

# The Health Transportation Shortage Index<sup>SM</sup>

The Development and  
Validation of a New Tool  
to Identify Underserved  
Communities

A Monograph from  
Children's Health Fund



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#### PREFACE

## Goal and organization of this report

The goal of this report is to present the new health planning tool developed by Children's Health Fund (CHF): the Health Transportation Shortage Index (HTSI<sup>SM</sup>). The report will discuss the rationale for developing this instrument, detail the data that support it, and describe its use to target communities that may need improved transportation resources to facilitate child health care access.

The report consists of an Abstract and Overview, which present the HTSI<sup>SM</sup> and the rationale for its development. The technical basis for the development of the HTSI<sup>SM</sup> is then presented in the following five sections. Section One is a review of the literature on transportation and health care access, including a discussion of prior efforts to quantify the extent of the problem. Section Two presents original data that describe the extent to which inadequate transportation compromises child health care access and the key factors associated with transportation shortages. Section Three discusses in detail the data that support the HTSI<sup>SM</sup>. While the Index is a simple tool that may be easily used by health planners, the factors that it incorporates were developed through extensive research and statistical modeling. Technical details are presented in footnotes and text boxes. Section Four briefly discusses potential solutions to improve transportation availability to support child health care access. A more extensive discussion of these transportation programs and strategies is beyond the scope of this report. Section Five is a brief conclusion.

A brief CHF Special Report summarizing this work is available from the Children's Health Fund website at: <http://www.childrenshealthfund.org/sites/default/files/Health-Transportation-Shortage-Index-HTSI.pdf>. Copies can be requested by email: [rgrant@chfund.org](mailto:rgrant@chfund.org).

# Abstract

Most discussions of barriers to access for child health care focus on the availability of comprehensive, continuous health insurance. Other factors, however, also may pose significant barriers, including shortages of health professionals and inadequate public transportation resources. Based on national and regional health survey data, Children’s Health Fund has developed a new tool, the Health Transportation Shortage Index (HTSI<sup>SM</sup>), to help identify areas and communities where transportation shortages contribute to difficulty getting health care.

The HTSI<sup>SM</sup> is based on data from a national survey and a regional survey done in the rural Mississippi Delta. The data show that nationally, each year 9% of children in families with incomes less than \$50,000 (4% of children overall) missed at least one health care appointment annually because transportation was not available. Regionally, 10% missed a health care appointment because of lack of transportation. Nearly one-third of these children later used a hospital emergency department for the condition associated with the missed appointment.

The national survey included a question asking parents if they had difficulty establishing a usual source of pediatric care. A positive response to this was used to identify families with problems accessing child health care services, because difficulty establishing a usual source of care is associated with higher rates of hospital emergency department use for routine illnesses. In the national survey, difficulty finding a usual source of care was significantly associated with: 1) rural area; 2) low income; 3) longer travel distance to source of care (especially noted in rural areas); and 4) lack of public transportation. In the regional survey, it was associated with not having a car.

Children’s Health Fund developed the HTSI<sup>SM</sup> to serve as a tool to guide users in the assessment of the most important factors associated with transportation barriers to child health care access. The HTSI<sup>SM</sup> factors are: 1) population as a proxy for rural area and for travel distance; 2) poverty as a proxy for automobile ownership; 3) public transportation availability; and 4) health care provider workforce availability. Points are assigned for each factor based on area characteristics and are added together. Higher scores indicate greater risk for transportation barriers to child health care access.

To overcome these barriers, targeted communities should be prioritized for additional public transit resources and/or improved coordination between health care and transportation providers. Some potential strategies are suggested at the end of this monograph.

## OVERVIEW

# Health Transportation Shortage Index (HTSI<sup>SM</sup>)

There is mounting evidence that improving transportation access to care at the primary care and specialist levels is a cost effective way to improve health outcomes. Transportation is an essential component of access to care for isolated urban and rural populations.

The issue of transportation access to health care services has not been extensively studied, especially for children, nor has the question of how to identify communities and geographic areas in which transportation resources should be improved to enhance access to health care services been adequately addressed in the literature. A “transportation shortage” designation could be used to identify areas in which transit infrastructure is inadequate to support health care access similar to the federal designation to identify communities in which the health care workforce is inadequate for the population.

The federal Health Professional Shortage Area (HPSA) designation reflects the ratio of health care providers to population and is available for primary care, mental health, and oral health provider shortages. For the purposes of this document, we are focusing on the primary care HPSA designation. Strategies to improve workforce in HPSAs, all of which are facilitated for an area by the HPSA designation, include location of health professionals through the National Health Service Corps, loan forgiveness programs to encourage health professionals to work in these areas, enhanced reimbursement rates to help make service delivery financially viable, and perhaps most important, the establishment of federally qualified health centers (FQHCs) to develop or improve a health care safety net in the area.

Similarly, there are a variety of strategies to develop additional public transit resources in designated health transportation shortage areas, were they to be designated as such, as will be discussed in Section Four of this document. Children’s Health Fund (CHF) has developed a new health planning tool designed to facilitate the identification of communities in which transportation shortages compromise health care access. The Health Transportation Shortage Index (HTSI<sup>SM</sup>) allows health planners to score geographic areas by factors associated with transportation-related barriers to child health care access. Once identified, these areas can be prioritized for these strategies to improve local transportation infrastructure.

The HTSI<sup>SM</sup> instrument and scoring protocol are shown on pages 2 and 3, followed by a summary of suggested data sources to consult in scoring the HTSI<sup>SM</sup>. They are suitable for reproduction and use.

## The Health Transportation Shortage Index<sup>SM</sup>

Rate each of these 5 factors associated with transportation and health care access in points, as indicated, and add the points for the HTSI<sup>SM</sup> score. A total score of 6 or higher indicates a transportation shortage area. The higher the score, the higher the risk for transportation-related barriers to child health care access.

### 1 Type of area, based on population (using Census Bureau population data)

RURAL POPULATION ≤ 5,000	4 points
SMALL TOWN POPULATION > 5,000 AND ≤ 10,000	3 points
SMALL CITY POPULATION > 10,000 AND ≤ 20,000	2 points
URBAN AREA POPULATION > 20,000 AND ≤ 50,000	1 point
METROPOLITAN AREA POPULATION > 50,000	0 points

### 2\* Child poverty rate (% in poverty) exceeds US (using most current available data)

YES BY 1.25X OR GREATER	3 points
YES BY LESS THAN 1.25X	2 points
SAME AS US	1 point
LOWER THAN US	0 points

### 3 Public transportation availability

NONE	3 points
DEMAND-RESPONSE (E.G., PARATRANSIT)	2 points
LIMITED (DOES NOT RUN FULL-TIME AND/OR ROUTES DO NOT COVER TARGET AREA)	1 point
YES	0 points

### 4 HPSA designation

YES ENTIRE GEOGRAPHIC AREA	2 points
YES PARTIAL GEOGRAPHIC AREA	1 point
NO	0 points

### 5 FQHC in area (for high poverty areas; include rural health clinics)

NO	2 points
ONE	1 point
TWO OR MORE	0 points
NOT APPLICABLE (NOT A HIGH POVERTY AREA)	0 points

#### \* NOTES:

1. There is a strong negative correlation between poverty and automobile ownership (i.e., higher poverty rate is associated with lower personal vehicle ownership). The HTSI<sup>SM</sup> incorporates personal vehicle ownership through the poverty factor as a component of assessing available transportation resources.

2. If child poverty rate is not available for an area, family or household poverty rates may be used as representative because of the strong correlation among these three indicators.

## Data Sources for HTSI<sup>SM</sup> Scoring

The following are suggested sources to obtain data for use in scoring the HTSI<sup>SM</sup>. For most data points, multiple sources are available. These recommended sources have proven reliable; however, when more than one source is consulted, further investigation may be necessary to resolve possible contradictions.

### 1 Type of area, based on population

SOURCE: 2010 UNITED STATES CENSUS BUREAU DATA

Specifically the Interactive Population Map is recommended and yields data for designated geographic areas, e.g., county or Zip Code. This can be found at: <http://2010.census.gov/2010census/popmap>. There is a link from this page to the American Factfinder 2010 Census search page which can also be used. This can be found at: <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>

### 2 Child poverty rate

SOURCE: 2010 UNITED STATES CENSUS BUREAU DATA

Child poverty data are not uniformly available for all geographic areas. It may be necessary to substitute data for Families with Related Children Under 18. If 2010 Census data are not available for this category, the Census Bureau American Community Survey (ACS) can be used. The American Factfinder search page can be used to find ACS data for county or Zip Code. This can be found at: <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>

### 3 Public transportation availability

SOURCE: SPECIFIC WEBSITE FOR EACH STATE

A Google search of public transportation in each state is likely to yield useful results including links to transit resources. State Government websites often have links to that state's Department of Transportation. There is a page on the American Public Transportation Association (APTA) website with links to information on transit resources in each state. This can be found at: <http://apta.com/resources/links/unitedstates/Pages/default.aspx>

### 4 HPSA designation

SOURCE: HRSA WEBSITE

This can be found at: <http://hpsafind.hrsa.gov>

### 5 FQHC in area (for high poverty areas; include rural health clinics)

SOURCE: HRSA WEBSITE

Together with HPSA status, federally qualified health centers and other health resources are listed at this site: [http://findahealthcenter.hrsa.gov/Search\\_HCC.aspx?byCounty=1](http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1). A list of rural health centers is available at: <https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistbyprovidername.pdf>

An additional source is each state's specific Primary Care Association (PCA) Website, using the Community Health Centers link.

## SECTION ONE

# Background and Literature Review

### A. BACKGROUND

The literature on transportation and health care access has mostly focused on automobile ownership and on health care for adults<sup>1</sup> [1-3]. Travel distance is recognized as a factor that may undermine health care access. For children, transportation barriers for their parents and caregivers may lead to health care appointments being missed or not scheduled, including those for preventive care provided at well child visits [4, 5]. While the focus in this report is on access to primary care, the same issues—poverty, workforce shortages, travel distance, and availability of transportation resources—affect access to other health care services, including oral health [6, 7], specialist services, and mental health care [8].

Transportation shortages interact with health care workforce shortages [9]. The combination is most often seen together in poverty communities, especially in rural areas. In a Houston, Texas study, the rate of emergency department (ED) use in safety net hospital use was associated with health care provider shortages and even more strongly with neighborhood poverty [10]. A state-wide study of geospatial access to primary care during the decade 1990-2000 revealed overall improvements, with the exception of rural and some inner city areas. These were identified as extremely socioeconomically disadvantaged communities [11]. Transportation barriers to health care services emerged as a problem disproportionately affecting poor and minority children in the 2003-2004 National Survey of Children's Health [12].

Though transportation barriers are often cited in studies of barriers to health care access in urban [13-16] and suburban areas [17], the greatest travel distances and fewest health care providers are found in rural communities [18]. About one American in four lives in a rural area, but only about 14% of primary care providers practice in

rural America. For children, the ratio of pediatricians to population in rural areas is one-third of that in urban areas [19]. The poverty rate in rural areas is higher than that in cities [20, 21] and rural poverty is more entrenched because of issues like geographic isolation, sparse population density, and limited economic diversity and opportunities [22]. For residents of rural areas near metropolitan centers, the situation is somewhat improved because of the greater concentration of health care resources in the metro areas, but access to them still requires some form of transportation [23, 24].

