

Supporting Mobile Health Clinics: The Children's Health Fund of New York City

The Children's Health Fund

The Children's Health Fund (CHF) develops and supports a national network of 22 programs and two affiliates in 15 to 17 states in the United States and the District of Columbia. The mission of the CHF is to provide comprehensive health care to the nation's most medically underserved children, from birth up to age 24. In-person primary health care, mental health, and oral health services are delivered by teams of doctors, nurses, dentists, psychologists, social workers, and nutritionists at more than 200 service sites across the United States in partnership with pediatric departments and specialists in affiliated academic medical centers or Federally Qualified Health Centers (FQHC).

The CHF's integrated approach to health care is consistent with the concept of an "enhanced medical home" in which continuity of care is ensured via coordination across multiple healthcare providers and specialties. In the United States, the Medical Home concept is being adopted as one aspect of health care reform to ensure a high quality standard of care that also seeks to increase efficiencies and reduce costs for acute care. This type of integrated health care delivery is enabled by health information technology (HIT)—not only computer software but also communications networks.¹

The cofounder and president of the CHF, Dr. Irwin Redlener, received his M.D. from the University of Miami in 1969. But his life mission for bringing medical care to underserved children reportedly began when he was a medical resident in pediatrics at the Children's Hospital of Denver and saw a poster for VISTA (Volunteers in Service to America) with the words: "If you're not part of the solution, you're part of the problem." Dr. Redlener's quest to become part of the solution began with delivering medical

care in Lee County, Arkansas, then working on earthquake relief in Guatemala, followed by serving as medical director for USA for Africa, and this poster is hanging in his office today.²

An important motivation in my life has been working with kids whose situation makes them vulnerable for reasons out of their control. They are desperately ill, or living in extreme poverty, or disconnected from medical care. I feel most energized by trying to help children who have the fewest resources.

—Irwin Redlener³

In 1987, Redlener cofounded the Children's Health Fund (CHF) in New York City. Its initial focus was on pediatric care for homeless kids, and his cofounder was singer/songwriter Paul Simon. While working for USA for Africa, he helped solicit the help of other recognized entertainers, including Joan Baez, Harry Belafonte, Lionel Richie, and Michael Jackson. When he learned that Paul Simon was interested in doing something for the homeless, he reached out to him:

I was working for USA for Africa, setting up the grant office in New York City. Paul Simon, who was on the We Are the World record, wanted to do something for the homeless. We visited a number of welfare hotels. In the Hotel Martinique [in Times Square] a thousand children and their families were warehoused. Somebody suggested that we should get a van and bring doctors there.

—Irwin Redlener⁴

That was the beginning of what would become CHF's national network of Children's Health Projects (CHP), in which health care is delivered via doctors, nurses, and

