Disease, Death, and the Body Politic: 
An Areal Interpolation Example for Political Epidemiology

James L. Wilson, Northern Illinois University, USA
Christopher J. Mansfield, East Carolina University, USA

ABSTRACT

More than a trillion dollars of public money is spent annually on health care in the United States. In order to inform policymakers, health advocacy groups, tax-paying constituents, and beneficiaries, it would be useful to present and analyze health outcome and health-related data at the U.S. congressional district level. Presently, health event data are not reported at this political unit; however, recent interest and advances in areal interpolation techniques are beginning to transcend the inherent limitations imposed by legacy data collection and analyses systems. In this paper, the authors use the dasymetric approach to illustrate how this areal interpolation technique can be used to transfer county-level mortality rate data from several causes of death to the U.S. congressional district level. The study’s primary goal is to promote areal interpolation techniques in the absence of a systematic and comprehensive national program for geocoding health events.

Keywords: Areal Interpolation, Congressional Districts, Dasymetric, Geographic Health Disparities, Health Expenditures, Mortality, Rates

INTRODUCTION

While the US has an excellent system for producing health statistics, data and rates are not reported at the fundamental political level, the US Congressional District. Failure to do so denies legislators and policymakers important information for representation of their constituents. The publication of health outcomes data at the legislative district level would be a useful tool for health advocacy groups; raising awareness of health issues to the political level, where decisions concerning healthcare funding and resource allocation are made. Health related data estimated or enumerated at the US Congressional District level would be congruent with US Census socio-economic data, which are important underlying determinants.
linked to poor health outcomes. Health status, interventions, and outlays could thus be modeled and assessed at a politically relevant level. Reformation in purpose and presentation of vital statistics and health outcomes data would be an important contribution to political epidemiology, addressing fundamental questions such as disparity of health, health resources, and public expenditures across legislative districts.

A large and growing proportion of the nation’s financial resources are being committed to health care each year. For the year 2009, total national expenditure for the United States is estimated to be $2.5 trillion or approximately 17.6% of the nation’s GDP. This translates into approximately $8100 per capita (Centers for Medicare and Medicaid Services, 2009). Using data from 2002, Selden and Sing (2008) estimated that more than 56% of the nation’s health expenditures can be accounted for by the public sector; comprised of Medicare for the elderly and disabled, Medicaid for low income groups, the Department of Veteran’s Affairs, State Children’s Health Insurance Program (SCHIP), and worker’s compensation, as well as tax subsidies of various forms that benefit middle- and high-income groups. If these estimates are correct, then more than $1.2 trillion or 8.8% of the nation’s GDP will have been distributed in public funds for health care in the year 2009. It is a non-trivial matter to describe results and show accountability at the political level for such large public expenditures.

National mortality and morbidity statistics are collected in a comprehensive and coordinated vital statistics system with counts and rates reported at the US county level. Unfortunately, vital statistics data are neither collected nor reported by legislative districts. The boundaries of legislative districts (state and congressional) are fluid and often bizarrely shaped geographic structures based on periodic and politically motivated re-apportionments of populations (Eyre, 1993). By contrast, county boundaries are relatively stable over time, rarely changing size and shape regardless of any growth experienced in their populations. They are not structured by fluctuation in political affiliations. Congressional legislative districts, although unstable regarding borders, have relatively large and similarly sized populations that produce stable rates for many causes of death and disease. Congressional districts are similar in concept to cartograms, where non-spatial attributes like densities and rates are transformed into area and shape. The congressional district cartogram is constrained by pre-determined population size and distribution, state, and national boundaries. The county and the congressional district are examples of incongruent areal units with different spatial bases and social purposes (Voss, Long, & Hammer, 1999).

Two solutions are possible for calculating vital statistics rates in areas other than counties. The first solution involves enumeration of vital events by geocoding individual residential addresses. Coordinates for health events are then assigned to the spatial unit of interest. The second solution is to estimate counts and rates for the target area (the spatial unit of interest) from an incompatible source area using areal interpolation techniques. These solutions have their merits and costs in terms of precision and accuracy in addition to what is socially and politically desirable or feasible. Enumeration is preferable, but may not be feasible, whereas estimation by interpolation may be more feasible, but potentially introduces errors that go beyond geocoding accuracy.

Healthy People 2010, the national blueprint for improving the nation’s health sets forth in objective, 23-3 to “[i]ncrease the proportion of all major national, state, and local health data systems that use geocoding to promote nationwide use of geographic information systems at all levels” (U.S. Department of Health and Human Services, 2000). We recognize that there are several impediments to realizing this objective. First, confidentiality needs to be assured when geocoding events into small areas like the census block, block group, and tract. Second, geocoding technology is not perfect. Small errors in interpolation can lead to a residential address being matched to the wrong area producing incorrect rates. Thirdly, a significant proportion of addresses are often
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