### B. TRANSPORTATION AND CHRONIC DISEASE MANAGEMENT

#### ADULTS

Many studies that describe the impact of transportation shortages on health care access have been done with patients, typically adults, with chronic conditions. This reflects the prevalence of adult chronic conditions and their impact on U.S. health care expenditures. An estimated 60% of adults (18 years and older) have at least one diagnosed chronic health condition [25], and 75% of national health care expenditures are attributable to potentially preventable chronic disease [26, 27].

Diabetes is a chronic condition with increasing prevalence and a very high cost to the health care system. According to the Centers for Disease Control and Prevention (CDC), almost 26 million people, comprising 8.3% of the nation's population, have diabetes—including an estimated 7 million who are not yet diagnosed. The cost of medical care for patients with diabetes is 2.3 times higher than for non-diabetic patients, and their risk of premature death is also more than twice as high. In 2007, the annual cost of medical care for diabetes was \$116 billion [28]. The largest proportion was for hospitalization (50%), with only 9% attributed to ambulatory care visits [29].

Lack of transportation to health care sites emerged as a barrier to effective diabetes management in numerous qualitative studies exploring reasons for patient failure to adhere to preventive interventions and for higher rates of preventable diabetes hospitalization. While this was found to be especially problematic in rural areas [30], inner city patients were similarly affected by issues of cost and unavailability of transportation that interfered with diabetes management, including missed outpatient follow-up appointments after a diabetes hospitalization

[31, 32]. Transportation emerged as one of the most frequently cited barriers to adherence in diabetes self-management activities, including weight reduction and health education, and it was recommended that health care providers find ways to address patient transportation needs [33]. In rural areas, distance from home to a health care facility providing diabetes management services was a factor in the effectiveness of the diabetic patient's glycemic control. Travel distance greater than 10 miles has been associated with worse control of blood glucose levels [34, 35].

Transportation is a frequently cited barrier to screening, prevention, and management of other chronic conditions, including cancer [36]. Distance from home to a mammography facility was found to be a potential barrier for urban women seeking breast cancer screening. Public transportation travel time was a factor, as was the patient's access to a personal vehicle [37]. In a study of rural communities, people with a driver's license kept twice as many visits for check-ups and for chronic disease management as those who did not drive [38]. In another study, adult patients receiving transportation vouchers following an asthma ED visit were more likely to keep follow-up appointments with their primary care provider than those who did not receive transit assistance [39].

#### CHILDREN

For children, problems of health care access increase reliance on hospital ED visits for non-urgent care [40]. Asthma, the most common chronic medical condition of childhood, is an ambulatory care sensitive condition (ACSC) [41, 42], as its severity and morbidity may be reduced by effective management in primary care. In 2009, nearly one in five childhood hospitalizations (18.4%) were for asthma [43]. Hospitalization and ED visits for asthma comprise one of the highest child health care costs in state Medicaid programs. In many poor inner city communities, for example in New York City, asthma is the leading cause of pediatric hospitalization and ED use [44]. The annual cost of pediatric asthma care exceeds \$3 billion [45]. These costs may be reduced through effective management of the condition in primary care, thus reducing the costs for potentially preventable hospital stays and ED visits [46, 47].

Qualitative data gathered from parents using hospital EDs for their child's asthma care reveal problems accessing

timely primary care services to be a major factor [48]. Access barriers cited include lack of health insurance, high out-of-pocket expenses associated with commercial health insurance, and lack of available transportation [49]. Compared to children in cities, several studies reported that children in rural areas have been found to have more severe asthma symptoms and to be less likely to have been appropriately diagnosed and effectively treated, with high rates of ED utilization [50, 51].

In a qualitative study of non-urgent pediatric ED users in a rural Mississippi Delta hospital, 10% of parents or caregivers reported that they had missed or not scheduled a child health care appointment because of transportation problems in the past year. Virtually all of these children were publicly insured, principally by Medicaid. In this study, which used a semi-structured parent/caregiver interviewer, more than one respondent in five (21%) of the children had a presenting problem of "asthma" or a "breathing problem" [52].

Transportation barriers to effective asthma treatment for children are not an exclusively rural problem. Transportation has been cited by low-income inner city parents as a barrier to keeping follow-up appointments after their child had an ED visit for asthma [53]. A mobile asthma intervention program has significantly improved asthma outcomes for inner city children [54]. Among the benefits of improving the availability of Medicaid transportation services was reduced costs for asthma ED visits [55].

#### ACCESS TO SPECIALISTS

Access to specialty care is often a significant problem for people living with chronic conditions. A study of adult patients with cardiovascular disease in rural upstate New York found that the mean travel distance for primary care was 6.4 miles, while the mean distance to see a cardiologist was 32.6 miles. Despite the diagnosis of heart failure, only half (50%) of these patients even scheduled an appointment with a cardiologist [56]. Travel distance undermined access to emergency care for up to 15% of adults suffering from a stroke or myocardial infarction in a study done in rural East Tennessee using Geographic Information System (GIS) analysis. Delayed receipt of emergency care for these conditions increases the risk of death that could have been prevented with timely treatment [57].

<sup>1</sup> This literature review included only articles describing health care access in the United States and excluded articles descriptive of access barriers and strategies to address them in the United Kingdom, Canada and elsewhere.

Access to specialists is an essential component of comprehensive primary care for all children, but especially for poor and medically underserved populations [58]. An analysis of the geographic distribution of pediatric specialists found that the population-weighted average distance to a specialist ranged from 15 to 78 miles. Many specialist disciplines were not available at all in more than half of the hospital referral regions. For many pediatric specialty disciplines—including adolescent medicine, developmental pediatrics, pulmonology, and emergency medicine—the travel distance to a provider was 40 miles or more for almost one-third of U.S. children and families. The disparity between urban and rural health professional distribution for specialists is greater than that for primary care providers. Children in areas with high poverty rates and low population density (rural areas and small towns) had the longest distances to travel and worst access for pediatric specialty care [59-62].

### C. ECONOMIC AND REGIONAL DISPARITIES IN TRANSPORTATION RESOURCES

Compared to middle class and more affluent households, the working poor spend a higher percentage of their income on transportation including commuting to and from work. For the lowest 20% of wage earners, transportation costs are 42% of their annual income. The highest commuting burden is on those who use automobiles [63]. The cost of gasoline is especially problematic in rural areas and small towns because the typical family must drive 17% more miles per year than their urban counterparts. Access to all needed goods and services, including health care, is compromised [64].

Because rural areas generally have higher poverty rates than metropolitan areas and fewer public transit resources, transportation access is often dependent on the individual or household owning and maintaining a personal vehicle. Census Bureau data show that rural communities have the highest rate of automobile ownership (92.7% vs. 88.9% urban); however, approximately 1.6 million rural households do not own a vehicle. Regionally, counties with high rates of households without an automobile are concentrated in the south [65].

Historically, rural areas have the worst public transportation resources in the country. Reasons include attributes that frequently characterize rural communities: sparse

population density, geographic isolation, and long distances from metropolitan centers. Especially for the poor, public transportation is essential. The U.S. Department of Agriculture estimates approximately 40% of rural counties do not have adequate public transportation resources, including 28% with partial coverage (limited routes or schedules) and 14% with no public transit service at all [66]. Public transit may not be a useable option even if it is otherwise available within the geographic area because many rural communities are not included in public transit routes [67].

The Institute of Medicine has identified transportation availability as a barrier to health care access in rural areas, and improving transportation availability as an important element of improving rural health [68]. This echoes a 1990 report from the Congressional Office of Technology Assessment which found transportation access to health care to be a problem even in relatively populous rural communities [69].

### D. BENEFITS OF TRANSPORTATION ASSISTANCE

Within Medicaid, transportation, like outreach, translation, and other non-medical patient support services, is considered an “enabling service.” Federally qualified community health centers are integral to the health care safety net for Medicaid-covered and uninsured patients. More than half offer transportation services. Providing transportation assistance improves access to care and retention in special health care programs, e.g., for substance abuse counseling [70].

In 2005, the Altarum Institute for the Transportation Research Board of the National Academies analyzed the economic value of providing transportation to facilitate access to five preventive health services and care and management of seven chronic conditions. Cost savings, defined as a lower total cost for transportation plus health care compared to baseline health care costs, were found for prenatal care, asthma, cardiovascular disease and diabetes. Non-emergency medical transportation was “highly cost-effective” for patients who needed influenza vaccines and preventive dental care, and for patients with four other chronic conditions: chronic obstructive pulmonary disease, hypertension, depression and other psychiatric disorders, and end-stage renal disease [71].

Experiencing barriers to timely receipt of primary health care is associated with preventable ED use. The impact of barriers to health care access is cumulative: patients experiencing more barriers are more likely to use an ED for non-urgent care. In a secondary analysis of National Health Interview Survey data two transportation-related barriers emerged: “no transportation” and clinic “not open when able to get there.” Transportation assistance and scheduling appointments when transportation resources are available are predicted to reduce preventable ED use [72], an important step in controlling health care costs.

For children, a benefit of providing transportation for primary care visits is increasing receipt of preventive health services. In a comprehensive 2009 report assessing Texas’s Medical Transportation Program, which provides non-emergency medical transportation (NEMT) to children and families covered by Medicaid, patients who used NEMT services missed fewer health care appointments and received more preventive health care services. In Medicaid, pediatric preventive care is included as part of Early and Periodic Screening, Diagnosis and Treatment (EPSDT) services. Among Medicaid EPSDT services are hearing, vision, developmental and dental screening, all services that promote child health and well-being including school readiness [73].

### E. QUANTIFYING THE EXTENT OF THE PROBLEM

Most of the studies cited provide qualitative and anecdotal information about the role of transportation in facilitating health care access. There have been few attempts to quantify the extent to which access to care is compromised by inadequate availability of transportation.

The term “transportation disadvantaged” has been used to describe people who, for one of a variety of reasons (generally poverty, disability, or age), are “unable to transport themselves or purchase transportation” [74]. The transportation disadvantaged designation has been related to social and environmental justice, focusing on transportation as a way to ensure equal access to goods and services [75]. The Government Accountability Office (GAO) has used this approach to quantify transportation disadvantaged populations by applying Census Bureau data and aggregating the number of people who are over age 65, who have a disability, and who have a household income at or below the poverty level. Using 2000 Census

data, the GAO found that 35.1 million people fall into these categories but acknowledged that many, but not all, have significant problems accessing needed transportation services [76]. Children not yet of driving age have also been included in the transportation disadvantaged population by the Federal Transit Administration [77].

This transportation disadvantaged designation is likely to overestimate the population in need of additional transit resources to facilitate access to health care. Many older adults continue to own and operate their own vehicles, transportation services are often made available specifically for people with disabilities, and people living in poverty may have access to public transportation and/or a personal vehicle. Also, Medicaid NEMT services may be available to otherwise transportation disadvantaged poverty populations to facilitate health care access. The transportation needs of children are likely to be met to the extent that their parents have adequate transportation resources. Targeted transit resources may be available, such as school buses provided by local education agencies.

Another approach to quantifying the problem is the use of survey methodology to identify the proportion of specific populations with transportation barriers to health care access. These results may only be generalized to the population at large if a nationally representative population was surveyed. The criterion typically used to identify a transportation barrier to health care access is having missed a health care appointment or having not scheduled an appointment during the preceding twelve months.

