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Community factors predicting dental utilization among older adults

Wonik Lee, PhD¹, Seok-Joo Kim, PhD², Jeffrey M. Albert, PhD³, and Suchitra Nelson, PhD⁴

¹Department of Community Dentistry, School of Dental Medicine, Case Western Reserve University

²School of Applied Social Sciences, Case Western Reserve University

³Department of Epidemiology and Biostatistics, School of Medicine, Case Western Reserve University

⁴Department of Community Dentistry, School of Dental Medicine, Case Western Reserve University

Abstract

Background—Few investigators have studied the influence of community factors on dental care utilization among older adults. The authors' objective in this study was to investigate the effect of community factors on dental care utilization after adjustment for individual factors.

Methods—Using data from a cross-sectional survey of Ohio residents, the authors assessed dental care utilization in a sample of 2,166 adults aged 65 years or older. They linked individual-level dental care utilization, predisposing factors (age, sex, race or ethnicity, marital status, education), enabling factors (poverty, dental insurance) and need-related factors (physical and mental health problems) with county-level data (socioeconomic environment and health resource environment) from the 2010 Area Health Resource Files (from the U.S. Department of Health and Human Services) and the American Community Survey (from the 2006–2010 U.S. Census). Using multilevel logistic regression models, the authors evaluated the association between dental care utilization and community factors after adjustment for individual factors.

Results—The results indicated that individual factors such as being female, married and nonpoor and having a higher educational level and private dental insurance were associated with higher odds of having utilized dental care. Furthermore, older adults living in a county with a higher dentist-to-population ratio were more likely to use dental services even after the authors adjusted the results for the individual-level factors (odds ratio = 1.10, $P = .03$).

Conclusions—County-level dentist-to-population ratio has independent effects on older adults' dental care utilization even after adjustment for individual-level characteristics.

Practical Implications—A comprehensive policy plan is required to intervene at both the individual and community levels to improve dental care utilization among older adults. By

Corresponding author: Wonik Lee, 2124 Cornell Road, Cleveland, OH 44106, USA, Telephone: 1-216-368-2199, wx1219@case.edu.

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understating the factors influencing dental care utilization among older adults, U.S. dentists will be better positioned to meet the dental needs of this population.

Keywords

Dental care for elderly patients; community dentistry; public policy; socioeconomic status

Oral health is essential to general health and well-being among older adults.¹ Poor oral health has been associated with chronic health conditions such as diabetes,² respiratory illness³ and cardiovascular disease,⁴ and older adults are at a high risk of developing these chronic conditions. In addition, results of previous studies have demonstrated that older adults with poor oral health have a lower level of psychosocial well-being and life satisfaction.⁵ The use of dental services plays a critical role to promote and maintain oral health.⁶ Regular dental visits allow older adults to receive early diagnosis and obtain restorative care as needed; thus, annual oral examinations are recommended.⁷ However, only 45 percent of adults 65 years or older had a dental visit in 2007.⁸ Furthermore, using the National Health Interview Survey, Wall and colleagues⁹ showed that the utilization rate for adults has steadily decreased in the last decade, whereas the utilization rate for children has increased.

The individual factors that predict dental care utilization among older adults have been well documented. Study results indicate lower dental care utilization is associated with being male and of a minority race and having a lower level of education, lower income, lack of dental insurance, a rural residence and cognitive impairment.^{9–12} In 2012, Manski and colleagues¹³ analyzed dental care utilization and the relevant individual factors among older adults aged 51 years or older by using data from the 2008 wave of the National Institute on Aging's Health and Retirement Study. They found that older adults with dental insurance were 2.3 times more likely to have dental visits during the two year period preceding the survey than were those without dental insurance. They also found that the odds of using dental services were lower among those with lower levels of income and wealth.

