MINNESOTA STROKE REGISTRY

Coverdell Data Stories
Volume 1, Number 2, March 2010

Theme: Pre-hospital transport and patient medical history

Purpose: This is one of a bi-monthly series of Data Stories from the Minnesota Stroke Registry (MSR). The purpose of these reports is to share data with the hospitals taking part in the registry, and to showcase the value in collecting data elements that do not directly contribute to the calculation of stroke performance measures. Each report focuses on a specific theme, showcasing a series of issues or questions related to that theme. The data elements box to the right displays those elements being used to generate the report. The report also includes a variety of tables or figures related to the theme. All of these reports include aggregate data collected by MSR hospitals.

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Introduction: In this report, we address the following questions: How is EMS utilized for stroke? What are the critical time intervals before a patient undergoes imaging? What are the medical histories of stroke patients? The Minnesota Stroke Registry is collecting data on all acute strokes being treated at participating hospitals. These 21 hospitals annually report approximately 50% of all stroke discharges in the state. Data reflect cases discharged between 1/1/08 and 12/31/09, as of 3/1/10.

Data Elements Used in this Analysis:
MN 1.4-1.5 (Date and Time Arrived)
MN 3.2 (Admission Source)
MN 3.3 (Arrival Mode)
MN 3.5-3.6 (Date and Time Call Received by EMS)
MN 3.7 (EMS Notification)
MN 4.8 (Transfer to ED from another hospital)
MN 5.2-5.3 (Imaging Date and Time)
MN 6.1-6.2 (Date and Time Last Known Well)
MN 6.3-6.4 (Date and Time Discovered)
MN 9.1-9.12, 9.25 (Medical History)

Issue 1: How do patients entered into the Minnesota Stroke Registry utilize Emergency Medical Services?

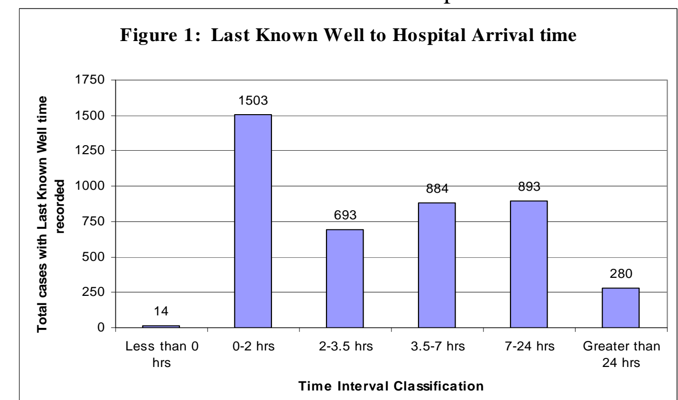
Table 1 shows the hospital arrival characteristics of 9,282 out-of-hospital cases from January 1, 2008 through December 31, 2009. Almost 50% of all stroke cases arrived via EMS. Of these, approximately 43% of patients arrived at the ED after pre-notification was sent by the transporting ambulance. One-third of patients came by some other means, and 3.8% had no arrival mode recorded. Approximately 14% of cases were transferred from other hospitals, reflecting the high representation of large tertiary-care facilities in the MSR dataset.

Table 1: EMS Utilization and Arrival Characteristics

Transportation Used	Frequency	Percent
EMS	4,610	49.7
Pre-notification to ED	*1,996*	*21.5*
No pre-notification	*2,386*	*25.7*
Missing	*228*	*2.5*
Private transportation/ taxi/other	3,015	32.5
Transfer from another hospital	1,303	14.0
Missing	354	3.8

Issue 2: Are there delays in arrival to the hospital?

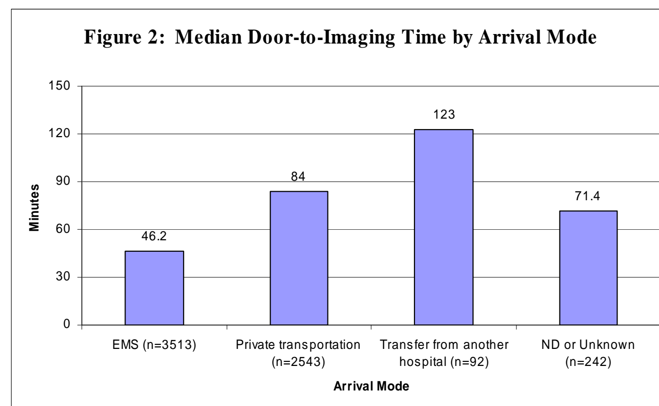
The time an individual was last known to be well was missing for 5,015 (54%) of all cases. For the remaining 4,267 cases, the interval between the time they were last known well and their arrival at the hospital is shown in Figure 1. Fewer than 1% of individuals had implausible times of less than 0 hours, and almost 7% had times of greater than 24 hours. Some of these may be due to incorrect data entry. Of the remaining 93%, 1,503 (35.2%) arrived within 2 hours of symptom onset and were potentially eligible for IV-tPA, according to long-standing treatment guidelines. Another 693 (16.2%) arrived within 3.5 hours and were potentially eligible for IV-tPA under the recently extended time window. An additional 884 (20.7%) arrived within 7 hours and were potentially eligible for IA-tPA, if available. Combined, approximately 72% of patients with a last known well time recorded were potentially eligible for some form of tPA. A total of 893 patients (21%) arrived within 24 hours but outside any window for potential thrombolytic therapy. More discussion of tPA eligibility and administration is reserved for a future report.

