



The Enhanced Medical Home: The Pediatric Standard of Care for Medically Underserved Children

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The American Academy of Pediatrics (AAP) originally defined *medical home* in the 1960s to address the need for an optimal level of health care for children with special health care needs (CSHCN), who are children who “have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition” and “also require health and related services of a type or amount beyond that required by children generally” [1,2]. The AAP describes the medical home model as a way to ensure continuity of care from birth to young adulthood, and to provide coordinated health care among specialist and related service providers. It identified seven characteristics of the medical home model: care that is accessible, continuous, comprehensive, family-centered, coordinated, compassionate, and culturally effective [3].

The value of the medical home in providing optimal health care to CSHCN is well established [4–6]. The federal Maternal and Child Health Bureau and the AAP have sponsored programs and training initiatives to disseminate the medical home model [4,7] and its importance for CSHCN is emphasized in Healthy People 2010, a set of health objectives for the United States to achieve over the first decade of this century. The AAP Task Force on the Future of Pediatric Education expanded its recommendation to include the medical home model as the standard of care for all children [8].

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The CSHCN rubric is typically used to describe children with neurobiological conditions that affect health and development. Such conditions include, for example, cerebral palsy and spina bifida. Yet there are other pediatric populations who require good quality, accessible health care “beyond that required by children generally” and who are at risk of reduced access to care primarily for environmental and psychosocial reasons. For example, previous research has suggested that vulnerable and medically underserved pediatric populations be considered children with special health care needs [9].

In this article we describe the risk factors that affect medically underserved children. These risk factors fall into three categories: economic, geographic, and psychosocial. We first focus on lack of health insurance, a pervasive problem that often accompanies the geographic and psychosocial risk factors next discussed. Based on this analysis and review of literature on the cumulative impact of multiple risk factors, we suggest a model to classify medically underserved children as a special health care needs population. These children require an “enhanced medical home” designed to meet their multiple clinical needs. We describe three model programs designed to reduce barriers to access for these populations and meet those needs. These programs each use mobile medical units (MMUs) to deliver service. Finally, we present policy recommendations to support and sustain such programs.

ECONOMIC BARRIERS TO HEALTH ACCESS

Most discussions of barriers to health care access focus on economic issues, specifically whether the child has health insurance. Children in families with annual incomes at or near the federal poverty level are eligible for public insurance, either through Medicaid or the state children’s health insurance program (SCHIP). The income threshold (percent above federal poverty level for family income) for Medicaid and SCHIP eligibility varies from state to state, as does the eligibility for noncitizen children.

Estimates of the number of uninsured children in the United States vary depending on the source of the data and basic definitions. The AAP estimates that 11.9% of children and adolescents through age 17 in the United States were uninsured in 2006, representing 9.3 million children and youth, and that 6.3 million of these uninsured children were eligible for either Medicaid or SCHIP [10].

Typically the term *uninsured* refers to children without insurance for a full year. If children whose insurance coverage was discontinued at some point during the year are included among the uninsured, the number of uninsured children more than doubles [11]. Also contributing to the general underestimate of the number of uninsured children is that the upper age used in the most frequently cited federal survey data is 17, with older adolescents and young adults excluded from the count [12]. Older adolescents and young adults are at the highest risk for being uninsured [13].

The most current available data show that up to 41% of children on Medicaid suffered 2- to 4-month gaps in coverage during the year [14]. These data are

consistent with the finding that one third of children counted among the uninsured in 2006 had been covered by either Medicaid or SCHIP the previous year [15]. In comparison to full-year uninsured children, children whose health insurance was discontinued within the 12-month period have similarly restricted access to primary care and a comparable level of unmet health need [16,17]. Compared with children with health insurance, uninsured children are three times more likely to have at least one unmet health care need during the year [18], are nearly four times more likely to use an emergency room [19], and have significantly higher hospitalization rates, including those for ambulatory sensitive conditions, such as asthma [20]. Being up-to-date for immunization is a standard indicator of access to primary care. In one study, 36% of uninsured children were underimmunized [21].

VULNERABLE POPULATIONS

All of the vulnerable populations we discuss have high rates of being uninsured for either part or all of the year. As a result, the risk factors associated with these populations tend to cumulate and exacerbate their vulnerability. Transient populations are especially vulnerable to losing public benefits because of the special difficulty they have meeting new documentation requirements for eligibility. These children and adolescents also have higher levels of health care need and more restricted access to primary care and specialist services than do other demographically similar children.

