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Associations between Area-Level Conditions, Socioeconomic Conditions, and Mortality: Do They Vary over the Life Course?

Abstract

Social factors affect people's mortality at the individual and the area level. While previous research has shown that the effects of individual-level factors on mortality vary over the life course, age differences in the effects of area-level factors have not yet been extensively studied.

We aim to investigate age patterns in individual- and area-level mortality inequalities simultaneously, thus exposing age differences in area-level influences on mortality net of population composition.

The study is based on Dutch register data enriched with area-level information. Multilevel models for individuals living in Dutch small area units are estimated sex-specifically and by age groups. Our results show that mortality inequalities are less manifest at younger ages, individual-level mortality differences are prominent in midlife, and area-level deprivation is related to higher mortality at older ages.

Our results aim to deepen the understanding of the multilevel nature of age-specific mortality inequalities and the identification of target groups for health policy interventions.

Background

Social factors at the individual level affect people's health. The additional influence of area-level factors on health, however, has only recently become an object of study (Diez-Roux 1998; Kawachi & Berkman 2003). Previous research has shown that the effects of individual-level factors on health vary with age; however, the effects of area-level factors for different age groups have not yet been extensively studied.

Research has shown that age patterns differ between the individual level and the area level. For instance, individual level socioeconomic health and mortality gradients tend to decrease over age (Hoffmann 2011; Huisman et al. 2004). Ecological studies, which fail to account for differences in population composition across areas, have shown that area-level health/mortality inequalities tend to be largest in midlife (Norman & Boyle 2013).

Evidence exists that there are indeed age patterns to area-level influences on mortality after compositional factors were taken into account. A recent meta-analysis of multilevel studies revealed that area-level conditions have a stronger impact on mortality among men. It also showed that people at younger ages are affected more strongly when assuming a linear age effect (Meijer et al. 2012). How the age pattern looks in detail, however, is still not known.

The objective of this study is to investigate age patterns in individual- and area-level mortality inequalities simultaneously, thus exposing age differences in area-level influences on mortality net of population composition.

Data and method

Our study is based on Dutch register data supplemented with area-level information provided by Statistics Netherlands. Place of residence is indicated by different administrative area classifications: municipalities (N=418), quarters (N=2542) and neighborhoods (N=11574). The study is based on the entire population residing in the Netherlands in 2007-2011 aged 25 to 74 years, resulting in 58 million exposure years and 0.67 million deaths.

Multilevel models for individuals living in Dutch municipalities, quarters and neighborhoods are estimated sex-specifically for different age groups. Explanatory variables for the individuals (e.g., partnership status, occupational status, educational level, ethnicity) and areas (e.g. socioeconomic conditions, population density, distance to facilities) are included (Merlo et al. 2005).

First, we separate the individual-level variation in mortality from the variation at the area level for each age group (null model). Second, we test how much of this area-level variation is due to compositional differences (due to socio-demographic factors) and investigate mortality inequalities by socioeconomic factors. Finally, we attempt to explain the area-level mortality variation by including area-level conditions.

Preliminary results

Age-specific area-level mortality inequalities follow a distinct reverse U-shape pattern with highest inequalities in midlife among men (Fig. 1, first bar, left panel) and exhibit a slight age-related increase among women (right panel). The second model reveals that these age patterns are largely due to differences in the population composition of the different areas (Fig. 1, second bar). This finding underlines the importance of using multilevel models in our study. While socioeconomic mortality inequalities start to decrease after age 40 among men, there is no pronounced age pattern among women. The mortality effect of area-level deprivation is modest and follows again a reverse U-shape pattern over age. Controlling for area-level deprivation in addition to controlling for population composition, however, reduces the area-level mortality variation only at older ages (Fig. 1, third bar).

Similar individual- and area-level effects are seen across different area classifications with larger area variation across the smaller area units.

Discussion/conclusion

Whilst mortality inequalities are less manifest at younger ages, individual-level (socioeconomic) mortality differences are prominent in midlife, and at older ages, living in more deprived areas is related to an increased mortality risk. Age-related differences in area-level mortality inequalities level out once differential population composition is accounted for. This deepens the understanding of age-specific mortality inequalities on different levels.