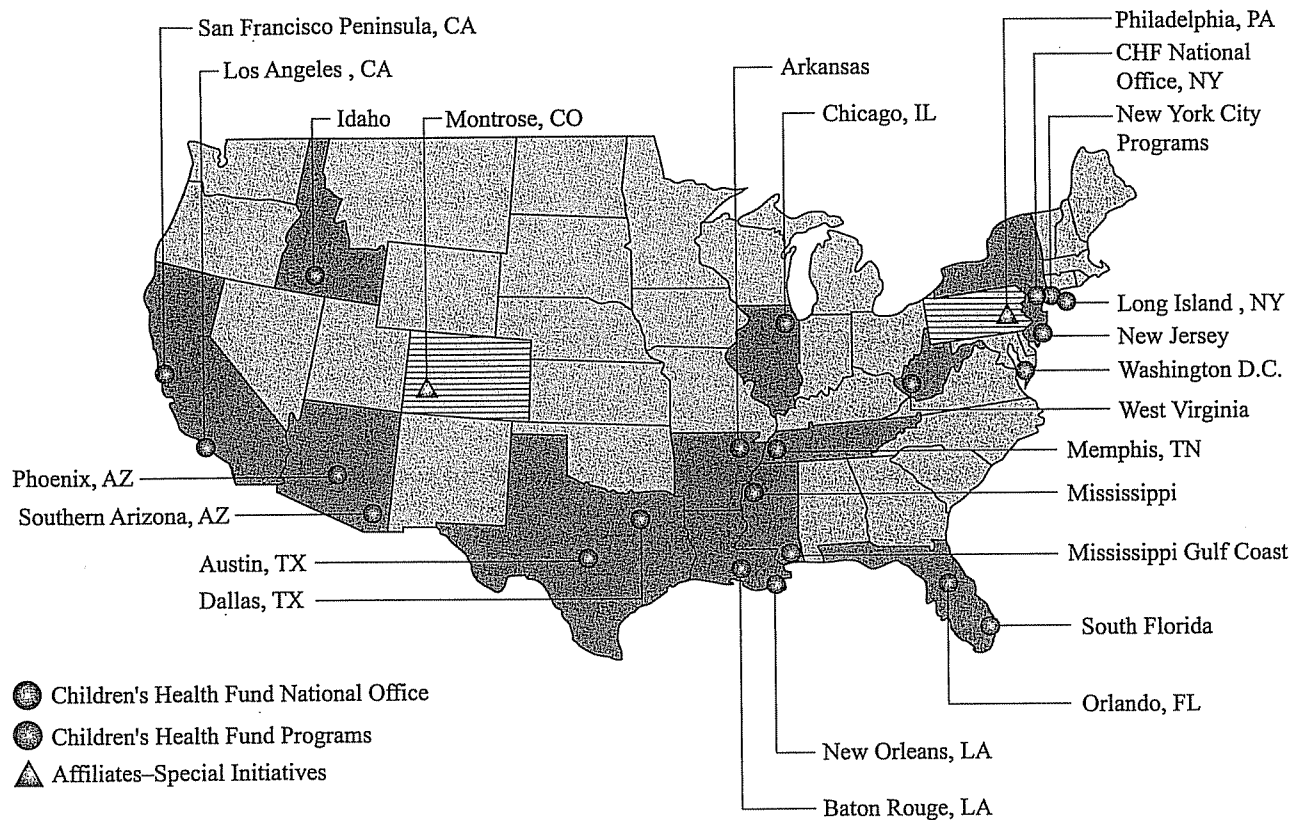
Copyright © 2010 by Carol V. Brown, Distinguished Professor, and Kevin Ryan, Distinguished Associate Professor, Stevens Institute of Technology.

¹The Medical Home concept, which originated with the American Academy of Pediatrics in the 1960s, is today being considered as a means to reinvent primary care in the United States. One of the current barriers to implementation is the fee-for-service reimbursement model within the United States.

²As reported by Tom Callahan, "Mobilizing for Kids," *Diversion for Physicians at Leisure* (April 15, 2004): 30–32.

³Ibid.

⁴Ibid. The "We Are the World" record was made to raise funds for the USA for Africa's famine relief efforts. For example, see: <http://www.inthe80s.com/weworld.shtml>.

**EXHIBIT 1 CHF National Network**

Copyright © the Children's Health Fund. Reproduced with permission. All rights reserved.

other professionals in an RV-size mobile medical clinic (MMC) that is driven to locations where the people are who need it—such as city shelters for homeless families. The flagship program with the first MMC was launched in NYC in 1987, and by 2009 the program had been expanded to cities and some deep rural areas within CHF's growing national network of clinics. The clinics are supported by 41 state-of-the-art MMCs (32 medical, 3 mental health, 5 dental, 1 public health field office, and 1 health education) operating in different programs across the country (see the map in Exhibit 1). By 2009, some had been in service for many years and while not obsolete, lacked some of the newest features, such as modular network cabling and upgraded electrical generators; 7 new MMCs were in some stage of procurement in June 2010.

The payments for the medical care provided by CHF primarily come from four sources: private individual and corporate donation, congressional aid, and two government health insurance programs that support children living in poverty. These programs are Medicaid and the State Children's Health Insurance Program (SCHIP). Medicaid insures kids whose parents earn little or no money; the federal government pays part of the costs, but programs are

administered and partially funded by state governments. SCHIP, a newer federal program initiated in 1997, insures children in families that earn too much to qualify for Medicaid, but too little to afford private health insurance. In February 2009, President Obama signed a bill that continues funding for SCHIP (\$32 billion over the next 4.5 years).

