Assessing the Accuracy of a Linkage Between the Michigan Emergency Medical Services Information System and the Michigan Coverdell Acute Stroke Registry

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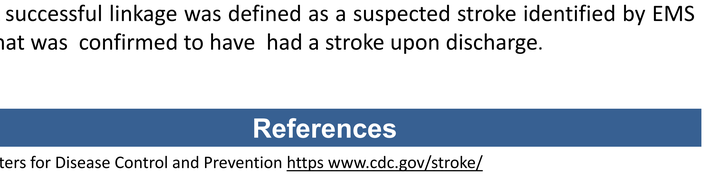
Introduction

Stroke is the fifth leading cause of death in Michigan and the United States and a leading cause of serious, long-term disability[1]. Michigan has been funded by the Centers for Disease Control and Prevention's Paul Coverdell National Acute Stroke Registry since 2001 to implement a stroke Registry and to develop an integrated approach to stroke systems of care. Michigan's Ongoing Stroke Registry to Accelerate the Improvement of Care (MOSAIC) program has been supporting the expansion of statewide stroke systems of care.

The primary objectives of this study were:

- to demonstrate the feasibility of deterministically linking the Michigan EMS Information System (MI-EMSIS) version 2.2 data file to a state-level stroke registry,
- to assess completeness and accuracy of match results



Methods

Linkage Design:

- Unidentified data from MI-EMSIS were linked deterministically to unidentified data from Get With The Guidelines–Stroke (GWTG) Patient Management Tool, using four data elements: receiving hospital code, patient admission date, date of birth, and sex.
- Completeness and accuracy of match results in addition to performance on EMS stroke quality measures and hospital outcomes were then calculated.

Linkage Procedure:

- The analysis was performed using Microsoft Office Professional Plus Excel 2016.
- The denominator of the EMS data included patients being transported to MOSAIC hospitals with a suspected stroke in 2017.
- The denominator of the GWTG data included confirmed stroke patients that arrived to the hospital via EMS or Mobile Stroke Unit in 2017.
- We simultaneously created groups using different matching criteria to link all possible matched records from both datasets. We used different criteria to address potential EMS data inaccuracy. We stored the final matched records in a combined database.
- A successful linkage was defined as a suspected stroke identified by EMS that was confirmed to have had a stroke upon discharge.

References

1. Centers for Disease Control and Prevention https www.cdc.gov/stroke/

Results

Match Results

- Of 249 EMS agencies that transported suspected stroke cases, 151 (61%) agencies transported 4,784 suspected stroke cases to MOSAIC hospitals.
- Of the 12,192 confirmed stroke/TIA cases discharged from 35 MOSAIC hospitals, 5,961 (48.9%) were documented to have arrived via EMS or Mobile Stroke Unit.
- Only 1,535 (25.8%) cases were successfully linked to MI-EMSIS data.
- Of the 4,784 suspected stroke transports, 1,535 (32.1%) were confirmed to be acute stroke cases at discharge (Table 1).

Table 1: Linkage Results

		MOSAIC data		Total
		Confirmed strokes EMS transported	Not linked	
MI-EMSIS data	Suspect stroke	1,535	3,249	**4,784**
	Not linked	4,426		
Total		**5,961**		

EMS Performance (Table 2):

- Of cases identified as stroke in the field by EMS and linked to MOSAIC data (matched EMS cases) the median age was 73 years; 44.7% were male and 63.5% were white.
- Of cases identified as stroke by EMS in the field but were not discharged from the hospital as stroke (unmatched EMS cases), the median age was 69 years, 43.9% were male, and 62.5% were white.
- Performance of care in the field recorded by EMS was higher for all measures among matched EMS vs. unmatched EMS cases.
- The median time from the 9-1-1 dispatch to scene, on-scene time, and time from EMS leaving the scene to destination was similar for matched EMS vs. unmatched EMS cases.

MOSAIC Performance (Table 3):

- Table 3 displays a comparison of MOSAIC cases that were successfully linked (Hospital matched) to EMS data vs. those that were identified as stroke by the hospital but were not recorded as having a primary impression of stroke by EMS.
- The median door-to-CT time for cases that were identified as stroke by EMS (matched cases) was less than half of the time vs. those that were not (unmatched) (12 vs. 25 minutes respectively).
- The median Door-to-Needle time was four minutes faster for matched vs. unmatched cases.
- More than twice the percent of Ischemic cases that were matched received t-PA compared to cases that were unmatched (30.9 vs. 14.3%).
- Advanced notification by EMS as reported by the hospital was greater among matched compared to unmatched cases (69.6 vs. 58.8%)