Studies of homeless children show that they have higher rates of acute and chronic health conditions and significantly higher emergency room use than do comparably poor but housed children [22,23]. Their need for specialty care is higher and, without such enabling services as transportation, access to specialists is extremely poor [24]. Similar issues affect immigrant and migrant children because of language and cultural barriers that inhibit access to or use of health care services [25,26]. For children in foster care, continuity of care is often interrupted by the instability of their family living situation compounded by issues of guardianship and consent for care [27,28]. The combination of higher level of need and restricted access to care for children and youth in these risk groups also applies to oral health and mental health services.

Access to health care services can be disrupted by such external events as natural disasters, as in the case of Hurricanes Katrina and Rita in 2005 on the Gulf Coast. In addition to losing their usual source of care, children affected by the hurricanes had dramatically higher mental health needs than previously. A particularly striking finding was the dramatic increase of domestic violence and maternal depression after the hurricanes [29].

NONECONOMIC BARRIERS TO CARE

The emphasis on economic barriers in describing restricted access to health care has deflected attention away from noneconomic barriers. These include workforce issues and transportation restrictions, which are often interlinked. In places with too few health professionals, people usually have to travel farther

to get to a health care provider. Poverty and inadequate public transportation can create insurmountable barriers to accessing needed medical care by putting convenient and affordable transportation to services beyond reach, even for children with adequate health insurance.

Health professional shortages and transportation restrictions converge most often in rural communities [30,31]. From 1981 to 1996, the number of pediatricians in the United States nearly doubled, but the increase in pediatric availability in rural communities was slight. Counties with fewer than 25,000 people did not benefit appreciably from this workforce increase [32].

Rural communities are home to 20% of the nation's people but less than 9% of its physicians. This maldistribution of medical workforce applies not only to primary care providers but also to specialists [33]. In one representative state, Mississippi, 62 of 82 counties are federally designated Health Professional Shortage Areas for primary care. In addition, 9 counties have only one dentist, and 7 counties have no dentists. A total of 76,000 people live in these counties [34]. There are also many urban communities that are formally designated as medically underserved areas based on the limited number of available primary care providers and level of need in the community. While most cities have public transportation, public transportation routes do not always cover the entire city. The inconvenience and expense of transportation to hospitals and other health care sites may be significant barriers to access [35].

Workforce issues have gotten considerably more attention in the literature on barriers to health access than have issues related to transportation. These workforce issues include the scarcity and geographic mal-distribution of health care providers, shortage of specialists, and mismatch of provider race-ethnicity and culture relative to the communities served. Health care providers are often clustered in areas with high population density. While this is especially true of sub-specialists, who frequently practice at or near hospitals, it also may apply to pediatricians, dentists, and other providers of routine health care for children. Given these workforce issues, it is not surprising that in a series of focus groups, the Children's Health Fund (CHF) found that many rural families reported that they had to travel as much as 30 miles to get to a pediatrician or hospital. These were families too poor to have two cars (with the head of household using the only car to get to work and the adult caring for the children unable to get the children to health care). In some cases they were too poor to afford car repairs, or even gasoline to keep the car running [36].

A survey conducted in South Carolina illustrates the importance of transportation as a barrier to care. It found that nearly 16% of caretakers who brought their child to a hospital emergency room for care reported not having been able to keep a pediatric appointment because they did not have transportation. In the single county in which the study was done, this translated to 3000 children per year with transportation barriers to health care [37]. CHF's 2006 transportation survey found that children in rural communities, especially in the South and Midwest, were most likely to miss pediatric appointments because of transportation difficulties, and that preventable emergency room use was associated

with these missed appointments [35]. Transportation problems are sufficiently ubiquitous that they also affect urban children. For example, transportation problems were significantly associated with missed health care appointments among urban poor children in a Texas study [38].

MEDICALLY UNDERSERVED: A SPECIAL NEEDS POPULATION

The impact of risk factors on children is cumulative. For example, child development outcomes are most compromised when multiple environmental risk factors impinge upon an infant [39]. It has also been shown that multiple risk factors (deficient access to care, continuity of care, and comprehensiveness of care) have a dose–response relationship to suboptimal health status. The relationship is such that children with the highest level of health care need are also those with the most compromised access to care [40].

