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Clinical case report based study

Implementing telestroke to reduce the burden of stroke in Louisiana

Praphul Joshi [a,*], Marisa Marino [b], Alok Bhoi [b], Kenneth Gaines [c], Elizabeth Allen [c], Julia Mora [d]

[a] University of New England, Center for Community and Public Health, University of New England, 716 Stevens Avenue, Portland, ME 04103, USA
[b] Louisiana Department of Health and Hospitals, 28 North 4th Street, Baton Rouge, LA 70802, USA
[c] Ochsner Medical Center, Ochsner Medical Center, 514 Jefferson Hwy, New Orleans, LA 70121, USA
[d] American Heart Association, 110 Veterans Boulevard, Suite 160 Metairie, LA, USA

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ABSTRACT

Cardiovascular diseases (heart diseases and stroke) are the leading cause of death in the United States. People living in rural areas have disproportionately high mortality rates due to stroke mainly due to lack of specialty services. Timely intervention is a critical factor in determining the prognosis for acute stroke and thousands of lives can be saved by recognizing/treating a stroke patient within an hour. This paper deals with telestroke, a unique intervention implemented in Louisiana that incorporated latest technology to integrate with advanced clinical protocols in treating acute stroke. People living in remote and rural areas of Louisiana were greatly benefited from this initiative and several lives saved as a result of timely intervention. Expanding these initiatives to larger populations and other states will greatly reduce the stroke mortality.

1. Introduction

Stroke is the fourth leading cause of death and the most common cause of adult disability in Louisiana as well as in the United States.[1] The mortality rate for stroke was 49 per 100,000 population in 2007, accounting for 2147 deaths in Louisiana. Currently there are six advanced comprehensive stroke Centers in Louisiana and a number of small primary stroke Centers that are distributed across the state. Time is of the essence for effective intervention in acute ischemic stroke and intravenous tissue plasminogen activator (tPA) is the only established effective therapy for acute stroke.[2,3] A network that triages most of Louisiana rural hospitals to go to these stroke Centers for tPA administration is not sufficient. Only a small fraction of acute stroke victims are currently treated with thrombolytics (<5% nationally), and few benefit from the expertise and experience of the stroke teams.[4] A majority of the deaths due to stroke is attributable to the lack of acute neurologic coverage, particularly in rural settings.

Recent advancements in technology can be effectively used in order to overcome the barriers of the lack of specialists in remote areas and improving patient outcomes.[5] Telemedicine is the use of electronic communication methods, such as the telephone, Internet, and videoconferencing, to exchange medical information from one geographic site to another. Telestroke is the use of telemedicine specifically for stroke care.[6] A tele neurological examination is reliable and systemic thrombolysis can be extended with telemedical consultation.[7] Monitoring of an entire tele-interaction can offer real-time assessments, which can then be analyzed in-depth at a later date for assessing reach and long-term impacts.[3,8] The STRoKE DOC Trial compared telemedicine to phone triage and showed good 6 month outcomes comparable to randomized trials and greater diagnostic accuracy for telemedicine.[9,10]

2. Materials and methods

A regional Telestroke Pilot Project was implemented in 2009 to provide rural hospitals of southeastern Louisiana with the ability to access a stroke neurologist 24/7 in an effort to provide the most appropriate stroke care to stroke victims. The pilot was funded in part by and the Louisiana Heart Disease and Stroke Prevention Program (HDSP) to implement a telestroke network in southeast Louisiana. The HDSP Program partnered a leading medical centre and the American Heart Association (AHA) to implement this program. This project involved the use of the Remote Evaluation of Acute Ischemic Stroke (REACH) Call Telemedicine System.

The hub hospital served as a comprehensive stroke center offering organized stroke care and the most recent interventions such as tPA or intra-arterial thrombolytics while promoting standard best practices for stroke care. The hub hospital's attending neurologist performed the audio-visual neurological consults via

* Corresponding author: Tel.: +207 221 4475.
E-mail address: pjoshi1@une.edu (P. Joshi).

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the telestroke system using a laptop with wireless web-based equipment. Additionally, the attending neurologist reviewed patients' Computed Tomography (CT) scans online while in communication with rural spoke hospitals, making recommendations regarding treatment.

The University of Miami's Advanced Stroke Life Support Course (ASLS) that is managed by the American Heart Association (AHA) was used as an educational tool for the Emergency Medical System's pre-hospital personnel. A stroke awareness campaign was also implemented to educate communities about stroke risk factors, recognizing the signs and symptoms of a stroke, and the importance of calling 911 for immediate medical attention when a stroke occurs or is suspected.

