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Geographic variation of dental utilization among low income children

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ABSTRACT

Spatial accessibility of dental care is mediated by dentist workforce availability and travel costs. In this study, we generated dental service areas through small area analysis of Medicaid administrative data and claims. Service areas were then used to assess dimensions of spatial accessibility, including dentist-to-population ratios, and examine relationships in geographic variation of routine dental care among Medicaid-enrolled children. Our findings indicate significant geographic differences in accessibility for Hispanic children compared to other children, even after controlling for individual and service area characteristics.

1. Introduction

Despite advances in prevention, dental caries (tooth decay) remains the most common chronic disease among children in the U.S. (DHHS, 2000). Five times more common than asthma (DHHS, 2000), 37% of children age 2–8 have a history of decay in their primary teeth (Dye et al., 2015). Marked disparities in disease prevalence and severity exist based on racial or ethnic background and family income. Black and Hispanic children in the U.S. have greater prevalence of dental caries and untreated primary tooth decay is twice as high in these groups as in White children (Dye et al., 2015). Children living in poverty demonstrate marked disparities in oral health: 54% of children living at less than 100% of the Federal Poverty Level (FPL) have a history of decay and 33% have untreated decay (Dye et al., 2007).

Despite federally mandated coverage of dental care for low-income children through the Early Periodic Screening, Diagnosis, and Treatment (EPSDT) Program (HRSA, 2012), utilization of dental services among Medicaid-enrolled children remains low. In 2010, approximately 22% of the approximately 250,000 children eligible for dental services through Iowa Medicaid received corrective dental treatment (IDPH, 2011).

1.1. Spatial accessibility is influenced by dentist availability and travel costs

Spatial accessibility is one dimension of access to health care and is shaped by local availability of providers and the travel costs associated with utilization (Guagliardo, 2004). One recent study of dental expenditures among Medicaid-enrolled children found higher rates of preventive visits in counties with higher dentist supplies (Beil et al., 2012). Another recent study of dental utilization among Medicaid-enrolled children with chronic conditions found that utilization of dental services was lower in counties with dental Health Professional Shortage Area (HPSA) designations (Chi and Leroux, 2012). While both studies examined the role of county urbanicity, other measures should be considered in order to evaluate the role of spatial accessibility.

Travel cost has been evaluated among Medicaid-enrolled populations and has been demonstrated to vary with urban or rural residence (Borders, 2006; Agili et al., 2005). Travel barriers faced by the Medicaid population include extended travel times, transportation expenses, and lack of reliable transportation (Borders, 2006; Mattheus, 2010). While previous research has examined relationships between spatial accessibility and medical care (Goodman et al., 1994; Peipins et al., 2011), few studies have directly examined the effect of travel costs on receipt of dental services.

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1.2. Service areas describe regional variations in utilization

The most common approach to examine variation in access to dental care is the use of fixed geopolitical boundaries, such as counties (Klauss et al., 2005; Krause et al., 2005; Mayer, 1999; Saman et al., 2010; Chi and Leroux, 2012; Susi and Mascarenhas, 2002). Using geopolitical units to approximate service areas offers several advantages, including ready availability of data. However, these units are arbitrary designations that do not necessarily correspond to actual markets for dental care. It has long been recognized that counties may not accurately describe local variations in culture, social capital, and availability of health care resources (Wennberg and Gittelsohn, 1982). In rural areas particularly, counties could be too small to capture the locations of providers and the populations that they serve. Similarly, several studies have examined dental workforce distribution at the zip code level (Susi and Mascarenhas, 2002; Horner and Mascarenhas, 2007) – however, zip codes are typically too small to adequately capture patterns of local supply and demand.

Service area analysis offers an alternative approach that addresses these limitations and can be used to evaluate geographic variation in health workforce supply, allocation of resources, and utilization of services. Several methods to define health service areas are routinely used in research (Baker, 2001; Paul-Shaheen et al., 1987; Garnick et al., 1987; Zwanziger et al., 1990). One straight-forward method defines service areas as the region encompassed by a circle of fixed radius around each provider. However, this method only measures potential access; it does not account for dentists' willingness to treat different populations (Garnick et al., 1987). This is especially important in dentistry, where dentists frequently limit their acceptance of young children or publicly insured individuals (Garg et al., 2013; ADA, 2008). Additionally, applying a fixed radius across the landscape may be inappropriate for populations in rural or mountainous regions, who often must travel further for health care services (Baker, 2001).