Two surveys of access to care for low-income adults at community health centers had similar results. In one done in Portland, Oregon (N=75) nearly one-third, 32%, reported that they had missed a health care appointment during the preceding twelve months because of transportation problems [78]. In a similar study in Montgomery County, Ohio (N=413), 30.5% of adults had missed health care visits because of transportation barriers [79]. By contrast, using nationally representative federal household survey data, Altarum Institute estimated that less than 2% (3.6 million people) each year missed or did not schedule a health care appointment because of transportation [71]. The discrepancy between this estimate and those derived from the much smaller surveys of low-income community health center populations strongly suggests that the impact of transportation as a barrier to health care access is not uniformly distributed across the income spectrum,

with poor and low-income families more affected. Estimating the extent of the impact of transportation on health care services access should therefore include both national and targeted regional surveys.

## SECTION TWO

# Original research leading to the HTSI<sup>SM</sup>

### A. PRELIMINARY INFORMATION GATHERING

#### PUBLIC FORUMS

During August 1998, one year after the passage of legislation to expand child health insurance through the State Children's Health Insurance Program (SCHIP), Children's Health Fund (CHF) held a series of public forums to discuss access to child and family health care. These were convened in cities (Washington DC, Philadelphia PA, and Nashville TN) and rural communities in Mississippi, West Virginia and Arkansas. Participants included state and local government officials, health care providers, administrators, and consumers.

Focus group participants emphasized that health insurance was not sufficient to guarantee access. Travel distance to the nearest health care facility was often 30 miles or more, and public transportation was generally unavailable in these rural communities. Many families could not afford to own or maintain an automobile. For some families one car was not enough because the wage earning parent used it to commute to work, leaving the other parent and children without transportation. Parents reported that public transportation in their communities was inadequate, and that children frequently missed school days because of conditions like asthma [80].

#### INITIAL SURVEY RESEARCH

CHF followed up these findings by commissioning the polling firm Zogby International to conduct a national survey of transportation and child health care access.<sup>2</sup>

<sup>2</sup> The survey was conducted during March 2001 using random digit dial (RDD) sampling methodology. The sample was comprised of 903 parents or guardians with a dependent child less than 17 years old living in the household. Race-ethnicity was representative of the most current U.S. Census Bureau data. All (100%) of respondents had a household income under \$50,000; 46% lived in an urban/metropolitan area, 17%

### Key Findings:

- Nearly 9% of parents reported missing or not scheduling at least one child health care appointment during the preceding twelve months because transportation was not available
  - Among children in families with incomes below \$15,000, 20% missed health care visits because of transportation
- Distance from home to a source of pediatric care was problematic: 31% of families lived more than 10 miles from the nearest health care site, including 7% that lived between 25 and 50 miles away
- More than half, 51%, of rural residents lived more than 10 miles away from their usual source of pediatric care compared to 17% in big cities
- Public transportation was available in barely half of the communities
  - Range: 21% in rural communities to 79% in big cities
- 90% of respondents owned at least one functioning automobile
  - The highest rate of households with no personal vehicle was the lowest income bracket, with 37% of households with incomes less than \$15,000 not owning a car
- Only 41% of parents whose children were covered by Medicaid were aware that transportation assistance is included as a benefit
  - Only 12% had ever used Medicaid NEMT
- Compared to children who had not missed an appointment, nearly three times as many children who missed a health care appointment because transportation was not available used a hospital ED at least once annually (35% vs. 12%).

in a suburb and 36% in a rural area. Child health insurance coverage: commercial, 65%; public, 26%; uninsured, 10%. Asthma had been diagnosed for 15% of children; 11% had a chronic health condition other than asthma. Margin of error was +/- 3.5%.

### B. THE CHF/MARIST INSTITUTE NATIONAL TRANSPORTATION SURVEY

CHF, with the Marist College Institute for Public Opinion, designed a national transportation survey in September 2006 to further understand the scope of the problem and identify factors associated with transportation barriers to child health care access. This telephone survey was done with a national sample representative of the U.S. population based on the most recent available Census Bureau demographic data. Questions were designed to elicit information about available transportation options and child health care access and utilization. Items included questions to ascertain difficulty finding a usual source of pediatric care. This was used as a proxy for barriers to child health care access, as it has been found to be significantly associated with preventable hospital ED use especially in rural communities [81, 82].

Details of survey methodology and demographics of the sample are summarized in Text Box 1 and 2 on pages 10 and 11.

### Key Findings:

#### 1. TRANSPORTATION AS A BARRIER TO CHILD HEALTH CARE ACCESS

The results show that each year, 4% of U.S. children, regardless of income or health insurance status, missed or did not have a scheduled health care appointment because transportation was not available. Of those that missed a health care appointment because of transportation barriers, nearly one-third later used a hospital emergency department (ED) to treat the condition for which that appointment had been missed. This translates to approximately 3 million children who miss needed health care each year because of difficulties with transportation and as many as one million pediatric ED visits that could be avoided through timely transportation-assisted access to primary care.

#### 2. TRANSPORTATION, TRAVEL DISTANCE, AND INCOME

The availability of public transportation varied significantly by type of community (p<0.01) and by region of the country (p<0.01). Public transportation was least available in rural areas. By region, public transportation was least available in the South and Midwest (50% and 53% respectively). By contrast, automobile ownership did not vary significantly by type of community or by region of the country. Variations in availability of transportation resources by type of community are shown in Figure 1 below.

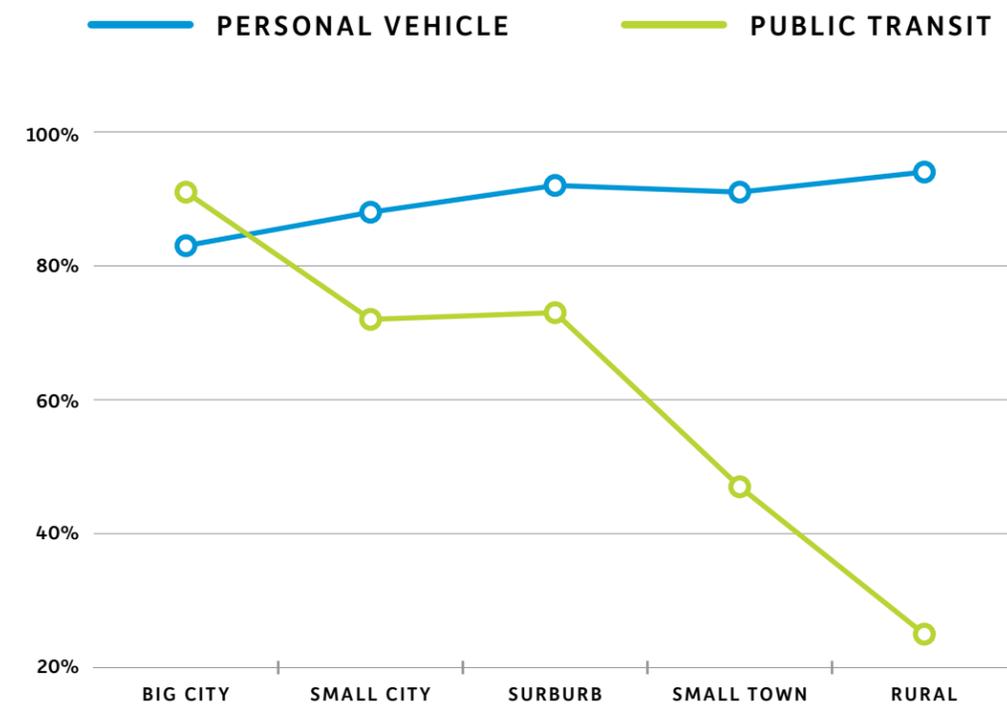


FIGURE 1  
Transportation resources by type of area

The mean travel distance to the family's usual source of pediatric care was 9 miles (range, 1-200 miles; standard deviation, 14.6 miles). More than one-third (35%) of parents had to travel ten or more miles to their child's usual source of care. Travel distances were significantly longer in rural areas and small towns, with more families reporting travel distances of 10 miles or more (47.9% vs. 26.5% in cities;  $p < 0.01$ ). Annual household income was significantly lower in rural areas and small towns than in cities (61.6% with income less than \$50,000 in rural areas compared to 49.1% with incomes less than \$50,000 in cities;  $p < 0.01$ ), consistent with the higher economic burden of transportation in rural areas.

More than half of parents (53%) reported they did not have public transportation from home to their usual source of pediatric care. This includes 34% with no available public transportation in the community and another 19% with transportation in the community that could not be used to get to a health care site.

### 3. USUAL SOURCE OF PEDIATRIC CARE

Type of community was significantly associated with difficulty finding a usual source of pediatric care ( $p < 0.05$ ). More than half (55%) of families who reported difficulty finding a usual source of care lived in rural areas (25%) and small towns (30%). Difficulty finding a usual source of care was significantly associated with longer travel

distances ( $p < 0.05$ ) and with lack of public transportation in the community ( $p < 0.01$ ), but not with lack of personal vehicle ownership. Families reporting difficulty finding a usual source of pediatric care were significantly more likely to report using a hospital ED for routine care (20% vs. 6%;  $p < 0.01$ ). Difficulty finding a usual source of pediatric care was also associated with lower income ( $p = 0.01$ ), as summarized in Figure 2. Among the families who reported difficulty finding a usual source of care, 16% had missed a child health care appointment or did not schedule one because transportation was not available during the preceding 12 months. Half, 50%, of these parents reported later bringing their child to a hospital emergency department for the same condition associated with the missed appointments.

### 4. ACCESS TO SPECIALISTS

Pediatric specialists generally practice in hospital settings, often in teaching hospitals which typically are located in urban centers. Access barriers to specialist care are exacerbated by limitations of many public transportation systems in reaching hospitals. Overall, more than half, 54%, of parents reported that they did not have public transit access to a hospital. Hospital access by public transportation was significantly worse in rural areas and small towns than in cities (69.6% without a public transit route to a hospital vs. 39.5%;  $p < 0.01$ ).

### 5. TRANSPORTATION ACCESS, CHILD HEALTH INSURANCE STATUS, AND FAMILY INCOME

There were no significant differences in availability of public transportation for families based on household income or on type of child health insurance (public, Medicaid or CHIP<sup>3</sup>, compared to commercial insurance). Automobile ownership, however, was significantly lower for families of children on public health insurance compared to commercial insurance ( $p < 0.01$ ). This reflected variance in automobile ownership by household income, with 13.8% reporting no owned vehicle in families with incomes below \$50,000 vs. 3.5% in families with income of \$50,000 or higher ( $p < 0.01$ ).

<sup>3</sup> Typically Medicaid covers children at the federal poverty level (FPL) or up to 125% or 150% of FPL with CHIP filling in the gap from the upper limit for Medicaid eligibility to 200% of poverty in most states. Some children with disabilities or other special health care needs may be deemed Medicaid eligible regardless of family income. [See: Medicaid and CHIP Payment and Access Commission. Report to the Congress on Medicaid and CHIP. March 2011. Available at: <http://www.macpac.gov/reports>. Accessed October 27, 2011.]

