Texas STEMI/Heart Attack Hospital Performance Measures

ST-Elevation Myocardial Infarction (STEMI) and Heart Attack System of Care Report

Conducted to advance heart attack reduction efforts, assess policies and practices regarding delivery of care across the state, and identify areas of opportunity for quality improvement

Texas Council on Cardiovascular Disease and Stroke & Texas Department of State Health Services
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EXECUTIVE SUMMARY

The prevalence of heart attack in Texas has remained steady over the last few years, affecting about 4% of the adult resident population each year from 2011 to 2013 (Table 1). In order to advance heart attack reduction efforts, it is important to analyze the system of care, specifically for STEMI, by collecting and analyzing data. During the 83rd Regular Texas Legislative Session, funds were appropriated to advance heart attack and stroke reduction efforts throughout Texas. To inform such efforts, the Texas Department of State Health Services (DSHS) has launched a heart attack and stroke data collection initiative.

Utilizing the time to treatment goals for primary percutaneous coronary intervention (PCI) and standards of care, percentages and medians were calculated using data collected from a group of hospitals that agreed to participate in this data collection initiative. The data were collected by the Acute Coronary Treatment and Intervention Outcomes Network (ACTION) Registry-Get With The Guidelines (GWTG), a program of the American College of Cardiology in partnership with the American Heart Association and other societies, from the fourth quarter of 2008 through the fourth quarter of 2014. Currently 134 PCI-capable hospitals are participating in the ACTION Registry-GWTG. In 2014, when the highest number of hospitals were reporting for each measure, at most 46 out of these 134 PCI-capable hospitals were included (34%).

Substantial findings from these data are as follows:

- **49** participating hospitals, distributed across **31** cities in Texas, provided data on individual episodes of care for heart attack.
- **33,138** individual episodes of care for heart attack occurred among **31,891** patients at participating hospitals.
- Of the **33,138** episodes of care for heart attack that occurred:
  - **59.9%** involved patients who either transported themselves or were transported by family to the hospital where they were first evaluated;
  - **77.4%** involved patients receiving their first ECG upon arriving at the hospital;
  - **32.9%** involved care for STEMI heart attacks.
- Between 2009 and 2014, the percent of STEMI patients receiving a pre-hospital ECG within 10 minutes of first medical contact ranged from a low of **70.0%** in 2012 to a high of **87.9%** in 2009. The number of hospitals reporting on this measure increased from 5 in 2009 to 45 hospitals in 2014.
- The **median time to first ECG** for directly admitted patients who arrived to the hospital by ambulance ranged from a low of **7 minutes** in 2009, 2012, and 2013 to a high of **9 minutes** in 2014. Between 2009 and 2014, the number of hospitals reporting on this measure increased from 10 in 2009 to 46 hospitals in 2014.
- Among patients who arrived at a STEMI referral hospital by ambulance, the percent of patients who received an ECG within 10 minutes of arrival at the STEMI referral hospital before being transferred to a STEMI receiving hospital ranged from a low of **55.0%** in 2012 to a high of **75.6%** in 2009. Between 2009 and 2014, the number of hospitals reporting on this measure increased each year, increasing from 5 to 44 hospitals in 2014.
- Among directly admitted patients, the percent of patients who received an ECG within 10 minutes of arrival by ambulance ranged from a low of **55.3%** in 2014 to a high of **69.1%** in 2009. Between 2009 and
2014, the number of hospitals reporting on this measure increased each year, increasing from 10 to 46 hospitals overall.

- Between October 2008 and December 2014, the **median time** spent awaiting transfer from the STEMI referral hospital to the STEMI receiving hospital for PCI was **44 minutes** among those who arrived by personal vehicle and **47.5 minutes** among those who arrived by ambulance.

- Between 2009 and 2014, the number of receiving hospitals reporting on ED dwell time among transfer patients increased each year, from 2 to 26 hospitals overall. Among patients who arrived at a STEMI referral hospital by ambulance and were then transferred to a STEMI receiving hospital, the **median ED dwell time** at the STEMI receiving hospital ranged from a low of **29 minutes** in 2009 to a high of **69.5 minutes** in 2012.

