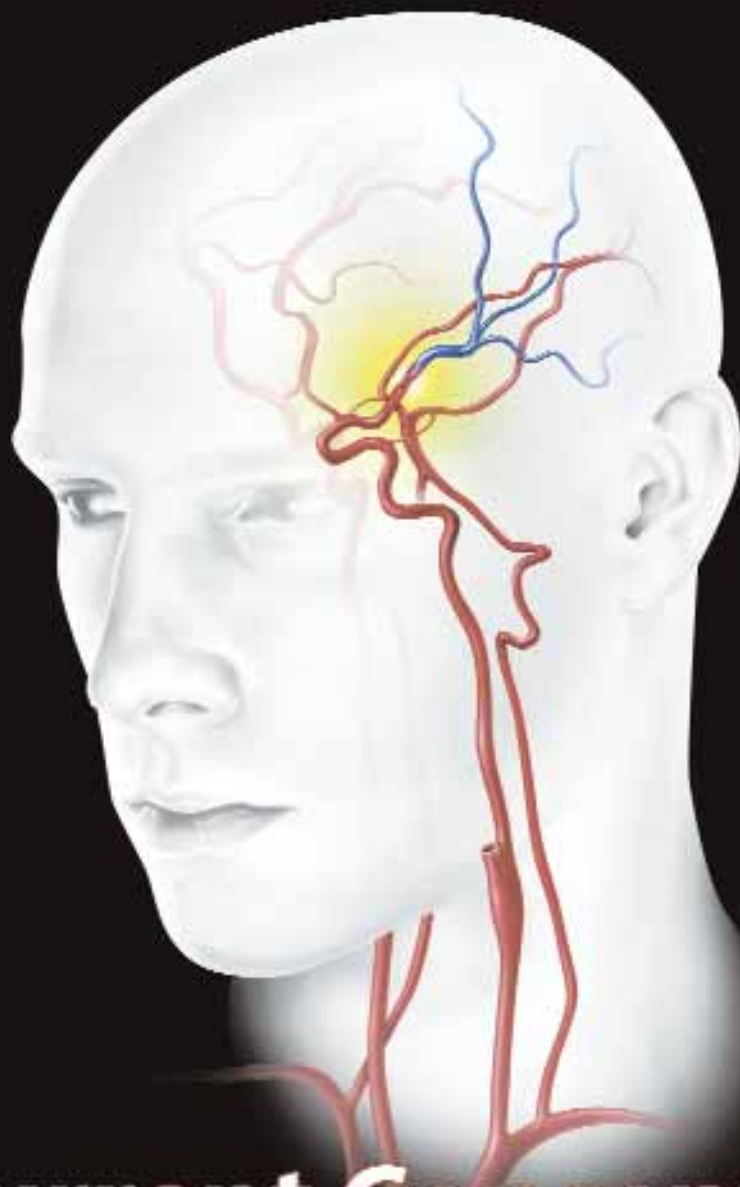


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**Current Concepts in
Comprehensive
Stroke Care**

Robotic Telestroke Program: Transforming Stroke Care

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BY FUJI LAI, MS

Stroke is the second cause of death worldwide and the third leading cause of death in the US. Recent development of new interventions including thrombolytic therapy and neuroendovascular procedures offers real hope to change the once bleak prognosis for acute stroke victims. However, these new therapies are not widely available. Most community hospitals do not have the basic patient-assessment capability in place on a 24/7 basis, nor have they established the appropriate emergency department (ED) treatment protocols. Furthermore, very few hospitals have the specialists on staff required for neuroendovascular procedures. Therefore, stroke patients are either immediately transferred without proper evaluation or go untreated. This scenario is no different and is especially true in the farther reaches of the state of Michigan. The Michigan Stroke Network (MSN) was launched in response to this need.

METHOD

The MSN is a collaborative network of hospitals working together to deliver the most comprehensive stroke care in Michigan. The goal of the MSN is to ensure that hospitals across Michigan, regardless of size or resources, can offer patients advanced stroke care. This would be done by addressing issues associated with delayed stroke care including time to hospital, time to diagnosis, finite window for intervention, lack of on-site expertise, and lack of infrastructure and resources (eg, tissue plasminogen activator [tPA], personnel, critical care, and transfer protocols). The idea was to bring expertise to the access point with 24/7 availability of stroke experts, encourage local expertise, make available algorithms for care, and assist in evaluation and triage of potential stroke victims. This would be accomplished by providing 24/7 access to stroke experts via a toll-free number, consults via telemedicine, and rapid transfer of patients as necessary via med flight.

