Chapter XV

Spatial Accessibility to Primary Care and Physician Shortage Area Designation: A Case Study in Illinois with GIS Approaches

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This chapter introduces two new GIS-supported methods of measuring accessibility to primary healthcare. The improved floating catchment method defines the service area of physicians by a threshold travel time while accounting for the availability of physicians. The gravity-based accessibility method considers two factors: travel times from service providers (a nearby supply is more accessible than a remote one) and competition intensity by residents for such a service (measured by gravity-based potential). The methods are applied to examining accessibility to primary care in the northern Illinois region in 1990 and 2000. The GIS-based methods may be used to help the U.S. Department of Health and Human Services and state health departments define health professional shortage areas.
INTRODUCTION

Access to healthcare is affected by where physicians locate (supply) and where people reside (demand). The geographic distribution of physicians does not necessarily match that of population. Some areas experience physician surplus, and others have physician shortage. The shortage has been especially pronounced in rural areas and impoverished urban communities (Council on Graduate Medical Education or COMGE, 2000; Rosenblatt & Lishner, 1991). The U.S. federal government spends about $1 billion a year on programs designed to alleviate access problems, including awarding financial assistance to providers serving designated shortage areas (General Accounting Office or GAO, 1995).

These federal programs depend on two main systems for identifying shortage areas (GAO, 1995; Lee, 1991). One designates Health Professional Shortage Areas (HPSAs), the other Medically Underserved Areas or Populations (MUA/MUPs). Both systems use the ratio of the number of providers to population within a geopolitical unit (usually a county) as a primary indicator. Neither system, however, adequately reflects the fact that the availability of services depends not only upon the supply of resources in a community, but also the supply of such resources in neighboring communities, and the distance and ease of travel among them (Klienman & Makuc, 1983, p. 543). This limitation of HPSA or MUA/MUP could easily overestimate shortage in some areas and underestimate shortage in others so that funding may not be channeled to where it is most needed (GAO, 1995). Despite efforts to improve the methods (Department of Health and Human Services or DHHS, 1998), two geographic problems have not been addressed appropriately: (1) not accounting for the actual spatial distributions of physicians and population within the areal unit (e.g., county), and (2) not considering the actual road network travel time between supply and demand and travel across geopolitical boundary. Better methods for defining physician shortage areas are needed to help direct the limited federal resources to the truly underserved population.

While we are aware that socio-demographic characteristics including ethnicity and socioeconomic status may also influence healthcare accessibility, this chapter will focus primarily on spatial accessibility. Identifying the spatial mismatch between healthcare supply and demand is the first step towards an improved healthcare delivery system. The purpose of this chapter is to show how the existing DHHS designation systems for physician shortage areas can be improved by applying GIS technology to data at a finer geographic resolution. Specifically, two new methods will be used: the improved floating catchment method and the gravity-based accessibility method. Both involve the analysis of travel time through a road network and better reveal the spatial access to healthcare. Physician shortage areas are more accurately identified by the methods.