MDH Minnesota Department *of* Health

CARDIOVASCULAR HEALTH UNIT

Rural Minnesota STEMI Systems of Care

Almost 250,000 Americans experience ST-elevation Myocardial Infarction (STEMI), the deadliest form of heart attack, each year. Of approximately 9,000 Minnesotans receiving hospital treatment for heart attack each year, almost 2,500 have experienced a STEMI.

- Thirty percent of STEMI patients fail to receive percutaneous coronary intervention (PCI) or thrombolytic therapy.
- Of those who receive PCI, only 40 percent are treated within the first medical contact to device timeframe of 90 minutes, recommended by the American Heart Association.
- Of those who receive thrombolytic therapy, fewer than half are treated within the recommended door-to-needle timeframe of 30 minutes.
- Seventy percent of those patients who aren't eligible for thrombolytic therapy fail to receive PCI, the only other option to restore blood flow to blocked arteries.

This report describes key performance measures on the quality of STEMI Systems of Care in Minnesota. These data come from Minnesota patients who are treated at five rural STEMI-receiving hospitals in Minnesota, and at seven STEMI-receiving hospitals in bordering sections of North Dakota and South Dakota. The five Minnesota hospitals annually report approximately 25% of all STEMI discharges in the state. Data reflect cases arriving at these twelve STEMI-receiving hospitals from April 1, 2014 through December 31, 2015.

Patient Characteristics

During the most recent 12 month reporting period, there were 564 patients treated for STEMI in participating hospitals. The median age of STEMI patients was 63 years, 73% were male, and 95% were white (Figure 1). About four in ten patients (39%) arrived at the first hospital via EMS vehicle (Figure 2).

Figure 1: Patient Demographics

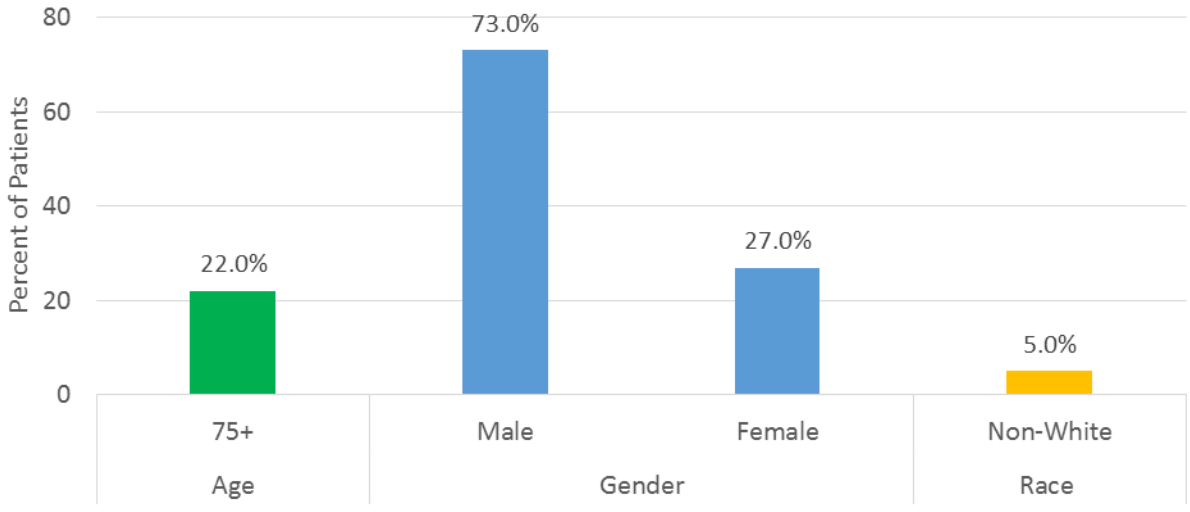
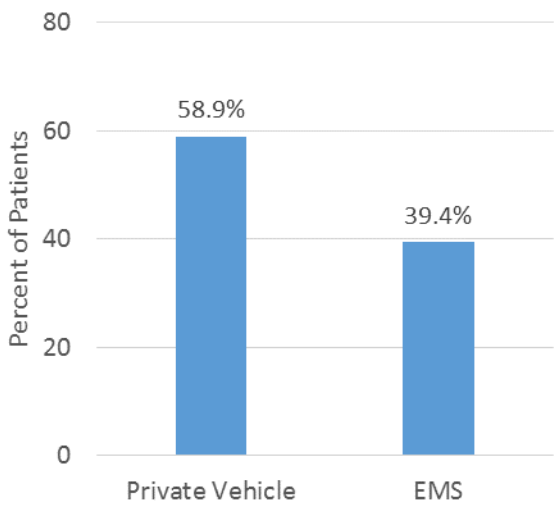


