NEIGHBORHOOD HEALTH INDICATORS IN GREATER CLEVELAND: THE USE OF MEDICAID CLAIMS TO MEASURE CHILDREN'S ACCESS TO PRIMARY CARE

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Summary

This study developed and tested six neighborhood indicators of children's access to primary care for the census tracts in Cuyahoga County (Cleveland) Ohio. The following indicators were derived from geocoded Medicaid claim and encounter records: 1.) Percent of newborns with a comprehensive preventive visit (CPV) before 3 months; 2.) Percent of infants with no CPV from birth to age 1; 3.) Percent of infants with 5 CPVs from birth to age 1; 4.) Average number of CPVs for infants birth to age 1; 5.) Monthly average percent of children under age 6 with an Emergency Department (ED) visit; 6.) Annualized number of ED visits per child under age 6. The neighborhood indicators based on CPVs were correlated with one another but not with the indicators based on ED visits. The neighborhood's proportion of newborns with a CPV before 3 months of age was not significantly correlated with any indicators of neighborhood poverty, demographics or health. The other measures using CPVs showed weak correlations with indicators of poverty, demographics and health. The indicators based on ED use showed the strongest pattern of association with other neighborhood indicators. Dependence on the ED among neighborhood children was positively correlated with poverty, female-headed households, African-American and Hispanic population and poor maternal and infant health. Violent crime rate and child maltreatment rate were correlated (negatively) with the percent of children who had 5 or more CPVs. Child maltreatment rate was also correlated (negatively) with the average number of CPVs per child. Violence indicators showed no correlation with ED use. These new indicators of access to primary care are being used by the Cuyahoga County Early Childhood Initiative to track progress on their goal of linking young children to a "medical home" where they can get appropriate preventive health care and lower their reliance on emergency services and to target neighborhoods where the need is greatest.

Purpose

Health policy researchers need tools to measure health and health care for small geographic areas such as neighborhoods due to the growing evidence of spatial inequality in America. Studies have shown that a number of health indicators are worse in economically disadvantaged neighborhoods. High mortality rates and poor birth outcomes have been shown to be correlated with neighborhood poverty rates and other factors in several cities including New York, Chicago and Cleveland (McCord and Freeman, 1990; Roberts, 1997; Coulton and Pandey, 1992). Such spatial patterning of health indicators is of growing concern in recent years because of the increased geographic concentration of poverty (Jargowsky, 1997). However, the concentration of poverty is not universal in all metropolitan areas but tends to be worse in cities that are racially segregated, have populations that are disproportionately affluent and poor rather than middle class and have older central cities that are disadvantaged relative to their suburbs (Coulton, Chow, Wang and Su, 1996). Thus, there is a need to investigate the degree to which poorer inner city health is widespread or whether it is concentrated in particular cities or neighborhoods within these cities.

Access to health care is an important determinant of health, and it may differ by neighborhood. However, most of the studies showing urban health disparities have relied upon birth and death certificates rather than measures of health service utilization or access. Although medical claims have been used in service utilization research, they have seldom been examined

by neighborhood or used as indicators of access to health care at the neighborhood level. Access to preventive health care is particularly important for young children, and there have been particular concerns about less than ideal utilization of primary care among poor children. Therefore, this study focuses on neighborhood indicators of primary health care access among young children.

The purpose of the study covered in this report was to:

1. Craft neighborhood indicators of child access to primary care using eligibility, claims and encounter records from Ohio's Medicaid Management Information System and document the methods used.
2. Determine the degree to which these indicators of primary health care access correlate with measures of neighborhood socio-economic conditions, demographics and other health and safety indicators.
3. Test the usefulness of the indicators with community based organizations.

Several theoretical perspectives are relevant to this investigation. The Anderson model of health care utilization posits that factors in the environment may encourage or discourage appropriate use of health services, and some of these influences may be present in particular urban locations to varying degrees. Such factors might include differential access to health care information, transportation and the service delivery system. Moreover, the stressful circumstances of urban locations with deteriorated housing, high crime and residential turnover may also interfere with health care use, independent of health insurance or resources. Social networks and social capital are additional concepts that are pertinent to an investigation of inner city health (Berkman and Syme, 1979; Putnam, 2000; Hawe and Shiell, 2000). Some of these resources may be undermined in inner city locations that have experienced rapid turnover, disinvestment and the disruptive effects of crime. Economic growth or stagnation can affect the resources available to residents for gaining health insurance, health care access and engaging in health promoting behaviors (Kawachi, Kennedy, Lochner and Prothrow-Stith, 1997; Dunn and Hayes, 2000). Studies have shown that economic inequality and racial segregation within metro areas is correlated with mortality, leading to disempowerment or relative deprivation hypotheses (LaVeist, 1993).

Medicaid policy changes provide an important context for this study. The Medicaid program underwent significant expansion since 1997, providing coverage to children up to 200% of the Federal Poverty Level (State Children's Health Insurance Program, or SCHIP). Findings from the evaluation of this program in the state of New York have shown increased access to and utilization of primary care, improved continuity of care, and improved health status among participating children, but unchanged utilization of emergency and specialty care (Holl, Szilagyi, Rodewald, Shone, et al., 2000). These improvements were associated with only a modest increase in expenditures (Zwanziger, Mukamel, Szilagyi, Trafton, et al., 2000). However, critics have argued that merely providing insurance coverage (public or private) is not sufficient to ensure access to care (Rosenbach, Irvin, & Coulam, 1999). Additional factors must account for the availability of medical homes, and for the effects of gaps in insurance coverage. Expanded availability of primary care physicians, coupled with various approaches in case management,

has been shown to be associated with decreased use of Emergency Department (ED) visits and pediatric hospitalizations -- although such favorable outcomes have not been consistent across studies (Christakis, Mell et al., 2001; Piehl, Clemens, & Joines, 2000; Gadomski, Jenkins, & Nichols, 1998; Schuster, Wood, Duan, Mazel, et al., 1998). In 1990, lack of a primary care provider was cited as a reason for more than 40% of non-urgent visits to the ED, nationwide (US GAO, 1993). Interventions in pediatric EDs consisting of educating parents on the importance of a primary care provider and assisting them in making an appointment to the provider of their choice have resulted in a decrease of subsequent ED use, with potentially modest savings to the Medicaid program (Grossman, Rich, & Johnson, 1998). While these are utilization and process measures, they have often been used as proxies for outcomes, because such encounters could have been prevented through adequate receipt of ambulatory care (Palmer & Miller, 2001).