In addition to individual characteristics, the economic and social attributes of the community might influence dental care use among people who reside in the community. The influence of contextual factors is recognized increasingly as being important to the study of dental problems.¹⁴ First, study results have indicated that economic conditions measured at the community level were associated with dental care utilization. For example, investigators in one study found that every increase of 10,000 unemployed people in the community was associated with a 1.2 percent decrease in preventive care utilization among the population with dental insurance in the Seattle area.¹⁵ Similarly, investigators in other studies have found that a higher level of neighborhood poverty was associated with lower dental care utilization among adolescents¹⁶ and Medicaid-enrolled children¹⁷ even after they accounted for individual characteristics. A lower supply of dentists in a community also has been associated with a higher proportion of disadvantaged people in a community—namely, minorities and low-income people.¹⁸

Second, it has been suggested that the availability of safety-net facilities such as federally qualified health centers (FQHCs) in the community may improve dental care utilization

among residents.^{19,20} Investigators in a recent study found that there were no racial or ethnic disparities in dental care utilization among FQHC patients, suggesting that these facilities may function as a critical access point to oral health services in disadvantaged communities.²¹ The federal statute under which FQHCs receive grants requires all of these facilities to provide preventive dental services either on site or by means of referral. According to the American Dental Association,²² 75 percent of FQHCs provided on-site dental services in 2009.

Despite a growing recognition of the importance of community characteristics in terms of health care in general, their effects on dental care utilization among older adults have not yet been well investigated. The only exception is a study conducted in France, the results of which showed that low-income older adults were less likely to obtain dental care but that the effects of income on utilization decreased as the density of dental practitioners increased, suggesting that community factors may mitigate the prevailing income-related disparities in health outcomes.²³ To our knowledge, no researchers have examined the association between community-level characteristics and dental care utilization among older U.S. adults.

Thus, our objective in this study was to investigate the impact of community factors on dental care utilization among older adults. We hypothesized that the social and economic environment of a community (rurality and poverty) and its health care system (number of dentists, shortage of dental health professionals and the number of FQHCs) are associated with dental care utilization after one accounts for individual factors: predisposing factors (age, sex, race or ethnicity, marital status, education), enabling factors (poverty, dental insurance) and need-related factors (physical and mental health problems).

METHODS

Conceptual model

This study was based on a modified multilevel health services utilization model suggested by Davidson and colleagues.²⁴ Extending Andersen's behavioral model of health service utilization,²⁵ this model focuses on the multilevel influences on health services utilization. As the figure shows, we organized our study variables into two levels: individual and community. In turn, we characterized the individual variables according to three domains: predisposing, enabling and need. We categorized community factors, which capture the socioeconomic and structural environment in which dental care utilization occurs, as social and economic environment and health system. We used county data to measure community-level characteristics because health care facilities are located outside residential census blocks or tracts and would be sought by people across larger regions (that is, a county).²⁶

Study population and data sources

The population of this study was noninstitutionalized older adults 65 years or older in Ohio. The study had multiple data sources. First, for the individual-level data, we used the 2010 Ohio Family Health Survey (OFHS) data collected by the Ohio Department of Health.²⁷ The OFHS is a statewide study based on a stratified sample that represents noninstitutionalized Ohio residents. The OFHS oversampled minorities from the six largest metropolitan

counties that have the greatest concentrations of African Americans in the state to obtain broader and more diverse set of information that would help to ensure the reliability of estimates.²⁷ The data collected from 8,276 people via telephone surveys includes information about health insurance coverage, health status, health care utilization and health care access. The total number of adults 65 years and older was 2,455; we excluded from the analysis those for whom we lacked any data for the model variables, which resulted in a study sample of 2,166. Missing values were less than 5 percent in each variable, and there was no statistically significant difference between cases with complete and incomplete information in the model variables. Second, we obtained county-level data from the American Community Survey (five-year estimates for the years 2006–2010) and the 2010 Area Health Resource Files. American Community Survey data available from the U.S. Census provided social and economic characteristics of each county,²⁸ and the Area Health Resource Files, administered by the U.S. Department of Health and Human Services, included information on health facilities and health professions at the county level.²⁹

Measures

Outcome variable—The dependent variable was individual-level dental care utilization in the preceding year. The measure was based on the individual response to the following question in the OFHS: “About how long has it been since you last visited a dentist? Include all types of dentists, such as orthodontists, oral surgeons, and all other dental specialists, as well as dental hygienists.”²⁷ We coded the responses as 1 for those who had visited a dentist within the preceding year and 0 for those who had not.

Individual-level predictors—We included five variables as predisposing characteristics: age, sex, race or ethnicity (non-Hispanic white versus other), marital status (married/coupled versus other) and educational attainment (< 12 years versus ≥ 12 years). Enabling factors included two variables: dental insurance (none, Medicaid, private only) and family income (< 100 percent, 100–200 percent, > 200 percent of income relative to the federal poverty guidelines). Need-related factors were two variables: physical health status and mental health status. The OFHS elicited these variables by asking the questions “How many days during the past 30 days was your physical health not good?” and “For how many days during the past 30 days did a mental health condition or emotional problem keep you from doing your work or other usual activities?”²⁷ We dichotomized these variables into “yes” for those who had the condition at least one day and “no” for those who did not have the condition.