Figure 2: Mode of Arrival to First Facility: Past 12 Months



About half of patients presenting directly to a STEMI-receiving facility arrived via EMS; whereas, only 1 out of 4 patients transferred to a STEMI-receiving facility arrived at their first hospital via EMS (Table 1A & B). EMS can perform an ECG to rapidly diagnosis a STEMI and make the decision to transport a patient directly the hospital providing the highest level of care.

Table 1A: Mode of Arrival by Rolling 12 Month Period Direct Presentation

Mode of Arrival	4/14-3/15	7/14-6/15	10/14-9/15	1/15-12/15
Private Vehicle	41%	51%	48%	47%
EMS	56%	46%	47%	48%

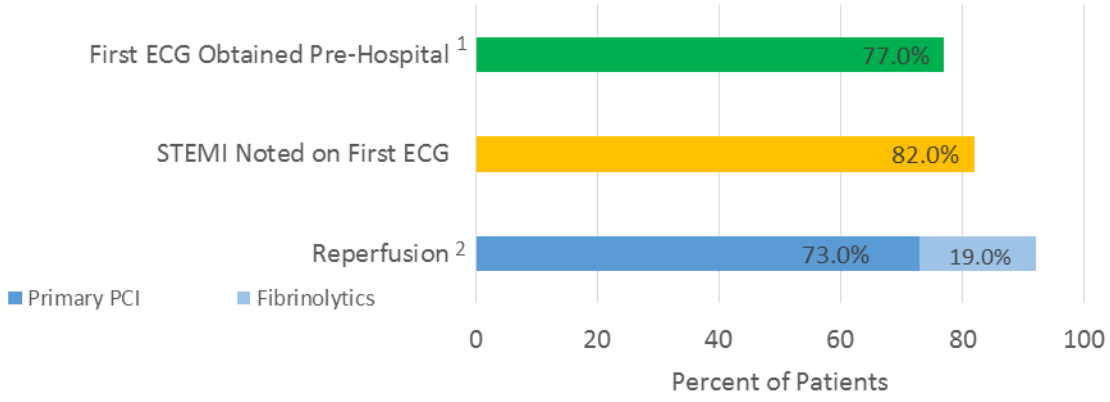
Table 1B: Mode of Arrival by Rolling 12 Month Period Transfer

Mode of Arrival	4/14-3/15	7/14-6/15	10/14-9/15	1/15-12/15
Private Vehicle	70%	71%	71%	74%
EMS	30%	29%	29%	26%