#### TEXT BOX 2

### CHF-Marist Transportation Survey

#### Demographics of the sample

HOUSEHOLD INCOME	
12%	less than \$15,000
23%	\$15,000 to just under \$25,000
23%	\$25,000 to just under \$50,000
16%	\$50,000 to just under \$75,000
9%	\$75,000 to just under \$100,000
12%	\$100,000 or more
(5%)	no response/unsure)
AREA OF RESIDENCE	
37%	City
21%	Suburb
26%	Small town
17%	Rural
RACE-ETHNICITY	
74%	White
13%	African-American
13%	Latino
REGION	
22%	East
22%	Central
33%	South
23%	West

Significantly more parents of children covered by public insurance reported difficulty finding a usual source of pediatric care than did commercially insured children (10.3% vs. 8.1%;  $p < 0.05$ ). There were no significant differences in reported difficulty finding a usual source of pediatric care between uninsured children and children covered by public insurance.

### C. THE DELTA RURAL POLL

The CHF/Marist Institute Transportation Survey revealed that while transportation availability was a problem with a national dimension, rural communities, poor and minority populations were most affected. To focus more specifically on these groups, CHF worked with a regional survey group to replicate key questions from the national survey in a geographically targeted area. A rural, poor, and predominantly minority area, the Mississippi Delta, was selected for survey replication. The selection of the Mississippi Delta for this follow-up survey was based on experience providing health care within the CHF National Network. Focusing on targeted low-income communities also helped control for potential sampling bias that has been associated with random digit dial telephone surveys. There is concern that this method, which typically relies on lists of land-line telephone numbers that have been relatively stable over time may under-represent populations that rely on cellular phones, that are residentially unstable, and that do not readily respond to telephone survey inquiries. These

#### TEXT BOX 1

### CHF-Marist Institute Transportation Survey: Demographics of the sample

The survey was conducted by Marist College Institute for Public Opinion from September 18 through September 21, 2006. A total of 1,819 adults 18 years of age and older within the continental United States were interviewed by telephone, of whom 610 were parents with children age 18 and under living in their household. Interviews were conducted in English and Spanish.

Data collection was done from a centralized telephone facility using interviewers trained in conducting household surveys and specifically briefed on this study. Supervisors regularly monitored, evaluated, and provided feedback to the interviewing staff during all scheduled shifts.

The margin of error for the entire survey was  $\pm 2.5\%$  and is higher for the parent subset and for cross-tabulations. All analyses were weighted to further ensure demographic representativeness of results.

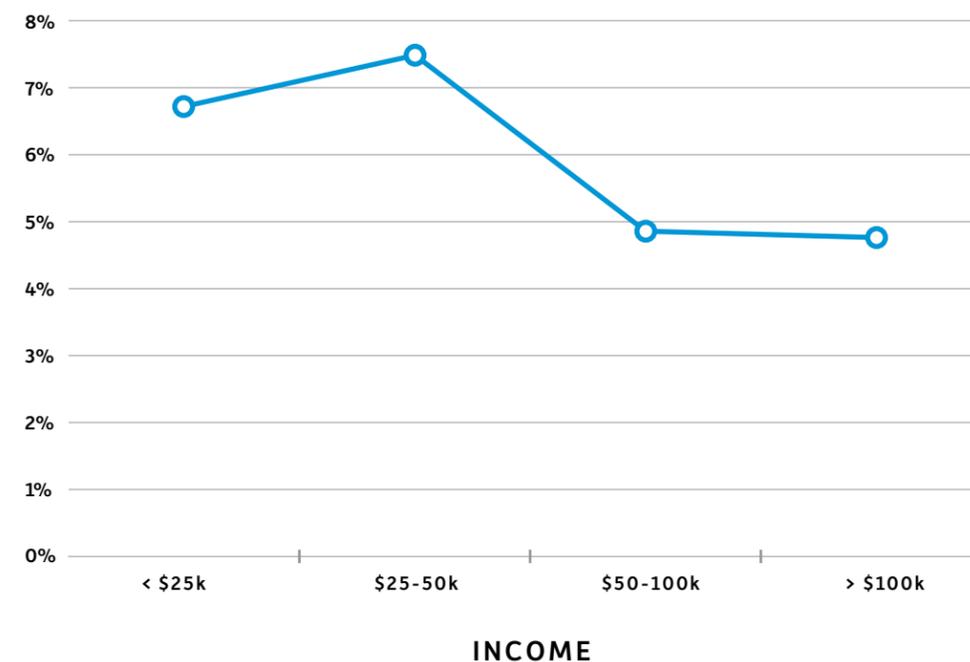


FIGURE 2  
No Usual Source of Pediatric Care by Household Income Level

surveys may therefore under-represent poor and minority populations [83, 84]. Working with a consultant from Delta State University in Cleveland, Mississippi, key questions from the CHF/Marist survey were incorporated into the 2011 Delta Rural Poll (DRP), a telephone survey of residents of 11 counties in northwestern Mississippi. This survey focused exclusively on a predominantly minority, rural population. The methodology is summarized in the Text Box 3 below.

### Key Findings:

#### 1. TRANSPORTATION RESOURCES, TRAVEL DISTANCE, AND CHILD HEALTH CARE ACCESS

In this survey of Mississippi Delta residents, two-thirds (67%) reported there was no public transportation in their community, while 19% reported not owning a personal vehicle. Not having a personal vehicle was significantly associated with not scheduling a child health care appointment ( $p < 0.01$ ), and 45% of families without a car reported having missed a child health care appointment because of lack of transportation ( $p < 0.01$ ). Not having public transportation available was evenly distributed between those who had missed a child health care appointment because of transportation and those who had not.

Half (49.8%) did not have a federally qualified health center (FQHC) or rural health center (RHC) in their county. In these rural counties, 9.6% of parents reported having missed or not scheduled a child health care appointment

#### TEXT BOX 3

##### The 2011 Delta Rural Poll: Methodology

The 2011 Delta Rural Poll was conducted by the Survey Research Laboratory of the Social Science Research Center at Mississippi State University working with the Institute for Community-Based Research at Delta State University in February 2011. The sampling was done for households in eleven counties in the Mississippi Delta (Bolivar, Coahoma, Humphreys, Issaquena, Leflore, Quitman, Sharkey, Sunflower, Tallahatchie, Tunica, and Washington). Respondents were selected using a random digit dialing (RDD) procedure that included households with unlisted numbers. Demographically, 63% of respondents were African-American, 35% white, and 1% Hispanic or Asian. The margin of error was +/- 3.0% at a 95% confidence interval. All analyses were weighted to further ensure demographic representativeness of the results. For more information on the Delta Rural Poll, see: <http://ntweb.deltastate.edu/abarton/DeltaRuralPoll/DRPHome.htm>.

during the preceding twelve months because of transportation. All of these children were in families with an annual income under \$50,000, and missing or not scheduling a child health care appointment because of transportation problems was significantly associated with lower annual household income ( $p < 0.01$ ). Thirty percent of the children who missed a health care appointment because transportation was not available had been previously diagnosed with asthma<sup>4</sup>, and 29% later received ED care for the same health problem for which care was missed.

Travel distance to a usual source of pediatric care was significantly greater in areas with lower population ( $p < 0.01$ ) and lower income ( $p < 0.01$ ). Overall, 9.5% of parents reported not having a usual source of pediatric care for their child. No usual source of pediatric care was reported by 18.9% of families with an income under \$30,000. Factors associated with not having a usual source of pediatric care were not having a personal vehicle (25.9% vs. 7.8% with a car;  $p < 0.01$ ), and more hospital ED visits for routine care ( $p < 0.01$ ).

#### D. A MODEL LINKING TRANSPORTATION RESOURCES AND CHILD HEALTH CARE ACCESS

The factors associated with transportation-related child health care access barriers (indicated by difficulty finding a usual source of pediatric care) were rural residence, long travel distance, lack of available transportation, and lower income. The survey results support using availability of public transportation as the significant transportation factor when looking at a large geographic area, for example a specific county within a state. Within a geographic area identified as being deficient in its public transit infrastructure, whether the family has a personal vehicle is a significant factor, mediating the potential impact of unavailable public transportation on child health care access. Because of the strong association between income and vehicle ownership, the area's poverty rate may serve as a proxy for the percentage of families with no owned vehicle. Higher income and vehicle ownership mediate the potential impact of public transportation shortages on health care service access.

<sup>4</sup> In this survey, 21.2% of children had been diagnosed with asthma.

#### E. VALIDATING THE MODEL USING GEOGRAPHIC INFORMATION SYSTEMS (GIS) DATABASES

Geospatial access barriers, specifically the availability of health care providers in the community and of transportation to facilitate geographic access, comprise a major reason why having health insurance is not enough to ensure access to care. For these reasons, and to validate the factors determined from the Marist and Delta surveys to be the key predictors of transportation barriers to child health care access, several additional data sets were developed. These involved complex analyses using GIS mapping to ascertain geospatial access to primary care services.

##### 1. METHODOLOGY

**Choice of location.** As hospital discharge data were most readily available from Texas, it was chosen as the location for the GIS mapping study. However, rural hospitals were exempt from many state reporting requirements, resulting in missing data in rural areas, especially if not proximate to a metropolitan center. As a consequence, data were unavailable for areas with the highest risk of health care access barriers because of sparse population density, long travel distances, and poverty. The analysis focused on Austin (Travis County), Dallas (Dallas County), and Houston (Harris County) because relatively complete data sets for each were available, and each county presented a mix of urban and rural areas.

**Selection of measures.** The rate of hospital ED use for ambulatory care sensitive conditions (ACSC), based on hospital discharge data from a state health department, was used as the outcome variable. High ACSC-related hospital use is a commonly used proxy for lack of access to primary care, and is considered to reflect health professional workforce shortages, poor geospatial access to care, lack of appropriate health care services to the community, and demographic factors including low income [85]. In a report done for the Centers for Medicare and Medicaid (CMS) using hospitalization rate for ACSCs as the principle indicator for access to health care, it was found that geospatial access to care, including transportation resources and travel distance, were key factors associated with ACSC-related hospitalization rates in the Medicare population [86].

In these analyses, all ACSC-related hospital ED discharges

#### TEXT BOX 4

##### Factors Associated with Poverty

The percentage of households in poverty is strongly associated with:

- Percentage of minority population ( $p < 0.01$ )
- Percentage of population with no high school diploma ( $p < 0.01$ )
- Percentage of households headed by a single mother ( $p < 0.01$ )
- Percentage of zip codes with at least 50% of population living in a HPSA ( $p < 0.01$ )
- Percentage of households with no owned automobile ( $p < 0.01$ )

were included, with the principle diagnosis being asthma. Other variables were Census Bureau data points including race-ethnicity, income, educational attainment, per capita automobile ownership, and commuting distance to work as an indicator of travel distances in the community. Public transportation routes and federally qualified health center (FQHC) and rural health clinic (RHC) locations were mapped. Distance to health care sites was determined by calculating the straight line distance from the area's geographic centroid to the nearest FQHC. Health Professional Shortage Area (HPSA) was coded based on primary care HPSA status only.

Factor analysis revealed significant associations among the variables (see Text Box 4). Further details on the methodology to assess transportation resources are summarized in Text Box 5, page 16.