Community-level predictors—We organized community-level variables into two conceptual factors: social and economic environment and health resource environment. Social and economic environment was reflected by the county-level poverty rate and rurality. Poverty rate is the proportion of people in a county with incomes less than 100 percent of the federal poverty guidelines. Rurality is defined by Rural-Urban Continuum Codes, developed by the U.S. Department of Agriculture. The Rural-Urban Continuum Code is a 10-point scale that ranges from 1 (for a county in a metropolitan area with 1 million population or more) to 10 (for a completely rural county with a population less than 2,500) indicating the level of urbanization on the basis of the population size and proximity to metropolitan areas.³⁰ Health resource environment includes the number of dentists per

10,000 people, the number of FQHCs in the county and the Dental Health Professional Shortage Area designation (yes or no), which is administered by the Health Resources and Services Administration.

Statistical analysis

We examined the association between dental care utilization among older adults and selected characteristics of individual and community variables. We used survey weights generated from the sampling strategy for all analyses. First, we assessed bivariate associations between older adults' dental care utilization within the preceding year and each of the following variables by using χ^2 tests: predisposing factors (age, sex, race or ethnicity, marital status, education), enabling (poverty, dental insurance) and need-related (physical and mental health problems) factors. Second, we used multilevel logistic regression models to assess the effects of individual- and county-level variables on the probability of dental care utilization within a year. The multilevel analytical approach accounts for shared characteristics among people within a group thus allowing researchers to examine the effects of individual-level and group-level predictors simultaneously without violating the independence of observations.³¹

We used a sequence of multilevel logistic regression models to assess the effect of county-level factors before and after accounting for individual-level factors. Specifically, we fit a multilevel logistic regression model with individual-level factors only plus random effects for community, followed by a multilevel logistic regression model with both individual- and county-level factors.

We fit models by using maximum-likelihood methods. We tested the coefficient (partial effect) of each model variable via model-based Student *t*-tests, and we obtained the corresponding estimated odds ratios (as the logarithms of the estimated coefficients). We used software (Mplus version 6, Muthén & Muthén, Los Angeles) for the analyses.

RESULTS

Descriptive and bivariate analyses

Table 1 describes individual- and county-level characteristics of the study sample. About two-thirds of older adults (66.5 percent) reported dental care utilization within the preceding year. More than one-half of older adults were female (53.4 percent) and were married or coupled (56.4 percent). The mean (standard deviation) age was 74.73 (7.23). Most participants were non-Hispanic white (87.8 percent) and had completed high school (79.4 percent). About 18.3 percent reported incomes below the federal poverty guidelines; more than one-half did not have dental insurance (56.8 percent), and 8.6 percent had Medicaid. One in three older adults reported having physical health problems, but less than 10 percent indicated they had mental health problems.

Bivariate analysis results indicate that being non-Hispanic white and married and having 12 years or more of education, private dental insurance and no physical or mental health problems were associated with higher odds of dental care utilization. Being poor or near poor was associated with lower odds of dental care utilization. Among community-level

variables, lower poverty rate, lower rurality, higher number of dentists and living in an area not designated as a Dental Health Professional Shortage Area were associated with higher odds of dental care utilization (Table 2).

Multivariate analyses

To investigate the effects of community factors on dental care utilization after accounting for individual characteristics, we used multilevel logistic regression models (Table 3). The likelihood ratio χ^2 test results indicated that the first model, which included only the individual-level factors, significantly predicted dental care utilization ($P < .001$). We explored interaction effects between individual-level variables (such as poverty status and dental insurance), county-level variables (such as poverty rate and number of dentists) and cross-level variables (such as poverty status and number of dentists), but none of them was statistically significant, and thus we excluded the interaction effects from the analytical models. The results showed that being married, being nonpoor and having 12 or more years of education, private dental insurance were associated with higher odds of dental care utilization.