Mobile Medical Clinics at the Children's Health Fund

CHF's Mobile Medical Clinics (MMCs) are housed in 36- to 44-foot long blue vans, designed to provide a full range of pediatric primary health care including preventive care (e.g., childhood vaccinations), diagnosis and management of acute and chronic diseases, mental health, dental, and health education services. In addition to care provided in the mobile clinics, care is provided at stationary clinical sites located in shelters, schools, and community centers, and traditional health clinics (e.g., the South Bronx Health Center for Children & Families in NYC). The mobile clinics routinely visit low-income neighborhoods and homeless and domestic violence shelters to provide medical services, but MMCs

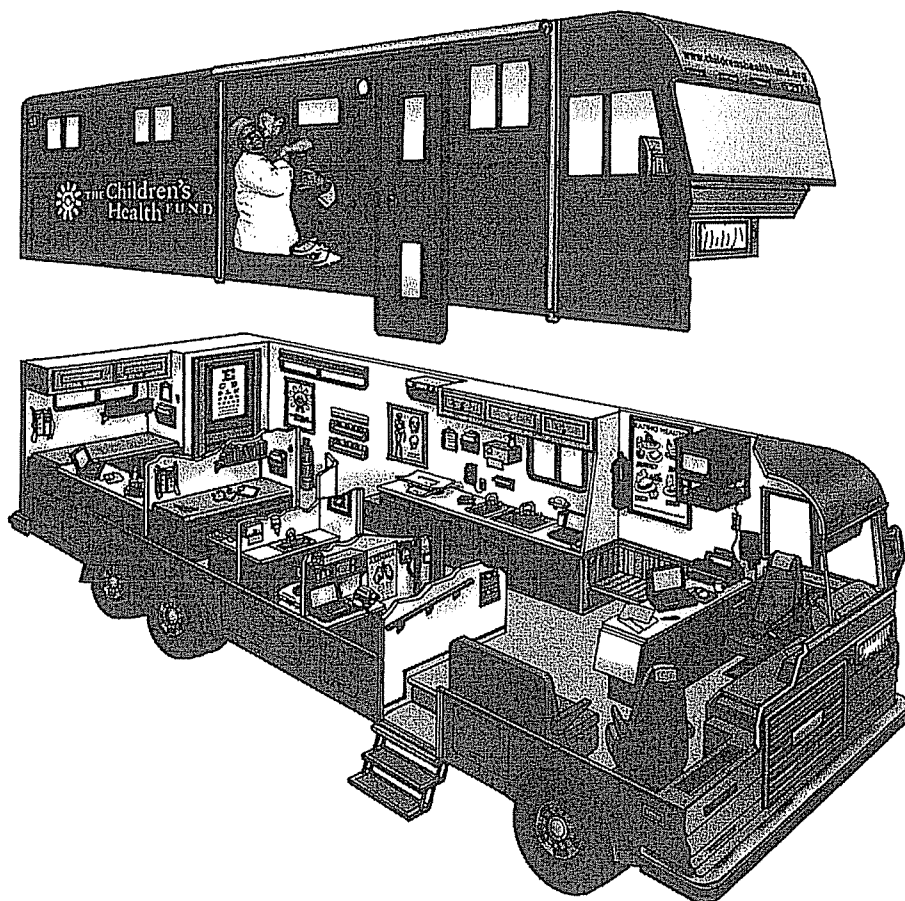


EXHIBIT 2 The CHF Medical Mobile Unit (MMU) Model

Copyright © the Children's Health Fund. Reproduced with permission. All rights reserved.

have also been deployed to provide medical services in response to public health crises or emergencies, including the 9/11 attacks on the World Trade Center, hurricanes Rita and Katrina in 2005, and the 2010 Gulf of Mexico oil spill.

Two primary CHF principles are at the heart of the design of the MMCs:

- To provide high-quality pediatric primary care as well as mental health services, dental services, and social services to medically underserved populations with children.
- To operate in partnership with a high-quality local medical institution, such as an academic medical center or FQHC, to ensure access to other medical experts as needed as well as coordinated health care for the local population.