- Between 2009 and 2014, the number of receiving hospitals reporting on ED dwell time among directly admitted patients increased each year, from 8 to 44 hospitals overall. Among directly admitted patients who arrived at a STEMI receiving hospital by ambulance, the **median ED dwell time** ranged from a low of 33 minutes in 2011, 2012, and 2014 to a high of 35 minutes in 2009 and 2010.

- Between October 2008 and December 2014, **36.4%** of patients who arrived to the first hospital by ambulance received fibrinolytic therapy within 30 minutes of arrival to the first hospital. The patients included in this measure were later transferred to another hospital.

- From 2011 to 2014, the number of receiving hospitals reporting on **median time** from hospital arrival to primary PCI increased each year, increasing from 26 to 44 hospitals overall. Among directly admitted patients who arrived at a STEMI receiving hospital by personal vehicle, the **median time** from hospital arrival to primary PCI ranged from a low of **66 minutes** in 2011 and 2014 to a high of **68 minutes** in 2012 and 2013. Among directly admitted patients who arrived at a STEMI receiving hospital by ambulance, the median time from hospital arrival to primary PCI ranged from a low of **52 minutes** in 2012 and 2014 to a high of **54 minutes** in 2011. Patients who arrived by ambulance had a lower median time to PCI than those who arrived by personal vehicle.

- From 2011 to 2014, the number of receiving hospitals reporting on number of patients receiving primary PCI within 90 minutes increased each year, increasing from 26 to 44 hospitals overall. Among patients who directly presented to a STEMI receiving hospital by personal vehicle, the percent who received primary PCI within 90 minutes ranged from a low of **89.6%** in 2011 to a high of **92.5%** in 2014. Among patients who directly presented to a STEMI receiving hospital by ambulance, the percent who received primary PCI within 90 minutes ranged from a low of **97.2%** in 2014 to a high of **98.5%** in 2013.

- From 2011 to 2014, the number of hospitals reporting on number of transfer patients who received primary PCI within 120 minutes of arrival increased each year, increasing from 17 to 32 hospitals overall. Among patients who arrived at a STEMI referral hospital by personal vehicle, the percent who received primary PCI at a STEMI receiving hospital within 120 minutes of arrival ranged from a low of **67.2%** in 2011 to a high of **73.3%** in 2014.
INTRODUCTION

When blood flow through the heart’s arteries is blocked, the heart is starved of oxygen and heart cells die. This is called a myocardial infarction or heart attack. An ST-Elevated Myocardial Infarction (STEMI) heart attack is a serious type of heart attack that occurs when a heart’s artery is completely blocked and a large part of the heart muscle is unable to receive blood. This type of heart attack requires immediate treatment to restore blood flow to the heart.

BACKGROUND

In order to advance heart attack reduction efforts, it is important to analyze the system of care, specifically for STEMI, by collecting and analyzing data. During the 83rd Regular Texas Legislative Session, funds were appropriated to advance heart attack and stroke reduction efforts throughout Texas. To inform such efforts, the Texas Department of State Health Services (DSHS) has launched a heart attack and stroke data collection initiative. The data collection initiative focuses on pre-hospital and hospital data elements. This report includes de-identified, aggregate data for hospitals who have agreed to share Acute Coronary Treatment and Intervention Outcomes Network (ACTION) Registry-Get With The Guidelines (GWTG) data with DSHS. All data is intended to inform stakeholders about opportunities for collaboration and system enhancement. No hospital level data will be distributed, nor will any hospital name be identified in the report.

The objective of the data collection is to gain an understanding of the prevalence of heart attack in Texas, and evaluate pre-hospital components of the systems of care and treatment of heart attack patients. The findings will be used to assess policies and practices regarding delivery of care across the state and identify areas of opportunity for quality improvement.

HEART ATTACK IN TEXAS

The prevalence of heart attack in Texas has remained steady over the last few years, affecting about 4% of the adult resident population each year from 2011 to 2013 (Table 1).