Target areas were designated as "hot spots" if their three year average rate for ACSC-related ED use was above the 75th percentile for the area. In this analysis, hot spots were identified at the Zip Code Tabulation Area (ZCTA) level.<sup>5</sup>

To describe the characteristics of hot spots, frequencies were generated for multiple variables, including: percent of children living in poverty; workforce shortages (percent of population living in a federally designated primary care health professional shortage area- HPSA); percent

<sup>5</sup> Several Zip Codes were excluded principally because of small population (fewer than 1,000 children) and very unstable rates even after averaging.

of population living in a designated rural area; distance to nearest FQHC; percent of households without a personal vehicle; and public transportation coverage.

## 2. RESULTS

**Factors associated with hot spots.** The key factors associated with areas with the highest rates of ACSC-related ED use within the county were higher poverty rates, rural area designation,<sup>6</sup> and longer travel distances from residential areas to health care sites (each  $p < 0.01$ ). Hospital ED use was significantly higher in Zip Codes where the travel distance to the nearest FQHC was ten miles or more ( $p < 0.01$ ). Within the Zip Code, not having a personal vehicle and living in a designated primary care HPSA were each independently significantly associated with higher rates of ACSC-related ED use.

**GIS Mapping.** Utilizing GIS mapping, a map indicating ACSC-related ED use was prepared for the metro Austin area of Travis County Texas (Figure 3). This map shows the concentration of health care resources (FQHCs) and public transit routes to be in the central city. The number of public transportation routes (scheduled stops) and of FQHCs is notably lower in areas more distant from the metropolitan center. The rural areas to the southwest and northeast are seen to differ significantly in their rates of ACSC-related ED use despite both areas being increasingly rural and distant from public transportation routes. The difference in ED use is explained by the high poverty rate (more than 25% above the national rate) in the southeast, and the low poverty rate (more than 50% below the national rate) in the northwest.

Factor analysis in the GIS data set showed a high negative correlation between poverty and automobile ownership; that is, the higher the percentage of households living with income below the federal poverty level, the lower the percentage of households with an owned automobile ( $p < 0.01$ ). This analysis strongly suggests that personal resources mediate the impact of public transportation

shortages, as indicated by the lower rate of ACSC-related ED use in the high income communities to the northwest of the metro Austin area compared to the low income communities to the southwest.

**Validating the model.** This methodology was repeated in another Texas county with diverse urban-rural areas, Harris County, including the city of Houston. This analysis provided additional information on the characteristics of hot spots: areas with the highest ACSC-related ED use had child poverty rates 1.25 times higher than the 2006 U.S. child poverty rate, and 1.57 times higher than that in areas with the lowest ACSC-related hospital use.<sup>7</sup> As in Travis County, significantly more of these hot spots were in rural areas than metro or urban ( $p < 0.01$ ). Also consistent with results for the Travis County/metropolitan Austin area, greater travel distance to nearest FQHC was significantly associated with rural area designation ( $p < 0.01$ ) and with high ACSC-related ED utilization rates ( $p < 0.05$ ). At the Zip Code level, the percent of the population living in a primary care HPSA was significantly associated with higher rates of ACSC-related ED use ( $p < 0.05$ ). Also associated with higher rates of ED use was the percent of households with no personal vehicle ( $p < 0.01$ ).

## 3. LIMITATIONS OF THE GIS MAPPING MODEL

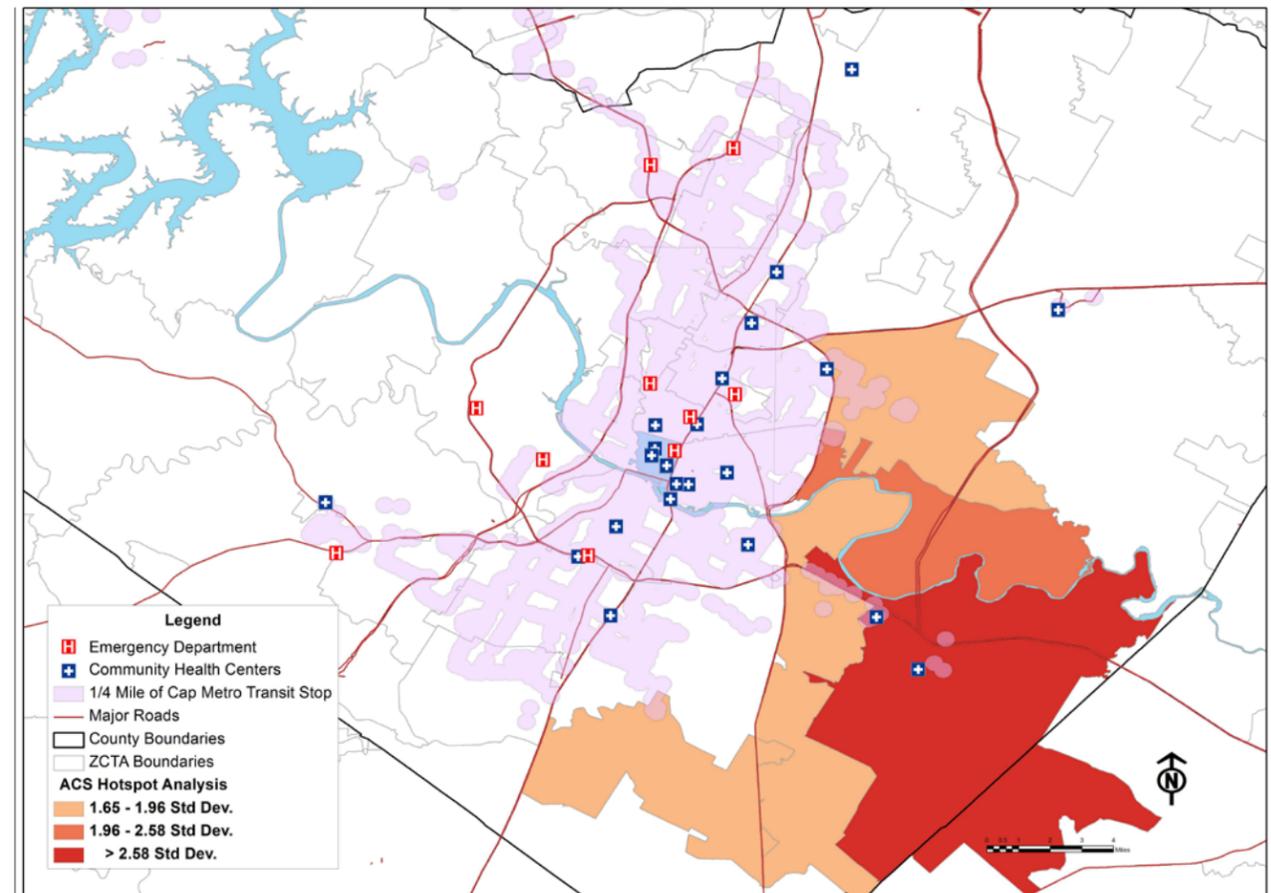
The data points used in the GIS methodology proved valuable in validating the key factors contributing to geospatial and other access barriers to health care. Problems with availability of data, however, rendered broader application of this methodology unsuitable for use in diverse states and communities throughout the country. Data for ACSC-related hospital ED use were not consistently available among the states. Some states did not make hospital discharge data publicly available at all, and in those that did, these data were least available for rural areas because rural hospitals were often exempt from reporting requirements. Public transit route information and data for per capita automobile ownership were not consistently available for all municipalities and communities. In order to develop a tool that could be used consistently, it was necessary to select factors for which data were readily and consistently available across all communities, counties, and states of the country. The lack

6 Rural designation reflected the highest quartile for "rural" characteristics using the Beale Rural-Urban Code. This assigns a numeric value on a continuum from 1 (central counties in a metro area with a population >1 million) to 9 (completely rural with a population <2,500 and not adjacent to a metro area). See Artz GM & Orazem PF. Reexamining Rural Decline: How Changing Rural Classifications and Short Time Frames Affect Perceived Growth. Paper presented at the American Agricultural Economics Association Annual Meeting, Providence RI. July 24-27, 2005. Available at: <http://ageconsearch.umn.edu/bitstream/19408/1/sp05ar01.pdf>. Accessed April 1, 2011.

7 Comparison was made with areas that had a three-year average rate below the 25th percentile for the area.

FIGURE 3

Map of Austin TX area indicating areas with high rates of ambulatory care sensitive condition-related ED use



of all data points used in the GIS analysis, principally the outcome variable, ACSC-related ED use, in diverse communities precluded the use of that data model on a larger scale. Further details are contained in Text Box 6. The resulting tool, the CHF Health Transportation Shortage Index (HTSI<sup>SM</sup>) was designed using difficulty finding a usual source of pediatric care as the outcome variable and incorporated factors associated with that variable as indicated in the survey research previously summarized.

#### TEXT BOX 5

##### Additional Considerations Regarding Personal Vehicle Ownership

The overall approach in designing the HTSI<sup>SM</sup> was to aggregate multiple complex indicators into a single dimension for the purpose of generating a single score reflective of this multiplicity of data. [a] For the transportation factor, the indicators were population access to private automobiles or other owned vehicles and to public transportation.

The measurable indicators for access to a private vehicle were the percentage of households without a car or other owned vehicle, and the ratio of vehicles to the driving-age population. U.S. Census Bureau data at the Zip Code level were used. For public transportation access, the indicator was the proportion in each Zip Code within walking distance (defined as 1/4 mile or less) of a fixed route public transit stop. The proportion of each Zip Code accessible to public transit was then weighted using a public transportation Effectiveness Rating Score as developed by researchers at the University of South Florida. [b]

Personal vehicle ownership may not be a necessary component of transportation access to health care or other services in areas where there is adequate availability of a public transportation. We therefore developed a weighting system in the analyses to account for such areas and to more comprehensively and accurately measure transportation availability in diverse communities. This methodology weighed down (de-emphasized) the importance of a private vehicle in areas where public transportation was highly available (high transit score). Where transit options were not available (low transit score), the model placed more emphasis on the availability of a private vehicle.

[a] Landrum MB, Bronskill SE, Normand, ST. Analytic methods for constructing cross-sectional profiles of health care providers. *Health Services & Outcomes Research Methodology*. 2000; 1: 23-47.

[b] Perk V, Nilgun K, Salzer M. (2004). *Benchmark Rankings for Transit Systems in the United States*. Tampa, FL: National Center for Transit Research. Available online at: <http://www.nctr.usf.edu/pdf/527-03.pdf>. Accessed October 18, 2011.

## SECTION THREE

# The Health Transportation Shortage Index (HTSI<sup>SM</sup>)

Similar to the designation of Health Professional Shortage Areas (HPSAs) to target communities in need of additional health care workforce resources, the HTSI<sup>SM</sup> can be used to target areas for improved transportation infrastructure to better support health care access. Using the HTSI<sup>SM</sup>, factors significantly associated with child health care access barriers, focusing on availability of transportation resources, are rated and a composite score for a geographic area is derived. Factor analysis was used to ensure that specific variables excluded from the HTSI<sup>SM</sup> were accommodated in the determination of a shortage area through included variables as proxies based on the high degree of correlation (multi-collinearity) among the variables. The result is an instrument that allows for objective and replicable identification of areas with inadequate transit infrastructure that should be the focus of interventions to improve health care access.