The evaluation for the Telestroke program was based on the roadmap as shown in Fig. 1. Hospital data generated by the REACH system and the Get With The Guidelines (GWTG) Program provided the basis for monitoring progress of the program. The National Institutes of Health Stroke Scale (NIHSS), which is a systematic assessment tool that provides a quantitative measure of stroke-related neurologic deficit, was used in this program. The NIHSS was originally designed as a research tool to measure baseline data on patients in acute stroke clinical trials. Now, the scale is also widely used as a clinical assessment tool to evaluate acuity of stroke patients, determine appropriate treatment, and predict patient outcome. In this initiative, NIHSS was assessed for all the consults that was determined by the consulting neurologist during the REACH process.

3. Results

3.1. Hospital data

A total of 10 spoke hospitals participated in the Telestroke program during 2010. The number of spoke hospitals participating in the program increased from 6 in the first quarter to 7, 8 and 10 in second, third and fourth quarters, respectively. The number of consults for each quarter and the corresponding clinical indicators are listed in Table 1. As shown in the table, a total of 283 consults were provided during the year and the number of consults more than doubled from first ($n = 41$) through fourth quarter ($n = 91$). The average score of severity based on NIHSS was 5.98. Out of all the consults, tPA was recommended for 29 patients and 27 of them received the treatment (one patient refused treatment and the other one was admitted too late to receive tPA). The number of patients recommended for tPA increased significantly (3, 5, 10 and 11 for 1st, 2nd, 3rd and 4th quarters, respectively). Over 75% of the consults had a "REACH initiation to MD consult" time of less than 15 min. The onset-to-door time (goals: <210 min for tPA window and <720 min for treatment window) showed significant improvements from first quarter and the overall goals were accomplished.

3.2. EMS trainings

A total of 154 EMS personnel from seven sites in the state participated in the ASLS train the trainer trainings, 14 as instructors. Pre and post-tests were conducted to assess the knowledge change upon the training. The knowledge scores increased from 68% (pre-test) to 86% (post-test). The trained instructors then branched out regionally to meet the goal of a minimum of 100 trained field medics.

4. Discussion

Overall, the Telestroke program expanded during the year and more consults were provided every quarter. Hence, the program had a broader reach in the state over the course of the year. Although the current data indicates the utility of telestroke consults, the results do not indicate the long-term outcomes for the patients. Future studies should consider follow-up of the patients

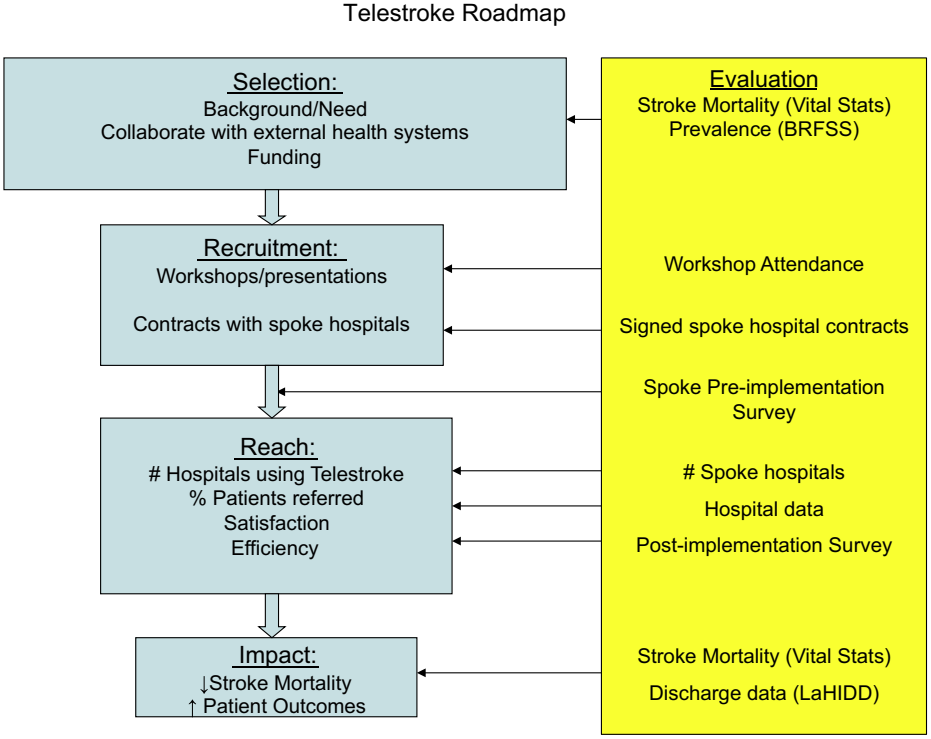

Fig. 1. Evaluation framework for Louisiana Telestroke Program. BRFSS = Behavior Risk Factor Surveillance Systems, LaHIDD = Louisiana Hospital Inpatient Discharge Data.