Approach

The basic approach of this study was to craft indicators of primary health care access for young children and examine their ecological correlations with other demographic, economic, and health and safety indicators. The census tracts in Cuyahoga County were the units of analysis for the study. There are 484 residential census tracts in Cuyahoga County. The City of Cleveland accounts for 213 of the census tracts and the remaining 271 are in suburban municipalities.

Medicaid claim and encounter records served as the data source for the new indicators of primary care access for children. The Ohio Department of Job and Family Services (ODJFS) maintains the Healthy Start/Medicaid claim and encounter files. Claim records are billing records generated in the fee-for-service (FFS) system for services paid for by the Ohio Medicaid program directly to the provider. Encounter data are pseudo, or shadow, claims generated by the Managed Care Organization (MCO) to account for services rendered to a beneficiary while s/he was enrolled in their system. While variations in the content and quality of encounter data may occur, it is generally believed that encounter data mirror claim records in format, content, completeness, and quality. In order to obtain a complete claims history and to account for possible lapses in MCO enrollment that may have occurred during the study period, claim records and encounter data were combined in the process of summarizing children's utilization experiences. The files for the study contained all of the records for Cuyahoga County children who were between birth and six years of age in State Fiscal Year (SFY) 1999, which goes from July 1998 through June 1999.

The claim and encounter records carry diagnosis and procedure codes that make it possible to identify respectively the condition(s) that prompted a given health encounter, as well as the type(s) of service received. These codes were used to summarize children's health care utilization at the individual level to derive measures relative to comprehensive preventive visits (CPVs); and visits to the Emergency Department (ED). Diagnosis and procedure codes used to identify these services are listed in Appendix 1. The claim and encounter records were matched with Medicaid eligibility files to obtain home addresses for the children in the analysis. The addresses were geocoded and approximately 90 percent of the addresses were successfully assigned to a census tract.

Utilization Measures

The new indicators were divided into two types: Comprehensive Preventive Visits (CPVs) and Emergency Department (ED) Visits. Conceptually, it was anticipated that these would work opposite of one another; that is, neighborhoods in which children were well served by preventive care would show lower rates of reliance upon Emergency Departments. We tried 4 methods of calculating neighborhood rates for CPVs and 2 methods of calculating ED visits.

Receipt of Comprehensive Preventive Visits (CPVs): The American Academy of Pediatrics (AAP) recommends at least one CPV by 4 weeks of age, 2 CPVs by 3 months of age, and 5 CPVs by one year of age. The first measure focused on Early Initiation of Care and included infants who were on Medicaid at birth (N=6,119). The other three measures focused on children who were enrolled in Medicaid throughout their first 12 months of life (N= 4,464). Specifically, the following four indicators were calculated for each census tract:

1) *Early Initiation of CPV*: the proportion of newborns that received at least one CPV by 3 months of age;
2) *All CPVs*: the proportion of children that received the recommended number of 5 CPVs in the first year of life;
3) *No CPVs*: the proportion of children that received no CPVs in the first year of life;
4) *Average CPVs*: the average number of CPVs per child in the first year of life.

Visits to the Emergency Department (ED): Visits to the Emergency Department were identified using the procedures codes that the doctors and hospitals use to describe the procedures and services provided to the patient. Records with the American Medical Association's Current Procedure Terminology codes (99281 to 99285) for 'evaluation and management services provided in the Emergency Department' were counted as an Emergency Department visit (the codes for critical care performed in the Emergency Department and evaluation and management services provided to a patient in an observation area of the hospital were not included in our definition). In order to insure that the same visit was not counted more than once, only one visit was counted per day; doctors and hospitals may each generate a record for the same service so two claims in one day are likely to represent a single event. For each month a child was under age 6, eligible for Medicaid and living in Cuyahoga County, we counted the number of visits to the Emergency Department. There were 57,738 individual children in the analysis. The specific neighborhood indicators were:

5) *Percent with ED Visit per month*: the percentage of enrolled children under 6 with at least one ED visit in the month (averaged for the tract for the year).
6) *Annualized ED Visits*: the annualized number of ED visits per child under 6.

Other Study Variables

The other variables for this study come from the Center on Urban Poverty and Social Change's CAN DO neighborhood information system (see http://povertycenter.cwru.edu for documentation). The neighborhood indicators based on administrative records were for 1998-1999. The census-based measures were taken from the 2000 Census. A list of these variables and their definitions is in Appendix 2. We had planned to also obtain data on the location of Medicaid primary care providers for the purpose of determining whether census tracts' distances

to providers were correlated with the new utilization indicators. However, we were unable to obtain provider addresses because ODJFS is in the process of updating and cleaning their provider files and was not ready to release them in time for the completion of this project. We did, however, obtain the State's list of census tracts in Cuyahoga County that were designated as having a shortage of health professionals, and we used this as a proxy for the location of medical providers.

