Transportation Barriers and Use of Dental Services among Medicaid-Insured Adults.

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The results of this study can be used by policy-makers and public health planners when designing programs and interventions to improve access to dental care. Consideration of transportation availability and costs could improve utilization of routine dental care, especially among low income populations.

ABSTRACT

This study explores how travel distance and other transportation barriers are associated with dental utilization in a Medicaid expansion population. We analyzed data from the Iowa Dental Wellness Plan (DWP), which provides comprehensive dental benefits for low-income adults aged 19-64 as part of Iowa’s Medicaid expansion. Transportation and geographical characteristics were evaluated as enabling factors within the framework of Andersen’s Behavioral Model of Health Services Use.

In March 2015, a random sample of DWP members (n=4800) was surveyed; adjusted survey response rate was 30% (n=1258). The questionnaire was based on the Consumer Assessment of Healthcare Provider and Systems (CAHPS) Dental Plan Survey and assessed need for dental care, use of dental services and transportation to visits and self-perceived oral health status. Respondent and dentist addresses were geocoded and used to calculate distance to the nearest DWP general dentist. A logistic regression model predicting utilization of dental care was developed using variables representing each domain of the Behavioral Model.

A majority of respondents (57%) reported a dental visit since enrolling. Overall, 11% of respondents reported unmet dental need due to transportation problems.
Median distance to the nearest general dentist was 1.5 miles. In the adjusted model, travel distance was not significantly associated with the likelihood of dental utilization. However, other transportation-related issues were significantly associated with utilization, including concern about cost of transportation and driver/passenger status. As concern about transportation cost increased, likelihood of having a dental visit decreased.

Targeted approaches to assisting low income populations with transportation barriers should be considered in designing policies and interventions to improve access to dental care.

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The 2010 Patient Protection and Affordable Care Act (ACA) was designed to improve potential access to health care by expanding the number of individuals covered with health insurance. As of February 2016, over 15 million Americans had gained health insurance coverage as a result of the ACA-related Medicaid expansion (Centers for Medicare and Medicaid Services 2016). However, insurance coverage may not be the only barrier that prevents people from receiving necessary care; access to health care is a multidimensional construct influenced by a myriad of additional social, financial, and environmental factors.

Among these, transportation is consistently reported to have a sizeable impact on whether an individual seeks care or not (Syed et al. 2013). Lack of transportation, difficulty obtaining transportation, and dependence on others to get to a medical appointment are associated with broken appointments and delayed or unmet medical care (Diamant et al. 2004, Mattson 2011, Nelson and Park 2006, Shook 2005). Transportation as a barrier to timely medical care is also associated with greater reliance on emergency departments (EDs) for ambulatory care (Cheung et al. 2012).

Transportation disadvantaged individuals are more likely to be elderly, poor, mobility-impaired, or members of racial/ethnic minority groups (Arcury et al. 2005a, Arcury et al. 2005b, Silver et al. 2012). In a study examining barriers to dental care among community dwelling older adults, 31% reported lack of transportation as one of the reasons for not getting recommended dental care (Montini et al. 2014). Additionally, a national study examining racial/ethnic disparities in children’s access to dental and medical care found that lack of transportation was significantly more associated with
unmet dental care needs among Asian/Pacific Islander and Native American children compared to white children (Flores and Tomany-Korman 2008).

In May 2014, Iowa began to provide dental benefits to its Medicaid expansion population through the Dental Wellness Plan (DWP). The DWP maintains a separate provider network from the traditional Medicaid State Plan; with higher reimbursement relative to traditional Medicaid and an emphasis on reduced administrative burden, DWP was designed to offer its members an improved dental provider network relative to traditional Medicaid. DWP provides fee-for-service dental benefits through a unique earned-benefits structure; members become eligible for additional covered services if they return for routine dental exams every 6-12 months. However, expanding Medicaid coverage to include more low-income individuals without addressing non-financial barriers, such as transportation, may not have the desired effects. The aim of this study is to explore prevalence of transportation barriers in a Medicaid expansion population and how these are associated with utilization of office-based dental care.

