Community- versus Individual-Level Indicators to Identify Pediatric Health Care Need

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ABSTRACT *Increasingly, geographic information systems employing spatial data are being used to identify communities with poorer health care status. Since health care indicators are strongly linked to income, could these data, usually based on adult indicators, be used for pediatric health care need? We hypothesized that individual-level indicators such as quality of life scales (QOL) would be better than community-level indicators at identifying families with poorer health care practices. Surveys and medical record reviews were used for a sample of 174 caregivers of young children. Lower level of income was associated with poorer scores on several QOL domains, and on the primary health practices (i.e., non-urgent emergency room use and lack of age-appropriate immunization status). One community-level indicator, the medically underserved area (MUA), was almost as good as the best individual-level indicators at predicting primary health care practices. The community-level indicator of MUA appears to meet its initial intent, providing information on the location of very low-income individuals with high health care need even among a sample of Medicaid-insured children with an identified health care provider.*

KEYWORDS *Emergency health service, Foster care, Geographic information system, Homelessness, Medicaid, Pediatrics, Primary health care, Quality of life.*

INTRODUCTION

U.S. children living in poverty have disproportionately more health problems and poorer utilization of preventive health care services than others.¹⁻⁷ Since large clinics and health centers target very low-income children, geographic information systems (GIS) with community-level indicators such as census tracts may be useful tools for identifying children in low-income families with low health care utilization.

HEALTH CARE UTILIZATION: EMERGENCY ROOM USE AND IMMUNIZATIONS

Many low-income children use emergency rooms as their chief source of health care. Use of the emergency room (ED) for non-urgent conditions often results in fragmented or nonexistent primary health care.⁸⁻¹¹ Equally concerning are the substantially higher costs of ED visits compared to primary health care visits for

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non-urgent health conditions; these higher costs have been attributed to additional tests that are performed in the ED as well as to the overhead costs that are necessary for the operation of an emergency room department.^{12,13} Providers have tried to dissuade families from using emergency rooms as the sole health care provider, but the practice persists.

Two frequently proposed explanations for under-utilization of pediatric health care are the lack of an identified health care provider and the absence of health care insurance.^{14,15} With this information, programs have worked to increase access to regular health care providers by giving clients health care insurance. This proved successful for one demonstration project¹⁵ but not for others who had provided either free health care, or in one situation, monetary incentives to promote health care utilization.^{16–18} These conflicting results suggest that at least some low-income families, *even when insured and with an identified health care provider*, relied on the emergency room for non-urgent health care.^{8,11,19–21}

Another indicator demonstrating routine primary pediatric health care, and linked to emergency room visits, is immunization status.²² For more than three decades, immunization status has served as an important indicator of preventive pediatric health care service utilization for federal agencies such as the Bureau of Primary Health Care (BPHC) and the Centers for Disease Control and Prevention (CDC)^{23,24} and is currently listed in Healthy People 2010.²⁵ Immunization status differs by income level; families with lower incomes compared to others are less likely to have age-appropriate immunizations.^{26–32} Among low income families, those living in the most difficult situations such as being transient, in foster care, or living in homeless circumstances are even more likely to have children who lack up-to-date immunizations.^{28,33,34}

Thus, the question remains—why are low-income families relying on emergency rooms for non-urgent care and *not* engaging in primary health care practices such as immunizations? Among the explanations are cultural differences about the perceived utility of preventive care, the 24 hour per day access of emergency rooms, and the perceptions of dissatisfaction due to poor communication, disrespect, and racial/ethnic discrimination by health care provider.^{35–41}

INDIVIDUAL-LEVEL INDICATORS (QUALITY OF LIFE)

Many low-income or impoverished families have less than high school education, self-identify as ethnic/racial minorities, and report histories of transiency, homelessness and substance abuse.^{10,27,28,42–47} These characteristics and experiences influence the community culture, physical and social environment, and ultimately the quality of life.