Limitations of Methods

Claim and encounter records are available for all services received by children during the time that they were enrolled in Medicaid, and paid for by Medicaid or the managed care organization. However, the files do not include records for services that were received by children when they were not enrolled in Medicaid, nor do they include records for services received through clinics that do not seek reimbursement from Medicaid (e.g., public health clinics). These limitations have important implications in designing the present study and interpreting the results. First, they imply that the claims history may be incomplete for children who are not continuously enrolled in the program during the study period. For this reason, several of the measures are restricted to continually enrolled children. Limitations should also be noted with regard to the completeness and accuracy of diagnosis and procedure codes recorded on claims data. For example, comprehensive preventive visits are counted as such only to the extent that the relevant codes are accurately recorded in the claims data. Similarly, we counted ED visits using the codes submitted by providers in their claims records. These codes are subject to variation across providers and across time. Finally, with respect to calculating neighborhood indicators, there were some census tracts with very small numbers of children on Medicaid. To protect confidentiality, we do not report rates for tracts with fewer than 5 children on Medicaid. However, such small numbers are apt to yield unstable rates in a single year. When more data become available we plan to calculate these rates using 3 years of Medicaid claims rather than a single year. It should also be noted that this study does not measure primary care access for privately insured children.

Findings and Implications

Description of New Indicators

The means and standard deviations of the 6 new neighborhood health indicators and the other study variables are presented in Table 1. It can be seen that the number of census tracts with valid data varies for the new health indicators. For example, for the health indicators based on continuously enrolled children from birth to age 1, there are quite a few missing tracts. This is due to the fact that many tracts had fewer than five such Medicaid enrollees. On the other hand, the ED indicators based on monthly Medicaid enrollment of children under age 6 yields fewer missing data points. Nevertheless, there are some tracts in the county that have no Medicaid children. Another variable that is subject to missing data is the violent crime rate. This is due to the fact that there are some suburban municipalities that do not report their crime data according to the Uniform Crime Reports or to the countywide information system.

Table 1. Means and Standard Deviations of Study Variables

Variable	Mean	Standard Deviation	Number of Census Tracts
Early Initiation of CPV	61.85	13.54	289
No CPVs	12.14	10.64	249
All CPVs	15.61	11.37	249
Average CPVs	2.64	0.49	249
Percent with ED Visit per month	5.16	2.09	481
Annualized ED Visits	0.68	0.29	481
Births with Inadequate Prenatal Care/1,000 Live Births	349.66	218.75	478
Low Birth Weight Birth Rate/1,000 Live Births	87.50	57.28	478
Births to Unmarried Mothers/1,000 Live Births	421.92	303.57	478
Children Maltreated/1,000 Child Population	39.68	255.38	481
Total Violent Crime/100,000 Population	1171.77	3619.63	400
Poverty Rate	17.43	16.76	481
Poverty Rate for Children Under Age 6	2.3	3.41	481
Employment Rate for Males Age 16 and Over	45.53	9.14	481
Employment Rate for Females Age 16 and Over	45.37	6.65	481
Percent White	60.67	37.34	481
Percent Black	35.05	38.56	481
Percent Hispanic	4.09	7.63	481
Percent of Households with Children Under Age 18 that are Female-Headed	36.30	22.63	481

Table 2 displays the ecological correlation coefficients among the six new indicators. First, it can be seen that the several measures based on CPVs are significantly correlated with each other and the signs of the coefficients are in the expected directions. Since the average number of visits shows the highest correlation with the other indicators, this indicator might be preferred if only one was going to be used. However, the indicator based on having at least one CPV within 3 months of birth might be preferred because this one could be calculated for a greater number of tracts. The one-year continuous enrollment requirement of the other 3 indicators led to a substantial amount of missing data.

Table 2. Correlation Coefficients of Health Access Indicators with Each Other

	Early Initiation of CPV	No CPVs	All CPVs	Average CPVs	Percent with ED Visit per Month	Annualized ED Visits
Early Initiation of CPV	1	-0.50**	0.19**	0.54**	0.09	0.07
No CPVs		1	-0.14*	-0.67**	0.01	0.03
All CPVs			1	0.57**	0.01	-0.02
Average CPVs				1	0.06	0.02
Percent with ED Visit per Month					1	0.98**
Annualized ED Visits						1

** Correlation is significant at the .001 level.
* Correlation is significant at the .05 level.

The two ED based indicators are very highly correlated with each other suggesting that either one could be used. Since they are based on person-months of enrollment rather than continuous enrollment, few tracts were missing on these indicators. More puzzling, though, is the finding that there are no significant correlations between ED use in the census tract and use of CPVs. This is somewhat contrary to expectation since it was assumed that neighborhoods with good access to preventive care for infants would show lower use of emergency care. Several explanations are possible for this lack of relationship. First, the ED indicators are calculated on children under age 6, whereas the CPV indicators focus on infants. Second, since ED use is for acute conditions rather than prevention, these two indicators are tapping into quite different types of utilization. Third, if we had an indicator of use of primary care doctors' offices and clinics for "sick visits", this indicator might have shown the anticipated negative correlation with ED visits. However, we chose to examine CPVs since there were agreed upon standards for the desirable number and timing of visits. Finally, the determinants of preventive health behavior, as reflected in CPVs, may be different than the factors that determine whether parents use EDs versus doctors' offices and clinics for acute care. There may be more uniform access to preventive care than to sick care in many of these neighborhoods.

Geographic Distribution of Neighborhood Indicators of Access to Primary Care

Thematic maps of the new indicators are presented in Figures 1-6. It can be seen that there is considerable variation among census tracts in their rates on these indicators. Problems with receiving early initiation of CPVs are just as common in the City of Cleveland as in the suburbs of Cuyahoga County. Similarly, Figure 1 shows that census tracts with the highest rates

of early CPV initiation are distributed evenly between Cleveland and the rest of the County, 18 and 15 tracts, respectively. In Figure 2, only one of the eight census tracts with an average of 4 CPVs can be found within the Cleveland borders. Even though Cleveland has fewer tracts with an average of 4, the average number of visits for tracts within the city and within the rest of the County is the same--3 visits.

Figures 3 and 4 show the percent of children with no CPVs and all CPVs. Once again, about half of the tracts—34 of 65—with no CPVs can be found within the Cleveland borders. However, only 2 of the 14 tracts with all CPVs are in Cleveland.