The MSN uses a “hub-and-spoke” network model whereby the hub stroke center of excellence provides expertise to 31 (at last count) spoke community and rural hospitals via telemedicine so that stroke patients across the state can now receive around-the-clock access to stroke expertise. The hub, which has comprehensive stroke center capabilities, offers tertiary care by providing 24/7 access to stroke expertise, 24/7 access to neuroendovascular specialists, access to study protocols to increase the potential treatment window, and access to technology to increase treatment window.

The development of the hub-spoke network showcased the collaborative nature of this endeavor. The implementation of the MSN brought together multiple stakeholders to collaborate on processes, which included recruiting and establishing relationships, training and in-servicing for readiness, robot installation and orientation, and the development of guidelines, to assist member hospitals to initiate acute interventions. The member hospitals ranged across the spectrum from critical access hospitals to larger community hospitals. The vision they shared was to enable stroke patients across the state to have access to stroke expertise and the right level of care.

The stroke expertise was delivered using the Remote Presence (RP) robotic technology (InTouch Health, Santa Barbara, CA). When a stroke patient presents at a spoke hospital ED, the ED staff call a toll-free number to activate the network and page the on-call hub stroke expert. The stroke expert uses a mobile laptop and wireless Internet to connect to the RP robot and be virtually at the patient’s bedside within minutes. The RP system is unique compared to traditional telemedicine systems in that the RP solution affords the physician complete autonomy and reliability to be able to initiate a connection without the need for support from either ED nursing or technical information technology staff. The significance of this is that the physician is able to

conduct an acute stroke consult on demand, immediately, from anywhere, at any time. Furthermore, once the connection is made, the physician is able to drive and maneuver the robot around the ED, essentially giving the physician complete mobility at the remote site, as if he/she were physically there. The stroke expert is able to use the two-way audio and video capability to conduct a neurological assessment with the patient, to read data visually off monitors and devices in the room by zooming in, and to interact with the family and ED staff (Figure 1). The entire process enables the stroke expert to have the information needed to make the most informed decision for management of the patient.



Courtesy of the Michigan Stroke Network.

Figure 1. An MSN stroke expert beams in to robot at spoke hospital ED to conduct acute stroke consult.

RESULTS

The MSN has successfully met its mission and objectives to enable stroke patients throughout the state of Michigan to receive around-the-clock access to stroke expertise. The established network included 31 member hospitals, which served as access points to tertiary care. These member hospitals had very diverse characteristics ranging in size and availability of resources (Figure 2).

Results thus far have exceeded expectation and initial projections. The overall effect of the stroke network on the community and hospitals involved includes:

- On-demand access to stroke expertise any time.

- 24/7 access to tertiary care and neuroendovascular specialists.
- Triage of complex cases to stroke centers of excellence.
- Timely delivery of appropriate care.
- Elimination of inappropriate patient transfers.
- Network-wide stroke awareness and education program.
- Positioning of hub hospital as neuroscience center of excellence.