Box 1 summarizes the risk factors we have identified that apply to vulnerable, medically underserved children. This model is consistent with the vulnerable population conceptual model of Flaskerud and Winslow [41], which relates health status to social and environmental factors, including resource availability. It is also supported by the findings of Larson and colleagues [42], which is based on 2003 National Survey of Children’s Health data. Larson and colleagues found that multiple social risk factors have a cumulatively detrimental impact on parent-reported child health status across physical and socioemotional domains. These risk factors include family income below 200% of the federal poverty level, single parent household, exposure to

Box 1: Key environmental determinants of a child being medically underserved

Economic

- Family income <200% federal poverty level
- No or inadequate insurance

Geographic

- Low-density rural county residence
- High-poverty inner-city residence
- Residence in a Health Professional Shortage Area
- Limited or no access to public transportation
- Lack of safety net providers, including MMUs and school-based health centers

Psychosocial

- Vulnerable population
- Domestic violence, maternal depression
- Limited English-language proficiency
- Low health literacy
- Living in an area affected by a disaster

community and domestic violence, maternal depression, and being uninsured. Following these models, we suggest that children who present risk factors from two or more of these categories are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and require care beyond that required by children generally; that is, they are children with special health care needs for psychosocial reasons.

To illustrate the point, homeless children in New York City are a vulnerable population living with incomes below the federal poverty level. A substantial percentage of these children have been exposed to domestic violence, or maternal depression, or both; others are recent immigrants living in households with limited English proficiency. Low health literacy is pervasive. This confluence of risk factors predicts poor health outcomes. Recent findings show that 22% of these children are underimmunized. There are high prevalence rates for asthma (31.5%), obesity, a body mass index (BMI) in the 95th or higher percentile for children 6 to 19 (31%), iron deficiency anemia for children under 36 months of age (19%), and psychiatric or developmental problems for children over 12 months of age (30%). Each of these rates exceeds the highest rate reported by the Centers for Disease Control and Prevention for any race or ethnic minority [43].

This extreme level of health disparity suggests that the risk profile correctly identifies a special health care needs population. The high prevalence of asthma indicates the urgency of getting these children into an enhanced medical home, and the potential cost to the health system (as well as the child's health status and quality of life) of failing to do so. The high prevalence of nutrition deficiencies, including obesity, indicates the long-term consequences (and again, with excess cost to the health care system) of continuing to leave these children and adolescents without adequate health care. Finally, the developmental and psychiatric problems among these poor and medically underserved children and youth make clear that without intervention their ultimate life outcomes will be compromised.

The enhanced medical home model that meets the needs of these special populations includes the following special characteristics, several of which are beyond the attributes of the medical home as defined by the AAP:

- The capacity to spend more time than typical at pediatric visits;
- The ability to provide evidence-based care to manage chronic conditions (eg, asthma care consistent with the National Heart, Lung, and Blood Institute guidelines);
- Integration of services that might otherwise require specialist referral (eg, family-centered nutrition counseling, allergy skin testing for children with persistent asthma, oral health screening and preventive care, maternal depression screening, and access to mental health services either colocated or by facilitated referral) and health education appropriate to language, culture, and health literacy level;
- Facilitated access to pediatric subspecialists, including dentists, with coordination of care at the primary care site.

REDUCING BARRIERS TO COMPREHENSIVE CARE

The categories of risk—geographic, economic, and psychosocial—combined with higher disease burden in both acute and chronic conditions require innovations in health care coordination and health service delivery to meet the unmet need in these populations. The medical home “is not a building, house, or hospital but an approach to providing care in a high-quality, cost-effective manner” [44]. Providing continuous, comprehensive, compassionate, culturally effective, family-centered, accessible, and enhanced care can be achieved in a variety of environments, one of which, the school-based health center (SBHC), has been thoroughly explored. Other environments include mobile clinics or MMUs. These have been used extensively in a variety of capacities but have not been as thoroughly studied. Both SBHCs and MMUs operate on the same general principle: If a child cannot get to the doctor, get the doctor to the child.

School-based health centers

SBHCs have been an integral part of the health care safety net in medically underserved communities since the early 1980s. The number of SBHCs has grown steadily to 1500 clinics within schools plus another 200 that are “school-linked” (ie, established on school property but not within the building). These include mobile programs in which an MMU is parked on school grounds [45,46].

In its policy statement on school health centers, the AAP emphasizes the need to coordinate the school-based or school-linked health care services with educational services, hospitals, and community-based social service and mental health agencies. These “integrated school health services” comprise comprehensive health care consistent with a medical home model. They emphasize the coordination of health care services delivered at the school with community-based primary care providers if they are available and involved in the child’s care [47]. Integrated school health centers are especially appropriate models to reach adolescents with health care services to which they would not otherwise have access [48].