The key variables in the HTSI<sup>SM</sup> are:

- Type of geographic area
- Income (poverty rate)
- Public transportation availability
- Health professional workforce
  - Primary care HPSA designation
  - Health care safety net programs indicated by presence of federally qualified health centers or FQHCs (including rural health centers or RHCs)

The key excluded variables are:

- Personal vehicle ownership
- Travel distance from home to health care facilities
- Primary care resources other than FQHCs and RHCs

### A. TYPE OF AREA

There are several different approaches to defining what constitutes a “rural” area. The key components of a definition of rural include density (low population density), size (relatively small geographic area), and location (geospatial isolation, e.g., from metropolitan centers) [87, 88]. For the purpose of scoring the HTSI<sup>SM</sup>, we used a valid method that uses the most readily available data, the population-based area designations used by the U.S. Department of Agriculture [89]. In large and diverse geographic areas, e.g., cities like New York, Chicago or Los Angeles, we recommend that Zip Code level data be used to accurately target the area of focus.

### B. INCOME (POVERTY)

Based on survey data and the analysis of hot spots in the Geographic Information System (GIS) databases, a poverty rate equal to or higher than the U.S. poverty rate current at the time of analysis can serve as constituting risk for child health care access barriers, with higher risk associated with poverty rates that exceed the national rate to a greater degree. In our analysis, the threshold was 25% or higher. The poverty rate (percentage with income at or below the federal poverty level) used in scoring the HTSI<sup>SM</sup> may vary based on the data that are available for the area of focus. For some communities the available data point will be the percentage of families in poverty and/or the percentage of households in poverty. For other areas, especially cities, the child poverty rate will be available. Based on factor analysis of the GIS data set, these data points—percentage of child, family and household poverty—are highly correlated ( $p < 0.01$  for each, range from  $p = 0.001$  to  $p = 0.005$ ), so any may be used as a valid indicator of child and family poverty in the area.

### C. TRANSPORTATION AVAILABILITY

While “public transportation” in the national survey referred to fixed-route transit systems, the value of a fixed-route transit system for health care access is mediated by its hours of operation and its routes [90]. Rural communities often have paratransit systems that differ from fixed route mass transit in being “booked” on a personal or per-use basis. Users may have to call in advance and specify pick-up and drop-off locations, a “demand-response” model that is not unlike taxi service. Cost may

be greater than mass transit because fewer riders use the service and the cost may be shared by users rather than principally borne by the municipality that operates a mass transit system [91]. Paratransit systems may be functional for health care access under some circumstances, but not necessarily at all times of the day or all days of the week. The necessity to call 24 hours or more in advance makes such systems unusable for urgent health care needs, although these systems may be useful for appointments scheduled in advance. Paratransit systems may offer relatively limited geographic coverage, with some residential areas and/or health care sites excluded.

The HTSI<sup>SM</sup> scoring was designed to distinguish among extensive fixed-route mass transit systems, fixed-route public transportation systems limited in the coverage of their routes and/or hours and days of operation, demand-response paratransit systems, and the absence of all types of public transportation.

### D. WORKFORCE AVAILABILITY

There are three types of HPSA designations: primary care, dental, and mental health. The HTSI<sup>SM</sup> is designed to be used with the primary care HPSA designation. Survey research with adult residents in primary care HPSAs reported that designated areas had worse self-reported health statuses and more access problems, indicated by reported difficulty finding a usual source of care, than residents in non-HPSA designated areas [92].

This supports the continued utility of the HPSA designation in targeting areas without adequate health care resources [93] despite the complex relationship between the HPSA designation and access to care [94, 95]. When an area is designated as a primary care HPSA, it is prioritized for the development of new primary care resources such as federally qualified health centers and rural health clinics. Once such facilities are established, the availability of health care professionals increases, as does the ratio of providers to population. One study found that many primary care HPSAs exceeded the designation’s threshold ratio of providers to population, indicating that while the HPSA designation had been effective in increasing the availability of health care resources to the area, its persistent designation may not reflect these changes [96].

The HTSI<sup>SM</sup> therefore assesses workforce availability by rating both the primary care HPSA status of the area and

## TEXT BOX 6

### Additional Considerations ACSC-Related Utilization Rates

We attempted to estimate ACSC-related ED utilization rates in the rural areas of Texas using data from the state's large urban areas and applying an Empirical Bayes (EB) method to develop stable rates across the rural zip codes. The EB method is a smoothing technique whereby raw rates are "shrunk" towards the mean [a]. We used weighted averages derived from the raw rates for each zip code and for the state, with the weight being proportional to the area's underlying population. In this method small population (rural) zip codes would tend to have their rates adjusted considerably while rates for the larger population zip codes barely changed [b]. These EB smoothing techniques have been successfully used in prior health studies to develop stable rates in areas with small populations [c]. After several adjustments and iterations of the model we determined that the amount of missing data in the more rural Zip Codes was too substantial to allow for the development of reliable estimates and concluded that the magnitude of missing data made it impractical to include ED utilization data for rural areas in the Index. For this reason ACSC-related ED use could not be used as the outcome measure to assess child health care access across a state or other geographic area with significant urban-rural diversity.

[a] Landrum MB, Bronskill SE, Normand, ST. Analytic methods for constructing cross-sectional profiles of health care providers. *Health Services & Outcomes Research Methodology*. 2000; 1; 23-47.

[b] Perk V, Nilgun K, Salzer M. (2004). Benchmark Rankings for Transit Systems in the United States. Tampa, FL: National Center for Transit Research. Available online at: <http://www.nctr.usf.edu/pdf/527-03.pdf>. Accessed October 18, 2011.

[c] O Berke. Exploratory disease mapping: kriging the spatial risk function from regional count data. *International Journal of Health Geographics*. 2004; 3: 18 [11 pages]; available at: <http://www.ij-health-geographics.com/content/pdf/1476-072X-3-18.pdf>. Accessed October 18, 2011. Percentage of households with no owned automobile ( $p < 0.01$ )

the presence of FQHCs and RHCs in the area.<sup>8</sup> The HPSA designations distinguish among "full county" HPSAs and counties or Zip Codes in which only specific census tracts are designated as HPSAs. Institutional HPSAs, such as prisons, are excluded from the analysis. The HTSI<sup>SM</sup> score

8 In some areas an FQHC or RHC will have multiple sites that are sufficiently distant from one another for each to be counted as a distinct health center resource.

therefore reflects current health professional workforce availability to supplementing the HPSA designation with the presence of safety net health care resources.

## E. KEY FACTORS EXCLUDED FROM THE HTSI<sup>SM</sup>

### 1. AUTOMOBILE OWNERSHIP

There was a strong correlation between household income and vehicle ownership ( $p=0.001$ ), with a higher percentage of population in poverty associated with a lower percentage of population with a personally owned vehicle. Therefore, the poverty factor in the HTSI<sup>SM</sup> serves as a proxy for lower vehicle ownership. The significant association at the national level between child health care access and public transportation availability, but not personal vehicle ownership, also contributed to the decision to include public transit directly in the HTSI<sup>SM</sup> scoring protocol while including household vehicle ownership through poverty as a proxy.

### 2. DISTANCE

Distance to travel to usual source of pediatric care was significantly associated with rural and small town area designation ( $p=0.01$ ) in the national survey. In the GIS databases, distance to nearest health center was significantly associated with percentage of population within the Zip Code considered to be living in a rural area ( $p < 0.01$ ). These findings indicate that in rural and other non-metropolitan areas travel distances are longer from home to a health care facility, allowing the distance factor to be included by assessing the degree to which the target community is rural, with smaller population as a proxy for longer travel distance.

### 3. PRIMARY CARE RESOURCES OTHER THAN FEDERALLY QUALIFIED HEALTH CENTERS AND RURAL HEALTH CLINICS

Federally qualified health centers, rural health clinics, and other health care facilities funded under Section 330 of the Public Health Service Act (public housing health centers, special population services such as health care for the homeless programs, etc.), comprise the largest network of primary care providers in the country. Federally qualified health centers provide care to more than 19 million patients; of these, 93% have annual incomes less than 200% of the federal poverty level, 39% are covered by Medicaid, and 38% are uninsured. It is anticipated that by 2015 FQHCs will double their capacity and serve 40 million patients [97, 98]. In a 2010 survey by

the Maine Rural Health Research Center, it was found that 97% of RHCs were currently accepting new Medicaid and CHIP patients and 86% offered free and/or discounted care. Rural health clinics in counties that did not also have an FQHC served a higher proportion of patients covered by Medicaid or CHIP than did RHCs in counties that also had at least one FQHC. It was concluded that RHCs are an important element of the health care safety net for rural counties [99, 100].

In addition to federally qualified health centers and rural health clinics, there may be other primary care options available in poverty and low-income communities. Because they are the major component of the health care safety net in these areas, it is sufficient for the purpose of scoring the HTSI<sup>SM</sup> to only include FQHCs and RHCs. A comprehensive review of the child health care resources in a geographic area, however, should also include ambulatory care hospitals (generally available from state health department and hospital association websites). If geomapping health care resources, it is recommended that these hospitals be included, since proximity of ambulatory care hospitals with emergency departments (ED) relative to other primary care resources may be an important factor in non-urgent ED use. In addition, a comprehensive inventory of the health care resources in an area should include the number of privately practicing primary care providers. Depending upon the state, this may be available for pediatricians, nurse practitioners, and family practice physicians (generally available from state health department websites).

## F. VALIDATING AND APPLYING THE HTSI<sup>SM</sup>

The HTSI<sup>SM</sup> was validated by applying it to multiple areas designated as hot spots based on high rates of ACSC-related ED use in the GIS data sets. When applied, the HTSI<sup>SM</sup> correctly identified hot spots as identified in the GIS databases for the three Texas Counties (Travis, Harris, and Dallas). Focusing on the metro Austin area, the scores reflected the high ED use in the area southeast of central Austin and the low ED use to the northwest, capturing the mediating variable of income on geographic isolation and public transportation shortages.

The HTSI<sup>SM</sup> was also tested by application to several diverse urban and rural areas. Four were selected because their access barriers, including transportation shortages, were known from experience in providing care in

the CHF National Network (Bisbee, Arizona; Clarksdale, Mississippi; Gulfport, Mississippi; and the Anacostia area in southeastern District of Columbia). As a further test of the ability of the HTSI<sup>SM</sup> to distinguish among economically diverse communities, it was applied to two contiguous neighborhoods in New York City (Manhattan): East Harlem, focusing on the southern portion of East Harlem, zip code 10029, and the adjacent and much more affluent Upper East Side neighborhood, zip code 10028. There were many difficulties obtaining current and consistent data at the zip code level, as may be the case for other localities when this degree of geographic specificity is sought.<sup>9</sup>

For each target area, the scores for individual factors, and composite scores, are shown in Text Boxes 7-12.

Using the composite HTSI<sup>SM</sup> scores appropriately stratified risk among these six diverse communities. Using the HTSI<sup>SM</sup> score of 6 as a cut-off for risk of transportation-related health child health care access barriers, the three rural communities (Bisbee, Clarksdale, and Gulfport) emerged as communities in which transportation resources should be improved to facilitate access to health care services. The lower HTSI<sup>SM</sup> score in Gulfport reflects its lower poverty rate and higher population than the other two rural areas. Scores for the three urban areas accurately reflect their degree of risk for child health care access problems. Anacostia had the highest score, reflecting an area in which transportation access could be problematic. East Harlem had a lower score, below the cut-off score for a transportation shortage area, reflecting the availability of multiple public transportation options. While there are child health care access problems in East Harlem, they are not transportation-related. The lowest score was in the affluent Upper East Side, which

9 The Census Bureau did not have Zip Code level data available for total population, so instead ZCTAs 10028 and 10029 were used. Census Bureau ZCTA poverty data were only available from the 2000 census and were not deemed sufficiently current. An alternative data source was therefore located: Community Committee for Children of New York, which had 2008 data available but at the community district (Upper East Side and East Harlem) rather than Zip Code or ZCTA level [a]. Reference to the Census 2000 poverty data showed consistency sufficient for this source to be used in scoring the HTSI<sup>SM</sup>. Similar considerations applied to the analysis for the Anacostia area in the District of Columbia.