Our results are derived from a high-quality population register, leading to reliable and representative results. A drawback of the data is that no information on health-related behavior was available and that the socioeconomic status indicators are rather crude, possibly resulting in an underestimation of SES mortality inequalities and eventually overestimated the unexplained area-level mortality variation. Further strengths and limitations of our approach and data in relation to the interpretation of the results, such as the role of migration over the life course, will be discussed.

Our results can contribute to sharpen the focus of health policy interventions for healthy aging.

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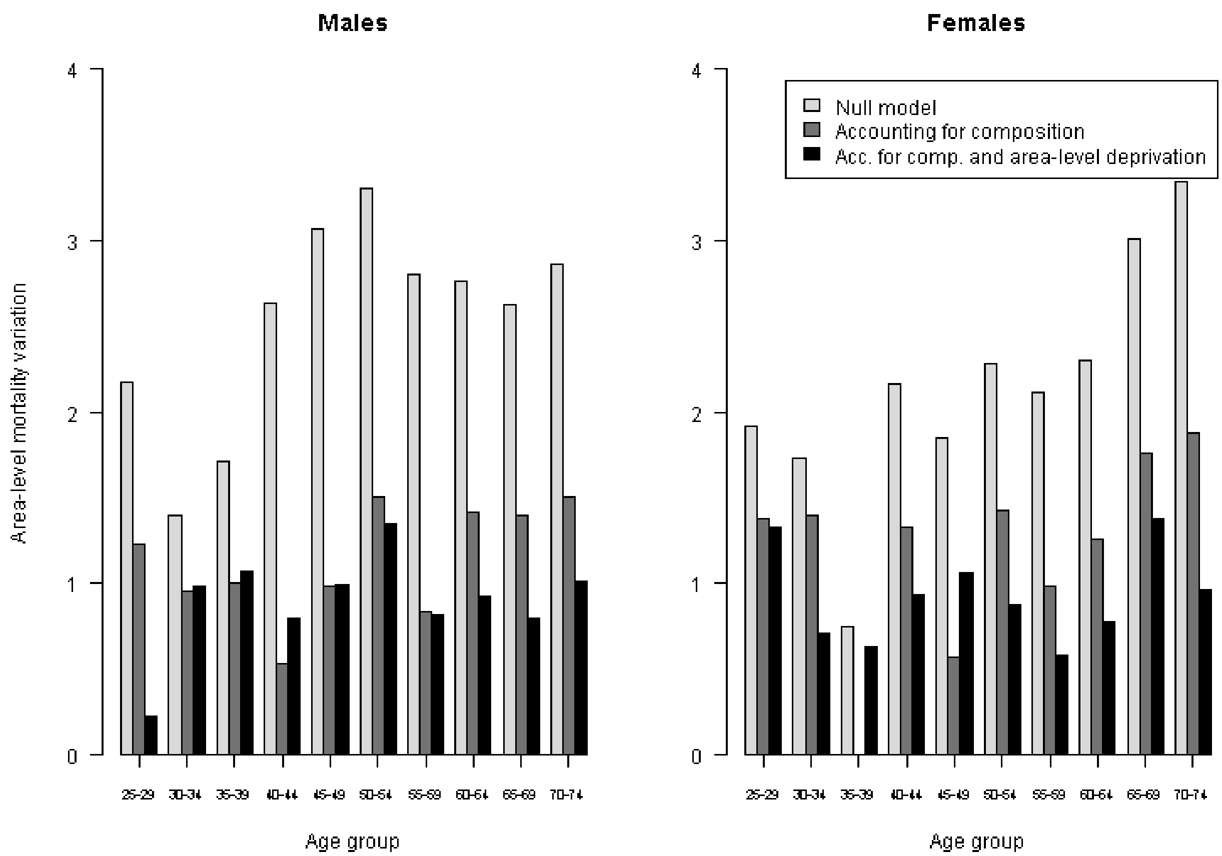

Figure 1: Area-level mortality variation across municipalities by age group (level-2 standard deviation in relation to model intercept); area-level deprivation: share of low income households