The ED indicators are mapped in Figures 5 and 6. In the suburbs of Cuyahoga County, more children have an ED visit and the number of annualized visits per child is also greater, when compared to the City of Cleveland. Further investigation is needed to determine the explanation for this pattern of higher ED use in the suburbs. It is possible that some suburbs are at a greater distance from those pediatric groups that are under contract to the Medicaid Managed Care Organizations or that suburban families face other barriers to getting their children to doctors' offices or clinics when they become ill. It is also possible that suburban children experience more instances of trauma or urgent conditions that necessitate Emergency Department care. This will be investigated further in the future by disaggregating trauma related codes from others in the Medicaid claim and encounter records.

Figure 1

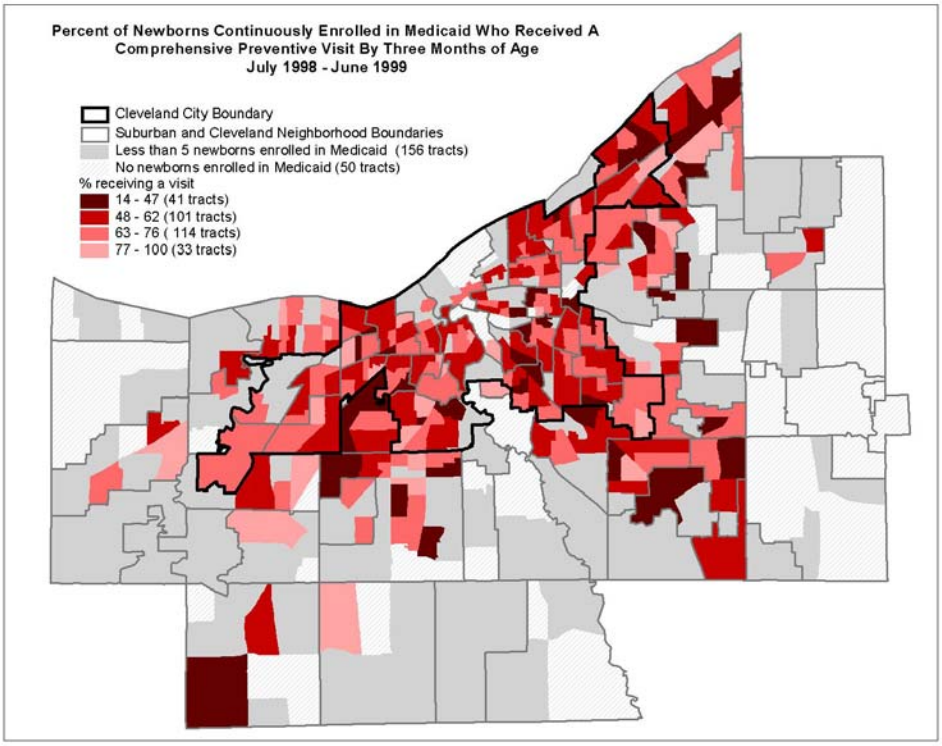


Figure 2

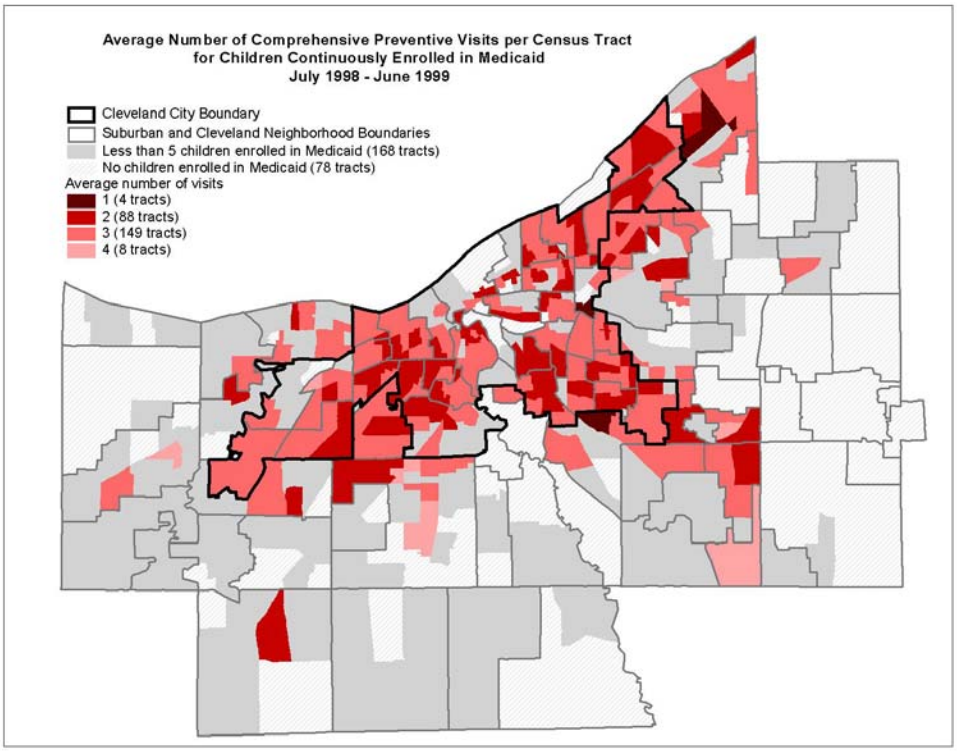


Figure 3

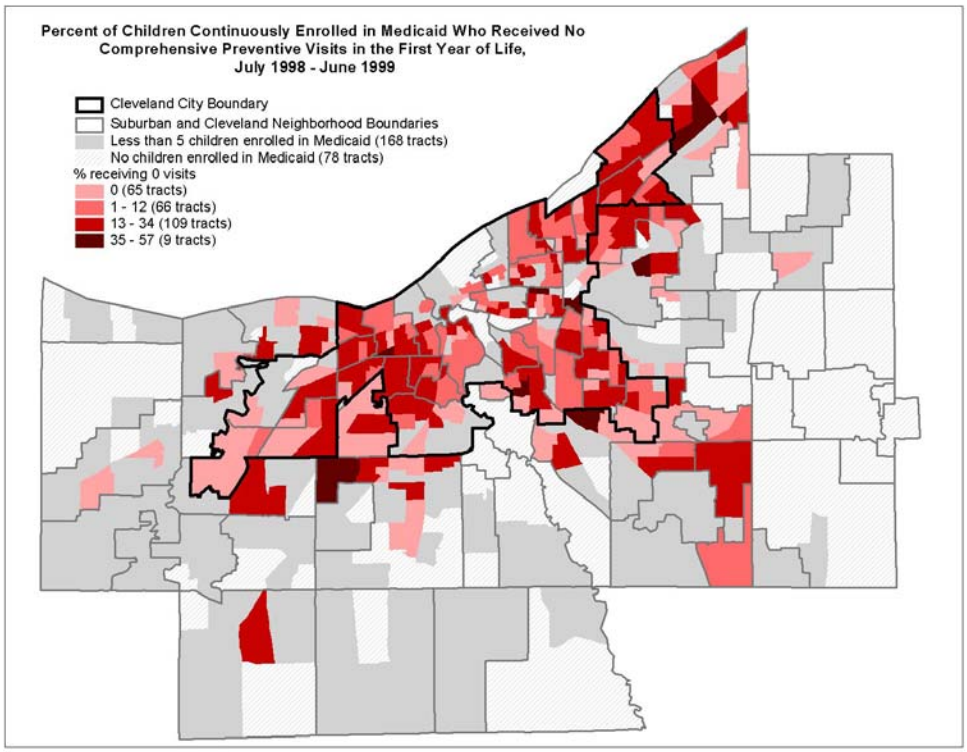


Figure 4

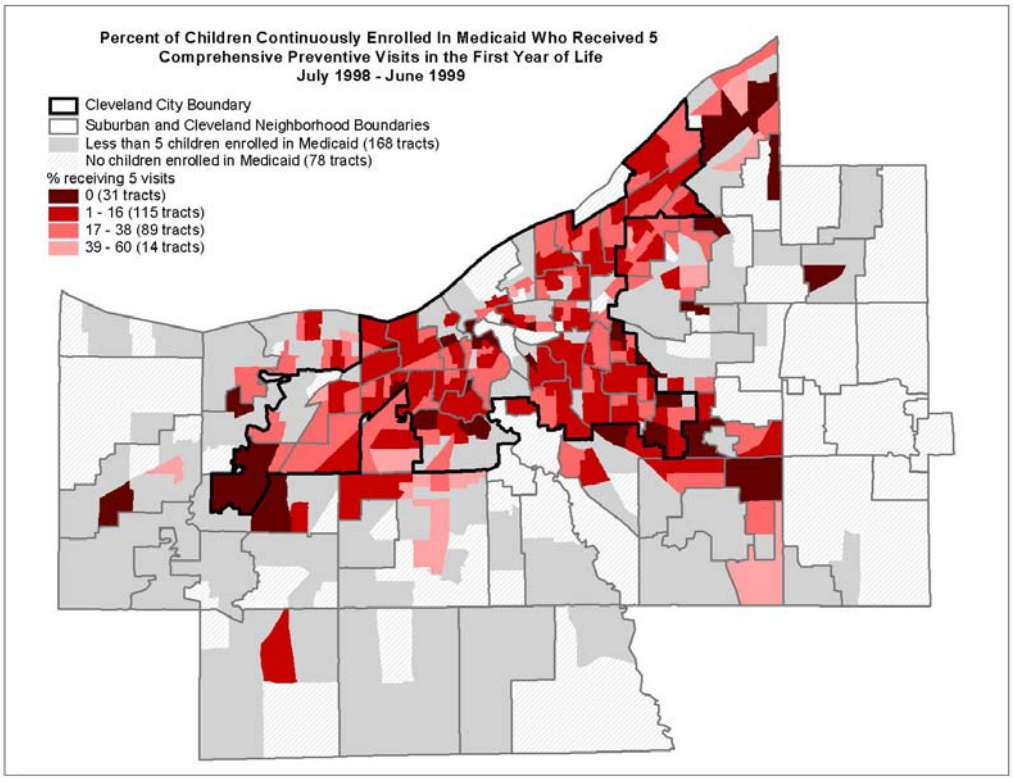


Figure 5

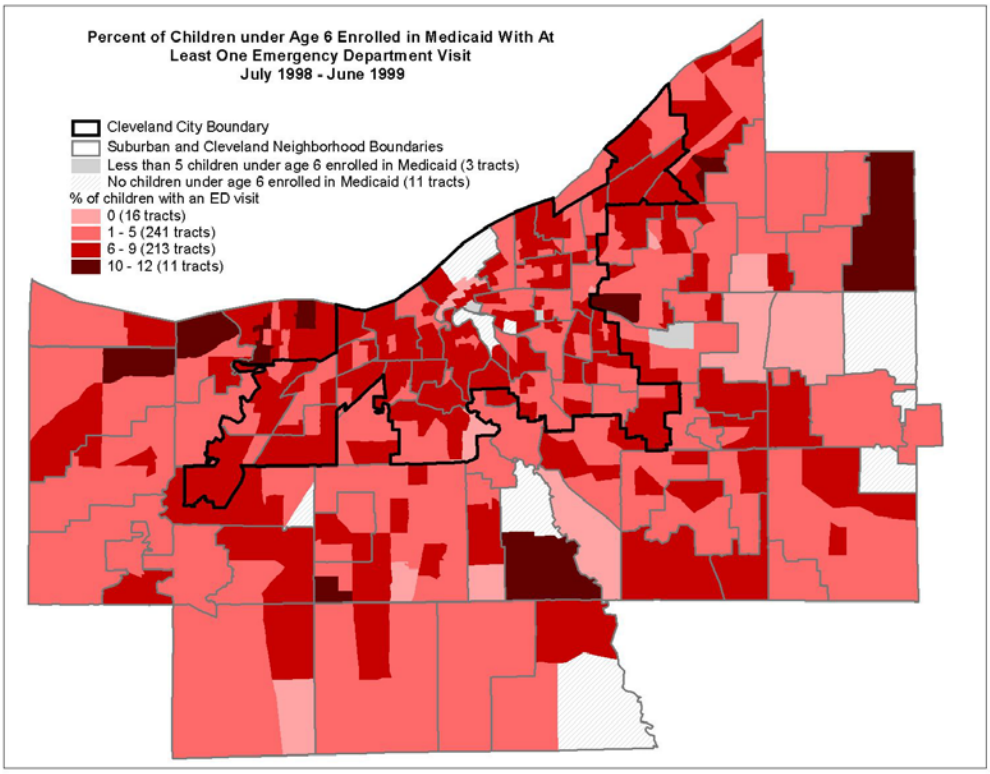
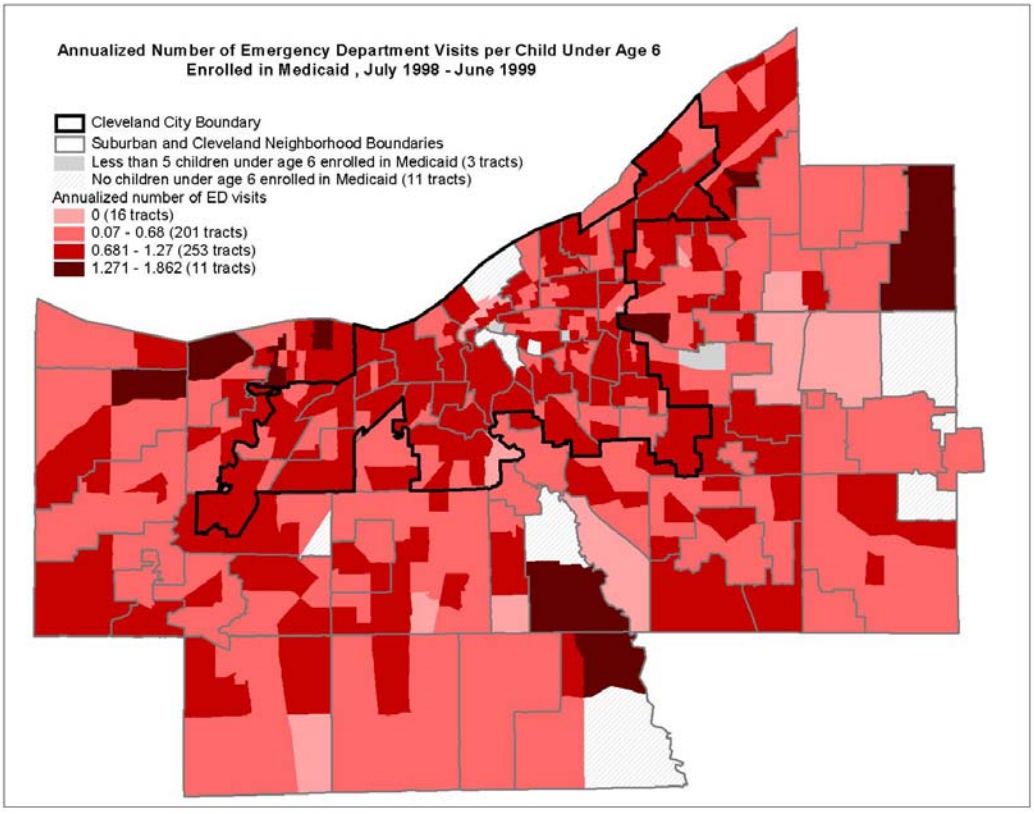


Figure 6



Hypothesis Testing