Table 1. Number and percent of adults, ages 18 years and older, that report ever having had a heart attack in Texas, by year

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Adults</th>
<th>% of Adults (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>740,234</td>
<td>4.1 (3.6-4.5)</td>
</tr>
<tr>
<td>2012</td>
<td>718,735</td>
<td>3.8 (3.3-4.2)</td>
</tr>
<tr>
<td>2013</td>
<td>763,932</td>
<td>3.9 (3.4-4.5)</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval.

However, using myocardial infarction (MI) hospitalization rates as an approximation of the incidence of disease, the rate of heart attacks has decreased since 2008 (Table 2). According to the 2013 Texas Behavioral Risk Factor Surveillance System (BRFSS) survey, an estimated 86.9% of adults in Texas said they would call 911 if they thought someone was having a heart attack or stroke. The remaining 13.1% of adults said they would take other
action such as taking the person to the hospital, telling them to call their doctor, call their spouse or family member, or do something else.

**Table 2.** Annual age-adjusted hospitalization rate (per 10,000) for heart attack among persons of all ages in Texas, by year

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Hospitalizations</th>
<th>Age-Adjusted Hospitalization Rate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>35,525</td>
<td>16.9 (16.8-17.1)</td>
</tr>
<tr>
<td>2009</td>
<td>34,603</td>
<td>16.1 (15.9-16.2)</td>
</tr>
<tr>
<td>2010</td>
<td>35,640</td>
<td>16.0 (15.8-16.1)</td>
</tr>
<tr>
<td>2011</td>
<td>35,878</td>
<td>15.5 (15.4-15.7)</td>
</tr>
<tr>
<td>2012</td>
<td>37,911</td>
<td>15.9 (15.7-16.0)</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval.

Looking at the geographic distribution of death rates, the highest rates emerge in counties located in east and northeast Texas (Figure 1).

**Figure 1.** Age-adjusted average annual number of deaths due to heart attack per 100,000 people of all ages during 2008-2012, by county, in Texas
Percutaneous coronary intervention, or PCI, is the preferred reperfusion strategy for STEMI patients. There are approximately 154 PCI-capable hospitals in Texas that have a catheterization lab ready to perform PCI, 24 hours a day, 7 days a week. These are often called “STEMI receiving hospitals.” For hospitals that do not have this capability, often referred to as “STEMI referral hospitals,” STEMI patients must be transferred to a PCI-capable hospital. Figure 2 illustrates the time to treatment goals for primary PCI for patients who have been directly admitted to a STEMI receiving hospital and for those who have been transferred from a STEMI referral hospital.

Figure 2. Time to treatment goals for primary PCI
Utilizing the time to treatment goals for primary PCI and standards of care, percentages and medians were calculated using data collected from a group of hospitals that agreed to participate in this data collection initiative. The data were collected by the ACTION Registry-GWTG from the fourth quarter of 2008 through the fourth quarter of 2014. Currently 134 PCI-capable hospitals are participating in the ACTION Registry-GWTG. In 2014, when the highest number of hospitals were reporting for each measure, at most 46 out of these 134 PCI-capable hospitals were included (34%). General findings from these data are as follows:

- 49 participating hospitals, distributed across 31 cities in Texas, provided data on individual episodes of care for heart attack.
- The majority of participating hospitals were located in urban or suburban communities, 9 of which were located in the city of Dallas; only 3 were located in rural communities.
- 33,138 individual episodes of care for heart attack occurred among 31,891 patients at participating hospitals.
- Of the 33,138 episodes of care for heart attack that occurred:
  - 59.9% involved patients who either transported themselves or were transported by family to the hospital where they were first evaluated;
  - 77.4% involved patients receiving their first ECG upon arriving at the hospital;
  - 32.9% involved care for STEMI heart attacks.