In the second model, we included both community- and individual-level characteristics. After we adjusted for individual-level characteristics, the community-level characteristics significantly improved the prediction of dental care utilization ($P = .026$). The results indicated that individual factors such as being married and nonpoor and having a higher educational level and private dental insurance were associated with higher odds of obtaining any dental care, and that being female and being poor or near poor were associated with lower odds. Among community-level predictors, the dentist-to-population ratio was significantly associated with higher odds of dental care utilization after we accounted for all individual characteristics (odds ratio = 1.10; $P = .03$). An increase of one dentist per 10,000 residents was associated with about a 10 percent increase in odds of having a dental visit among older adults.

DISCUSSION

To our knowledge, this is the first study in which investigators examined the effects of both individual- and community-level factors on dental care utilization among older adults in the United States by using multilevel analyses. The results indicate that older adults living in counties with a higher dentist-to-population ratio are more likely to use dental services even after one accounts for individual-level factors. This finding is consistent with those of a previous study, which indicated that the density of dental practitioners was associated with dental care utilization among French older adults.²³ More specifically, our study shows that an increase of one dentist per 10,000 residents is associated with about a 10 percent increase in odds of having a dental visit among older adults in the community. This result can be explained in terms of predicted probability. One dentist per 10,000 population will increase the predicted probability in the dental care utilization rate among older adults by approximately 2 percent. For example, when the number of dentists per 10,000 increases by one, dental care utilization will increase from 67 percent to 69 percent. The estimate of older adult people (those 65 years or older) in Ohio was 1,584,699 in 2010.²⁸ Thus, an increase of

one dentist per 10,000 people could help 31,693 more older adults use dental services. This increase should be an important change in dental care utilization among older adults, considering the lower utilization rate among older adults compared with that in other age groups.^{8,9} In addition, these national estimates demonstrate that the dental care utilization among older adults, unlike that among children, decreased in the past 10 years.

Our results show that the effect of community poverty was not significant in the multilevel logistic regression model, which included both the individual-level and the community-level factors. This finding is different from those in previous studies in which investigators examined dental care utilization among children and adolescents to find a statistically significant effect of community poverty.^{16,17} The results from our study imply that dental care utilization in poor communities is lower because of the individual-level characteristics of residents in the community rather than because of neighborhood effects.

Although the number of FQHCs in the community was not associated with dental care utilization among older adults, readers should interpret this result with caution. Our data on FQHCs in each county did not cover the extent of dental services provided. The American Dental Association²² reported that about 75 percent of FQHCs provide on-site dental services. Thus, it is possible that some counties in our study may have had FQHCs without on-site dental services. Investigators in future studies may use detailed information on FQHCs (for instance, whether a particular FQHC provides on-site dental services and how many dental professionals work in the FQHC) to elaborate on the role of FQHCs in improving dental care utilization for underserved populations.

Consistent with results from previous studies, our results indicate that individual enabling factors were associated significantly with dental care utilization among older adults.^{9,13,32,33} Nonpoor older adults were more likely to obtain dental care than were poor older adults, and older adults with private dental insurance were more likely to obtain dental care than were those without dental insurance. However, dental care utilization among older adults enrolled in Medicaid was not different from those without dental insurance, even though Ohio is one of 28 states whose Medicaid programs provide adult enrollees with dental coverage beyond emergency treatment.³⁴ This result is consistent with those of previous studies in which investigators reported that adults with public insurance had lower dental care utilization rates than did the privately insured.^{35,36} One explanation could be that the reasons for not obtaining dental care among low-income older adults are not limited to the treatment cost but include psychosocial variables such as perceived dental care need, attitude toward dental care, self-efficacy and lack of awareness of their dental coverage.^{10,37-39} Another explanation is the availability of community dental resources, as our findings imply. Even though older adults have dental coverage provided by Medicaid programs, they might have difficulty finding dentists who participate in Medicaid. Investigators in one study reported that the low reimbursement rates, combined with bureaucratic complexities, discourage many dentists from participating in the state Medicaid programs.³⁹ There is more research on Medicaid-enrolled children in which investigators have found that low reimbursement rates impeded dentists' participation,^{40,41} but little is known about adult Medicaid enrollees. Future studies should establish a more comprehensive model to examine predictors of dental care utilization among Medicaid-enrolled adults.