The first hypothesis was that the new health care utilization indicators would be related to other measures of health and safety. These ecological correlations are presented in Table 3. The rate of newborn CPVs is unrelated to the other measures of health and safety in the census tracts. The percent of infants with no CPVs is correlated with the percent of births with inadequate prenatal care. The percent of infants receiving all CPVs and the average number of CPVs show weak but significant negative correlations with low birth weight rates, unmarried birth rates and child maltreatment rates. Indicators reflecting reliance on the ED are positively correlated with the health problems indicators but uncorrelated with the measures of safety in the census tracts. The fact that ED use correlates positively with the percent of births with inadequate prenatal care suggests that these types of indicators may be sensitive to a similar problem of shortage of primary care providers. It is notable that inadequate prenatal care in the census tracts does not necessarily lead to inadequate preventive care for infants.

Table 3. Correlation Coefficients of Health Access Indicators with Health and Safety Indicators

	Early Initiation of CPV	No CPVs	All CPVs	Average CPVs	Percent with ED Visit per Month	Annualized ED Visits
Births with Inadequate Prenatal Care/1,000 live births	-0.03	0.13*	-0.13*	-0.11	0.24**	0.23**
Low Birth Weight Birth Rate/1,000 live births	-0.02	0.05	-0.19**	-0.14*	0.16**	0.16**
Births to Unmarried Mothers/1,000 live births	-0.02	0.12	-0.21**	-0.21**	0.22**	0.21**
Children maltreated/1,000 child population	-0.08	0.10	-0.15*	-0.19**	0.01	0.01
Total Violent Crime/100,000 population	-0.09	0.07	-0.13*	-0.11	-0.10	-0.09

** Correlation is significant at the .001 level.
* Correlation is significant at the .05 level.

The second hypothesis was that low-income neighborhoods would have lower scores on the new health care access indicators. Table 4 displays the ecological correlations for various measures of census tracts' economic status. None of the economic indicators correlate with the rate of newborn CPVs or with the percent of infants with no CPVs. This suggests that efforts to provide preventive services to residents of poor neighborhoods have been successful. The fact that there is a weak negative correlation of neighborhood poverty and receipts of all visits

suggests that there may be some remaining difficulties in achieving complete access. Poverty is consistently and positively correlated with ED use as anticipated. However, employment rates in the census tracts are uncorrelated with these new health indicators.

