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Coronary heart disease prevalence and occupational structure in U.S. metropolitan areas: A multilevel analysis

Akihiko Michimi [a,*], Gregory Ellis-Griffith [a], Christine Nagy [a], Tina Peterson [b]

[a] Department of Public Health, College of Health and Human Services, Western Kentucky University, 1906 College Heights Blvd, Bowling Green, KY 42101 USA
[b] Department of Social Work, College of Health and Human Services, Western Kentucky University, 1906 College Heights Blvd, Bowling Green, KY 42101 USA

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ABSTRACT

This research explored the link between coronary heart disease (CHD) prevalence and metropolitan-area level occupational structure among 137 metropolitan/micropolitan statistical areas (MMSA) in the United States. Using data from the 2006–2008 Behavioral Risk Factor Surveillance System and 2007 County Business Patterns, logistic mixed models were developed to estimate CHD prevalence between MMSAs controlling for individual-level socioeconomic characteristics and various types of occupational structure. Results showed that CHD prevalence was lower in MMSAs where their economy was dominated by 'tourism and resort' and 'the quaternary sector' and higher in MMSAs dominated by 'manufacturing', 'transportation and warehousing', and 'mining'. MMSA-level effects on CHD were found in 'tourism and resort' and 'the quaternary sector' having lower risk and 'mining' having higher risk of CHD. Although these effects prevailed in many MMSAs, some MMSAs did not fit into these effects. Additional analysis indicated a possible link between metropolitan population loss and higher CHD prevalence especially in the coal mining region of the Appalachian Mountains.

1. Introduction

1.1. CHD mortality and morbidity

Coronary heart disease (CHD) is a major public health problem worldwide. In the United States, CHD is a leading cause of death for both men and women. According to the U.S. National Vital Statistics Report, roughly an equal number of men and women died of CHD (315,706 men and 315,930 women) in 2006, which accounted for approximately 26% of all deaths for both sexes (Heron, 2010). In the same year, about 17.6 million Americans (9.2 million men and 8.4 million women) had angina (chest pain due to CHD), heart attack, and other forms of CHD and they continued to live with such conditions and lead an impaired quality of life (Herlitz et al., 1999; Ford et al., 2008; AHA, 2010).

Epidemiological research shows that CHD mortality and morbidity vary widely based on sex, race/ethnicity, socioeconomic status, and geographic locations. Between 1988 and 1992, CHD mortality rates were higher in the Lower Mississippi Valley and Oklahoma for both white and black men and women than in the rest of the contiguous U.S. (Pickle and Gillum, 1999). Between 2005 and 2007, the CHD prevalence was also high in these areas as well as the Appalachian Mountains region of Kentucky, Ohio, and West Virginia and the prevalence was particularly higher among older white males with lower socioeconomic status and financial burden in seeking health care (Neyer et al., 2007; Braveman et al., 2010; Michimi 2010). The CHD prevalence at the metropolitan area- and county-levels in 2006 ranged from 6.1% in Billings MT metropolitan area to 21.6% in Huntington–Ashland WV–KY–OH metropolitan area and from 5.6% in Submit County UT to 20.0% in Luzerne County PA, respectively (Kilmer, et al., 2008). The spatial patterns of CHD mortality and morbidity suggest that the health disparities may be related to community characteristics and people living in various social and physical environments. (Diez-Roux et al., 1997; Dragano et al., 2007; Matheson et al., 2009).

1.2. Occupational structure and CHD

Research has identified occupational structure as one of the important risks in determining CHD mortality (Wing et al., 1987; Dobson et al., 1991; Armstrong, et al., 2004). The occupational structure consists of a set of jobs that exist in a community and is related to community economic resources and availability, and quality of local services (Armstrong et al., 2002). Areas of higher proportions of professional workforce signify higher levels of social and economic resources in a community, thus such occupational structure contributes to lower CHD mortality (Armstrong et al., 2004; Casper et al., 1991). During the 1980s and mid-1990s

* Corresponding author. Tel.: +1 270 745 4082; fax: +1 270 745 7073.
E-mail addresses: akihiko.michimi@wku.edu (A. Michimi), gregory.ellis-griffith@wku.edu (G. Ellis-Griffith), chris.nagy@wku.edu (C. Nagy), tina.peterson@wku.edu (T. Peterson).

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in New York and Washington states, CHD mortality rates were higher where the percentage of professional occupations was lower and availability of basic social and consumer services was lower, such as grocery stores, doctor's offices, and exercise facilities (Armstrong and Castorina, 1998; Armstrong et al., 2002). Stroke mortality followed this trend where areas of higher proportions of white collar workers had the lower mortality (Casper et al., 1991).

Researchers have conceived and measured occupational structure in a variety of ways based on the research setting, scale of analysis, and data availability. For example, studies used a skill-based classification of occupations which reflected individuals' social class in New Zealand (Pearce et al., 1985) and Madrid, Spain (Regidor et al., 2005), classification of occupation by various types of work in New South Wales, Australia (Dobson et al., 1991), and employment class based on occupational title, employment status whether self-employed or not, and supervisory status in Europe and the U.S. (Kunst et al., 1998, 1999). Overall, the classification of employment characterizes the socioeconomic status of workers, which has relevance to cardiovascular health (Steptoe and Marmot, 2005). Most studies conducted throughout the world are consistent in supporting the relationship between higher managerial-level professional occupation and lower CHD mortality rates, and vice-versa.