Although we have many quality of life scales (QOL), most were designed to assess the impact of severe acute or chronic illnesses on the social and physical environment. QOL traditionally have a wide variety of dimensions such as financial, social or psychological stressors; concerns related to home, social and community environments; and barriers to accessing health care services. Results from QOL studies *not* only have characterized the impact of an illness on the quality of life, but also the fundamental role that the family's financial status plays on the quality of life.³⁷ Consequently, it is likely that QOL might identify differences in the quality of life between income groups, even though that is not their initial intent.

But QOL are individual-level indicators. Community-level indicators also may be effective. Due to costs of living, it is likely that low-income families congregate and develop their own cultures with similar behaviors and activities including health care practices and utilization.^{48,49} Consequently, with this neighborhood homogeneity, community-level indicators may be as effective as individual-level indicators at identifying certain characteristics.

COMMUNITY-LEVEL INDICATORS (CENSUS TRACTS AND MEDICALLY UNDERSERVED AREAS)

The community perspective is increasingly visible in public health as they use geographic information systems (GIS) to examine underlying population characteristics within communities. GIS use census tracts, small subdivisions of a county that average 4,000 people, by linking them with demographic data collected by the U.S. Census Bureau.⁵⁰ With this information, service providers are able to identify geographic areas with low income populations, disproportionately high prevalence rates of a particular disease, and inadequate resources for health care.^{51–53}

Some census tracts have been designated by the U.S. government as medically underserved areas (MUAs) and include residents with low incomes, inadequate use of health care services, high infant mortality rate, and large numbers of adults aged 65 and older.⁵⁴ Agencies who were applying for federal funding to support their health care programs have been required to identify the MUAs that would be targeted to demonstrate their intent to serve communities in need of health services.^{55,56} MUAs also have been used to examine trends of service use among low-income communities with high health care needs.⁵⁷

The purpose of this study is to compare the ability of community-level indicators (i.e., census tracts linked to U.S. Census data and MUA) and individual-level indicators (gleaned from surveys) to identify two established health care indicators, pediatric non-urgent emergency room use and age-appropriate immunization levels for a Medicaid-insured sample of children with an identified health care provider. We hypothesize that individual-level indicators such as health care perceptions and QOL will be better than community-level indicators at distinguishing families with poorer health care practices (i.e., non-urgent emergency room use and lack of age-appropriate immunization status) even among a sample of very low-income families.

MATERIALS AND METHODS

Sample

The target population consisted of families with young Medicaid-insured children who had access to a primary care provider. The sample was drawn from an urban children's hospital ambulatory care services' department. This site was chosen for two reasons:¹ it had a very large proportion of low-income children, of which approximately 75% are Medicaid-insured;² all children who obtained care at the clinics had access to and had used an identified primary care provider. We restricted enrollment to children under six who, compared to older children, have more

scheduled routine immunizations and are less likely to encounter the mandatory immunization policies that are common for elementary school registration.

Study participants (caregivers of children) were obtained through a systematic random sampling technique applied to the daily appointment list of the Ambulatory department. Inclusion criteria were:

- ◆ Children under 6 years old
- ◆ Medicaid insurance (Medi-Cal in California)
- ◆ Language translation services were not requested.

Only one child per family unit was eligible. Approximately five caregivers were selected for participation weekly. Each received a \$10 grocery store certificate for their time and transportation. Caregivers were recruited over a 1-year period (between May 5, 1998 and April 24, 1999).

Procedure

The sampling frame consisted of the ambulatory department appointment list. This list contained the child's name, insurer, date of birth and request for translation and ensured that only families with children who met the eligibility criteria were approached. The interviewer explained the nature of the project and time commitment and obtained consent for participation (approved by the Institutional Review Board). A total of 291 caregivers were approached. Of these, approximately 27.8% ($n=81$) caregivers refused to participate. Of the 210 participants, one caregiver was mistakenly reinterviewed. Another 14 children under 6 months old were excluded due to the dependent variable of age-appropriate immunizations. Twenty-one children had addresses that could not be accurately geocoded into a census tract; they did not differ from the others by child age or ethnicity. Consequently, 174 participants were included in this study.