Table 4. Correlation Coefficients of Health Access Indicators with Economic Indicators

	Early Initiation of CPV	No CPVs	All CPVs	Average CPVs	Percent with ED Visit per Month	Annualized ED Visits
Poverty Rate	-0.07	0.11	-0.16*	-0.18**	0.13**	0.13**
Poverty Rate for Children under age 6	-0.07	0.09	-0.12	-0.14*	0.19**	0.18**
Employment Rate for Males age 16 and over	0.08	-0.06	0.10	0.09	-0.08	-0.06
Employment Rate for Females age 16 and over	0.04	-0.05	0.09	0.11	-0.06	-0.06

** Correlation is significant at the .001 level.

* Correlation is significant at the .05 level.

The third hypothesis was that there would be relationships between race, ethnicity and family structure measures and the health care access indicators. These ecological correlations are presented in Table 5. None of the indicators correlate with the rate of newborn CPVs. However, census tracts with a higher Hispanic population are more likely to have infants that receive no CPVs during their first year. Tracts with large numbers of African Americans have fewer infants who receive all of their CPVs in the first year. The percents of African American and Hispanic populations in census tracts are positively correlated with use of the ED for children less than 6 years old. The percent of households with children that are headed by females is negatively correlated with the rate at which infants receive CPVs in their first year and positively correlated with ED use.

Table 5. Correlation Coefficients of Health Access Indicators with Race/Family Structure Indicators

	Early Initiation of CPV	No CPVs	All CPVs	Average CPVs	Percent with ED Visit per Month	Annualized ED Visits
Percent White	0.04	-0.05	0.15*	0.09	-0.12**	-0.11*
Percent Black	-0.04	0.03	-0.13*	-0.07	0.10*	0.10*
Percent Hispanic	0.03	0.13*	-0.12	-0.14*	0.17**	0.16**
Percent of Households with Children Under Age 18 that are Female-Headed	-0.04	0.09	-0.20**	-0.18**	0.23**	0.22**

** Correlation is significant at the .001 level.

* Correlation is significant at the .05 level.

The last hypothesis stated that the census tract's distance from primary care sites would lead to poorer performance on the health care access indicators. Unfortunately, we were not able to get the addresses of all of the primary care providers in the region. However, the State of Ohio has designated certain census tracts as "Health Professional Shortage Areas". Therefore, we compare rates on the new indicators for tracts with this shortage designation with all other tracts (See Table 6). A significantly higher percentage of infants get all 5 of their CPVs in areas that are not shortage areas. Moreover, ED use is higher among children in census tracts that are classified as shortage areas.

Table 6. Means (SDs) for Health Access Indicators by Health Professional Shortage Area Designations

	Health Professional Shortage Area Designation	**Not a Health Professional Shortage Area Designation**	**t value**
Early Initiation of CPV	61.63 (10.34)	61.99 (15.33)	-0.24
No CPVs	12.68 (9.09)	11.69 (11.79)	0.75
All CPVs	13.76 (7.64)	17.15 (13.55)	-2.48*
Average CPVs	2.60 (0.38)	2.68 (0.57)	-1.26
Percent with ED Visit per Month	5.65 (1.10)	4.97 (2.32)	4.32**
Annualized ED Visits	0.75 (0.15)	0.66 (0.32)	4.04**

**p< .001
* p< .05

Implications

The major purpose of this study was to determine whether neighborhood indicators of health care access could be crafted from Medicaid claim and encounter records and whether the new indicators would correlate with other health, economic and demographic measures. The study has implications for both the practicality and validity of the indicators.

Practical Issues and Problems

The use of the claims and encounter data proved to be more difficult than anticipated. There were problems with obtaining children's addresses, assigning events to census tracts, determining which codes to use and obtaining addresses of providers. The children's addresses in the Medicaid files were overwritten so we could not be sure of where the child lived at the time of the event. Therefore, after extracting the events of interest, we had to match the event to an eligibility file that stored the child's address for every month of Medicaid eligibility. Some events did not match an eligibility record so they could not be geocoded. The most common

reason for a non-match was that Medicaid eligibility was established retroactively following the medical event so there was no recorded address at the time of the event.

A second challenge was assigning children and events to census tracts. Both Medicaid eligibility and address can change monthly. Medical events have dates, but some events, such as CPVs have to occur within particular time periods to be considered medically appropriate. These issues dictated our choices about how to assign the events to census tracts. Because CPVs have to occur in a sequence, the choice was made to assign the child to the census tract at birth. Thus, even if he or she moved, the visits were assigned to the birth tract. With respect to EDs, though, we were able to count visits and eligible children in each tract each month. This allowed us to create an average monthly rate for each tract for the year. Monthly rates, though, are not as intuitively meaningful as yearly rates, but they do overcome the problem of changing residences and eligibility that occurs in Medicaid data. A related problem was the small number of Medicaid children in some census tracts. In the future, we plan to combine 3 years of data to achieve more stable rates for the neighborhood indicators.

A third complication was the existence of multiple claims, or encounters, for what is probably the same event. For example, an ED visit might generate a claim from the hospital plus claims from other providers. We made the decision to allow only one event to be counted per day per child.

Finally, we had hoped to be able to geocode the addresses of providers so that we could perform a spatial analysis of where the major primary care providers were located. We learned, though, that the billing addresses may not represent the actual location of care. Moreover, some providers deliver care at multiple locations so that the provider address in the Medicaid system may not reflect the actual location at which the care is delivered.