Access to reliable, affordable transportation is a major constraint for those living in poverty at government-sponsored

locations, as well as areas where there are few health care providers, known as HPSAs (Health Professional Shortage Areas). To help remove this constraint for low-income and homeless residents in New York and four other major areas, GlaxoSmithKlein provided a \$2.3 million grant to support transportation funding in 2004: \$35,000 on taxi rides and \$20,000 on bus tickets for adults were spent by the Dallas Children's Health Project (CHP) the prior year. In New York, this Referral Management Initiative had dramatic results: specialist appointment compliance rose from 5 to about 70 percent.⁵

The medical home concept is based on the premise that a returning patient will be supported by a trusted healthcare team who knows the patient and has access to documentation of his or her health history. Exhibit 2

⁵ Tony Hartzel, "Transportation a Vital Health Link," *The Dallas Morning News* (December 19, 2004).

shows a model of the MMC and its layout, with a separate registration area and waiting room, a nurse's station, and examination rooms.

The sides of the blue vans are painted (like "billboards") to clearly signal that they are CHF units with qualified medical personnel onboard. On a given day during a given time period each week, the MMCs are scheduled to be at the same location with the same medical personnel onboard.

We don't just show up like in an ice-cream man mode, give a shot and disappear. The protocol is that every Tuesday from X-time to Y-time the doctor is there.

—Jeb Weisman, CIO

Providing high-quality primary care from a mobile clinic does present some unique challenges for supporting those who are delivering the health care, such as:

- Designing an environment which is consistent with and will support standard physician office and clinic processes. This includes providing the required space and medical equipment to support high quality delivery of primary care, including sufficient, high-quality electrical power.
- Complying with regulatory standards such as those set forth by JCAHO (e.g., PC locations) and government legislation (e.g., HIPAA laws for privacy and security of personal health information).⁶
- Supporting a mobile unit that operates at multiple, primarily urban, sites—each with its own unique environmental factors.
- Providing computer and communications technologies within the MMC that are reliable and dependable, as well as off-site access to technical support.

Another important consideration is the overall cost for each mobile clinic—including the initial costs for a state-of-the-art MMC as well as continuing operating costs. The majority of the approximately \$500,000 capital budget for each MMC is allocated to the required medical equipment and associated vehicle requirements (i.e., space, power, and transportation needs). Preventive care via a medical home should of course result in long-term cost savings for state and federal payers as children receive immunizations

and regular health checkups that can avoid costly visits to hospital emergency rooms, but these are difficult to measure. Given the national shortage in primary care physicians, CHF's association with a major medical center also means that MMC may be part of medical residents' formal training rotation, often in pediatrics or community medicine, as part of the medical team.

Healthcare Information Systems to Support Primary Care

In the United States today, it is still not unusual to find paper-based record keeping in physician practices (referred to as ambulatory or outpatient practices). Two types of functionality are provided in software packages developed and maintained by vendors who specialize in the healthcare industry:

- Practice Management Systems (PMS) support administrative tasks such as patient workflow and the revenue cycle, with data including patient contact information, appointment scheduling, and patient insurance plan information.
- Electronic Medical Record (EMR) systems support clinicians, such as patient diagnosis, treatment and physician orders, with data including patient demographics (age, gender), family history information, allergies, medications, and clinical documentation of diagnoses, treatments, and outcomes for prior visits and specialty referrals.

By 2008, only 4 percent of physicians in ambulatory settings had a fully functional EMR; 13 percent had a partially functional EMR; but 50 percent of those in larger practices (11 or more physicians) had partial or full EMR support.⁷

Some vendors provide packaged solutions with PMS and EMR modules designed to exchange data with each other. However, since some of the clinical packages are designed to specifically support certain types of care—such as pediatrics, OB/GYN, cardiac care, and so on—specialty practices in particular may have purchased software from different vendors. In addition, software that supports electronic prescription transactions to pharmacies and insurers has recently been widely adopted as this capability has become required for reimbursements by government and other insurers. Investments in software packages to support clinical processes in small practices (1–3 physicians) in particular will be made at a much faster rate during the second decade of this century due to financial incentives administered by Medicaid and Medicare to eligible physicians who have implemented

⁶JCAHO (Joint Commission on Accreditation of Healthcare Organizations) is the accreditation body for healthcare organizations. The HIPAA (Health Insurance Portability and Accountability Act) Privacy Rule governs all protected health information; the HIPAA Security Rule sets security standards for protected health information maintained or transmitted in electronic form.

⁷ 2007 study by the Institute of Health Policy at Massachusetts General Hospital (MGH).

certified electronic health record systems and reported specific metrics for Meaningful Use beginning in 2011 under the HITECH Act.⁸

The advantages of using computerized health information systems were recognized early on by the CHF. Jeb Weisman, the current CIO, initially joined the organization in the late 1980s prior to the implementation of the first MMC to lead the efforts to provide state-of-the-art support for the MMCs. Initially a home-grown system was developed and maintained.