Clinical Outcomes

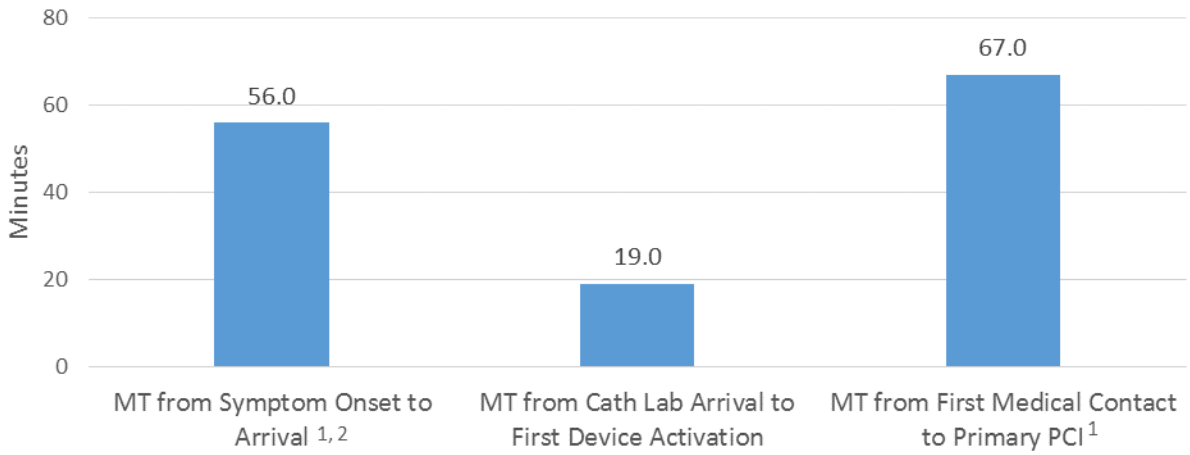
For 77% of patients, the first ECG was obtained by EMS before the patient arrived at the hospital, and 82% of patients had their STEMI noted on the first ECG. By getting a STEMI diagnosis in the ambulance, EMS are better able to deliver patients directly to a hospital providing the highest level of care. Seventy-three percent of patients received primary PCI to physically open their blocked arteries (Figure 3).

Figure 3: Clinical Characteristics: Last 12 Months



[1]Among patients arriving via EMS
[2]Among patients eligible for reperfusion

Figure 4: Median Time (MT) to Action (Minutes): Last 12 Months



[1]Among direct presenters arriving via EMS
[2]Five Minnesota STEMI-receiving hospitals only

Over the last 12 months, the median time from symptom onset to hospital arrival was 56 minutes for patients transported by EMS directly to a STEMI-receiving hospital in Minnesota. The median time from arrival in the cath lab to first device activation was 19 minutes, and the median time from first medical contact with EMS to first device activation was 67 minutes

(Figure 4). STEMI patients transported directly to a STEMI-receiving hospital benefit from pre-hospital diagnosis and care in the ambulance and pre-arrival notification to the hospital.

Table 2: Clinical Characteristics by Rolling 12 Month Period
All STEMI Patients

Clinical Characteristics: Trends	4/14-3/15	7/14-6/15	10/14-9/15	1/15-12/15
First ECG Obtained Pre-Hospital[1]	75%	73%	75%	77%
STEMI Noted on First ECG	80%	82%	82%	82%
Reperfusion - Primary PCI[2]	75%	74%	74%	73%
Reperfusion - Fibrinolytics[2]	18%	19%	18%	19%

[1]Among patients arriving via EMS
[2]Among patients eligible for reperfusion

Over the last 12 months, patients transported directly to a STEMI-receiving facility by EMS, approximately 3 out of 4 had their first ECG performed in the ambulance. STEMI was noted on the first ECG performed in 82% of patients over the last year.

For patients who were eligible for reperfusion, 73% received primary PCI and 19% received fibrinolytic therapy (Table 2).

These percentages have been steady over the last four reporting periods.