Instruments

This study used two instruments, an interview survey and a medical record abstraction tool. The interview was administered to the caregiver and consisted of a 30 min, in-person interview incorporating several demographic variables as well as established instruments: quality of life interview (QOLI) and the client satisfaction scale (CSQ-8).

The quality of life index (QOLI) was developed in 1991 and was tested for utility, validity, and reliability on men and women, and homeless adults with substance use problems, mental illness, and the dually diagnosis (mental illness and substance use problem).⁵⁸⁻⁶¹ The QOLI has nine sections assessing general life satisfaction (the overall perception of their life in general), living situation (overall home environment includes periods of homelessness), daily activities and function, family relationships, friend relationships, finances, work/school, and legal status, safety and health.

The client satisfaction scale (CSQ-8) is one of several CSQ versions developed to elicit perceptions on pediatric health care with eight items using an ordinal Likert format.⁶² This scale was tested for internal consistency, validity and reliability on several samples of patients from mental health and primary care facilities.⁶³⁻⁶⁶

The medical record abstraction tool was a structured instrument. Each medical record was reviewed completely including: date of visit, place of visit (e.g., primary care, urgent care, emergency room or ER, inpatient), insurer billed for the visit,

diagnosis, and disposition. In addition, records were reviewed for immunizations using a format resembling the centers for disease control and prevention tool used in the kindergarten retrospective survey (KRS) and abstracted for type of immunization, date of immunization, and immunizations that were considered but not administered.⁶⁷ The child was categorized as having age-appropriate immunizations in accordance with county health department standards.⁶⁸ Although the immunization record was the primary source of data, the entire chart was reviewed to find evidence that an immunization was provided but inadvertently recorded in other sections of the medical record. For situations where the immunization record showed a first and third dose but no second dose, the record was examined to determine if the second dose had been administered. If there was evidence that the second dose was administered (usually found in the pharmaceutical record), all three doses were recorded. If not, no assumption was made that the second dose was provided. From these data, the dichotomous variable of age-appropriate immunization versus not was created.

MapInfo[®], a geographic information system, was used to determine the census tract where each participant lived at date of interview. Census tracts designated as MUAs were obtained from the Health Resources and Services Administration (HRSA) website.⁶⁹ Using MapInfo[®], we determined whether children lived within a census tract that was designated as a MUA. Based on U.S. Census data from the year 2000 (as data collection was completed in 1999), the proportion of families with annual incomes of less than \$12,000 per total number of individuals was calculated for each census tract. The annual income of less than \$12,000 was selected since it is extremely low and approximates the 100% federal poverty level for a family of three. A median split where 10% or more households had annual incomes of less than \$12,000 versus other census tracts was used to categorize very low-income census tracts.

Analysis

Data were analyzed using SAS[®] Release 8.0.⁷⁰ Discrete categorical variables were compared using chi-square tests of independence or Fisher's exact test for categorical variables with sparse cells. Student's *t* tests were used to compare means of continuous variables such as QOLI scores; and the Satterthwaite's approximation method, rather than pooled differences, was used to determine statistical significance for unequal variances.

Logistic regression with stepwise elimination was used for multivariable analyses with binary outcomes. Due to sample size, models were restricted to a maximum of four independent variables. Odds ratios (OR), 95% confidence intervals (CI), *p* values, $-2 \log$ likelihood values, model chi-square (χ^2), sensitivity, specificity and correct classification are presented. Significance was declared at the $p < 0.05$ level.