Michigan EMS Linkage Report

Michigan EMS Linkage Report January - December 2017

Table 2: Analysis of EMS Suspect Stroke Transports	EMS Suspected Stroke Matched		EMS Suspected Stroke Unmatched	
	N	%	N	%
Total:	**1,535**	**32.1%**	**3,249**	**67.9%**
DEMOGRAPHICS				
Age				
Median	73.1		69.4	
Range	28 - 102 years		15-117 years	
Gender				
Female	822	54.0%	1,759	54.1%
Male	713	44.7%	1,427	43.9%
Not Available	0	0.0%	63	1.9%
Race				
White	974	63.5%	2,030	62.5%
Black or African American	238	15.5%	363	11.2%
Asian	6	0.4%	6	0.2%
American Indian or Alaska Native	28	1.8%	56	1.7%
Multi-racial*	6	0.4%	8	0.2%
Other Race	30	2.0%	60	1.8%
Not Available	253	16.5%	726	22.3%
EMS PERFORMANCE				
1.On-scene time ≤15 minutes	880	57.3%	1,663	51.2%
2.Unit left scene to destination time ≤15 minutes	1,071	69.8%	3,249	63.2%
3.Blood Glucose level checked and recorded	1,369	89.2%	2,694	82.9%
4.EMS called in a stroke alert / pre-notification	303	19.7%	493	15.2%
5.Stroke screen completed and recorded	1,072	69.8%	2,119	65.2%
6.Time last known to be well was documented	49	3.2%	95	2.9%
Total Incident Time (Median in minutes)				
Dispatch to patient time	5.9		6.0	
On-Scene time	14.0		15.0	
Unit left scene to destination time	10.0		11.4	

*Multi-racial: Native Hawaiian/Other Pacific Islander/Hispanic/Latino/White/Black/ Asian/American Indian

Table 3: Analysis of MOSAIC Stroke Cases	MOSAIC Matched Stroke		MOSAIC Unmatched Stroke	
	N	%	N	%
Total:	**1,535**	**25.8%**	**4,426**	**74.2%**
Stroke type				
Ischemic	1,190	77.5%	3,244	73.3%
Hemorrhagic	201	13.1%	637	14.4%
TIA	142	9.3%	537	12.1%
Stroke Not Specified	2	0.1%	7	0.2%
ED EVALUATION AND TREATMENT*				
Door-to-CT Time				
Median	12.0		25.0	
Range	0-55 minutes		0-210 minute	
Received t-PA				
(Ischemic Stroke Cases Only)	368	30.9%	634	14.3%
Door-to-t-PA Time				
Median	50.0		54.0	
Range	20-106 minutes		15-134 minutes	
DISCHARGE DISPOSITION **				
Transfer to higher level	79	5.1%	180	4.1%
Home	485	31.6%	1,647	37.2%
Acute/Subacute rehab	714	46.5%	1,925	43.5%
Hospice/Death	257	16.7%	674	15.2%
Pre-Notification by EMS				
Advanced notification by EMS/Mobile Stroke Unit	1,068	69.6%	2,294	51.8%

*Outliers removed from Door-to-CT and Door-to-t-PA times.

** Transfer to higher level includes cases that were transferred to an Acute Care Facility. Home includes cases that were discharged to home or left against Medical Advice/AMA. Hospice/Death includes cases that were discharged to a Hospice-Healthcare Facility, Hospice-Home, or those who expired.

Discussion and Conclusions

- We were able link MI-EMSIS data to MOSAIC Coverdell data which allowed us to evaluate the quality of care that was recorded from initial contact with EMS through hospital discharge.
- Any mismatch prevented a linkage, whether it arose from a true non-match, an error, or a missing value of a potential true match, or EMS did not suspect stroke and thus the EMS run was not in the MiEMSIS data used in the match.
- This data linkage will expand the MOSAIC Program's ability to measure and support performance improvement activities for participating hospitals and EMS agencies.
- GWTG has developed a new tab that incorporates essential information from transporting EMS agencies that HAS BEEN ADOPTED by more than half (54%) of hospitals participating in MOSAIC. This will enable us to provide feedback to hospitals regarding matched cases.
- Educational efforts are ongoing to improve documentation; current quality improvement targets include documentation of "Last Know to be Well" and "hospital prenotification".

Conclusions: A deterministic linkage between Coverdell stroke cases and EMS suspected strokes from a state EMS registry resulted in low match rates. Alternative linkage methods such as probabilistic matching and inclusion of all EMS transports will be explored.

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