18-Month Clinical Results

- More than 300 calls initiating stroke consultations

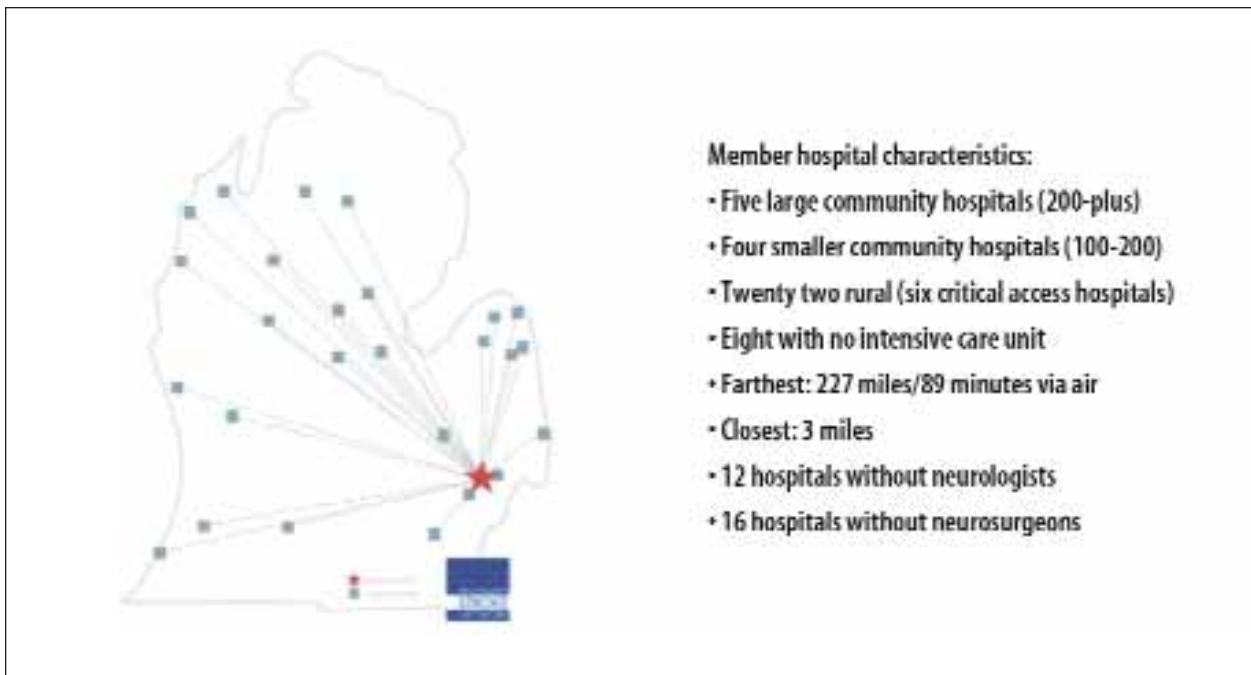


Figure 2. The geographical reach of MSN and access point characteristics.

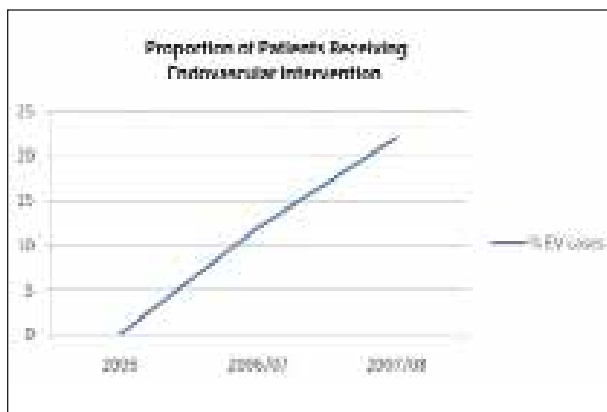


Figure 3. MSN resulted in an increased proportion of patients receiving an endovascular intervention.

- have occurred thus far during the life of the program.
- 83% of eligible patients received intravenous tPA.
- MSN enabled stroke patients at spoke hospitals to have faster access to stroke expertise:
 - Time interval from time patient last seen normal to patient arrival at spoke ED=67 minutes;
 - Time interval from patient arrival at spoke ED to MSN callback=8.5 minutes;
 - Time interval from MSN callback to tPA administration (at remote site)=33 minutes;
 - Door-to-needle time=8.5+33=41.5 minutes.
- 18 hospitals administered tPA for the first time.
- 30% of patients were transferred to hub for advanced care.
 - 25% of patients transferred went to catheterization lab.
 - Of those transferred to catheterization lab, about 50% received an intervention.
- 22% of patients received interventional procedures: emergent and elective endovascular cases have grown progressively to comprise a larger proportion of cases (0% in 2005; 12% in 2006/2007; and 22% in 2007/2008) (Figure 3).
- Average National Institutes of Health Stroke Scale scores: admission=10; discharge=3.

