



# Are older adults living in more equal counties healthier than older adults living in more unequal counties? A propensity score matching approach



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## ARTICLE INFO

### Article history:

Received 6 June 2015

Received in revised form

13 July 2015

Accepted 22 July 2015

Available online 26 July 2015

### Keywords:

Income-inequality

Health disparity

Propensity score matching

Contextual effects

U.S. adult health

## ABSTRACT

We assessed the potential contextual effect of income inequality on health by: 1) comparing individuals with similar socioeconomic status (SES) but who reside in counties with different levels of income inequality; and 2) examining whether the potential effect of county-level income inequality on health varies across SES groups. We used the Health and Retirement Study, a nationally representative study of Americans over the age of 50. Using propensity score matching, we selected SES-comparable individuals living in high-income inequality counties and in low-income inequality counties. We examined differences in self-rated overall health outcomes and in other specific physical/mental health outcomes between the two groups using logistic regression ( $n = 34,994$ ) and imposing different sample restrictions based on residential duration in the area. We then used logistic regression with interactions to assess whether, and if so how, health outcomes differed among participants of different SES groups defined by wealth, income, and education. In bivariate analyses of the unmatched full sample, adults living in high-income inequality counties have worse health outcomes for most health measures. After propensity score matching, adults in high-income inequality counties had worse self-rated health status (AOR = 1.12; 95% CI 1.04–1.19) and were more likely to report diagnosed psychiatric problems (AOR = 1.08; 95% CI 0.99–1.19) than their matched counterparts in low-income inequality counties. These associations were stronger with longer-term residents in the area. Adverse health outcomes associated with living in high-income inequality counties were significant particularly for individuals in the 30<sup>th</sup> or greater percentiles of income/wealth distribution and those without a college education. In summary, after using more precise matching methods to compare individuals with similar characteristics and addressing measurement error by excluding more recently arrived county residents, adults living in high-income inequality counties had worse reported overall physical and mental health than adults living in low-income inequality counties.

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## 1. Background

Compared to their peers in other high-income countries, Americans have worse health and higher mortality rates (Banks et al., 2006; Banks et al., 2010; Cohen et al., 2011; Crimmins et al., 2011; Ho, 2013; Ho and Preston, 2010; Woolf and Aron, 2013). Income inequality is also significantly greater, with the United States

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ranking as the fourth most unequal country among 34 high-income countries (OECD, 2013). Numerous ecological studies have shown a significant association between higher income inequality, measured at the national-, state-, or community-levels, and worse population health (Kaplan et al., 1996; Kennedy et al., 1996). However, multilevel analyses have reached mixed conclusions about the contextual effects of income inequality on population health (Ash and Robinson, 2009; Babones, 2008; Ben-Shlomo et al., 1996; Daly et al., 1998; Deaton and Lubotsky, 2003, 2009; Fiscella and Franks, 1997; Fisella and Franks, 2000; Kennedy et al., 1998; LeClere and Soobader, 2000; Lochner et al., 2001; J. W. Lynch et al., 1998; Muramatsu, 2003; Soobader and LeClere, 1999; Wilkinson and Pickett, 2006, 2008). Systematic literature reviews and meta-analyses suggest that studies examining income inequality over larger geographic boundaries (e.g., states) are more likely to report significant associations between income inequality and health, compared to studies examining income inequality over smaller geographic units (e.g., county or census tract) (Kondo et al., 2009; Subramanian and Kawachi, 2004; Wilkinson and Pickett, 2006).

A number of studies have also found mixed results for the contextual effect of income inequality on health across socioeconomic groups. Lochner et al. (2001) found that the mortality risk of near-poor individuals was more strongly associated with state income inequality than the mortality risk of the poor (Lochner et al., 2001). Subramanian et al. (2001) reported a differential impact of state income inequality on high-income groups, such that the affluent report better health from living in high inequality states (Subramanian, Kawachi and Kennedy, 2001). In contrast, according to Subramanian and Kawachi (2006), income inequality exerts a comparable contextual effect across all socioeconomic sub-groups with self-rated health status (Subramanian and Kawachi, 2006).