RESULTS

Of the 174 caregivers responses analyzed, almost half reported annual incomes below \$12,000 (see Table 1). Most caregivers were biological parents, 30 years old or more, caring for children under 2 years old, self-identifying as Black/African American, high school graduates, never married, and living in a home or apartment. Approximately 15% of caregivers were residing in homeless shelters or transitional

housing; and more than half drove themselves to the pediatric appointments. Almost two-thirds of caregivers' children were under 2 years old.

Caregivers with annual incomes below \$12,000, compared to those with higher incomes, were more likely to be the child's biological parents ($p<0.001$), 29 years or younger ($p<0.01$), without a high school diploma ($p<0.01$), and living in a homeless shelter or transitional housing ($p<0.001$). Additionally, low-income families were less likely to have driven to the pediatric appointment at time of interview ($p<0.001$).

Caregivers were asked about their personal experiences with their regular doctor (see Table 2). Most reported having a regular doctor, receiving the care they

TABLE 1. Demographic characteristics of caregiver and child by reported annual income

Characteristics of caregiver and child	Total		Reported annual income			
	Percent	Number	<\$12,000 (n=77)		≥\$12,000 (n=97)	
			Percent	Number	Percent	Number
Relationship to child**						
Biological or step-parent	78.2	136	92.2	71	67.0	65
Relative, foster parent or other caregiver	21.8	38	7.8	6	33.0	32
Caregiver age (years)**						
<30	46.0	80	61.0	47	34.0	33
30+	54.0	94	39.0	94	66.0	64
Child's age (years)						
<2	61.5	107	68.8	53	55.7	54
2+	38.5	67	31.2	24	44.3	43
Ethnicity/race						
Black/African American	73.6	128	74.0	57	73.2	71
Latino	9.2	16	11.7	9	7.2	7
White	7.5	13	7.8	6	7.2	7
Other	9.8	17	6.5	5	12.4	12
Education level*						
<12th grade	23.0	40	33.8	26	14.4	14
High school diploma or more	77.0	123	66.2	51	85.6	83
Marital status						
Never married	53.5	93	62.3	48	46.4	45
Separated/widowed/divorced	21.8	38	20.8	16	22.7	22
Married	24.7	43	16.9	13	30.9	30
Living situation**						
Stable house or apartment	84.5	147	87.0	67	82.5	80
Foster home	8.6	15	—	0	15.5	15
Homeless shelter or transitional housing	6.9	12	13.0	10	2.1	2
Transportation to pediatrician**						
Drove	61.5	107	42.9	33	76.3	74
Public transportation	24.1	42	37.7	29	13.4	13
Dropped off	14.4	25	19.5	15	10.3	10

* $p<0.01$
** $p<0.001$

TABLE 2. Caregivers’ access and experiences with their health care providers by reported annual income

Questions asked of caregivers	Total		Reported income			
	Percent	Number	<12,000/year (n=77)		≥12,000/year (n=97)	
			Percent	Number	Percent	Number
Caregiver has a regular doctor*	62.1	108	53.3	41	69.1	67
Gets the needed care at the doctor	82.8	144	80.5	62	84.5	82
Doctor treats caregiver with respect	93.1	162	90.9	70	94.9	92
Has a check-up at least once a year	81.0	141	79.2	61	82.5	80
Has a social worker or case manager	38.5	67	36.4	28	40.2	39
Doctors or nurses treated caregiver badly because of race, religion, sexual orientation or income	16.7	29	16.9	13	16.5	16
CSQ-8 (Were very or mostly satisfied with pediatric care)	76.4	133	80.5	62	73.2	71

**p*<0.05

needed, being treated with respect, having received a check-up at least once per year and being satisfied with their care. More than one-third reported having a social worker or case manager that helped them. Almost one-fifth said doctors or nurses had treated them badly due to race, religion, sexual orientation or income. The only statistically significant difference between families living on annual incomes below \$12,000 versus their higher income counterparts, was that lower income families were less likely than their higher income counterparts to report having a regular doctor.