Table 3: Median Time to Action (Minutes) by Rolling 12 Month Period
All STEMI Patients

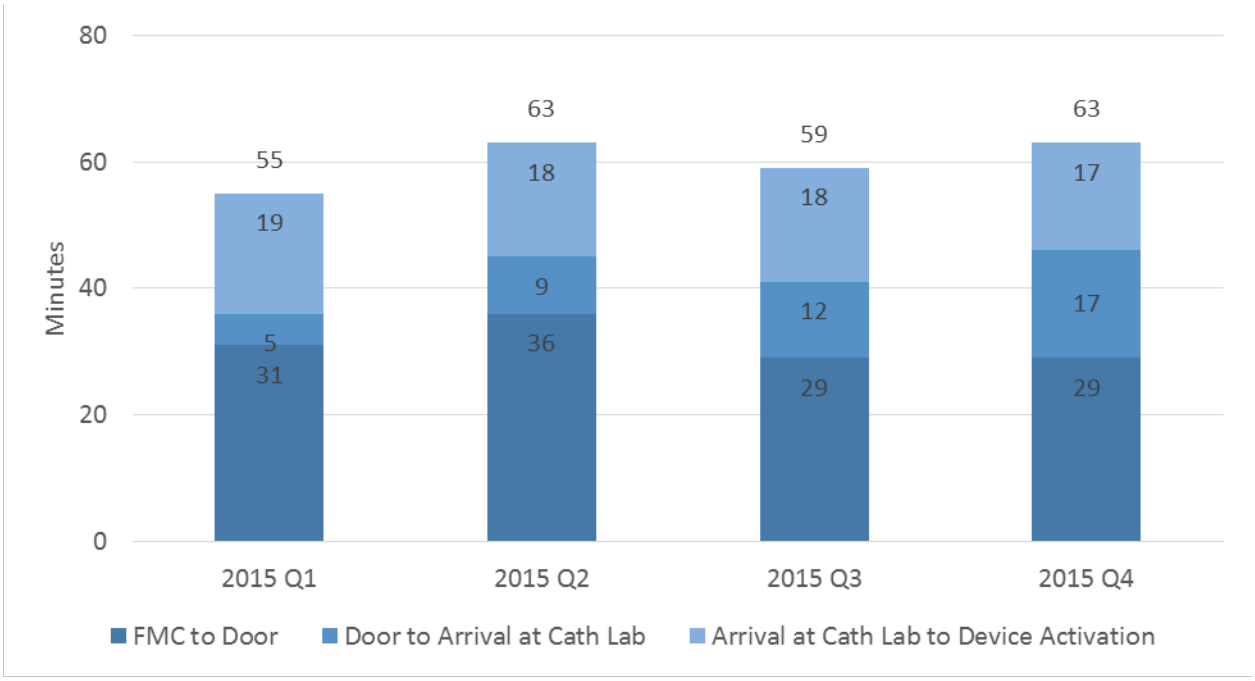
Median Time to Action: Trends	4/14-3/15	7/14-6/15	10/14-9/15	1/15-12/15
Median Time from Symptom Onset to Arrival[1, 2]	56	58	55	57
Median Time from Cath Lab Arrival to First Device Activation	19	19	19	19
Median Time from First Medical Contact to Primary PCI[1]	74	70	68	67

[1]Among direct presenters arriving via EMS

Among patients transported by EMS directly to a STEMI-receiving hospital, the median time from symptom onset to arrival was 57 minutes over the last year, approximately the same as in previous periods. For these patients, the median time from first medical contact with EMS, the median time to primary PCI was 67 minutes, which has improved by 7 minutes over the previous three reporting periods.

Once in the cath lab, the median time to first device activation was 19 minutes over the last year. This has remained steady for several quarters (Table 3).

