

Purpose: This is the first in 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: How best do we describe the population of stroke patients in the state of Minnesota? 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 9/30/09, as of 11/20/09.

Data Elements Used in this Analysis:
MN 1.9-1.10 (Birth Date / Age)
MN 1.11 (Gender)
MN 2.1 (Health Insurance Status)
MN 2.2 (Race)
MN 2.3 (Hispanic Ethnicity)
MN 3.1 (Patient location when stroke systems discovered / Place of occurrence)
MN 4.4 (Presumptive Admission Diagnosis)
MN 12.2 (Principal Discharge Diagnosis)

Issue 1: What is the age, race, and sex of stroke patients entered into the Minnesota Stroke Registry?

Table 1 shows the age, sex, race, and ethnicity of 8,427 cases added to the Minnesota Stroke Registry from January 1, 2008 through September 30, 2009. Female stroke patients (53% of the total) were significantly older (4 years) than their male counterparts, with patient ages ranging from 18 to 103 years. More than 80% of cases were classified as white, with approximately 9% from other races and 9% unknown. Slightly more than 1% of cases were classified as Hispanic, but this data element was not recorded for almost 28% of cases.

Table 1: Demographics of Stroke Patients

Demographic Characteristics	Mean	Range
Age (yrs)		
Men	68.1	18-100
Women	72.0	18-103

Demographic Characteristics	Frequency	Percent
Sex		
Men	3,958	47.0
Women	4,469	53.0
Race		
White	6,878	81.6
Black	374	4.4
American Indian/Alaska Native	39	0.5
Asian	222	2.6
Pacific Islander	12	0.1
Other	51	0.6
Multi-race	33	0.4
Unknown	818	9.7
Hispanic Ethnicity	113	1.3
Unknown/Missing	2,336	27.7

Issue 2: How are stroke patients entered into the Minnesota Stroke Registry paying for their care?

Fewer than 2% of MSR cases had no insurance, and almost half of all cases had multiple types of insurance for payment, usually in conjunction with Medicare. Medicare, alone or in combination with other insurance types, was documented for 59% of all cases. Insurance type was missing or not documented in 5% of MSR cases.

Table 2: Health Insurance Coverage

Type of Health Insurance	Frequency	Percent
Medicare alone	1,131	13.4
Medicaid alone	372	4.4
Private/VA/Champus alone	2,372	28.3
Other Insurance	89	1.1
Multiple of above	3,927	46.6
Self Pay/No Insurance	121	1.7
Not documented	208	2.5
Missing	207	2.5

Issue 3: Where did strokes entered into the Minnesota Stroke Registry occur?

As shown in Table 3, more than three-fourths of all strokes entered into the Minnesota Stroke Registry occurred outside of the hospital. Almost 9% are transferred to an MSR hospital directly from another acute care hospital, usually as part of a formalized transfer protocol. Another 8% of stroke cases come from chronic health facilities, usually skilled nursing facilities. Note that while the MSR and CDC do not ask for inpatient strokes to be added to the database, some hospitals have chosen to do so. The percentage displayed in this table does not accurately reflect the percentage of acute strokes occurring in hospitals.

Table 3: Place of Occurrence

Location	Frequency	Percent
Not in a healthcare setting	6,461	76.7
Another acute care facility	736	8.7
Chronic health care facility	656	7.8
Inpatient	342	4.1
Outpatient healthcare setting	51	0.6
Cannot be determined	178	2.1
Missing	3	0.1

Issue 4: What types of strokes are occurring? Does the diagnosis change from admission to discharge?

Table 4 shows the frequency and distribution of stroke types both at admission (presumptive, in column 2) and discharge (final, in column 3). The number of diagnoses that were the same at admission and discharge is shown in column 4, the percentage of stroke types at discharge that were correctly recognized at admission is shown in column 5 (**Sensitivity**), while the percentage of stroke types at admission that remained the same at discharge is shown in column 6 (**Positive Predictive Value**). In this analysis, we assume that the final discharge diagnosis most accurately classifies the clinical event. Rapid identification of the type of stroke is critical to opening the patient to the broadest range of helpful therapies.

For both types of hemorrhagic stroke, patients were correctly classified at the time of admission approximately 90% of the time, with more than 95% of presumptive hemorrhagic stroke diagnoses correct at discharge. While the ability to definitely diagnosis hemorrhagic stroke quickly was very high, this was not the case for other cases entered into the MSR. Only two-thirds of ischemic stroke cases and 72% of TIA cases were identified as such at admission. Still, more than 90% of presumptive ischemic stroke diagnoses turned out to be correct.

Table 4: Sensitivity and Positive Predictive Value of Admission Diagnosis

Diagnosis	Total Admission Dx (+ %)	Total Discharge Dx (+ %)	Matching Dx	Sensitivity (%)	Positive Predictive Value (%)
Intracerebral Hemorrhage	984 (11.7)	1,058 (12.6)	940	88.8	95.5
Subarachnoid Hemorrhage	497 (5.9)	518 (6.1)	474	91.5	95.4
Ischemic	3,427 (40.7)	4,819 (57.2)	3,181	66.0	92.8
Ill-defined	797 (9.5)	250 (3.0)	139	55.6	17.4
TIA	1,549 (18.4)	1,563 (18.5)	1,119	71.6	72.2
Non-Stroke	855 (10.1)	217 (2.6)	41	18.9	4.8
Total	8,427	8,427	5,894	69.9	69.9

Ischemic stroke represented more than half of all cases entered into the MSR, therefore it was the most frequent stroke type to be initially classified as something else. Figure 1 below shows the more common differences between presumptive and final diagnoses for MSR cases. Presumptive diagnoses of non-stroke, ill-defined stroke, TIA, and no presumptive diagnosis at all in ischemic stroke cases were the most common. The eight most common changes in classification were all between non-hemorrhagic stroke types. These numbers can provide some insight into cases where stroke presentation is atypical, difficult to classify, and/or diagnostic procedures could be improved.

Figure 1: Most common changes in diagnosis from Admission to Discharge

Non-Stroke → Ischemic 579	Ischemic → TIA 167
Ill-defined → Ischemic 483	Ill-defined → TIA 90
TIA → Ischemic 356	Ill-defined → Non-Stroke 70
Missing → Ischemic 196	Missing → TIA 52

Conclusions

- Women comprise 53% of stroke patients, and are four years older than men
- 9% of stroke patients are non-white, 9% unknown
- More than 75% of strokes occur outside the hospital
- Hemorrhagic strokes are correctly identified at admission more than 90% of the time
- Ischemic strokes can be hard to identify at admission
- TIA at admission becomes ischemic stroke 1 of 5 times