Table 1
Summary of consults data for 2010.

	# Of consults	Average age (years)	NIH score ave	Sex	TIA or CVA?	ICH?	Onset-to -door time (min)	Door to REACH initiation (average min) goal: 30 min	# Door to REACH initiation ≤30 min	REACH initiation to MD online (Ave. min) goal: 15 min	# REACH initiation to MD online (≤15 min)	TPA recommended (#)	Average door to needle time (min)
Q1	41	64	4.93	66% of F	25 (61%)	4	333	97	15 (37%)	8	38 (93%)	3	89
Q2	63	65	6.26	59% of F	45 (71%)	7	169	50	26 (41%)	11	50 (79%)	5	96
Q3	88	63	6.46	56% of F	68 (77%)	4	243	77	26 (30%)	15	66 (75%)	10	113
Q4	91	65	5.81	55% of F	67 (74%)	10	284	54	36 (40%)	15	64 (70%)	11	112
2010	283	64	5.98	57% of F	205 (72%)	19	252	66	101	13	215	29	107

TIA/CVA = transient ischemic attack/cerebrovascular accident, ICH = intracerebral hemorrhage, TPA = tissue plasminogen activator.

using both quantitative and qualitative measures to assess the quality of life and clinical outcomes one year after administering telestroke. Such a study can then assess the differences in clinical outcomes for stroke patients who received telestroke consults versus those who did not go through the process.

The implementation of this program was successful due to a comprehensive approach that involved the training of physicians, EMS personnel and other hospital personnel involved in treating stroke. Successful implementation of the program was achieved due to the collaboration of partners participating in the consortium and their respective expertise and resources. As indicated in previous studies, implementation of telestroke meets the needs of communities that lack specialists to handle stroke. Although this program was implemented in the southeastern part of the state, expansion of this program to include spoke hospitals across the state will enhance the reach and reduce the stroke mortality in the state.

Conflicts of Interest

All authors have none to declare.

References

1. Centres for Disease Control and Prevention, National Centre for Health Statistics. *Compressed Mortality File 1999–2007. CDC WONDER On-line Database, Compiled from Compressed Mortality File 1999–2007 Series 20 No. 2M*. Available from: http://www.wonder.cdc.gov/cmf-icd10.html; 2010 [Last accessed on 7.6.2011].
2. Stewart SF, Switzer JA. Perspectives on telemedicine to improve stroke treatment. *Drugs Today (Barc)*. 2011;47:157–167.
3. Levine SR, Gorman M. "Telestroke": the application of telemedicine for stroke. *Stroke*. 1999;30:464–469.
4. Ning M, Sarracino DA, Buonanno FS, et al. Proteomic protease substrate profiling of tPA treatment in acute ischemic stroke patients: a step toward individualizing thrombolytic therapy at the bedside. *Transl Stroke Res*. 2010;1:268–275.
5. Demaerschalk BM, Hwang HM, Leung G. Cost analysis review of stroke centers, telestroke, and rt-PA. *Am J Manag Care*. 2010;16:537–544.
6. Demaerschalk BM, Kiernan TE, Investigators S. Vascular neurology nurse practitioner provision of telemedicine consultations. *Int J Telemed Appl*. 2010;2010. Article ID 507071.
7. Audebert H. Telestroke: effective networking. *Lancet Neurol*. 2006;5:279–282.
8. Wang S, Lee SB, Pardue C. Remote evaluation of acute ischemic stroke: reliability of National Institutes of Health Stroke Scale via telestroke. *Stroke*. 2003;34:e188–e191.
9. Meyer BC, Raman R, Hemmen T, et al. Efficacy of site-independent telemedicine in the STRoKE DOC trial: a randomized, blinded, prospective study. *Lancet Neurol*. 2008;7:787–795.
10. Schwab S, Vatankhah B, Kukla C, et al, TEMPiS Group. Long-term outcome after thrombolysis in telemedical stroke care. *Neurology*. 2007;69:898–903.