The graphs and tables that follow display either percentages or medians for specific measures of effective care for heart attack. For measures with more than 100 cases reported for each mode of hospital arrival, the data are displayed by year using six full years of data from the first quarter of 2009 through the fourth quarter of 2014 (January 2009-December 2014). For measures with less than 100 cases reported for each mode of hospital arrival, the data are cumulative using all available data from the fourth quarter of 2008 through the fourth quarter of 2014 (October 2008-December 2014). These estimates are stratified by patient type, that is, whether the patient was transferred in from another hospital or directly presented to a PCI-capable hospital. The measures include:

1. Pre-hospital ECG within 10 minutes of first medical contact
2. Time from first hospital arrival to first ECG
3. First ECG within 10 minutes of first hospital arrival
4. Dwell time in the emergency department (ED)
   a. Dwell time in the emergency department of referral hospital
   b. Dwell time in the emergency department of receiving hospital
5. First door to needle time for transfer patients
6. Door to needle time within 30 minutes for transfer patients
7. Door to balloon time for directly admitted patients
   a. Median time from hospital arrival to primary PCI (in minutes)
   b. Primary PCI within 90 minutes of hospital arrival
8. First door to balloon time for transfer patients
   a. Median time from first hospital arrival to primary PCI (in minutes)
   b. Primary PCI within 120 minutes of arrival to first hospital

Additional information, including data source, inclusion criteria, and exclusion criteria can be found in Appendix I.
PRE-HOSPITAL ECG WITHIN 10 MINUTES OF FIRST MEDICAL CONTACT

The ability to diagnose a STEMI early is the initial and one of the most important steps impacting heart attack survival. An Emergency Medical Services (EMS) unit equipped with 12-lead equipment (ECG capability) is able to identify a STEMI patient and communicate with the receiving hospital, leading to activation of the catheterization lab and a more efficient system of care. In an optimal system of care, a pre-hospital ECG will allow a heart attack patient to bypass the emergency department (ED) and advance directly to treatment in the catheterization lab. The sooner EMS staff can perform an ECG and accurately interpret the findings, the more timely the communication of results to the receiving hospital, and the more time the receiving hospital has to prepare for the incoming patient.

Figure 3 and Table 3 below display the percentage of eligible episodes of care for heart attack in which patients received their first ECG within 10 minutes of first medical contact. The patients included in this measure arrived at the hospital by an ambulance equipped to perform pre-hospital ECGs.

Figure 3. Pre-Hospital ECG within 10 minutes of first medical contact among those arriving by ambulance and by year

![Graph showing percentage of ECGs within 10 minutes of first medical contact by year]

Table 3. Pre-Hospital ECG within 10 minutes of first medical contact among those arriving by ambulance and by year

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases with pre-hospital ECG (n)</th>
<th>Cases with pre-hospital ECG within 10 minutes of first medical contact (n)</th>
<th>% of cases with pre-hospital ECG within 10 minutes of first medical contact</th>
<th>Reporting hospitals (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>91</td>
<td>80</td>
<td>87.9</td>
<td>5</td>
</tr>
<tr>
<td>2010</td>
<td>277</td>
<td>202</td>
<td>72.9</td>
<td>18</td>
</tr>
<tr>
<td>2011</td>
<td>739</td>
<td>519</td>
<td>70.2</td>
<td>25</td>
</tr>
<tr>
<td>2012</td>
<td>1042</td>
<td>729</td>
<td>70.0</td>
<td>34</td>
</tr>
<tr>
<td>2013</td>
<td>1520</td>
<td>1121</td>
<td>73.8</td>
<td>40</td>
</tr>
<tr>
<td>2014</td>
<td>1944</td>
<td>1393</td>
<td>71.7</td>
<td>45</td>
</tr>
</tbody>
</table>

Between 2009 and 2014, the number of hospitals reporting on this measure increased each year, increasing from 5 to 45 hospitals overall. The percent of STEMI patients receiving an ECG within 10 minutes of first medical contact ranged from a low of 70.0% in 2012 to a high of 87.9% in 2009. In order to improve EMS performance in this measure, it is important to first consider ECG capability among the responding EMS units. Possessing the equipment to perform an ECG, in particular for rural areas, greatly affects the timeliness of care for heart attack
patients. For those with 12-lead equipment, implementation of a standard EMS protocol for care of suspected heart attack patients should include performance of an ECG within 10 minutes of first medical contact.