A second option for service area analysis is a variable market area approach, which takes into account regional differences (Baker, 2001; Garnick, 1987; Zwanziger, 1990). Variable market approaches are prevalent in health services literature where methods can vary based on research priorities. One such method involves varying the radius around a provider until it encompasses a certain percentage of the actual market population, as seen in a study of dental service areas for Medicaid-enrolled children in North Carolina (Mayer, 1999). However, that study was limited by its use of counties as the minimal unit of aggregation to assemble service areas.

Finally, one of the most common variable market approaches used to determine hospital and physician market areas is small area analysis (Goodman et al., 2003; Klauss et al., 2005). This technique relies on patient origin data to generate service areas as aggregates of small geopolitical units, such as zip codes or census tracts. Early studies by Wennberg and Gittelsohn pioneered the use of this technique to identify hospital service areas in New England based on Medicare admissions data (Wennberg and Gittelsohn 1973; 1982). Despite the long-standing use of variable market analysis in health services research, applications in dentistry are lacking. One previous study (McKernan et al., 2013) has applied small area analysis to evaluate access to orthodontic services among Medicaid-enrolled children and adolescents in Iowa.

1.3. Study aim

The two goals of this study were to (1) use methods of small area analysis to identify dental service areas for the pediatric Medicaid population in Iowa and (2) examine geographic variation in utilization of routine dental care within this framework. If local, contextual characteristics are found to be significantly associated with utilization, this research would support the importance of community-wide initiatives to improve access to oral health services for Medicaid-enrolled children.

2. Materials and methods

2.1. Data

We obtained data from Iowa Medicaid enrollment and dental claims files for calendar years (CYs) 2008 through 2010. The enrollment files contained information about each individual's date of birth, sex, race/ethnicity, eligibility program (e.g., based on income), zip code, and county of residence. The claims dataset included all claims submitted by general and pediatric dentists during the three-year period. Dental claims data included dates of service, providers' locations, and procedures performed. Procedures were identified using Current Dental Terminology (CDT) Codes (ADA, 2010). Patient and provider locations were geocoded to the zip code level. We used zip code tabulation areas (ZCTAs) produced by the U.S. Census Bureau as geographic approximations of zip codes (U.S. Census Bureau, 2011).

2.2. Study population

The inclusion criteria for this project required that an individual be between the ages of 3 through 18 years with continuous enrollment in the Iowa Medicaid program for at least 11 months within any CY from 2008–2010, which corresponds to the Health Effectiveness Data and Information Set (HEDIS) protocol requirement for children to be continuously insured for at for at least 11 months during the study period (AHRQ, 2012). Age was calculated at the beginning of this qualifying enrollment period. The study population was further limited to individuals eligible for Medicaid based on income eligibility requirements or through Supplemental Security Income (SSI). We excluded individuals eligible for Medicaid through foster care, those residing in medical institutions, and the medically needy population.

All claims submitted to Iowa Medicaid by a primary care dentist (i.e. general or pediatric dentist) on behalf of individuals who met the inclusion criteria were used to delineate dental service area boundaries. Medicaid enrollees (hereafter, "children") were required to have a residential zip code on file located in Iowa. Provider locations were not constrained to Iowa.

The final enrollment dataset contained 146,055 children who met the inclusion criteria during 2008 through 2010. The final claims dataset used to generate service areas included 247,245 dental claims submitted on behalf of 73,426 enrollees.

2.3. Outcome variable

The primary outcome of interest was having a routine dental visit during the study period (2008–2010). Routine dental visits were defined as having a periodic or comprehensive oral evaluation (CDT D0120 or D0150), with or without additional preventive or therapeutic procedures from a pediatric or general dentist. Preventive procedures include services such as topical fluoride applications and pit and fissure sealants (D1000–1999); therapeutic procedures include services such as amalgam or composite restorations, root canal therapy, or other restorative procedures (D2000–9999). This definition was chosen to represent utilization of routine, comprehensive dental care focused on primary prevention and early treatment of dental disease.