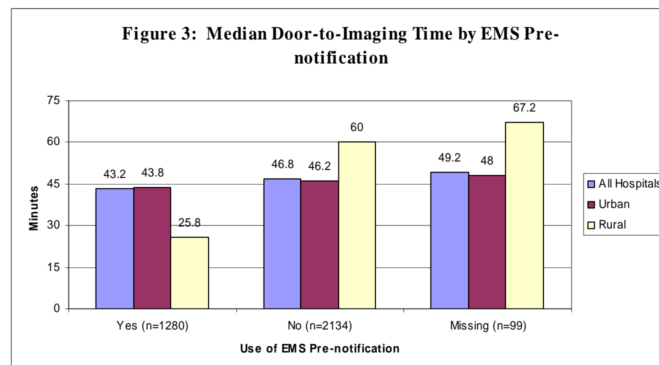


Issue 3: How does arrival mode influence door-to-imaging time?

Figure 2 shows the distribution of median door-to-imaging times for MSR stroke cases by their mode of transportation to the hospital. As can be seen, those individuals arriving by EMS have a median door-to-imaging time of 46 minutes, almost 40 minutes shorter than those arriving via private transportation. This difference is statistically-significant. The vast majority of transfer cases had imaging performed at the sending hospital, so the times shown below do not reflect the door-to-*first* imaging time, which is of most interest.

The median door-to-imaging times for MSR stroke cases arriving via EMS by use of EMS pre-notification, stratified by hospital location are shown in Figure 3. Though the cases where pre-notification was used had a median door-to-imaging time of only 3.5 minutes shorter than those where no pre-notification was used, this was largely driven by the urban hospitals. For rural hospitals, the median door-to-imaging time was 35 minutes faster when EMS pre-notification was used, which is statistically-significant. Use of EMS pre-notification at rural hospitals changed median door-to-imaging times from 14 minutes *slower* (statistically-significant) to 16 minutes *faster* (not-statistically significant) than in urban hospitals. The door-to-imaging times for those cases with missing information on EMS pre-notification were similar to those where EMS pre-notification was not used.





Issue 4: What are the medical histories of stroke patients?

Table 3 shows the frequency of previous clinical events and related risk factors for stroke. More than 13% of cases have prior history of stroke, and almost 6% have a prior history of TIA. Combined, 1,563 stroke patients (16%) have a previous history of some cerebrovascular event. An even larger percentage -- almost one-fourth -- has a history of MI.

As expected, hypertension is the most prevalent major risk factor for stroke, present in more than 70% of MSR cases. Dyslipidemia and atrial fibrillation was present in 46% and 18% of cases, respectively. Only 20% of stroke cases did not have a documented medical history of one of these stroke risk factors, and 4,301 (46.2%) have at least two major risk factors.

Almost one-fourth of MSR patients were diabetic, and there were significant numbers of individuals with a history of carotid stenosis, heart failure, peripheral artery disease, or heart valve prosthesis. 3,338 stroke patients (35.9%) had a medical history of at least one of these conditions.

Table 3: Previous Medical History of Stroke Patients

Previous Medical History	Frequency	Percent
Clinical Events		
Stroke	*1259*	*13.5*
TIA	*526*	*5.7*
MI	*2252*	*24.2*
Major Risk Factors		
Hypertension	*6541*	*70.3*
Dyslipidemia	*4229*	*45.5*
Atrial Fibrillation	*1694*	*18.2*
Other		
Carotid Stenosis	*473*	*5.1*
Heart Failure	*753*	*8.1*
Diabetes	*2217*	*23.8*
PAD	*520*	*5.6*
Valve Prosthesis	*266*	*2.9*

Conclusions

- EMS is utilized for approximately 1/2 of all cases
- The critical element of when a patient was last known well is missing for more than 1/2 of all cases
- Approximately 1/3 of cases with time last known well recorded arrive within two hours, and are potentially eligible for IV-tPA
- Use of EMS shortened the door-to-imaging time by almost 40 minutes
- EMS pre-notification shortened door-to-imaging time by a significant margin at rural hospitals
- 16% of patients have experienced a previous cerebrovascular event, and 24% have a history of MI
- At least one of the major risk factors (hypertension, dyslipidemia, and atrial fibrillation) was present in 80% of cases