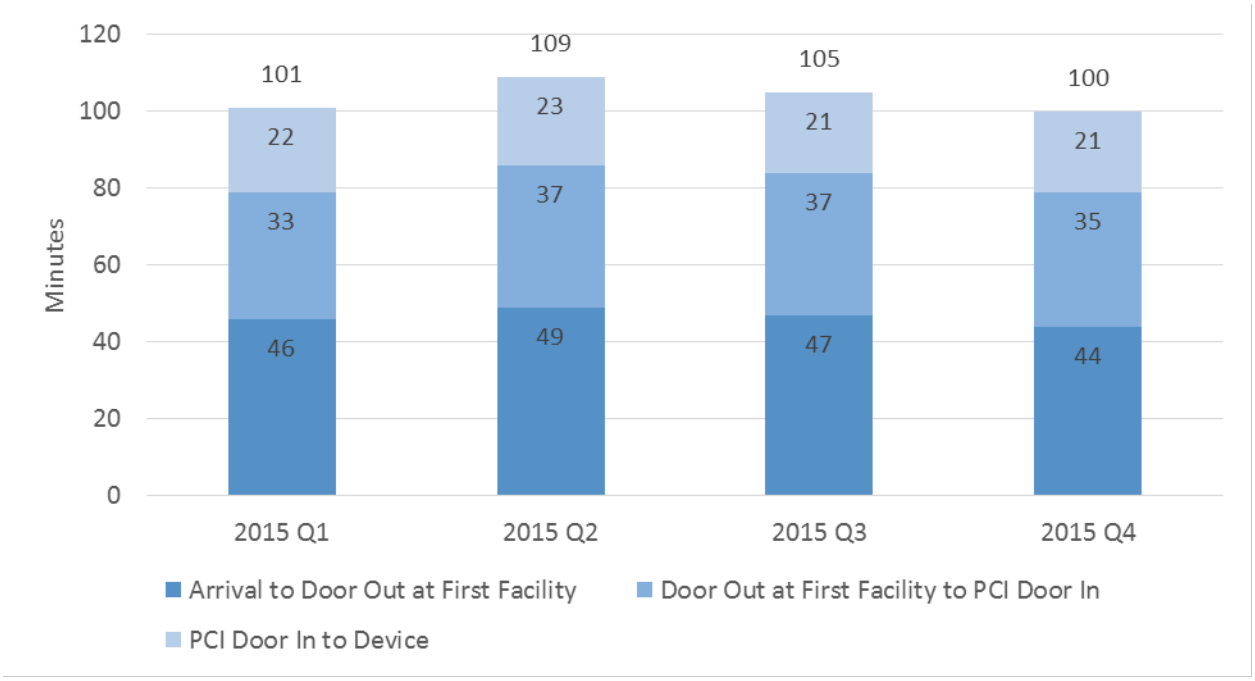
Figure 5: First Medical Contact to Device
Median Time (Minutes)
Direct Presentation, Arrival via EMS



There are major benefits to arriving directly at a STEMI-receiving hospital after activating EMS. These bar graphs show the median time for three components: 1) First medical contact with EMS to the hospital door, 2) the hospital door to arrival in the cath lab, and 3) arrival in the cath lab to device activation.

In the most recent calendar quarter, the median time from first medical contact to first device activation was only 63 minutes. This is slightly slower than in Quarter 1 and Quarter 3 of 2015. Much of this seems to be driven by increasing median door to arrival at cath lab times over the year (from 5 minutes in Quarter 1 to 17 minutes in Quarter 4) (Figure 5).

Figure 6: Arrival at First Facility to Device Median Time (Minutes) Transfer In for Primary PCI



For patients who arrive first at a STEMI-referring hospital, time to treatment is usually longer than for those going directly to a STEMI-receiving hospital. These bar graphs show the median time for three components: 1) Arrival at first STEMI-referring hospital to leaving for a cath lab in a STEMI-receiving hospital, 2) leaving the STEMI-referring hospital to arriving at the STEMI-receiving hospital cath lab, and 3) arrival in the cath lab to device activation.

In the most recent calendar quarter, the overall time from first arrival at a STEMI-referring hospital to first device activation was 100 minutes. This was somewhat shorter than the time over the previous two quarters, with the primary reason being a shorter time spent inside a STEMI-referring hospital awaiting transfer to a cath lab in a STEMI-receiving hospital (Figure 6).