Given the way the transitional housing system for the homeless worked at the time—there were enforced moves every 3 weeks and that sort of thing—it was incredibly important that you had a real history. Some of these kids were being immunized half a dozen times for measles, by the time they were 6 or 7 because if something would show up, it is better to give them shots than not . . . So you had as much as medical over-neglect as under-neglect going on. Records are vitally important.

—Jeb Weisman

In 1999, CHF partnered with a now defunct vendor to develop specialized technology for the MMC environment. This system was then phased out in 2007 when CHF partnered with another leading Electronic Health Record (EHR) software vendor: eClinicalWorks.⁹ Given the CHF's early investment in custom software that supported the data collection of detailed clinical data specifically for pediatric care, Weisman's team built in a similar data collection capability for use with the commercial software package. Having this detailed information in a standard format enables high-quality patient-physician interactions on not only the first but also subsequent visits, in addition to providing the data needed for referrals. Medically underserved populations typically have higher levels of lead in their bloodstreams, asthma, and other chronic conditions.¹⁰

One of the record keeping challenges faced by all physician practices is the integration of laboratory and imaging results with the rest of a patient's health record.

⁸ The implementation of an HITECH Act, which is a portion of the American Recovery and Reinvestment Act legislation signed into law by President Obama in February 2009, is overseen by the Office of the National Coordinator for HIT within the U.S. Department of Health and Human Services. An EHR is similar to an EMR, except it is designed to exchange data with other healthcare systems external to the healthcare provider who owns it.

⁹ Soon after this adoption date, eClinicalWorks was selected as an EHR vendor for the New York City Department of Health and Mental Hygiene's (DoHMH) Primary Care Information Project (PCIP).

¹⁰ As reported in an interview of Irwin Redlener by Janice Lloyd, "Kids Can't Wait" for Health Care," *USA Today* (May 21, 2009): 7D.

In a paper environment, the test results are typically faxed from the facilities performing and interpreting the tests to the requesting physician, and then paper copies and film (such as x-rays or CAT scans) are filed in the patient's folder along with other hard-copy records. When test results are not received in a timely manner, a nurse or other staff member typically makes a call to the test facility's staff and can receive the missing record in a relatively short time period. Today's more sophisticated healthcare information system (HIS) solutions integrate electronic reports of test results with the patient's record so that the physician can quickly access all relevant data with the same patient record interface.

However, maintaining an accurate medical history for a patient who lives in poverty and may be residing in a homeless shelter or other temporary housing is more complicated than for patients with a more permanent address. In cities and towns with CHF clinics, a patient served by a specific clinic in a given neighborhood in the Bronx this month may be domiciled in a different shelter in a different borough and show up at a permanent clinic or MMC in a different location in NYC the next month. To retrieve a record from another clinic may require a phone call and fax capabilities.

Both telephone and fax capabilities are therefore basic requirements for not only retrieving missing data but also consulting with other medical experts, and supporting patient referrals to other clinicians, including specialists. An ideal solution to capture the patient data that have previously been collected for the same patient—especially when the same software package is being used at multiple clinics—would be to have it available in structured electronic form.

Connectivity Needs to Support Mobile Medical Clinics

There are therefore two primary communications needs for clinicians to deliver quality healthcare via a mobile clinic: (1) access to patient data previously captured at another medical facility (or MMC) but not yet available in the patient record system in the clinic and (2) access to personnel at another medical facility for either an emergency consult or referral, or a more routine referral. In an ideal world, all of the network requirements described below for a mobile clinic environment would be satisfied. However, some unique challenges are associated with MMC service environments.

- **Network availability and reliability.** The number 1 networking requirement is that remote access to data and people needs to be available. Yet the MMCs are deployed mostly in dense urban areas—and sometimes in sparsely populated rural areas—that may

not provide network availability or may not provide reliable access to voice and data networks.