Collectively, our study results support the adoption of a comprehensive perspective when planning interventions for improving dental access among older adults. Investigators in previous studies have associated individual enabling factors such as income or dental coverage with dental care utilization among older adults.^{11,13,31} Our findings indicate that individual-level factors are significant predictors for dental care utilization. However, focusing only on individual economic barriers without addressing community problems might be an incomplete strategy. In addition, our study results indicate that the dentist-to-population ratio was relatively more important than were community-level socioeconomic characteristics. This finding implies that specific policies attracting dentists to practice in dental service shortage areas are necessary beyond intervening to stimulate economic development and, therefore, increase dental care access in both rural and urban areas.

Limitations

This study has several limitations. First, we used state-specific data in this study; thus, the results may be generalizable only to older adults living in Ohio. However, our study has provided critical data that can be expanded to larger multistate studies to identify important trends for policy promotion and intervention. Second, other important factors such as behavioral or psychosocial factors at the individual level and social capital at the community level were not available in the data sets used in this study. Third, we used county-level data in assessing community factors. For the health resource environment, a larger unit such as a county is preferred because health resources (such as dentists and FQHCs) are not limited to neighborhoods but are accessed by residents across larger regions. On the other hand, social and economic environment variables (for example, percentage of households with income below the federal poverty guidelines) would be more meaningful when measured in a smaller unit such as a census tract. Because the dataset we used (OFHS) provides only residential information at the county level, we were not able to use a smaller unit. Finally, we used dental care utilization data collected through self-reported phone surveys, the results of which are likely to be affected by social desirability bias.

CONCLUSION

Older adults living in counties with a higher dentist-to-population ratio are more likely to use dental services even after one accounting for individual-level factors. A comprehensive policy plan is required to intervene at both the individual and community levels to improve dental care utilization among this population.

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Figure.
Conceptual Framework for Dental Care Utilization

Table 1

Descriptive statistics of the study population (N = 2,166).

VARIABLE	MEAN (STANDARD DEVIATION)	NO.	PERCENTAGE [†]
Self-Reported Dental Care Utilization Within the Preceding Year	NA *	1,440	66.5
Predisposing			
Age	74.73 (7.23)	NA	NA
Sex			
Male	NA	1,014	46.6
Female	NA	1,152	53.4
Race or ethnicity			
Non-Hispanic white	NA	1,899	87.8
Other	NA	267	12.2
Marital status			
Married/coupled	NA	1,219	56.4
Other	NA	947	43.6
Education			
12 years or more	NA	1,716	79.4
Less than 12 years	NA	450	20.6
Enabling			
Poverty status [‡]			
Poor	NA	398	18.3
Near-poor	NA	613	28.4
Nonpoor	NA	1,155	53.3
Dental insurance			
Medicaid	NA	184	8.6
Private only	NA	748	34.6
No insurance	NA	1,234	56.8
Need			
Physical health problem			
No	NA	1,406	64.8
Yes	NA	760	35.2
Mental health problem			
No	NA	1,983	91.5
Yes	NA	183	8.5

* NA: Not applicable.

[†] Percentages are weighted distribution; thus, they are not just the simple fraction of the numbers given.[‡] Poor: Income below 100 percent of the federal poverty guidelines. Near-poor: Income between 100 percent and 200 percent of the federal poverty guidelines. Nonpoor: Income higher than 200 percent of the federal poverty guidelines.

Table 2

Unadjusted bivariate associations between individual-level and county-level characteristics with dental care utilization among older adults (N = 2,166).

VARIABLE	ODDS RATIO (95% CI)	P VALUE
Individual Level		
Predisposing		
Age	1.00 (0.99–1.02)	.698
Sex		
Male	0.91 (0.76–1.08)	.275
Female	Reference	Reference
Race or ethnicity		
Non-Hispanic white	1.88 (1.45–2.43)	< .001*
Other	Reference	Reference
Marital status		
Married or coupled	1.79 (1.50–2.15)	< .001*
Other	Reference	Reference
Education		
12 years or more	3.37 (2.72–4.18)	< .001*
Less than 12 years	Reference	Reference
Enabling		
Poverty status		
Poor (< 100 percent of the federal poverty guidelines)	0.29 (0.22–0.36)	< .001*
Near poor (< 200 percent of the federal poverty guidelines)	0.39 (0.32–0.49)	< .001*
Nonpoor	Reference	Reference
Dental Insurance		
Medicaid	0.49 (0.36–0.67)	< .001*
Private only	1.47 (1.20–1.80)	< .001*
No insurance	Reference	Reference
Need		
Physical health problem		
No	1.57 (1.30–1.89)	< .001*
Yes	Reference	Reference
Mental health problem		
No	2.25 (1.66–3.05)	< .001*
Yes	Reference	Reference
Community Level		
Social and economic environment		
Percentage of people with incomes below the federal poverty guidelines	0.95 (0.93–0.98)	< .001*
Rurality (Rural-Urban Continuum Code)	0.93 (0.88–0.98)	.005 [†]