Direct Presentation vs. Transfer

Over the last 12 months, patients arriving directly at a STEMI-receiving hospital were more likely to arrive via EMS, and most of them will have already had an ECG diagnosing their STEMI. For patients who are transferred into a STEMI-receiving hospital from a STEMI-referring hospital, 74% arrived via private vehicle, with their first ECG delayed until arriving at a hospital (Figure 7).

Figure 7: Mode of Arrival by Presentation: Last 12 Months

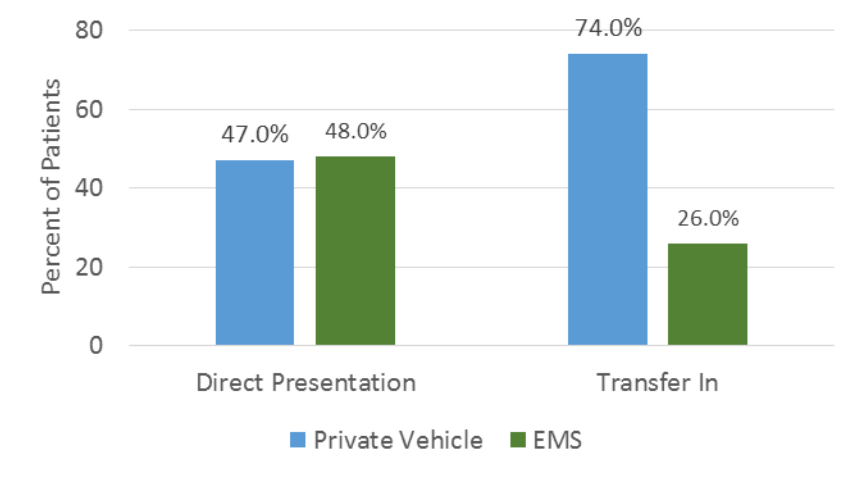


Table 4A: Mode of Arrival by Rolling 12 Month Period
Direct Presentation

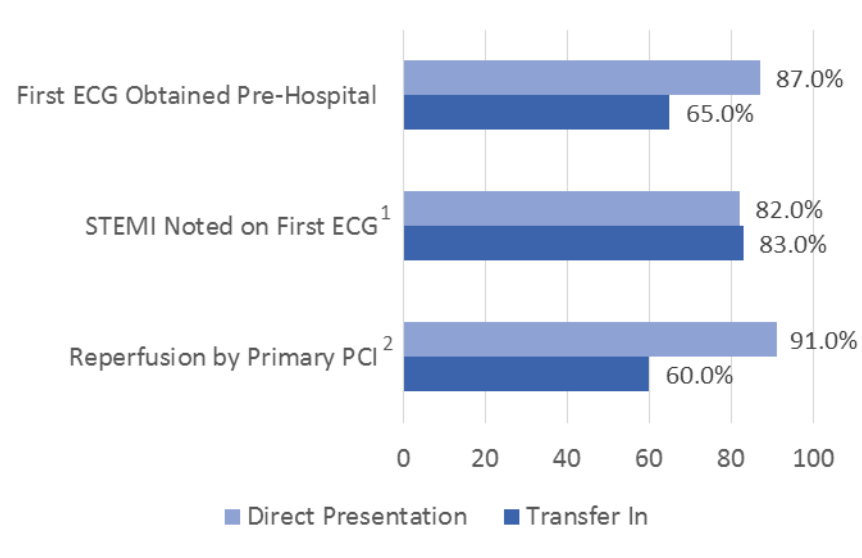
Mode of Arrival	4/14-3/15	7/14-6/15	10/14-9/15	1/15-12/15
Private Vehicle	41%	51%	48%	47%
EMS	56%	46%	47%	48%

Table 4B: Mode of Arrival by Rolling 12 Month Period
Transfer

Mode of Arrival	4/14-3/15	7/14-6/15	10/14-9/15	1/15-12/15
Private Vehicle	70%	71%	71%	74%
EMS	30%	29%	29%	26%

Over the last four reporting periods, more patients have been arriving directly at STEMI-receiving hospitals and to STEMI-referring hospitals not via EMS, but instead through private vehicle (Table 4A & B). By not activating EMS by calling 9-1-1, these patients have their first ECG delayed until they arrive at the hospital.