- **Data security.** At a minimum, HIPAA requirements for data security must be met. User data must be encrypted at the database server level, and additional encryption and “network tunneling” are needed for protection of patient data at the network level.¹¹
- **Easy to use with zero on-site support.** Networking technologies in the MMCs are there to support the high-quality delivery of pediatric primary care. Since the highly trained and educated medical staff is not necessarily sophisticated in knowledge about networking technology and maintenance of equipment, it is critical for the networking solution to be “push-button” technology and require little infield maintenance and provisioning.
- **Inexpensive to deploy and operate.** The installed networking equipment should not add significant expense to the cost of an MMC. The network solutions should also be readily available and easy to acquire plus easy to install in the MMC.
- **Network throughput (data rate) and latency.** The data rate must support the transfer of text-based files (medical health records and patient referrals). The transmission of high-density medical images (e.g., digital X-rays) requires much higher throughput rates and therefore provides a different challenge. Another critical requirement is to minimize network latency; large latency results in inefficiencies and possible confusion on the part of the MMC staff (e.g., “Is the network connection still active or not? Why is it taking so long to load?”).

Connectivity Solutions: What Worked and What Didn't

Since the launch of the first MMC in the 1987, several networking solutions have been tried and newer technologies have become available and affordable. Two different wireless network solutions were tried, with mixed results.

Satellite-Based Access

In 2005, a number of MMCs were equipped with rooftop-mounted satellite antenna systems. These antenna systems were equipped with a setup function which automatically unfolds the antenna and raises the antenna from a horizontal (“flat”) position to a position where the

antenna is facing the sky. The antenna then performs a scanning operation to detect the strongest available satellite signal and begins establishing a communications link with the satellite. When the system is powered down, the antenna folds back into the original horizontal position. Although these systems were expensive and designed for mobile operation, they proved to be mechanically unreliable.

You have these structural limitations to the system. Every day it goes up and down but unlike mom-and-pop casual use, we're dealing with vital health care information and communications. Invariably, the mechanical system breaks down—a gear strips, a connector fails, or a circuit fries. We have had doctors and nurses climbing on the roof to manually lower the antenna system, and these are high-end, sophisticated devices . . . Well, that is not good on many levels, not the least of which alienates users towards the technology.

—Jeb Weisman

They also posed structural problems for the MMCs (due to their weight). In some situations, the satellite communications also had unacceptably large latency due to the nature and design of satellite communication systems.

It is interesting how expectations get managed in these kinds of environments. In terms of throughput or capacity in a perfect world, most of the data that you are moving is simple structured textual data. So actually you need very little bandwidth, but you need bandwidth without significant latency . . . A 1.5 Megabit satellite connection is way different from 1.5 Megabit connections on a wired line or even in Wimax, or whatever the flavor of the month is, in a traditional Ethernet-based system. The latency is a killer. It is deceptive for the end user: even if the throughput is okay to move that image down, or to move those data up, they don't trust it—because it takes longer to refresh than we are used to today at home or in the office. Do they step away and hope their data are refreshed when they are taking care of the patient, or do they stand there for twice as long waiting for something to happen? Very often wireless communication at the satellite level can make things worse than just going with the flow—which is to say ‘we are here, we are in a box in the middle of nowhere, and we just have got to manually write it down and deal with it later.’

—Jeb Weisman

¹¹ Tunneling is a networking technique that encrypts user data for secure transport over the public Internet.

Cellular Wireless Networks—Wireless Modem Solution

First piloted in 2004 and formally entered into service in 2007, the MMC was equipped with a Sierra Wireless AirLink PinPoint X wireless modem that provided Third Generation (3G) wireless service with a “fall-back” capability to 2.5G wireless service in areas where 3G service was not available. The advantage of this specific wireless modem was that it supported both 3G standards widely deployed in the United States: both Universal Mobile Telecommunications Service (UMTS) and cdma2000. The potential for 3G rates is in the range of several Mbps, so this wireless solution provided the MMC with a high data rate to and from the Internet. However, the transmission of patient data requires cellular coverage and reliability at a “mission-critical” or “professional” level, but today’s general purpose wireless networks are designed for “consumer” levels. If the wireless coverage is not available and reliable, this solution can only be used to support MMC communications that are not mission critical.

For the clinicians working in the mobile clinics, dependable and predictable wireless access to the Internet is more critical than achieving higher data rates. 3G and the emerging 4G networks do have the required throughput (4G wireless networks are promising 100 Mbps) for transmitting more than text-based data. However, what these networks do not deliver is reliable and dependable coverage (i.e., network access) at the level required.