**METHODS**

**Survey Design & Administration**

A mixed-mode survey was administered in early 2015 to a random sample of DWP members aged 19 to 64. The sampling frame included members enrolled continuously from May 2014, when the program first began, through February 2015; one month of ineligibility was permitted. A random sample of 4,800 individuals was drawn from a total of 125,122 eligible members. Sample size was based on guidance from the Consumer Assessment of Healthcare Providers and Systems (Agency for Healthcare Research and Quality 2009).
Since this survey targeted a newly insured population, DWP members were oversampled in order to have adequately sized representation of individuals who reported having a dental visit since joining the program.

Surveys were mailed in March-April 2015 and respondents were given an option to complete the paper survey or a web-based survey. A reminder postcard was sent two weeks after the initial mailing and a second survey was sent two weeks later. Respondents received a $2 bill as compensation for their time; individuals who returned their surveys within the first two weeks were entered into a drawing for one of ten $25 gift cards to Walmart.

The Consumer Assessment of Healthcare Providers and Systems (CAHPS) Dental Plan Survey served as the basis for the survey instrument (Agency for Healthcare Research and Quality 2009). Additional items were included to address transportation to dental visits; these questions were modified from previous University of Iowa Public Policy Center surveys evaluating the Iowa Health and Wellness Plan. The survey instrument was approved by Iowa Medicaid prior to distribution; a copy of the survey is available in the supplemental online materials. It was determined by the University of Iowa Human Subjects Office that this project did not meet the regulatory definition of human subjects research under a waiver approved by the Secretary, US Department of Health and Human Services, for Section 1115 projects conducted by the Centers for Medicare and Medicaid Services (CMS). The Iowa Health and Wellness Plan has federal approval via Section 1115 demonstration waiver (Iowa Health…c2016). A cover letter accompanying the survey served as an informed consent document.
Dependent Variable

The outcome of interest for this study was having at least one self-reported dental visit since enrolling in the DWP. Dental utilization was assessed by the survey question “Since joining the Dental Wellness Plan, not counting any times you went to an emergency room, how many times have you gone to a dentist’s office or clinic to get dental care for yourself?” While this question excludes services received in an emergency room, it does not necessarily exclude emergency services that may have been received in a dental office.

Independent Variables

Potential predictors of utilization were categorized as predisposing, enabling, or need-related within Andersen’s Behavioral Model of Health Services Use (Figure 1) (Andersen 1968). Variables were selected to represent the individual determinants of health service utilization as described by Andersen and Newman (1973). Transportation and spatial characteristics were included as enabling factors within this framework; these variables and their relevant survey items are listed in Table 1. Driver/passenger status was categorized based on the US National Household Travel Survey (NHTS) variable (Probst et al. 2007). In response to the survey item asking “When you need to get dental care, what is the type of transportation you use most often to get to your visit?” respondents were categorized as drivers, passengers, or public transportation/walk/other.

Distance Calculations

The addresses of all survey respondents were geocoded to the street level. For post office boxes (n=275) and incomplete addresses (n=30), a random point within the
postal zip code was created to represent that location in order to avoid loss of subjects. Addresses for general dentists in the DWP network (n=817) were obtained from Delta Dental of Iowa, which administers this program, and geocoded. For this study, dentists in Iowa who worked in either private practice or public safety net settings (e.g., Federally Qualified Health Centers) were considered. For each respondent, network travel distance to the nearest DWP provider was calculated using parameters that minimized travel time in order to most accurately represent route choice to the closest provider. Geocoding and network analysis were performed using esri ArcMap 10.3.

Statistical Analysis

Bivariate and logistic regression analyses were performed to evaluate relationships between potential predictors and having at least one dental visit. All analyses were conducted using IBM SPSS Statistics (version 23; Chicago, IL, USA). A significance level of 0.05 was used for hypothesis testing.