[a] Citizen's Committee for Children of New York City. Keeping Track of New York City's Children. Online data query: [http://www.cccnewyork-keepingtrack.org/new\\_search/CreateUser.aspx?ReturnUrl=%2fnew\\_search%2fprivate%2fCommunitySearch.aspx](http://www.cccnewyork-keepingtrack.org/new_search/CreateUser.aspx?ReturnUrl=%2fnew_search%2fprivate%2fCommunitySearch.aspx). Accessed May 30, 2012.

shares the same public transportation resources as East Harlem, but has a dramatically lower poverty rate (4.6% vs. 24.6%).

The text boxes below summarize the data used to calculate the score and the source of these data, including the Internet links. These can serve as a model for use of the HTSI<sup>SM</sup> to generate a risk score for an area. The HTSI<sup>SM</sup> user should evaluate the suitability of data from online sources, including reconciliation of contradictory data if multiple sources are consulted for the same data point (e.g., HRSA and state primary care association for the number of health centers in the area). It may not always be possible to have the same target year for each data point, and other inconsistencies may also be unavoidable depending upon the nature of available data.

In these representative HTSI<sup>SM</sup> calculations, it was necessary to determine whether each listed health center was a potential source of child health care services. In Clarksdale, two health centers were listed: Aaron E. Henry Community Health Center and Delta Home Health Agency. The Delta Home Health Agency website<sup>10</sup> clarifies that this is a home health care service agency only, and therefore it was not counted in the calculation as a child health care resource. In East Harlem, the focus was on the southern portion of the community (Zip Code 10029); health centers in the northern portion of East Harlem (Zip Code 10035) were not counted. In Zip Code 10029, two resources were listed: Settlement Health & Medical Services and East Side Health Center—El Faro. Reference to the website for El Faro<sup>11</sup> showed this to be a multi-service center for adults who are HIV positive. This resource was not included in this HTSI<sup>SM</sup> calculation. These considerations indicate the need to apply the HTSI<sup>SM</sup> separately for pediatric and for adult health care access.

10 Available at: <http://www.local.com/business/details/clarksdale-ms/delta-community-home-health-agency-5966012/>. Accessed April 16, 2012.

11 Available at: [http://www.harlemunited.org/?n1=services&n2=health\\_care](http://www.harlemunited.org/?n1=services&n2=health_care). Accessed April 16, 2012.

TEXT BOX 7

## HTSI<sup>SM</sup> Calculation for city of Clarksdale, Mississippi

DATA POINT	VALUE	SOURCE	URL	SCORE
<b>Population</b>	17,962	2010 Census Census Bureau-American FactFinder	<a href="http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml">http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml</a>	2
<b>Poverty</b> (FAMILIES WITH RELATED CHILDREN UNDER 18)	49.2%	Census Bureau American FactFinder American Community Survey 2006-2010 5 year estimate	<a href="http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml">http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml</a>	3
<b>Public Transit</b>	Partial	American Public Transportation Association, Mississippi Department of Rehabilitation Services, Aaron E. Henry Community Health Services Centers, North Delta Planning Development District, and Mississippi Department of Transportation	<a href="http://www.apta.com/resources/links/unitedstates/Pages/MississippiTransitLinks.aspx">http://www.apta.com/resources/links/unitedstates/Pages/MississippiTransitLinks.aspx</a> <a href="http://www.mdrs.state.ms.us/Documents/TransportationResources.doc">www.mdrs.state.ms.us/Documents/TransportationResources.doc</a> <a href="http://www.aehcommunityhealth.org/darts.html">http://www.aehcommunityhealth.org/darts.html</a> <a href="http://www.ndpdd.com/">http://www.ndpdd.com/</a> <a href="http://www.gomdot.com/portal/home.aspx">http://www.gomdot.com/portal/home.aspx</a>	1
<b>HPSA</b>	Full County: Coahoma	HRSA website	<a href="http://hpsafind.hrsa.gov/HPSASearch.aspx">http://hpsafind.hrsa.gov/HPSASearch.aspx</a>	2
<b>FQHC (#)</b>	1	HRSA website and Centers for Medicare & Medicaid Services	<a href="http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1">http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1</a> <a href="https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf">https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf</a>	1
<b>HTSI<sup>SM</sup> SCORE</b>				<b>9</b>

TEXT BOX 8

### HTSI™ Calculation for city of Gulfport, Mississippi

DATA POINT	VALUE	SOURCE	URL	SCORE
<b>Population</b>	67,793	2010 Census Census Bureau-American FactFinder	<a href="http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml">http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml</a>	0
<b>Poverty</b> <small>(FAMILIES WITH RELATED CHILDREN UNDER 18)</small>	22.3%	Census Bureau American FactFinder American Community Survey 2006-2010 5 year estimate	<a href="http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml">http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml</a>	3
<b>Public Transit</b>	Partial	American Public Transportation Association, Mississippi Department of Rehabilitation Services, Mississippi Department of Transportation, and Coast City Transit	<a href="http://www.apta.com/resources/links/unitedstates/Pages/MississippiTransitLinks.aspx">http://www.apta.com/resources/links/unitedstates/Pages/MississippiTransitLinks.aspx</a> <a href="http://www.mdrs.state.ms.us/Documents/TransportationResources.doc">www.mdrs.state.ms.us/Documents/TransportationResources.doc</a> <a href="http://www.gomdot.com/portal/home.aspx">http://www.gomdot.com/portal/home.aspx</a> <a href="http://coasttransit.com/">http://coasttransit.com/</a>	1
<b>HPSA</b>	Full County: Harrison	HRSA website	<a href="http://hpsafind.hrsa.gov/HPSASearch.aspx">http://hpsafind.hrsa.gov/HPSASearch.aspx</a>	2
<b>FQHC (#)</b>	2	HRSA website and Centers for Medicare & Medicaid Services	<a href="http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1">http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1</a> <a href="https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf">https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf</a>	0
<b>HTSI™ SCORE</b>				<b>6</b>

TEXT BOX 9

### HTSI™ Calculation for city of Bisbee, Arizona

DATA POINT	VALUE	SOURCE	URL	SCORE
<b>Population</b>	5,575	2010 Census Census Bureau-American FactFinder	<a href="http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml">http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml</a>	3
<b>Poverty</b> <small>(FAMILIES WITH RELATED CHILDREN UNDER 18)</small>	32.1%	Census Bureau American FactFinder American Community Survey 2006-2010 5 year estimate	<a href="http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml">http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml</a>	3
<b>Public Transit</b>	Partial	American Public Transportation Association, and Arizona Department of Transportation	<a href="http://www.apta.com/resources/links/unitedstates/Pages/ArizonaTransitLinks.aspx#a7">http://www.apta.com/resources/links/unitedstates/Pages/ArizonaTransitLinks.aspx#a7</a> <a href="http://www.azdot.gov/">http://www.azdot.gov/</a> <a href="http://www.azdot.gov/MPD/Transit_Programs_Grants/Bisbee.asp">http://www.azdot.gov/MPD/Transit_Programs_Grants/Bisbee.asp</a>	1
<b>HPSA</b>	Partial	HRSA website	<a href="http://hpsafind.hrsa.gov/HPSASearch.aspx">http://hpsafind.hrsa.gov/HPSASearch.aspx</a>	1
<b>FQHC (#)</b>	1	HRSA website and Centers for Medicare & Medicaid Services	<a href="http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1">http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1</a> <a href="https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf">https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf</a>	1
<b>HTSI™ SCORE</b>				<b>9</b>

## HTSI™ Calculation for city of East Harlem, New York

DATA POINT	VALUE	SOURCE	URL	SCORE
<b>Population</b>	76,003	2010 Census, Census Bureau-American FactFinder ZCTA 10029	<a href="http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml">http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml</a>	0
<b>Poverty</b> (FAMILIES WITH RELATED CHILDREN UNDER 18)	24.6%	Citizen's Committee for Children of New York – Community District Data	<a href="http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml">http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml</a>	3
<b>Public Transit</b>	Full	New York City Metropolitan Transit Authority, American Public Transportation Association, and New York City Department of Transportation	<a href="http://www.mta.info/nyct/maps/submap.htm">http://www.mta.info/nyct/maps/submap.htm</a> <a href="http://www.mta.info/nyct/maps/manbus.pdf">http://www.mta.info/nyct/maps/manbus.pdf</a> <a href="http://www.apta.com/resources/links/unitedstates/Pages/NewYorkTransitLinks.aspx">http://www.apta.com/resources/links/unitedstates/Pages/NewYorkTransitLinks.aspx</a> <a href="http://www.nyc.gov/html/dot/html/home/home.shtml">http://www.nyc.gov/html/dot/html/home/home.shtml</a>	0
<b>HPSA</b>	Partial	HRSA website	<a href="http://hpsafind.hrsa.gov/HPSASearch.aspx">http://hpsafind.hrsa.gov/HPSASearch.aspx</a>	1
<b>FQHC (#)</b>	1	HRSA website – Zip Code 10029 and Centers for Medicare & Medicaid Services	<a href="http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1">http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1</a> <a href="https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf">https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf</a>	1
<b>HTSI™ SCORE</b>				<b>5</b>

## HTSI™ Calculation for city of Upper East Side, New York

DATA POINT	VALUE	SOURCE	URL	SCORE
<b>Population</b>	45,141	2010 Census Census Bureau-American FactFinder ZCTA 10028	<a href="http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml">http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml</a>	1
<b>Poverty</b> (FAMILIES WITH RELATED CHILDREN UNDER 18)	4.6%	Citizen's Committee for Children of New York – Community District Data	<a href="http://www.cccnewyorkkeepingtrack.org/new_search/private/QueryResults.aspx?dids=111,108&amp;bids=3&amp;catid=all&amp;flag=&amp;type=community&amp;colids=193">http://www.cccnewyorkkeepingtrack.org/new_search/private/QueryResults.aspx?dids=111,108&amp;bids=3&amp;catid=all&amp;flag=&amp;type=community&amp;colids=193</a>	0
<b>Public Transit</b>	Full	New York City Metropolitan Transit Authority, American Public Transportation Association, and New York City Department of Transportation	<a href="http://www.mta.info/nyct/maps/submap.htm">http://www.mta.info/nyct/maps/submap.htm</a> <a href="http://www.mta.info/nyct/maps/manbus.pdf">http://www.mta.info/nyct/maps/manbus.pdf</a> <a href="http://www.apta.com/resources/links/unitedstates/Pages/NewYorkTransitLinks.aspx">http://www.apta.com/resources/links/unitedstates/Pages/NewYorkTransitLinks.aspx</a> <a href="http://www.nyc.gov/html/dot/html/home/home.shtml">http://www.nyc.gov/html/dot/html/home/home.shtml</a>	0
<b>HPSA</b>	None	HRSA website	<a href="http://hpsafind.hrsa.gov/HPSASearch.aspx">http://hpsafind.hrsa.gov/HPSASearch.aspx</a>	0
<b>FQHC (#)</b>	0	HRSA website – Zip Code 10028 and Centers for Medicare & Medicaid Services	<a href="http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1">http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1</a> <a href="https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf">https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf</a>	0
<b>HTSI™ SCORE</b>				<b>1</b>