The occupational structure both influences and reflects socioeconomic landscapes in a community. These place characteristics are known to impact human health concerns like CHD (Bosma et al., 2001). From 1986 to 1992, CHD mortality decreased at differential rates in various socioeconomic areas in Nottingham, England (Huff and Gray, 2001). In Winnipeg, Canada, the elderly living in the poorest neighborhoods were more likely to have CHD, stroke, and other chronic disease conditions compared to ones living in the most affluent neighborhood (Menec et al., 2010). Thus, the social structure and place characteristics associated with the occupational structure may explain CHD disparities (MacIntyre et al., 2002; Pickett and Pearl, 2001).

The occupational structure and CHD disparities may be linked based on the composition of people living in a community and their social class. For example, older unskilled workers in the United Kingdom were more likely to develop CHD compared to older skilled professionals, and this difference was in part due to behavioral risk factors (Ramsay et al., 2009). Women employed outside of the home had a lower risk of CHD and stroke, compared to homemakers (Carson et al., 2009). In addition, racial and ethnic variability in CHD mortality are explained by social inequalities such as income and racial segregation (Cooper, 2001; Williams and Collins, 2001). Racial inequalities in CHD mortality, however, are spatially heterogeneous suggesting that sociodemographic factors such as poverty and segregation may affect individuals differently in each community (Gebreab and Diez Roux, 2012). Geographic variations in CHD prevalence, therefore, should incorporate both area-level and individual-level effects (Condon, 2009).

In addition to place and demographic factors, the occupational structure can affect CHD due to the quality of work place and living environments. Acute and long-term exposure to air pollution has been linked to cardiovascular events and CHD (Mills et al., 2009). Coal mining-related workers were especially at greater risk of CHD because of long-term exposures to air pollution in their work settings (Mills et al., 2009; Friesen et al., 2010). The relationship between ischemic heart disease mortality and silica-dust exposure among miners has also been reported in Sweden (Weiner et al., 2007). Moreover, adults living in the Appalachian coal mining counties had elevated risks of cardiovascular disease and CHD for both men and women compared to adults living in other counties (Hendryx and Zullig, 2009).

Previous research examined CHD mortality in relation to a few critical occupational categories. Less is known, however, about how CHD morbidity is associated with various types of occupational structure or work environments (Wamala et al., 2000; Ingram and Gillum, 1989). To date, research conducted previously has failed to examine the relationship between CHD prevalence and various types of metropolitan occupational structure. In addition, focusing on the prevalence of people living with CHD may provide new insights because CHD survivors may be clustered in specific locations. Local business landscapes and health care delivery may be influenced by such concentrations of people that require specialized medical needs (Rosenthal, 2012).

1.3. Metropolitan economies and CHD

A metropolitan area-based approach is likely to add new insights into occupational health research because many metropolitan areas manifest various business clusters (Bee, 2003) and such clusters may explain higher and lower CHD prevalence. Some metropolitan areas such as New York, Baltimore, and Atlanta, have experienced job growth in recent decades and have occupational structure that favors professional occupations, while other metropolitan areas such as Pittsburgh and Cleveland have lost jobs and population due to economic restructuring (James, 1995). The economic health of cities may play an important role in population health (Galea et al., 2005).

Metropolitan areas in the United States continue to be shaped by dynamic movements of workers and retirees which impact the economy of local areas. Professional workers are concentrated in the Northeast and other large growing cities in the South and West, while unskilled workers in the tertiary service sector are concentrated in smaller cities throughout the country (Michimi and Berentsen, 2008; Berube et al., 2010). Thus, larger metropolitan areas may have a cumulative healthy effect on CHD prevalence because of the higher concentration of business professionals and proximity to health care services (Rosenthal et al., 2005).

Retirees, on the other hand, are attracted to less populated areas with natural environmental amenities and tourism-oriented small cities (Walters, 2000; Poudyal et al., 2008). In this regard, the elderly in good health are likely to make discretionary moves to retirement homes in areas with warmer climate compared to others with poor health (Patrick, 1980). A naturally occurring retirement community results as a consequence of a high concentration of older residents or seniors who remain or move to those communities after they retire. These types of communities are found in different geographic areas and have important implications for senior-sensitive determinants of health (Masotti et al., 2006). To some degree, some retirement communities may be healthier than others because social and physical environmental characteristics vary greatly by geographic locations, and these environmental amenities may account for observed patterns of health disparities and health risks (Anderson et al., 2003; Michimi and Wimberly, 2012).

Cities experiencing population loss are typically dominated by location-specific industries that are tied to the availability of areas' natural and human resources, such as farming, mining, and manufacturing in the industrial core of the Northeast and Midwest (Michimi and Berentsen, 2008). Population decline in cities has a substantial impact on urban health and adults living in declining cities suffer from excess mortality (Geronimus, 2000; Galea et al., 2005). Thus, population redistribution through movement of workers and retirees with or without diseases may influence the observed pattern of population health (Bentham, 1988; Bolye, 2004). These studies imply that disparities in CHD prevalence may be explained in part by the area's economic and