The final regression model used a best fit method for model selection. The Box-Tidwell approach to test for non-linearity of distance to the nearest dentist was not statistically significant, indicating a linear relationship with the logit. However, several transformations of distance were explored in the adjusted model due to positive skew of this variable, including log, natural log, and quartiles; magnitude and direction of model coefficients remained unchanged when alternative forms of this variable were tested. Driver/passenger status was alternately categorized based on the NHTS variable “mode of travel” (i.e. personal vehicle or public/walk/other) (Probst et al. 2007); magnitude and direction of model coefficients remained unchanged when this categorization was substituted in the adjusted model.
Regression analysis evaluated potential interactions between age, sex, and transportation variables; no statistically significant interactions were identified. The full model was run with and without transportation variables; a Chi-square test of the -2 Log Likelihood statistic was used to test the significance of the difference between these two models. Nagelkerke’s $R^2$ was also used to compare the models with and without transportation variables.

**RESULTS**

**Demographic Characteristics of Survey Respondents**

In total, 1,258 DWP members responded to the survey; accounting for undeliverable addresses, the adjusted survey response rate was 29.5%. Previous analysis of these data assessed nonresponse bias by comparing respondents and non-respondents based on administrative data (Reynolds et al. 2015). Respondents to this survey were significantly more likely to be older (mean age 45 vs. 39 years, respectively; $p<.0001$), female (59% vs. 51%, respectively; $p<.05$), and white (67% vs. 64%, respectively; $p<.05$) compared to non-respondents.

Among respondents, 57% reported having at least one dental visit since joining the DWP. The majority of respondents (66%) reported driving themselves to dental appointments (Table 2); 11% reported that having to travel too far or other unmet transportation needs had stopped them from getting needed dental care since enrolling in the DWP. For individuals with unmet transportation need ($n=131$), mean distance to the nearest dentist was not significantly different than distance among individuals without unmet needs ($F=1.47; p=0.26$).
Among respondents who reported unmet transportation need, 45% described themselves as passengers who relied on someone else to get to dental visits, 29% drove themselves to appointments, and 26% relied on other forms of transportation (results not shown). Respondents who relied on other forms of transportation were the most likely to report worrying about transportation cost “a great deal” (28%) compared to drivers (6%). Overall, median distance to the nearest general dentist was 1.5 miles; approximately 6% (n=72) of survey respondents lived more than 20 miles from the nearest dentist. There was no statistically significant difference in unmet transportation need based on residential urbanicity.

Regression Analysis

The full model (Table 3) was compared to a reduced model that excluded transportation variables. Adding the four transportation variables reduced the -2 Log Likelihood statistic; a Chi-square test of this change was significant ($X^2=100.15; p<.001$), indicating that the addition of the transportation variables significantly improved the model. Goodness of the final model fit was evaluated using the Hosmer-Lemeshow test, which was non-significant ($X^2=10.30; p=0.24$), indicating that the final model appropriately fit the data. Nagelkerke’s $R^2$ was also higher in the full versus reduced model (0.081 versus 0.059, respectively).

In the final, full model (Table 3), males were significantly less likely than females (OR=0.68) to have had a dental visit since joining the DWP. Individuals with lower levels of education and those who were edentulous were also significantly less likely to have had a dental visit. Individuals with chronic physical health conditions were significantly more likely to have had a visit than those without any chronic conditions (OR=1.44).
Two transportation variables demonstrated statistical significance in the full model: driver/passenger status and worry about transportation cost. Respondents who reported that they relied on public transportation, biked, or walked were 0.56 times as likely to have had a dental visit as those who depended on someone else to drive them.