Other Results

Additional results from the program include an increased number of stroke patients presenting at the network from locations throughout the state of Michigan (Figure 4). The hub hospital also realized a doubling of stroke patient volume over the prior year. The use of a robot for telestroke has captured the imagination of the community and generated significant attention, resulting in over 100 television and public relations events. The work of the MSN has also been recognized at the state level—the MSN received the

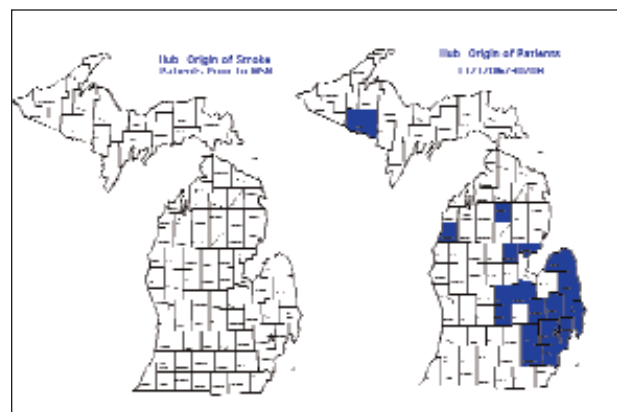


Figure 4. Extending the reach of stroke expertise to patients throughout the state of Michigan.

2007 Detroit “Health Heroes” award. Furthermore, the success of the network for delivering stroke care throughout the state has prompted initiatives to expand on the network by layering other specialty services, such as cardiology, to be delivered through the network as well.

DISCUSSION

From the endovascular specialist perspective, although intravenous tPA remained stable, the number of interventional stroke cases as well as the number of elective endovascular cases have grown and have become an even larger segment of the practice. The philosophy was to encourage local expertise at each of these spoke hospitals. Education and assistance were provided to each of the sites so that they could become better stroke facilities. Training and education of spoke hospital ED staff in assessment of stroke resulted in the spoke hospital staff now being more comfortable administering tPA and handling certain kinds of patients. The more stroke patients the spoke hospitals saw, the more tertiary-level stroke patients the hub saw. The goal was for the stroke expert to help the spoke hospitals rapidly triage their patients. Today’s emergency rooms (ERs) are often overwhelmed with patient flow, and the average ER physician is in the triage business. ER physicians excel at acute stabilization and management of patients but do not have the time to sit down and take a detailed history, which is what is needed for the proper management of a stroke patient. Ninety percent of stroke patients can be taken care of emergently and acutely by ER physicians; however, in the middle of the night in a small rural hospital, sometimes a second opinion from a stroke expert can prove invaluable. Services delivered through the RP robot added an element of safety to help the ED determine the best course of action for the patient.

The MSN has effectively delivered expert care to an underserved population in Michigan. The enabling technology that has defined this program is Remote Presence robotics, which has allowed the MSN to leverage expertise across huge geographic regions within the state. In particular, with this technology the standard of care being delivered has been demonstrated to be at 40 to 60 times the national average. The result is enhanced patient safety, patient satisfaction, efficiency, and physician satisfaction.

CONCLUSION

The MSN experience has demonstrated how a Remote Presence telestroke network has enhanced stroke care in Michigan. Similar models could be used around the country to give stroke patients everywhere a better chance of survival by delivering faster and more efficient access to state-of-the-art stroke expertise and care. ■

Fuji Lai, MS, is with InTouch Health, in Santa Barbara, California.

ABOUT REMOTE PRESENCE

Remote Presence is a next-generation telemedicine technology platform that combines the power of robotics, wireless, and the Internet to enable hospitals and physicians to bring the right care to a patient at the right time. Capabilities include two-way audio/visual communication, mobility at both ends, and a software architecture that ensures reliable and robust connections from anywhere with Internet access. This enables a physician to “beam in” immediately to the patient’s side to render care. Remote Presence systems have already been deployed in more than 100 stroke network hospitals around the country, with results including improved geographical reach of stroke specialists and more timely delivery of appropriate stroke care.

These networks have also resulted in enhanced stroke education and awareness throughout the community, further improving stroke care and patient outcomes.



ABOUT INTOUCH HEALTH

InTouch Technologies, Inc. (d.b.a. InTouch Health) is a privately held company based in Santa Barbara, California. The company has pioneered Remote Presence technology for healthcare providers. Through its Remote Presence Robotic System, a proprietary mobile robotic and communications platform, doctors are able to consult with hospital-based patients and staff more easily and frequently.

The InTouch Health solution leverages the time and expertise of healthcare professionals across multiple care facilities, improving the efficiency and effectiveness of care delivery. The company now has more than 200 RP systems deployed in acute care settings, which are utilized for a range of clinical applications, including stroke and multidisciplinary outreach, remote critical care coverage, on-call services, and rounding.

For more information about InTouch Health, please visit www.intouchhealth.com.

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