There are many clinical outcome studies documenting the value of the SBHC model in reducing barriers to access and improving child health status. Many have focused on asthma. These studies have found, for example, that SBHCs contribute to a 75% decrease in asthma hospitalizations and better use of asthma action plans, peak flow meters, and inhalers. Readiness to learn was improved because the children experienced fewer asthma-related disruptions to sleep [49]. A study of urban elementary school children (ages 4–12) in Georgia found that students who received school-based asthma care had lower inpatient hospital costs, lower emergency room costs, lower nonemergency medical transportation costs, and lower prescription drug costs [50]. These findings have been corroborated among inner-city Bronx elementary school children in an SBHC model that focused on coordination of school-based health care with community-based health providers [51].

Some studies have focused on the cost-effectiveness of SBHCs in providing immunizations, including flu vaccines [52]; obesity prevention and intervention programs [53]; and improved access to oral health services, especially for rural children. Because of the similar underlying principle of both MMUs and SBHCs, similar clinical outcomes can be expected.

Mobile medical units

Health education programs, health fairs, and other public health outreach and health screening activities are familiar applications of mobile vans in health service delivery [54]. These activities represent an episodic and limited use of MMUs to reach large numbers of people. Less common is the use of MMUs to bring targeted services for specific chronic conditions, and still less common is their use to provide comprehensive primary care services in a medical home model.

MMUs have been used successfully to provide enhanced asthma care to high-risk populations to supplement other health care resources. Mobile asthma intervention programs in Chicago, Illinois, and Orange County, California, were structured to provide the full complement of clinical and case management supervision for children with asthma, and to connect high-risk communities with much-needed specialists. Both programs were designed to identify children and serve them in conjunction with a school-linked or school-based clinic site. Both successfully identified previously undiagnosed cases of asthma and improved asthma management. Among the clinical outcomes documented were reduced school absences, emergency room visits, and hospitalizations for asthma. In addition, the Chicago program demonstrated its cost-effectiveness based on Medicaid billing data. Savings were achieved through reduced cost for emergency room and in-patient use [55–57].

Oral health services are often unavailable to low-income and Medicaid-insured populations, and MMUs have proven to be an effective way to provide this critical service. While there is a generally low availability of dentists in underserved communities, the problem is worst for children, especially young children, because of the even greater lack of pediatric oral health specialists. The inadequate supply of dentists is related to the extremely low rate of Medicaid reimbursement for oral health services. Many dentists no longer accept public insurance or choose not to locate their practice in low-income communities where public insurance coverage predominates [58,59].

Only a few reports have documented the use of MMUs to serve rural communities. One documented program, in Walhalla, South Carolina, was designed to meet the specific cultural needs of a growing population of Hispanic immigrants in rural Oconee County. The program served an adult population in a medical home model, providing more than 1000 patient visits in its first year. This included 92 prenatal care visits to women who had no other access to this critical service [60].

Another successful MMU program was created to be a site for faculty practice and professional education while enhancing care for underserved rural and uninsured Hispanic Appalachian residents living within a 60-mile radius of

a southwest Virginia university. This model was designed to assess community needs; identify individuals at highest risk; deliver health education; and coordinate referrals, case management, and care. The multidisciplinary clinical team was led by a nurse practitioner [61].

Mobile dental vans have been effectively deployed to overcome geographic and cultural barriers to regular oral health care. Examples include three programs that were part of the W. K. Kellogg Foundation's Community Voices program. Successful models include those that linked MMU-based oral health services with school and early education sites, such as Head Start centers [62–64].

The CHF has pioneered a different approach to MMU service delivery, using the model to provide comprehensive pediatric care in a medical home model to reduce barriers to access to health care for medically underserved, high-risk children and families. Mobile clinics at CHF that serve this purpose are based on 36 to 40 ft long recreational vehicles or trucks. These “doctors’ offices on wheels” are generally comprised of a registration area, laboratory/procedure room, two examining rooms, and a restroom. Storage space is maximized so that medical supplies and medication can be carried to service sites on a daily basis. A refrigerator is on the MMU for vaccine storage. Cold chain is maintained throughout. Integral to the model are programmatic safeguards to ensure ongoing access to care; comprehensive care, including oral health and mental health services; facilitated and coordinated access to subspecialists; and 24-hour, 7-days-a-week coverage.