**DISCUSSION**

Transportation concerns represented a substantial barrier to dental care in this study; 11% of respondents reported that transportation problems had prevented them from getting needed dental care. In a state such as Iowa with a large rural population, we expected travel distance or rural residence to have a significant impact on dental utilization. The DWP was designed to offer members an improved provider network relative to the traditional Medicaid State Plan. During the first year of implementation, 817 general dentists were contracted as DWP providers, representing approximately two-thirds of Iowa’s general dentists in 2015 (N=1229). Among DWP contracted providers, 88% (n=703) submitted at least one claim to the program during that year. Our findings indicate that median distance to the nearest dentist was not significantly associated with having had a dental visit.

Studies in the dental literature reporting on distance as a transportation barrier are scarce. However, one recent population-based survey found that 4% of adults with unmet dental need attributed this to the dentist being too far away (Malecki et al. 2015). Studies examining distance as a barrier to general health care have found shorter distances and reduced drive time significantly associated with greater health care utilization (Mattson 2011, Nemet and Bailey 2000). Previous research also suggests
that relatively few people receive dental care from the nearest provider (McKernan et al. 2016).

Rather than travel distance, other transportation issues were more important for those Medicaid-enrolled adults with a transportation barrier. For example, respondents who reported that they relied on public transportation, walking, or other forms of transportation were significantly less likely to have had a dental visit than individuals who depended on someone else to drive them. Approximately 12% of this population reported relying on these modes of transportation (i.e. public/walk/other) to get the dentist. Additionally, concern about the cost of transportation had the strongest association with dental utilization among all variables in this study.

These findings support other research examining the effect of vehicular access and mode of transportation on health care utilization. Individuals who have a driver’s license, those who own a car, or have access to a car through family or friends have greater health care utilization and lower unmet health care needs compared to those without private transportation (Arcury et al. 2005a, Flores et al. 1998, Pesata et al. 1999). In comparison, greater dependence on public transportation has been shown to be associated with lack of usual source of care, delayed health care, and greater unmet health care needs (Rask et al. 1994, Silver et al. 2012, Yang et al. 2006).

One strength of this study was that it was able to evaluate the role of transportation within a comprehensive framework that included other determinants of healthcare utilization. Results of this analysis support the inclusion of transportation variables within the Behavioral Model of Health Services Use as it relates to utilization of dental care. Our analysis relied on binary logistic regression, however, with
independent variables predicting a single outcome (Figure 1). Relationships between predictors in the Behavioral Model and the outcome are more complex than this model may imply. Updates to the Behavioral Model have seen the addition environmental factors, including characteristics of the health care system, and personal health behaviors, which could include dietary choices and oral hygiene practices (Andersen 1995). Future studies should explore other levels of influence – especially environmental characteristics – which may interact with the transportation variables explored in this study.

Additionally, survey-based research has important limitations, including the potential for response bias and recall bias. Our overall survey response rate was approximately 30%. However, low response rates alone are not indicative of data accuracy. While we identified differences between respondents and nonrespondents based on age, sex, and race, previous research has found that high rates of nonresponse by various demographic groups do not necessarily create a biased sample (Lee et al. 2009). Generalizability is potentially limited as this analysis considers individuals from a single state; however, findings are consistent with studies, as described above.

Overall, transportation appears to be a substantial barrier to dental care for this population and should be considered when new policies and interventions to improve access are designed. Many new initiatives are seeking to co-locate medical and dental providers in order to facilitate improved integration of medical and dental services and create an overall health home. These models offer convenience to those needing transportation assistance by being able to schedule medical and dental visits on the
same day. Additionally, the provision of dental services in public health and community settings allows individuals to receive care in more convenient settings. For example, school-based health centers (SBHCs) are convenient for both parent and children since these eliminate the need for additional transportation, time off from work, or missed school (Institute of Medicine and National Research Council 2011). Innovations in the dental delivery system, including health home models and SBHCs, should emphasize cost-effective ways to improve access to dental care by reducing transportation-related barriers. Future studies should explore actual travel distances and how these are affected by provider limitations on accepting publicly insured patients.
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