VARIABLE	ODDS RATIO (95% CI)	P VALUE
Health resource environment		
Number of dentists per 10,000 residents	1.05 (1.00–1.10)	.039 [‡]
Designation as a Dental Health Professional Shortage Area	0.89 (0.79–0.99)	.030 [‡]
Number of Federally Qualified Health Centers	1.00 (0.99–1.01)	.864

* $P < .05$;

[†] $P < .01$;

[‡] $P < .001$

Table 3

Multilevel logistic regression analyses for dental care utilization among older adults (N = 2,166).

VARIABLE	RESULTS, ACCORDING TO MODEL*			
	Model 1		Model 2	
	Odds ratio (95% confidence interval)	P value	Odds ratio (95% confidence interval)	P value
Individual Level				
Predisposing				
Age	1.02 (1.00–1.03)	.080	1.02 (1.00–1.03)	.081
Sex				
Male	0.71 (0.55–0.92)	.010 [†]	0.71 (0.55–0.92)	.009 [†]
Female	Reference	Reference	Reference	Reference
Race/Ethnicity				
Non-Hispanic white	1.24 (0.84–1.82)	.278	1.26 (0.85–1.86)	.243
Other	Reference	Reference	Reference	Reference
Marital status				
Married or coupled	1.41 (1.09–1.83)	.009 [‡]	1.43 (1.10–1.86)	.007 [‡]
Other	Reference	Reference	Reference	Reference
Education				
12 years or more	2.34 (1.63–3.36)	< .001 [§]	2.27 (1.58–3.25)	< .001 [§]
Less than 12 years	Reference	Reference	Reference	Reference
Enabling				
Poverty status				
Poor (<100% FPL)	0.46 (0.30–0.69)	< .001 [§]	0.46 (0.31–0.70)	< .001 [§]
Near poor (<200% FPL)	0.54 (0.42–0.69)	< .001 [§]	0.54 (0.42–0.69)	< .001 [§]
Nonpoor	Reference	Reference	Reference	Reference
Dental Insurance				
Medicaid	0.73 (0.52–1.02)	.069	0.75 (0.53–1.05)	.094
Private only	1.44 (1.10–1.90)	.008 [‡]	1.45 (1.11–1.89)	.007 [‡]
No insurance	Reference	Reference	Reference	Reference
Need				
Physical health problem				
No	1.24 (0.98–1.59)	.079	1.24 (0.97–1.58)	.083
Yes	Reference	Reference	Reference	Reference
Mental health problem				
No	1.72 (0.97–3.07)	.065	1.74 (0.97–3.11)	.061
Yes	Reference	Reference	Reference	Reference
Community Level				
Social and economic environment				

VARIABLE	RESULTS, ACCORDING TO MODEL*			
	Model 1		Model 2	
	Odds ratio (95% confidence interval)	P value	Odds ratio (95% confidence interval)	P value
Proportion of people with incomes below the federal poverty level (%)	NA [¶]	NA	0.98 (0.93–1.03)	.387
Rurality (Rural-urban Continuum Code)	NA	NA	0.98 (0.88–1.08)	.650
Health resource environment				
Number of dentists per 10,000 residents	NA	NA	1.10 (1.01–1.20)	.031 [†]
Designated as a Dental Health Professional Shortage Area	NA	NA	1.34 (0.89–2.01)	.165
Number of Federally Qualified Health Centers	NA	NA	1.00 (0.98–1.02)	.729
Model χ^2 from null	502.134 ($P < .001$)		514.824 (P	< .001)
Model χ^2 between Model 1 and 2	NA		12.69 ($P = .026$)	

* Model 1 is a multilevel model with only individual-level factors and Model 2 is a multilevel model with both individual- and community-level factors.

[†] $P < .05$.

[‡] $P < .01$.

[§] $P < .001$.

[¶] NA: Not applicable.