Of the eight scales measuring quality of life (using the QOLI), five revealed statistically significantly lower mean scores among families living on annual incomes below, compared to equal or above, \$12,000 (see Table 3). Differences were found in the general life satisfaction (*p*<0.01), living situation (*p*<0.01), family relationships (*p*<0.05), financial situation (*p*<0.001), and health status (of the caregiver; *p*<0.05). No differences were found in daily life, social relationships and neighborhood safety scales.

Next, we examined two indicators of health utilization: non-urgent ER use and lacking age-appropriate immunizations. Results indicated that families living on annual incomes below \$12,000, compared to their higher income counterparts, were more likely to have had at least one ER visit (71.4% versus 54.6%, respectively; *p*<0.02); and were less likely to have had age-appropriate immunizations (36.1% versus 53.9%; *p*<0.02; not shown in tables).

To examine the variables that were more associated with the dependents variables and to determine the utility of using individual versus community

TABLE 3. Quality of life index (QOLI) scores of caregivers by reported annual income: means and standard deviations (SD)

QOLI indices—care giver’s perspective	Reported income			
	<12,000/year (n=77)		≥12,000/year (n=97)	
	Mean	SD	Mean	SD
General life satisfaction**	4.82	1.16	5.53	0.98
Living situation**	5.08	1.12	5.74	0.81
Daily life	4.52	1.06	4.76	0.84
Family relationships*	4.87	1.35	5.48	1.08
Social relationships	5.20	0.89	5.45	0.65
Financial situation***	2.80	1.50	4.19	1.29
Neighborhood safety	4.66	1.26	5.13	0.82
Health status*	4.73	1.08	5.20	0.80

**p*<0.05
***p*<0.01
****p*<0.001

indicators, two sets of logistic regression models were created (see Table 4): one with the dichotomous dependent variable of at least one ER visit or not; and the other with the dichotomous dependent variable of not having had age-appropriate immunizations or not. Based on bivariate analyses, the possible independent variables were: drove to pediatric appointment, caregiver’s age, African–American or Black race, education, annual income below \$12,000 per year, stably housed for 6 months, quality of life-general life satisfaction, quality of life-living situation,

TABLE 4. Odds ratios (OR) and 95% confidence intervals (CI) for models with dependent variable of emergency room use (n=174)

	Model 1	Model 2	Model 3
	OR (95% CI)		
Reported annual income<\$12,000 per year	2.02* (1.06–3.83)		
Lived inside MUA		2.52** (1.34–4.76)	
By Census data—tracts where at least 10% of households reported annual income<\$12,000			1.76 (0.95–3.27)
–2 Log likelihood with intercept only	226.13	230.98	230.98
–2 Log likelihood with intercept and covariates	221.38	222.69	227.73
Model chi-square $\chi^2_{(df)}$; <i>p</i> value	4.75 ₍₁₎ ; 0.029	8.28 ₍₁₎ ; 0.004	3.25 ₍₁₎ ; 0.072
Sensitivity	100.0%	70.4%	100.0%
Specificity	0.0%	51.5%	0.0%
Correct classification	62.6%	63.2%	62.1%

**p*<0.05
***p*<0.01

quality of life-family relationships, and quality of life-health status. For the individual-level model, only a maximum of four independent variables was allowed to enter the model. For the two community-level models, the variables for each model was living inside an MUA or living inside a census tract where 10% or more households have annual incomes below \$12,000, respectively.