## HTSI™ Calculation for Anacostia area, southeast Washington D.C.

DATA POINT	VALUE	SOURCE	URL	SCORE
<b>Population</b>	49,864	2010 Census Census Bureau-American FactFinder ZCTA 20020	<a href="http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml">http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml</a>	1
<b>Poverty</b> (FAMILIES WITH RELATED CHILDREN UNDER 18)	47%	Neighborhood Info DC – The Urban Institute and Washington DC Local Initiatives Support Corporation 2005-2009 Zip Code 20020	<a href="http://www.neighborhoodinfodc.org/zip/nbr_prof_zip18.html">http://www.neighborhoodinfodc.org/zip/nbr_prof_zip18.html</a>	3
<b>Public Transit</b>	Full	Washington Metropolitan Area Transit Authority, American Public Transportation Association, and District of Columbia District Department of Transportation	<a href="http://www.wmata.com/rail/maps/map.cfm">http://www.wmata.com/rail/maps/map.cfm</a> <a href="http://www.wmata.com/rail/station_bus_maps/PDFs/Anacostia%20Station%20Howard%20Rd.pdf?">http://www.wmata.com/rail/station_bus_maps/PDFs/Anacostia%20Station%20Howard%20Rd.pdf?</a> <a href="http://www.apta.com/resources/links/unitedstates/Pages/DistrictofColumbiaTransitLinks.aspx">http://www.apta.com/resources/links/unitedstates/Pages/DistrictofColumbiaTransitLinks.aspx</a> <a href="http://ddot.dc.gov/DC/DDOT/">http://ddot.dc.gov/DC/DDOT/</a>	0
<b>HPSA</b>	Full	HRSA website and District of Columbia Department of Health	<a href="http://hpsafind.hrsa.gov/HPSASearch.aspx">http://hpsafind.hrsa.gov/HPSASearch.aspx</a> <a href="http://dchealth.dc.gov/doh/lib/doh/services/administration_offices/mch/pdf/dc_primary_care_hpsas_map_views_%282%29.pdf">http://dchealth.dc.gov/doh/lib/doh/services/administration_offices/mch/pdf/dc_primary_care_hpsas_map_views_%282%29.pdf</a>	2
<b>FQHC (#)</b>	2	HRSA website – Zip Code 20020 and Centers for Medicare & Medicaid Services	<a href="http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1">http://findahealthcenter.hrsa.gov/Search_HCC.aspx?byCounty=1</a> <a href="https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf">https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/rhclistby-providername.pdf</a>	0
<b>HTSI™ SCORE</b>				<b>6</b>

### SECTION FOUR

## Proposed Solutions to Transportation Barriers

Transportation access to health care services will be essential to the successful implementation of national health reform legislation and a key factor in determining the extent to which health reform will actually be of benefit to medically underserved children. A major benefit of the ongoing federal health care reform efforts for children is insurance expansion, which will result in millions fewer uninsured children [101]. Simply having an insurance card is not going to improve a child’s health if the child and family lack geospatial access to a health care provider. The following is a brief summary of approaches that may be taken to improve the transportation infrastructure in communities found to need additional transit resources to support child health care access. These areas can be identified and prioritized by applying the HTSI™. Within a targeted area, health care and transportation providers can come together to plan strategies to improve transportation access to health care services.

### A. IMPROVE MEDICAID NON-EMERGENCY MEDICAL TRANSPORTATION (NEMT) SERVICES

Non-Emergency Medical Transportation (NEMT) has been an integral part of the Medicaid program since its inception. The criterion to provide Medicaid-supported patient transportation is that the ride must be to and from a medically necessary, Medicaid-reimbursable health care appointment. For children, Medicaid has been required to assure transportation to preventive care visits (Early and Periodic Screening, Diagnosis and Treatment or EPSDT) since 1981. In litigation, it was established that Medicaid will provide transportation as a last resort and could deny transportation if the patient has access to alternatives such as an owned vehicle, public transportation, or assistance from friends or family.

Utilization and cost data for Medicaid show that nationwide NEMT services are not used nearly as extensively as needed [102]. States have discretion as to how they will provide NEMT, and there is considerable variation among the states in the quality and utilization of these services. States also have discretion as to whether they will extend

transportation benefits to their CHIP enrolled population [103]. Evidence shows that strong and well marketed NEMT services would improve primary care access and reduce health care costs through avoidance of preventable hospitalizations and ED visits [104].

To ensure comprehensive child health care access, some restrictions on the services for which NEMT may be provided should be lifted. One way to improve NEMT for acute health care access is to reduce or eliminate 24 hour or longer pre-booking requirements required in some NEMT programs. Medicaid NEMT services may be restricted to transportation for Medicaid reimbursed services. Eliminating this restriction would expand transportation access to related health care services, including supplemental nutrition (e.g., WIC) and parent support services. An alternative strategy would be for states to empower primary care providers to determine whether a service is a medically necessary and waive the restriction on NEMT on that basis, not unlike the way that caps on allowable numbers of visits in a managed care plan may be waived with a primary care provider override.

### B. COORDINATE EXISTING TRANSPORTATION RESOURCES (MIXED-USE MODEL)

In a 2004 Presidential Executive Order, the Bush Administration created an interdepartmental Federal Council on Access and Mobility, “United We Ride,” within the Federal Transit Administration (FTA). This federal initiative is intended to maximize efficient use of existing federal transportation resources to increase access to needed services for the elderly, people with disabilities, and economically disadvantaged populations, including children [105].

Many programs have vehicles targeted for a specific service population, e.g., the elderly or individuals with disabilities. These vehicles may be idle for predictable periods of time during the day and potentially available for other use such as facilitating health care access. This model is also sometimes referred to as “consolidation” or “joint use.” Issues that need to be considered include: ensuring that the additional usage does not disrupt utilization by the target population, assessing the potential impact of these changes on liability and insurance costs, and addressing concerns that some may have about mixing diverse populations (e.g., senior citizens and preschool

aged children) [106, 107]. States have the option to establish models and protocols for transit coordination, including through legislation. This allows states to establish an independent transportation coordination agency within state government if deemed necessary [108].

There are several basic strategies to facilitate coordination of existing federally funded transportation resources. These include:

1. **Lead Agency Model**, in which all participating agencies agree upon one agency to assume responsibility for the major administrative functions associated with the coordinated transportation program, including managing and tracking expenditures and vehicle dispatching and maintenance. This model works well when demand for services is relatively low and there is no need to establish a new agency specifically for transportation resource coordination. The lead agency model has been effective in rural communities.

2. **Brokerage Model**, in which a designated intermediary organization contracts with a sponsoring agency or agencies, e.g., one or more health care facilities, to operate the transportation service (dispatching and managing vehicles, scheduling, managing finances). The term “mobility manager” is sometimes used for agency brokers of transportation services. In this model the broker determines the per-trip fare and purposes for which transportation will be provided.

3. **Administrative Agency Model**, in which one agency, generally a public entity and most frequently a public transportation authority, takes responsibility to provide coordinated transit services. This is generally an endpoint to which coordinated transit service programs evolve over time. The establishment of an administrative agency helps to leverage additional federal, state and local government funding to support and sustain the transportation coordination effort [109].

### C. DEVELOP HYBRID DEMAND-RESPONSE TRANSIT SYSTEMS

Demand-response transit systems, also called paratransit systems, generally have scheduled hours of operation, but with routes (pick-up and drop-off points) determined by the rider. They typically require that the user call ahead to schedule a pick-up 24 to 72 hours in advance, limiting the value of these resources for urgent health care. This

model is especially prevalent in relatively sparsely populated rural areas.

Transportation in these communities could be improved by linking paratransit systems with the limited service fixed-route public transit systems that are also available in some rural communities. In this model the demand-response vehicle is considered a “feeder,” connecting passengers with the fixed-route system. This hybrid model extends the reach of fixed route public transportation systems into more isolated areas and increases their utilization [110]. This model can be especially effective for health care access when the health care site is not readily reached by public transit routes, and/or the patient’s residence is not sufficiently close to a public transit stop. Reducing delays between requesting a ride and pick-up will maximize the value of paratransit services for health care access.

### D. COORDINATE HEALTH CARE SCHEDULING WITH TRANSPORTATION AVAILABILITY

In settings with fixed-route transit systems that do not operate daily or operate only at certain hours of the day, it may be possible to improve health care access through schedule coordination. For example, in one rural county, health care workers manually flagged patient charts of known public transit users. Subsequent appointments were scheduled to coincide with available transit. Access was further facilitated because the transit provider modified its regional bus schedules as part of this cooperative effort [111].

This model would effectively maximize the value of limited public transit systems for health care access by ensuring that appointments coincide with days and times at which transportation is available. In targeted communities, transportation coordination should become integral to case management and care coordination for patients with chronic conditions. Another approach would be to modify clinic hours to coincide with transportation availability. Having clinics open during evenings and weekends, for example, would facilitate access for single vehicle households in which the family car is used by one parent to commute to work.

### E. INCREASE INVESTMENT IN PUBLIC TRANSPORTATION

According to the American Public Transportation Association, use of public transit has steadily increased over the past several decades. There are significant benefits to use of public transportation, including reduced national dependence on imported oil and less traffic congestion for people who continue to use cars. Health benefits of having fewer cars on the road include less pollution from vehicular emissions, with decreased incidence and severity of respiratory and cardiovascular diseases, and fewer injuries and deaths from motor vehicle accidents [112, 113]. Public transportation is a cost-effective means to achieve public health goals [114].

Public transportation is essential to the financial well-being of both urban and rural communities, increasing the consumer base for goods and services, thus strengthening small businesses, facilitating access to the full range of human services including health care, and reducing disparities by making mobility services available to people who are unable to afford a personal vehicle [115]. An elevated HTSI™ score could trigger provision of additional funding to improve public transit resources in targeted communities, e.g., through extending hours of operation or developing and expanding routes (just as the HPSA designation is used to target areas for additional health workforce resources). Local governments could receive transportation coordination funding to maximize the value of existing resources.

## SECTION FIVE Conclusion

Lack of available transportation is a powerful barrier to child health care access and is associated with children not having a usual source of care and using hospital emergency departments for problems that could have been treated in a primary care setting. Areas where transportation shortages impede child health care access may be identified through the confluence of these factors: type of area (rural/urban), income (poverty), availability of transportation resources, and availability of health professionals.

The Health Transportation Shortage Index (HTSI™) is a simple tool designed to assess these factors in an objective and replicable manner, yielding a score that may be used to determine relative risk for transportation-related health care access barriers and to target such areas for interventions to improve access to health care for children. The HTSI™ may become an important tool in rural health service planning as it provides an objective way to stratify risk based on the multiple factors associated with barriers to child health care access. It is our hope that this tool can be used to guide cost-effective strategies to improve the health and well-being of children across the country.

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