Five general population groups are the focus of MMU service: uninsured and underinsured children who otherwise would not have access to comprehensive health care; children living in rural areas designated as Health Professional Shortage Areas; children living in urban communities lacking pediatric-experienced health care providers; children affected by disasters who require mobile clinic services on a temporary basis; and special populations, such as homeless, immigrant, and foster children, who face unique psychosocial barriers that are effectively overcome by the use of mobile clinics.

The first CHF program was developed in New York City in 1987 to specifically address the needs of homeless children and their families. Health care was (and continues to be) provided to thousands of homeless children sheltered with their families in overcrowded and often dangerous “welfare hotels.” Although the majority of children at these temporary shelters qualified for Medicaid, few were enrolled and, for those who were, access was a challenge for a number of reasons, not the least of which was the lack of a permanent address. Most children were unable to gain access to a medical home before the use of a mobile clinic, which provided comprehensive health care at shelters throughout the city at regularly scheduled intervals. Without this service, these children frequently relied on episodic care at hospital emergency rooms.

At the Hotel Martinique, for example, which sheltered approximately 1000 children, 70% of 2-year-old children had delayed immunizations or had no documentation of immunizations. Most school-age children did not attend school

regularly, if at all. About three fourths of young children were delayed in their development. Asthma prevalence was high and asthma control virtually absent. Infectious illnesses were highly prevalent and generally recurrent. Depression and other serious psychiatric disorders were noted among the mothers of the pediatric patients [65,66]. Shelter conditions have subsequently improved considerably. Recent data from this same program (The New York Children's Health Project) show improvements in immunization status and some acute health conditions. There has, however, been a sharp increase in prevalence of asthma and iron deficiency anemia [67,68].

CHF's use of the MMU model included from its inception a focus on comprehensive, continuous, and coordinated care to meet the needs of multiproblem children and families whose prior poor access to care was often associated with a medically complex initial presentation characterized by poorly controlled and, in some cases, previously undiagnosed chronic conditions, acute conditions exacerbated by late delivery of care and environmental triggers, and serious psychosocial problems. From the start, the projects emphasized the creation of a permanent medical record for each patient to prevent the loss of documentation, which was rampant in this highly transient population. Permanent records were maintained through electronic health records with central storage on servers and ready access on laptop or tablet computers on each MMU. In this and subsequent CHF model projects, 24-hour, 7-day-a-week coverage was provided by staffing the MMU with physician-faculty of the partner teaching hospital or community health center. This created the same full coverage as would be available to patients of the hospital-based ambulatory clinic or community health center [69]. Another feature of this partnership has been facilitated access to specialty care.

An additional established use of MMU services is in postdisaster health care. The model has proven successful in international relief efforts, as in the case, for example, after the Southeast Asian tsunamis of 2004 [70]. The U.S. Public Health Service employed MMUs to provide medical screening immediately after Hurricane Wilma hit Florida in 2005 [71]. Again, CHF has used this model differently, first to provide comprehensive primary care services in the immediate aftermath of a disaster, and later to continue to provide these services in a medical home model on an ongoing basis as a new addition to the community's safety net providers. This approach was used first in south Florida in 1992 following Hurricane Andrew, one of only three category 5 hurricanes to make landfall in the United States during the 20th century.

After the terrorist attacks in New York City of September 11, 2001, CHF developed a mobile mental health unit to do both preventive care (resilience building) and direct clinical mental health services to respond to the widespread psychologic impact of the event [72]. After Hurricanes Katrina and Rita, CHF immediately dispatched mobile medical units to affected areas of Louisiana and Mississippi [73]. These units were supplemented by a public health research component that documented an enormous and continuing level of unmet need for primary pediatric care, including management of chronic conditions,

such as asthma, and a dramatic increase in need for mental health services at a time when already limited resources were decimated by the storms [74].

MODEL MOBILE MEDICAL UNIT-BASED ENHANCED MEDICAL HOME PROGRAMS

We discuss three CHF child health projects to illustrate the use of MMUs to provide an enhanced medical home for diverse medically underserved communities: an urban MMU program in Dallas, Texas; a rural school-linked MMU project in serving Appalachian communities in West Virginia; and a project serving post-Katrina New Orleans with mobile medical and mental health units.