The first set of models show the association of independent variables with the dependent dichotomous variable of having at least one ER visit. Using stepwise selection, the best model consisted of only one independent variable (see Model 1) showing that families with annual incomes below \$12,000 (OR=2.02, CI=1.06–3.83) were twice as likely compared to others to report at least one ER visit. This model correctly identified 62.6% of the observations, with a sensitivity of 100% and specificity of 0% ($\chi^2_{(1)}=4.75$; $p<0.029$). Model 2 shows that families living inside compared to outside MUA (OR=2.52; CI=1.34–4.76) were more than two-and-a half times more likely to have at least one ER visit. This model correctly classified 63.2% of the observations with a sensitivity of 70.4% and specificity of 51.5% ($\chi^2_{(1)}=8.28$; $p<0.004$). Model 3 with the census tracts categorized as low income were not significantly associated with ER use and correctly classified only 32.3% of the observations with a sensitivity of 56.6% and specificity of 0% ($\chi^2_{(1)}=3.25$; $p<0.072$).

The second set of models show the association of selected independent variables with the dependent dichotomous variable of having age-appropriate immunization status. Using stepwise selection, Model 1 indicates that the strongest model contained only one independent variable, demonstrating that caregivers who were biological parents versus other relative or foster parent were almost two-and-a-half times (OR=2.47; CI=1.18–5.16) more likely to have children who did *not* have age-appropriate immunizations. This model correctly identified 61.4% of the observations, with a sensitivity of 84.5% and specificity of 31.1% ($\chi^2_{(1)}=5.87$; $p<0.015$).

TABLE 5. Odds ratios (OR) and 95% confidence intervals (CI) for models with dependent variable of *not* having age-appropriate immunization (n=174)

	Model 1	Model 2	Model 3
	OR (95% CI)		
Biological parent versus other	2.47 (1.18–5.16)*		
Lived inside MUA		1.29 (0.70–2.39)	
By census data-tracts where at least 10% of households reported annual income<\$12,000			1.66 (0.91–3.04)
–2 Log likelihood with intercept only	233.95	237.89	237.89
–2 Log Likelihood with intercept and covariates	228.07	237.25	235.19
Model chi-square $\chi^2_{(df)}$;p value	5.87 ₍₁₎ ; 0.015	0.65 ₍₁₎ ; 0.421	2.70 ₍₁₎ ; 0.100
Sensitivity	84.5%	100.0%	56.6%
Specificity	31.1%	0%	0%
Correct classification	61.4%	56.9%	32.2%

* $p<0.05$

Models 2 and 3 illustrate the association of MUA and U.S. Census information with the dependent variable, not having age-appropriate immunizations (Table 5). In Model 2, MUA designation was not significantly associated with the dependent variable of *not* having age-appropriate immunizations (OR=1.29, CI=0.70–2.39); yet the model correctly identified 56.9% of the observations, with a sensitivity of 100% and specificity of 0% ($\chi^2_{(1)}=0.65$; $p<0.421$). Similarly in Model 3, the census tracts categorized as low income where at least 10% of households reported annual incomes below \$12,000 were not significantly associated with *not* having age-appropriate immunizations use (OR=1.66; CI=0.91–3.04). The model correctly identified 32.2% of observations with a sensitivity of 56.6% but had no specificity ($\chi^2_{(1)}=2.70$; $p<0.010$).

DISCUSSION

This study found that the two community-level indicators, MUAs and the census tracts identified based on U.S. Census data, show promise at identifying health care need among a very low-income pediatric population. In fact, MUAs were better at predicting non-urgent ER compared to individual-level indicators. Past studies have noted that inappropriate ER use is higher among very low-income families.^{8,11,21} Others have suggested that increased ER use is more common among patients who do not have an identifiable primary care physician.⁷¹ However, the children enrolled into this study, by design, had an identifiable physician and were insured by Medicaid. Still, even among the low-income families, those with the lower reported annual incomes of less than \$12,000 per year were more likely to have non-urgent ER visits. Two models, one with a single individual-level indicator on reported income level and the other with the community-level indicator of an MUA, were equally good at correctly identifying participants with non-urgent ER use. The model with another community-level indicator, census data linked to census tracts, was not significantly associated with non-urgent ER use, but correctly identified almost as many participants as the model with the individual-level indicator of reported income or the model with the community-level indicator of MUA status.

