. Based on our analyses, we present place-based elements of risk perceptions in low-resource communities adjacent to an oil refinery, including: (1) place identity, (2) stigma, and (3) social control. We begin with a description of the project area, collaboration driving this project, methods and results from the study. We then describe how findings can influence public outreach, health interventions and risk assessment.

2. Background

The Philadelphia Refinery began operation in Southwest Philadelphia in 1866 (see Fig. 1). Sunoco Inc. purchased this refinery in 1988, and the Carlyle Group obtained partial ownership in 2012. It currently processes 330,000 barrels of crude oil each day for retail throughout the Northeast Atlantic region of the United States. Approximately 1000 individuals are employed in refining processes.

This refinery is the largest source of air pollution, by pound, in the greater Philadelphia area. In 2012, the refinery reported 762,000 pounds of chemical releases, which was more than 70 times higher than any other nearby facility. This refinery and other industrial facilities in the U.S. are subject to regulations under the Clean Air Act regarding air toxic releases. According to the Toxics Release Inventory (TRI; a mandatory, self-reporting program affecting certain facilities), the Philadelphia Refinery ranked 23 out of 134 similar facilities in the U.S. for total on-site releases in 2012.

In addition, the refinery has been out of compliance with at least one regulatory requirement (e.g. operating requirements, maximum emission rates or quantities) despite 28 Notice of Violations and \$740,000 in penalties since September of 2000.

There have been concerns about the unfair impact of heavy industrial activities, including oil refining, on nearby neighborhoods in the Philadelphia area. First, environmental hazards are more highly concentrated in communities bordering the Delaware River, which includes our study area (Sicotte, 2010). Second, the refinery is surrounded by vulnerable populations potentially exposed to physical and psychosocial stressors associated with poverty and the physical environment. According to the 2010 Census, of the 45,000 residents living in census tracts within 1.6 km from the refinery (which includes the study area), 59% were black, 29% were white, 8% were Asian, and 4% were Hispanic or Latino. Thirty-two percent of residents live below the federal poverty level, 21% of residents age 25 and older have not graduated from high school and 41% have a high school diploma or equivalent (U.S. Bureau of the Census, 2009). Other studies document the presence and nature of stressors in Philadelphia neighborhoods, such as hazardous waste sites, traffic volume (Yang and Matthews, 2010), vacant properties and lots (Branas et al., 2011).

Third, health risks tend to be greater in areas with a higher percentage of non-white residents, and lower levels of education and income (Sicotte, 2010). The most recent National Air Toxics Assessment, conducted by the U.S. Environmental Protection Agency (U.S. EPA) and based solely on pollutant exposure, indicated high health risks in Philadelphia; an excess lifetime cancer risk of greater than one in a million from exposure to 12 different toxins, including benzene, formaldehyde, acetaldehyde, and arsenic compounds.

Multiple studies have documented compounding effects of air pollution exposure and stress on asthma (Chen et al., 2008; Clougherty et al., 2007; Gordian et al., 2005; Pittman et al., 2012; Shankardass et al., 2009). Residents in the study area suffer from high rates of asthma. The Asthma and Allergy Foundation of America ranked Philadelphia as having the fourth worst asthma rate in the country in 2013. The Philadelphia Health Management Corporation's 2012 Household Survey confirmed that residents of Philadelphia (24% of children; 19% of adults), and South/Southwest Philadelphia in particular (14% of children; 24% of adults), suffer from high rates of asthma compared to national averages (9% of children; 8% of adults) (Philadelphia Health Management Corporation, 2012).

Point Breeze and Grays Ferry are historically working-class neighborhoods. Both are located near to the central business district, major academic and health care-related employment centers in Philadelphia. Residents see rising real estate values,

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