An urban model

The Dallas Children's Health Project, established in 1991, is a program of Parkland Health & Hospital System. The MMUs provide services to homeless children and adolescents in Dallas County, which includes the city of Dallas with a population of nearly 2 million people. About one third of the population, 34%, is Hispanic; 25% is African American; and 33% is Caucasian. One fourth, 25%, of the city's residents were born outside the United States [75]. In 2006, Dallas County had approximately 9200 homeless individuals, up from 6100 in 2005. More than 1000 were children under the age of 18 [76]. About two thirds (~6000) of these homeless persons were in the city of Dallas [77]. Automobiles are the principle means of transportation in the area, according to the Dallas Area Rapid Transit agency [78]. Dallas' public transportation system does not include all parts of the city, illustrating the transportation disadvantage experienced by Dallas' poor and homeless families.

The project serves a population with significant levels of developmental delay and school failure; nutritional problems, including anemia and obesity; and psychosocial problems, including domestic violence, child abuse and neglect, and mental illness. Comprehensive primary care is delivered via MMUs to the children and families at Dallas homeless shelters, transitional apartments, elementary schools, and a childcare center for homeless children.

Essentially all of these children qualify for Medicaid but typically only half are covered at the time of the visit. As families move from place to place, important documents, such as birth certificates and immunization records, are lost, and letters reminding parents to recertify every 6 months are not forwarded. An additional barrier to care in Dallas is Medicaid Managed Care. Even if the child has Medicaid, the primary care provider may not be accessible via the limited public transportation system in Dallas.

In 2007, The Dallas Children's Health Project saw 2225 infants and children who would not have otherwise had access to primary health care, providing a total of 5264 visits. Included are 1321 well-child visits and 2779 visits where immunizations were provided. Nearly 400 children had at least one asthma visit during the year, more than 250 infants and young children were identified

with iron deficiency anemia, over 100 were obese, and more than 250 school-age children were diagnosed with serious behavioral problems.

Those numbers do not tell the whole story. The crowded living conditions of shelters are perfect for passing on minor acute illnesses, which is the main reason that parents bring their children to the MMU. Parents often lack the most basic knowledge of how to treat a common cold and when a visit to the doctor is needed. These parents rarely if ever bring up concerns about school performance or exposure to domestic violence. Those problems are so ubiquitous among homeless families that only the most severe behavioral problems are mentioned.

All pediatric providers are faced with the daunting task of screening and educating families in a very limited time. In a high-risk, transient homeless population, the need for services can be overwhelming. By offering comprehensive pediatric services without appointments, having the MMU travel to almost all the family shelters in the Dallas area, selecting a culturally sensitive staff, and using an electronic health record, this model of an enhanced medical home literally follows its patients as they move around the city.

A rural model

The West Virginia Children's Health Project is a program of the Department of Pediatrics of the Joan C. Edwards School of Medicine at Marshall University in Huntington, West Virginia. Since 1992, the West Virginia Children's Health Project has served permanently housed Appalachian families in the extremely isolated southwestern region of the state. This mountainous region is so sparsely populated that no pediatric practice in a set location could be economically viable. Although the majority of children have health insurance through Medicaid or SCHIP, the transportation barriers make access to care difficult.

In addition to chronic disease and high rates of both infant mortality and low birth-weight babies, this population also presents a range of environmentally based health conditions. Obesity is a significant problem as it is throughout West Virginia, with many cases of type 2 diabetes diagnosed. Cardiovascular conditions are noted at all ages, and there is a high prevalence of asthma.

The West Virginia Project resolves the related problems of low population density and transport restrictions by deploying an MMU in front of multiple school sites. Transportation to and from school is provided through the state's Education Department. By providing school-linked care, these education transport resources double as transportation access to nonemergency health care. Services are provided at 11 schools, the majority of which are elementary schools. Some schools incorporate Head Start centers. With this multiplicity of sites, 565 pediatric patients were seen for medical visits in 2007, with nearly all receiving a comprehensive physical examination. The project also provided more than 500 mental health encounters in 2007 through the use of graduate students in psychology for whom the MMU serves as an externship placement. Nearly one fourth (23%) of the visits were with children diagnosed with asthma, and nearly half (49%) were for children overweight or obese (BMI

above 85th percentile). It is not uncommon in this population for young adolescents to have a BMI within the adult obesity range ($BMI > 30$).