These studies examining the association between income inequality and health attempted to control for measured confounders by including individual-level socio-economic characteristics as independent variables in multiple regression analyses. A far more rigorous method to adjust for potential confounders, such as socioeconomic status (SES), would compare the health outcomes of a matched sub-sample of individuals with similar demographic and socioeconomic characteristics, but who live in places with different levels of income inequality. Yet, to our knowledge, no prior multilevel analyses to date have used a matched sample based on propensity scores to select individuals who are comparable on their SES characteristics to assess the possible contextual effect of income inequality on adult health. Chiavegatto Filho et al. (2012) used a propensity score matching technique to match districts but not individuals, using an aggregate, district-level dataset (Chiavegatto Filho et al., 2012). To assess individuals' health differences attributable to the level of income inequality of the place where they reside, a better approach is to match study samples at the individual level, based on individuals' demographic and socioeconomic attributes, and then examine differences in health outcomes between those who live in high versus low-income inequality places.

Another important empirical issue in identifying whether a contextual measure of income inequality is associated with health outcomes is the potential measurement error that could occur as a result of recent migration to the area, as recent arrivals may not have lived in the community long enough to experience any consequences of local conditions. To experience health consequences, individuals would likely need to be exposed to the local conditions for some time. However, to our knowledge, no prior study has addressed the potential measurement error resulting from the inclusion of individuals who have recently moved to the area.

Accordingly, in this study, we aimed to contribute to the literature by: 1) improving the measurement of a potential contextual

effect of income inequality on residents' health by using a propensity score matching technique to identify comparable individuals living in counties with different income inequality levels; 2) addressing the measurement error in the potential income inequality effect which arises from varying lengths of residence in the area; and 3) assessing whether any contextual effect on key health outcomes is moderated by individual/family-level socioeconomic status, as measured by educational attainment, household income, and household wealth.

## 2. Conceptual model

Our conceptual model is based on existing theory and prior research linking levels of income inequality and individual health through both material and psychosocial pathways (Brunner and Marmot, 2005; Daly et al., 1998; Kondo et al., 2009; Lynch et al., 2004; Subramanian and Kawachi, 2006). Fig. 1 shows the conceptual model guiding our hypotheses regarding the mechanisms by which area-level income inequality could influence individuals' health outcomes, independent of individual-level demographic and socioeconomic status.

Material pathways suggests that living in a place of high-income inequality is associated with a set of economic, political, social, and institutional processes reflecting systematic underinvestment in human, physical, health, and social infrastructures (Daly et al., 1998). As a result, residents may have fewer resources to buy housing, healthy food, medical care and have access to a lower quality education, health services, transportation, recreational facilities, and/or publicly provided services. As a consequence, the physical and mental health of residents may suffer (Lynch et al., 2004).

In terms of psychosocial factors, inequitable income distribution may influence individuals' perceptions of and experiences with their social environment in ways that undermine mental health (Daly et al., 1998). Important aspects of the perceived social environment include relative poverty, relative economic insecurity, and lack of social cohesion and trust. Feelings of relative deprivation may affect both the endocrine and immune systems (Brunner and Marmot, 2005). Therefore, individuals living in a place of high-income inequality may have greater distress, and hence have poor health. Moreover, psychosocial factors such as fear of losing one's current socioeconomic status in the face of weak safety nets and lack of trust and cohesion that come with greater income inequality may affect the health of not just the poor, but even higher SES individuals that live there as well (Kondo et al., 2009; Subramanian and Kawachi, 2006).

The conceptual model also suggests the magnitude of the potential contextual effect of income inequality on health may well vary depending on individuals' SES. Each of these material and psychosocial pathways might have different effects depending on the social and economic circumstances of individuals. More specifically, material pathways are likely to affect the health of both poor and middle-class individuals (Daly et al., 1998) but not necessarily the health of high-income individuals. Although the psychosocial pathways may affect all SES groups, because the health of low income individuals is affected by their own poor economic circumstances to a large extent, additional health effects of living in a higher income inequality area may not translate into an increased risk of health problems for these low income individuals. While there is extensive research on health differences among individuals by area-level income inequality, and separately by individuals' SES, few studies have discussed whether and if so, how, the potential contextual effect of income inequality might interact with individuals' social and economic status.

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