The utility of community-level indicators for predicting children who did *not* have age-appropriate immunizations was less clear. For the individual-level indicator, stepwise selection identified biological parents compared to relative or foster parents as the best predictors of children without age-appropriate immunizations. The community-level indicator of MUA was almost as accurate but not significant at identifying children without age-appropriate immunizations, whereas census data was inaccurate and insignificant.

That the MUA was the best predictor of non-urgent ER use and a good predictor of being without age-appropriate immunizations was surprising since it not only is a community-level indicator but is also developed by a system with serious limitations. First, the MUA system has been criticized for its infrequent reviews to assess continued eligibility for MUA designation.⁵⁴ Consequently, a community that may be revitalized and become populated with high-income individuals may remain on the MUA list. Second, the MUA is primarily based on adult health care rather than child health care indicators.

The finding that biological parents compared to relative or foster parents were more likely to *not* have children with age-appropriate immunizations may be

explained by income level. Bivariate analyses found that biological parents were more likely to have the lowest income level, and those with the lowest income level, compared to others, were younger, less likely to have high school education, more likely to live in a homeless shelter or transitional living situation, and less likely to have arrived at pediatric appointments by public transportation or being dropped off. Therefore, we believe that being a biological parent was a proxy measure for several parent characteristics associated with low income.

Poor service utilization is associated with negative experiences in health care such as reporting poor communication with one's physician⁷² or reported mistreatment by their regular physician.¹¹ However, we found few differences other than families with higher versus lower incomes were more likely to report having a regular health care provider. Accordingly, there was no evidence of differences in treatment or satisfaction in our sample. The lack of differences may be attributed to the study's sampling frame in which both groups were selected from low-income families insured by Medicaid. Still, the group with the lower annual incomes of less than \$12,000 exhibited few differences compared to low income families with higher annual incomes.

As anticipated, we found that the lower income families, compared to others, reported a poorer quality of life on several QOL indices. Four of the seven individual indices (i.e., living situation, family relationships, financial situation, and health status) and the general life satisfaction on the QOLI were significantly poorer for lower versus higher income families. We anticipated all indices would differ by group, particularly neighborhood safety since the poorest neighborhoods often have the most violence and crime.^{73,74} Still, the majority of indices demonstrated differences supporting the contention that even among low-income families, those with lower incomes have a poorer quality of life.

Findings in this study are based on a sample of children from a pediatric hospital's ambulatory department, and therefore, may not be generalizable to other pediatric ambulatory settings. In addition, only families who brought their children to an ambulatory care clinic were selected into the sample; consequently, findings may not be generalizable to families whose children were not receiving preventive services. Children may have had visits to other pediatric providers (outside the ambulatory department) or have received immunizations elsewhere, which may have resulted in misclassification of immunization status. Another consideration is that the study's sample was significantly small and that many census tract (averaging 4,000 people) were represented by only one individual; consequently, the children and their families in the study sample may not be representative of other children and their families living within the census tracts or MUAs. As a result, it is likely that community-level indicators would be even more accurate with larger samples where higher numbers of respondents were living in each census tract.

CONCLUSION

In summary, the community-level indicator of MUA appears to meet its initial intent, providing information on the location of very low-income individuals with high health care need even among a sample of Medicaid-insured children with an identified health care provider. Our findings suggest that community-level indicators are potentially useful tools for health services providers or researchers targeting communities with high-need populations, even among those who already

have access to services. Health care access, insurance and providers simply may not be sufficient. Outreach efforts are needed to change the community culture on how preventive care is used and perceived.

This study contributes to the literature by assessing the association among an individual-level and two community-level indicators and measuring their ability to indicate health service utilization among Medicaid-insured children. Clinicians, researchers and administrators who are targeting very low-income pediatric populations may want to consider using community-level indicators, including MUAs, to identify geographic areas of need.

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