Because of the extreme difficulty that children and families have getting to hospitals or other community health providers, the pediatrician's scope of practice is wider than typical and incorporates a range of activities that might otherwise be provided by a specialist. This includes family-centered nutrition counseling in these communities, where clinical nutritionists are not available. Nonetheless, 16% of the pediatric patients required referral to a subspecialist when caries or other acute problems were identified on the MMU. Specialists included cardiologists; ear, nose, and throat specialists; audiologists; and dentists. In addition to providing direct health care, the mobile clinic serves as an educational tool for training pediatric residents.

An extensive health education program is implemented for the school and community. At two schools, nutrition and healthy lifestyle classes are taught to the third and fourth grades, representing over 800 health education encounters in 2007. Multiple nutrition and other health education presentations were done for parents, school personnel, and other members of the community throughout the year. Because West Virginia has the second highest pediatric obesity rate in the United States (20.9% for ages 10–17) [79], this constitutes an important preventive health service.

Other health education services are targeted for specific populations. For Head Start and other preschool groups, basic hygiene, including tooth brushing, is taught. Sessions about the health risks associated with smoking tobacco are presented starting at the elementary school level. Universal precautions are taught at high schools. Services to schools include consultations with teachers to help with the management of behavior problems in the classroom.

A postdisaster model

Following the devastating impact of Hurricanes Katrina and Rita in 2005, CHF formed Operation Assist, a collaborative effort with the National Center for Disaster Preparedness at Columbia University's Mailman School of Public Health. The New Orleans Children's Health Project was established as an integral component of CHF's response to the disaster, and has since become an integral part of the city's postdisaster pediatric infrastructure. It is affiliated with the Tulane University School of Medicine.

In the course of providing care to victims of the hurricanes, it became clear that the effects of the storms were greatly worsened by pre-existing deficiencies in the health care system. According to one assessment taken a year after Katrina, over half of parents and caregivers reported that at least one child in the household had experienced new emotional or behavioral issues since the hurricane. By one estimate, rates of depression or anxiety had quadrupled, and rates of behavioral or conduct problems doubled. A substantial proportion of households also reported that children had lost their usual source of care following the hurricane. Finally, households reported that rates of uninsured children were noticeably higher following the storms [74].

Overall, the storms of 2005 exacerbated an already difficult health care situation for children in the Gulf Coast region. Asthma rates have been notably higher after Katrina, rising from around 15% before the hurricane to over 20% after. There is both statistical and anecdotal evidence of a significant increase in developmental delay for many children and unusually high numbers of infants and young children with iron deficiency anemia. Following the hurricanes, lack of transportation, lack of insurance, loss of citizenship documentation required for enrollment in Medicaid or SCHIP (as well as for other governmental assistance programs), financial instability, loss of housing, and the postdisaster shortage of health professionals combined to exacerbate already serious barriers to health care access. Nearly one quarter of children living in the Federal Emergency Management Agency trailer parks requiring specialty care were unable to receive it, and one in five children remained without insurance coverage [74].

The New Orleans Children's Health Project addresses this troubling disparity in access by using state-of-the-art mobile medical units to deliver comprehensive pediatric care. It delivers comprehensive primary care without regard to insurance status or the family's ability to pay, and operates by linking to either a school or community center at each of its service delivery sites. Mobile medical units are uniquely suited to the provision of postdisaster health care, allowing clinical teams to bring services directly where they are needed most and to respond to the changing conditions and needs of the community. The project has over the past 2 years transitioned from providing emergent/urgent care to providing continuity of care and serving as a medical home model. This transition and integration into a health care safety net that is still being rebuilt illustrates the unique role that MMUs can play in postdisaster health care delivery.

Many of the children seen on the mobile unit were displaced from their home. Some remain displaced as of this writing, more than 2 years after the disaster. In July 2007, 16% of the 947 patients seen on the project's MMUs were still homeless. Some were sheltered in trailers and other transitional housing sites that were overcrowded and posed environmental hazards, such as high levels of formaldehyde emissions [80]. In addition to dealing with children with upper respiratory conditions, including asthma, the project has been working with high numbers of infants and young children with elevated lead levels. Routine screenings, extensive health education, and primary preventive care are key program elements.

As with any population exposed to a large-scale disaster, the children and families of the Gulf Coast region struggled to cope and remain resilient in an environment still without a sense of security and stability. In July 2007, nearly 2 years after Hurricane Katrina, more than 50% of the patients who came to the project's MMU requested mental health services. A high level of need was noted among children, who present a range of symptoms that may not be readily recognized as a mood or anxiety disorder, including posttraumatic stress disorder. These children are at risk of being misdiagnosed with attention

deficit hyperactivity disorder because, especially among younger school-age children, their behavior is marked by agitation and distractibility. Among older children and adolescents, these symptoms often lead to conflict, with the possibility of being misdiagnosed with oppositional defiant disorder. Prominent symptoms among preschool children included developmental delay, enuresis, and nightmares.