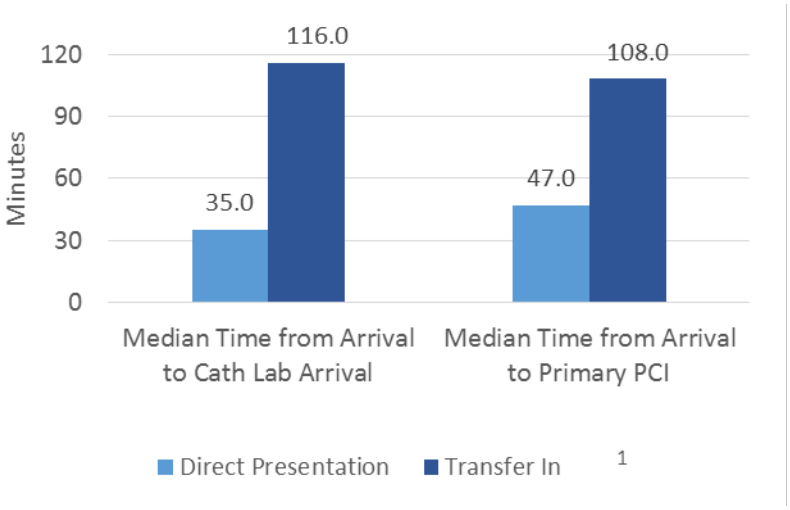
Figure 8: Clinical Characteristics by Presentation: Last 12 Months



[1]Among patients arriving via EMS
[2]Among patients eligible for reperfusion

Over the last 12 months, patients being transported via EMS directly to a STEMI-receiving hospital were more likely to have an ECG pre-hospital than patients who were transferred in. There was no difference in recognition of STEMI on the first ECG by arrival mode. Patients transported by EMS directly to a STEMI-receiving hospital were more likely to have primary PCI vs. those who were transferred in from a STEMI-referring hospital (91% vs. 60%) (Figure 8).

Figure 9: Median Time to Action (Minutes) by Presentation: Last 12 Months



[1]Time from arrival at first facility

Over the last 12 months, the median time from arrival at the first facility to cath lab arrival was much faster in STEMI-receiving hospitals vs. STEMI-referring hospitals (35 vs. 116 minutes). This difference equated to a much faster time from arrival at the first facility to initiation of PCI (47 vs. 108 minutes) (Figure 9).

EMS vs. Private Vehicle Arrival

For patients arriving first at a STEMI-receiving hospital via EMS compared to patients arriving via a private vehicle, the median time to get to the cath lab is 17 minutes faster, and the median time to PCI is 28 minutes faster (Figure 10). ECGs performed in the ambulance and pre-notification help to dramatically cut the length of time it takes for patients to get the right treatment.

Figure 10: Median Time to Action (Minutes) by Mode of Arrival Among Direct Presenters: Last 12 Months