Validity of Indicators

This study also has implications for whether the indicators are valid measures of access to primary care for a neighborhoods' children. The ideal of primary care is a medical home where children can get regular preventive or well child care and can also receive medical treatment for acute or chronic illnesses that are treated appropriately by pediatrician's in their clinics or offices. We assumed that CPVs were indicative of access to preventive care, one aspect of primary care. However, we did not have a direct way of measuring access to primary care providers for illnesses. Instead, we chose to measure a negative indicator, ED use. The assumption was that high use of the ED would be a proxy for lack of access to primary care for illnesses. We recognized that some ED visits, especially for trauma, or critical conditions, were appropriate, but we have not yet perfected a method for removing these appropriate ED visits from our counts. The fact that CPVs and ED visit rates were not correlated at the census tract level suggests that they are measuring different things. It is possible they are measuring two, unrelated aspects of primary care access or that one of them is not an indicator of access but mainly due to other factors. In the future, it would be useful to refine the indicators based on ED visits. One improvement would be to count "low intensity" visits rather than all visits if such could be accurately identified from the diagnostic and procedure codes. Another refinement

would be to examine ED use for "ambulatory sensitive conditions" such as asthma or diabetes. If well managed in doctors' offices, ED visits for these conditions should be rare.

Another puzzlement in the findings was that several of the measures of CPV usage rates were not correlated with poverty and other economic indicators in the neighborhood. This may reflect the fact that local agencies and the managed care organizations have made concerted efforts to reach out to poor families to assure that they get their well child visits, especially the first visit after birth. Thus, these rates do not show any ecological correlations because the usual barriers have been removed. If such is the case, failure to get a visit is more due to individual situations than to a pattern of economic, social or geographic disadvantage.

Indicators based on ED visits show more of the patterns of ecological correlations that were expected. Tracts with other indicators of economic, health and safety problems show higher rates of ED visits for children. It is not clear, though, whether lack of access to primary care is driving these higher rates of visits or whether it is other factors in the neighborhoods or individual households. For example, poor, female-headed families may have more difficulties arranging transportation for illness care during clinic or office hours and end up using the ED because they can get a ride during evening or weekend hours. Or, even though primary care access may be adequate for preventive visits that are scheduled ahead of time, families from low-income neighborhoods may find it difficult to get same day appointments for illnesses.

Community Process

The Early Childhood Initiative (ECI) in Cuyahoga County has chosen as one of its goals a "medical home" for every child under age six. Their initial focus has been on newborns and their parents. The ECI is very interested in using these indicators as a way of measuring their progress. The ECI has already succeeded in expanding Medicaid enrollment to virtually all of the County's uninsured children. As of September, there were 46,315 children under age 6 enrolled in Medicaid. The new indicators of access to primary care will allow the initiative to determine whether there are particular neighborhoods that need to be targeted for assistance with access to primary care. Moreover, these indicators can be disaggregated in other ways, such as age or program status, that will allow the ECI to refine its approach. Since the indicators are only now being reported, it will be several months before all of the uses become apparent.

Appendix 1. Diagnosis and Procedure Codes used in Identifying Comprehensive Preventive Visits, Emergency Department Visits, and Office Visits

Category	ICD.9 Diagnosis Codes	CPT Procedure Codes
Comprehensive Preventive Exams	V20.1 Other healthy infant or child receiving care V20.2 Routine infant or child health check V70.0 Routine general medical examination at a health care facility V79.3 Special screening for developmental Handicaps (V79.3)	99201-99205 (office/outpatient service, new patient) 99211-99215 (office/outpatient service, established patient) 99420 (Counseling/risk factor reduction intervention, new or established patients) 99431, 99432 (newborns) 99381, 99383 (new patient, infant; age 1-4, 5-11) 99391, 99393 (established patients; infants, age 1-4, 5-11)
Emergency Department Visits	Any diagnosis code, excluding 800-995, E800-877; E880-889; E950-999	99281-99285

Appendix 2. Definitions of Other Neighborhood Indicators

Indicator Name	Definition	Source
Births with Inadequate Prenatal Care/1,000 Live Births	Inadequate prenatal care is determined using the Kessner Index. The indicator is the average of 1998 and 1999 data.	Ohio Department of Health, Vital Statistics Division
Low Birth Weight Birth Rate/1,000 Live Births	Low birth weight is defined as less than 2500 grams or 5.5 lbs. at birth. The indicator is the average of 1998 and 1999 data.	Ohio Department of Health, Vital Statistics Division
Births to Unmarried Mothers/1,000 Live Births	The indicator is the average of 1998 and 1999 data.	Ohio Department of Health, Vital Statistics Division
Children Maltreated/1,000 Child Population	Children maltreated include all indicated and substantiated reports of maltreatment. The child population is the population under age 18. The indicator is the average of 1998 and 1999 data.	Cuyahoga County Department of Children and Family Services
Total Violent Crime/100,000 Population	Violent crimes include homicide, rape, robbery, and aggravated assault. The indicator is 1999 data.	Municipal Police Departments
Poverty Rate	The total persons below poverty divided by the population for whom poverty status is determined. The indicator is based on 1999 income.	Census 2000, U.S. Census Bureau
Poverty Rate for Children Under Age 6	The total persons under age 6 below poverty divided by the population under age 6 for whom poverty status is determined. The indicator is based on 1999 income.	Census 2000, U.S. Census Bureau
Employment Rate for Males Age 16 and Over	Male Civilian Population age 16 and over who was working divided by the Age 16 and over male and female civilian population. The indicator is based on 1999 work status.	Census 2000, U.S. Census Bureau

Indicator Name	Definition	Source
Employment Rate for Females Age 16 and Over	Female Civilian Population age 16 and over who was working divided by the Age 16 and over male and female civilian population. The indicator is based on 1999 work status.	Census 2000, U.S. Census Bureau
Percent White	The percent of the population that classified itself as White in 2000.	Census 2000, U.S. Census Bureau
Percent Black	The percent of the population that classified itself as Black in 2000.	Census 2000, U.S. Census Bureau
Percent Hispanic	The percent of the population that reported Hispanic origin in 2000.	Census 2000, U.S. Census Bureau
Percent of Households with Children Under Age 18 that Are Female-Headed	The female-headed households with children under age 18 divided by the family households with children under age 18 in 2000.	Census 2000, U.S. Census Bureau

These variables are from the Center on Urban Poverty and Social Change's CAN DO neighborhood information system (see http://povertycenter.cwru.edu).

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