In response to the pervasive level of need for mental health services, and the limited availability of mental health professionals, the project expanded its services with the addition of a second MMU with an interior custom-designed to provide comprehensive mental health care to children and their families and to ensure an appropriate level of patient privacy. The mental health MMU is staffed with four social workers, two of whom are bilingual, and a part-time child psychiatrist. The mental health unit and the medical unit work in concert, traveling together to sites and comprising a multidisciplinary team of health care providers, social workers, and case managers, to address the physical and psychosocial needs of the children and families affected by the storm. Colocation of mental health and primary care services has established efficacy in improving access and providing comprehensive services [81].

POLICY RECOMMENDATIONS

We have sought to establish a model of vulnerable, medically underserved children who are at such substantial risk to warrant consideration as children with special health care needs. Our model focuses particularly on the cumulative effect of several classes of risk factors, starting with economic barriers to access to care and extending to geographic and psychosocial factors as well. Our policy recommendations seek to address this combination of risk factors, and speak both to the need for an enhanced medical home and the role MMUs can play in implementing the enhanced medical home model.

Traditionally, public policy and advocacy efforts have focused on economic barriers to health care access. As should be clear from this discussion, barriers to care for medically underserved children extend far beyond the issue of health care coverage. Moreover, the cumulative effect of the risk factors we identify intensifies the need for a focus beyond economic barriers to health care access. Changes to public policy can play a substantial role in mitigating the effects of many of the noneconomic barriers to care.

For example, the challenges surrounding access to health care in rural areas are by now well known. Often these communities, or entire counties, are health professional shortage areas with limited or no public transportation. Public policies, such as loan forgiveness or scholarship programs that seek to address health workforce shortages by providing incentives for physicians to locate in rural areas, particularly for primary care, would have a direct impact on access to care and serve to improve health status and health outcomes for many rural residents. Similarly, innovative approaches to providing transportation for rural residents through shared use of existing transport resources, or by bringing care to residents via MMUs can have a substantial impact on access

to care. Developing a designation for communities that are both health professional shortage areas and transportation shortage areas would help to target areas of greatest need.

Innovations designed to reduce the effects of psychosocial barriers to care through policy change could have a dramatic impact as well. Financial and other incentives that could develop a more diverse health workforce, one which is more demographically similar to high-risk patient populations, could help lower cultural and language barriers to access. Efforts to reduce the impact of language or low health literacy have a demonstrated effect on improving care and health outcomes. Screening for maternal depression in the pediatric primary care setting, particularly during well-child visits, could substantially reduce this risk factor. On a governmental level, policies aimed at providing greater social and financial support to low-income families would likely have the added benefit of producing better health outcomes for vulnerable children.

A more general set of policy changes revolves around basic support for the enhanced medical home model. Federal policy should recognize the importance of the medical home and the centrality of the medical home model of care for adults and children. There are the beginnings of such a movement in Congress, but more work is needed both to demonstrate the importance of the medical home and to advocate for its central place in the health care delivery system. To appropriately deliver care to high-risk and medically underserved populations, an enhanced medical home model that integrates evidence-based treatment (eg, for asthma), nutrition, mental health, and oral health services, should be established and maintained.

For the special health care needs population we have described, the enhanced medical home encounter necessarily takes more time and requires the involvement of diverse health professionals at a single visit. Central to the continued success of this model is sufficient funding to ensure long-term sustainability. Federal and state reimbursement rates for Medicaid and SCHIP must be at a level commensurate with the effort required to deliver quality care to this population, including that portion of the population in communities with very low incomes and in rural areas where these services must be located.

We have sought to demonstrate the viability of the MMU as a medical home for medically underserved children. Public insurance policy also needs to acknowledge the role of MMUs as medical homes and provide reimbursement for services delivered at these venues. At last check, only 19 states had Medicaid regulations that permitted the licensing or billing for clinical services provided via mobile medical clinics. Several of these were rural states where the need is greatest, but expansion of this approach to reimbursement for services would assure that MMUs could continue to fulfill the medical home model for populations that are otherwise medically underserved.

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