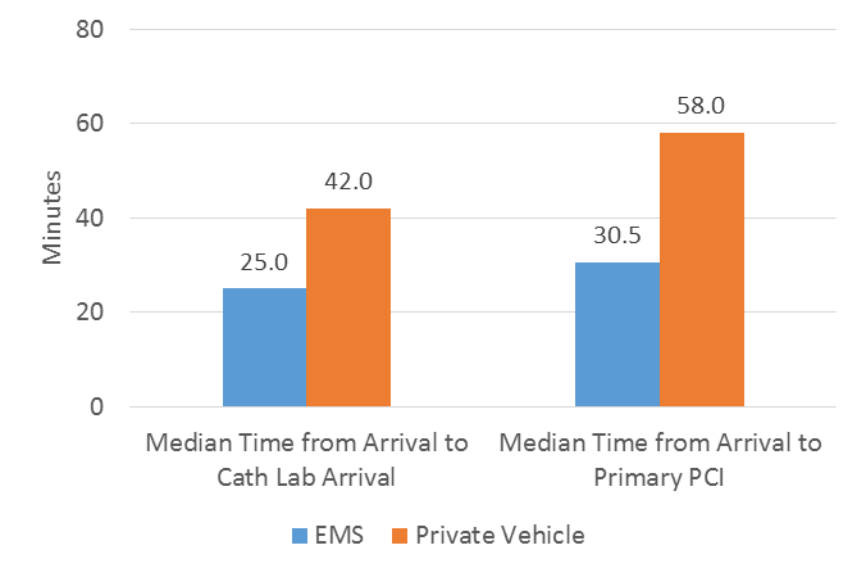


Table 5A: Median Time to Action (Minutes) by Rolling 12 Month Period Among Direct Presenters – EMS

Time Trends	4/14-3/15	7/14-6/15	10/14-9/15	1/15-12/15
Median Time from Arrival to Cath Lab Arrival	26	21	21	25
Median Time from Arrival to Primary PCI	31	32	31	30.5

Table 5B: Median Time to Action (Minutes) by Rolling 12 Month Period Among Direct Presenters – Private Vehicle

Time Trends	7/13-6/14	7/14-6/15	10/14-9/15	1/15-12/15
Median Time from Arrival to Cath Lab Arrival	48	41	41	42
Median Time from Arrival to Primary PCI	64	58	58	58

Over the past year, the rolling 12-month median time of arrival to cath lab arrival and to initiation of primary PCI at STEMI-receiving hospitals has been steady. There has been more improvement for patients arriving via private vehicle (42 vs. 48 minutes to cath lab, and 58 vs. 64 minutes to initiation of primary PCI) (Table 5A &B).

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Glossary of Terms

STEMI (ST-elevation Myocardial Infarction): This is the deadliest form of heart attack caused when an artery supplying blood to the heart is completely blocked. The reduce risk of death and disability, blood flow must be restored.

Primary PCI (Percutaneous Coronary Intervention): This is the preferred treatment for STEMI patients which involves physically opening the artery using mechanical methods. PCI is only available at large hospitals with specialized equipment and expertise. The goal is to open the blocked artery within 90 minutes of the start of the heart attack. As of summer 2015, patients experiencing STEMI in Minnesota only had access to PCI at 18 hospitals in Minnesota, or 7 hospitals close to the border in neighboring states. Most of these hospitals are concentrated in large urban centers.

Fibrinolytics: Also known as thrombolytic therapy or lytics, this is another treatment for STEMI patients available in most hospitals in Minnesota, including rural areas. It involves using drugs to dissolve the blood clot, restoring blood flow to the heart. It can be administered quickly, but works best when the patient is treated within 30 minutes of the start of their heart attack.

FMC (First Medical Contact): This is the point of first patient contact with a medical provider. For patients calling 9-1-1, this is when EMS personnel arrive. For patients arriving at the hospital emergency department by some other means, this is when the first ED provider assesses the patient.

EMS (Emergency Medical Services): EMS or Emergency Medical Services are activated by calling 9-1-1 when you suspect you or someone near you is having a heart attack.

ECG (Electrocardiogram): This procedure records the electrical activity of the heart over a period of time. A 12-lead ECG uses 12 wires and pads placed on a person's chest an limbs. Most EMS agencies are able to administer an ECG and send the results to a physician before reaching the hospital. A doctor will diagnose the type of heart attack which will determine if the patient goes to the closest community hospital to receive thrombolytic therapy or if they are rapidly transported to a STEMI-receiving hospital for PCI.

Reperfusion: This occurs when the blocked artery has been reopened, either by PCI or by thrombolytic therapy, restoring blood flow through the previously blocked artery.