A hybrid alternative that has been tried is to delay data transmission from the MMC until there is access from the van to a wired broadband solution, such as in a community center or school.

Delayed Broadband Wired Access

In this mode of operation, the MMC operates as a “store-and-forward” device: patient records, medical referrals, and digital images are stored on an MMC server until wired broadband Internet access is available. A typical configuration is to have a wireless LAN (WiFi) connection via a wireless router from the MMC to the broadband access point into the other facility. The obvious disadvantages of this approach are the delay in accessing and transferring information, and the security of the wireless LAN link. In addition, the MMC is not always able to use a nearby third-party’s wired network due to local restrictions on access to its wired broadband connection or HIPAA security concerns.

Many of these organizations or institutions, particularly ones that are city based, won’t allow you to install your own telecom infrastructure in their buildings. So we can go to shelters where they even often

have an Internet or network-based infrastructure and we are not allowed to connect to it. Plus then we have some problems around what I will generically refer to as a HIPAA Issue—we can’t just go through any old network . . . HIPAA rules are actually changing substantially—becoming much more restrictive, much better prescribed and set out, and much more painful if you violate them . . . So when we look at the solutions, we have to make sure we can tunnel.

—Jeb Weisman

Asynchronous Multi-Master Database Replication (AMMR)

In the absence of a reliable, high-speed networking solution to enable patient data transfers from the MMCs to the central server at the headquarters of the New York CHP in the Bronx, a more hands-on solution has been adopted to enable (1) the integration of patient record data collected at multiple sites and (2) provide a backup capability. But it also requires physical proximity of the servers in the MMCs to the CHP offices.

Banks figured out years ago that if you could put a teller machine in a town in Montana, people would use it and you would make money on every transaction. But do you think there was telecommunications out to that town? There was not. So how did it work? AMMR. At some point the cash machine could dial up in the middle of the night, when rates were low, and send the data up to Wells Fargo. It all got merged together, business rules were applied, and then it sent back down inserts to the [ATM] database. [The ATM] knows what it needs to know and makes it through another day, without real-time high bandwidth telecom.

What happens here is that all the servers from the vans are physically brought in to a central location so that there are X number of what we call the laptop servers connected to the master or primary server. We press the button and it goes through a kind of round robin, moves the data up to the master from each one, applies business rules, aggregates the data, and then copies the identical data set to every single one of those [servers]. We do it through inserts; we are not actually copying 10 gigs of data down to each one, so it is a very efficient process. And when you are done, each one of those devices is an exact working copy of the entire data set. It’s an elegant solution to an inelegant problem.

—Jeb Weisman

Other Support Challenges and Solutions

The IT infrastructure on the mobile unit includes a server built from a Panasonic ToughBook laptop (CF30) and a number of client computers which are a lighter-duty ToughBook. They support a wireless Ethernet capability, but the recommended MMC solution is wired—because of greater throughput and more reliability:

These generators—anywhere between 5 and 20 kilowatts—are underneath the mobile units, and they produce electromagnetic radiations. You don't get a lot of wireless connectivity when you have got 20 kilowatt generators standing under your feet . . . It is a 36 foot van, and you are 20 feet (or 15 feet) from the server and you cannot make a wireless connection that is reliable—the power is too dirty . . . Even the best regulated generator will produce increasingly dirty power with a lot of harmonics and a lot of brownouts. Brownouts are the danger. In a spike, the thing explodes, melts . . . you just buy a new one. But a brownout slowly degrades the electronics in delicate medical equipment. You don't know that it is dying, and it begins to create false data or fails at an unexpected time. Plus you have got air conditioners and air filtration in the mobile unit, which have these big startup power needs. So what you have to do is to put at least a real time UPS in front of these things and preferably something like a line conditioner voltage regulator that pre-cleans it and then gets it to the UPS, because the UPS is for the most part not built for this degree of dirty power.

Jeb Weisman

Inkjet printers also have to be used instead of laser printers—because laser printers can't generally be used with a UPS that fits in the mobile environment. Unfortunately, the operating cost of an inkjet printer is higher.

The CHF's NYC office provides the initial on-site IT setup and training for new MMC programs and ongoing remote help desk support. Most of the MMC teams supported by CHF have gone 100 percent live with electronic record keeping for all of their patients within the first week. One of the reasons for the fast start-up is that the training team now includes a clinician who is an experienced user of the EMR:

Our training team typically consists of me, another person on our staff—kind of an application specialist—and we typically take either a medical director or a high-level clinical provider from one of our projects within the network who has been using eClinicalWorks

out in the field. That actually makes a huge difference. We always have members of the training team stay with [the MMC team], on-site, in clinic support. Usually they are there for the first afternoon of seeing patients live with the system, and then also for the next morning. We try to split it that way so that we go to more than one site—covering as many sites as possible in case there are any technical or clinic process problems. One of the great things that has really worked so well for us in our training is not separating out according to role during the training: we are not training all of our providers in a room by themselves, not training the registrar alone, or the nurses. They are developing [their own] built-in tech support; they are learning each other's jobs and how to help each other. This is how a clinic really works and the training simulates this.

—Jennifer Pruitt, Director,
Clinical Information Systems

Mobile Health Clinics for Crisis Response

In 2003, Dr. Redlener also became the first director of the National Center for Disaster Preparedness within Columbia University's Mailman School of Public Health. One of the goals of this center is to deal with the aftermath of major disasters and assess the impacts on high risk, vulnerable children and communities. Prior to that date, CHF had already sent its MMCs to respond to crises related to Hurricane Andrew (1992) and the 9/11 World Trade Center attack in New York City (2001).

The best choice for communications technology following a natural disaster is highly dependent on the crisis situation. If cell towers and base stations previously available in the region have not been lost, the existing commercially available cellular network can be utilized. However, this is the same network available for public cell-phone service, and following a disaster there can be network overload due to an increase in call demands by the public. Most wireless providers do not implement a call-priority capability, so a mobile clinic's usage of the network will typically compete with calls from the public at large. In worse scenarios, there may be no cellular network access available in the emergency relief area. The same may be said during other public disruptions such as blackouts. In 2003, a large portion of the United States lost electrical power. Within hours virtually all cell phone communications in New York City had failed as uninterruptible power supply batteries were depleted and generators failed or

were inadequately sized for the scale of the outage. A possible alternative, of course, is to use the MMC vans equipped with their own generators and with satellite antennas.

Just days after Hurricane Katrina hit New Orleans in 2005, Redlener personally accompanied two mobile healthcare units with a team of medics to provide vaccinations and treat infections in the Gulf coast region. In the initial weeks, they had treated more than 7,000 patients whose doctors' offices had been wiped out—either washed away or flooded. The following year, a study by the center reported that one in three children that were housed in trailers sponsored by the Federal Emergency Management Agency (FEMA) had at least one chronic illness, and the number of children housed in trailers in the Baton Rouge area were twice as likely to be anemic than children in NYC's homeless shelters. The need for more ongoing health support for children was clear, and CHF helped to establish and finance new mobile clinics in the Gulf port (Biloxi, Mississippi) and in the New Orleans and Baton Rouge, Louisiana, areas.¹²

¹² Martin Nelson, "A Hero at Large," *People* (November 7, 2005); Mary Carmichael, "Katrina Kids: Sickest Ever," *Newsweek* (December 1, 2008) and Janice Lloyd, "'Kids Can't Wait' for Health Care," *USA Today* (May 21, 2009): 7D.

The Future

By early 2009, Dr. Redlener was on another quest: to build awareness about the long-term health impacts on children from economic recessions. His "Kids Can't Wait" campaign emphasized that missed immunizations and early health assessments have long-term impacts that can be hard to recover from.

By mid-2010, the need for mobile clinics in the United States was even more widespread, and the television coverage of the 2009 earthquake devastation in Haiti had greatly increased public awareness about the need for quick, mobile healthcare solutions. Installing technology on a new MMC, training the staff on-site, and providing remote support for the first weeks of operation was now a well-honed capability among the NYC-based CHF staff.

However, CIO Weisman wonders how even better support could be provided for the mobile clinics and what new support challenges lie ahead. Are there newer more affordable network communications solutions that should be tried? Will the federal government's HITECH stimulus funds and Meaningful Use standards lead to better software integration solutions? Will the increase in software adoptions at physician offices make it more difficult for him to retain his staff? What combination of conditions could emerge that render the mobile medical clinic model obsolete?

Answer Questions