**TIME FROM HOSPITAL ARRIVAL TO FIRST ECG AMONG TRANSFER PATIENTS**

Current Texas data shows that a STEMI is found on the first ECG over 85% of the time.⁴ Performing an ECG is the first step in heart attack care within the hospital, and not having one performed in a timely manner can have a detrimental effect on the patient’s outcome. The national standard for hospital ECG performance time is within 10 minutes of arrival.⁷ Rapid performance of ECG and interpretation can lead to reduced dwell time in the ED for a heart attack patient and timely activation of the catheterization lab.

**Figure 4** and **Table 4** below display the median time (in minutes) elapsed from hospital arrival to receipt of first ECG among transfer patients with eligible episodes of care for heart attack, by mode of arrival to the first hospital and year. Episodes of care in which a patient received an ECG prior to arriving at the hospital were excluded.

**Figure 4.** Median time from first hospital arrival to first ECG among transfer patients by mode of arrival to first hospital and year

![Graph showing median time from first hospital arrival to first ECG among transfer patients by mode of arrival to first hospital and year. The graph displays two lines, one for personal vehicle and one for ambulance, with the median time in minutes indicated for each year from 2009 to 2014.]

**Table 4.** Median time from first hospital arrival to first ECG among transfer patients by mode of arrival to first hospital and year

<table>
<thead>
<tr>
<th>Mode of arrival to first hospital</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal vehicle</strong></td>
<td><strong>Ambulance</strong></td>
<td><strong>Personal vehicle</strong></td>
<td><strong>Ambulance</strong></td>
<td><strong>Personal vehicle</strong></td>
<td><strong>Ambulance</strong></td>
<td><strong>Personal vehicle</strong></td>
</tr>
<tr>
<td>Cases with ECG at STEMI referral hospital (n)</td>
<td>Median minutes</td>
<td>Cases with ECG at STEMI referral hospital (n)</td>
<td>Median minutes</td>
<td>Cases with ECG at STEMI referral hospital (n)</td>
<td>Median minutes</td>
<td>Reporting hospitals (n)</td>
</tr>
<tr>
<td>Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>269</td>
<td>7</td>
<td>78</td>
<td>5.5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>550</td>
<td>7</td>
<td>178</td>
<td>7</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>912</td>
<td>7</td>
<td>257</td>
<td>9</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>1078</td>
<td>8</td>
<td>278</td>
<td>9.5</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>1639</td>
<td>7</td>
<td>325</td>
<td>8</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>1581</td>
<td>6</td>
<td>233</td>
<td>7</td>
<td>44</td>
<td></td>
</tr>
</tbody>
</table>

Between 2009 and 2014, the number of hospitals reporting on this measure increased each year, increasing from 5 to 44 hospitals overall. The **median time to first ECG** for transfer patients who arrived by personal vehicle...
to the first hospital ranged from a low of 6 minutes in 2014 to a high of 8 minutes in 2012. The median time for those who arrived by ambulance ranged from a low of 5.5 minutes in 2009 to a high of 9.5 minutes in 2012.

**TIME FROM HOSPITAL ARRIVAL TO FIRST ECG AMONG DIRECTLY ADMITTED PATIENTS**

Figure 5 and Table 5 below display the median time (in minutes) elapsed from hospital arrival to receipt of first ECG among directly admitted patients with eligible episodes of care for heart attack, by mode of arrival to the hospital and year. Episodes of care in which a patient received an ECG prior to arriving at the hospital were excluded.

Figure 5. Median time from first hospital arrival to first ECG among directly admitted patients by mode of arrival to hospital and year

![Graph showing median time from hospital arrival to first ECG by mode of arrival and year](image)

Table 5. Median time from hospital arrival to first ECG among directly admitted patients by mode of arrival to hospital and year

<table>
<thead>
<tr>
<th>Year</th>
<th>Personal vehicle</th>
<th>Ambulance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases with ECG at STEMI receiving hospital (n)</td>
<td>Median minutes</td>
</tr>
<tr>
<td>2009</td>
<td>193</td>
<td>7</td>
</tr>
<tr>
<td>2010</td>
<td>1094</td>
<td>8</td>
</tr>
<tr>
<td>2011</td>
<td>2119</td>
<td>7</td>
</tr>
<tr>
<td>2012</td>
<td>2707</td>
<td>6</td>
</tr>
<tr>
<td>2013</td>
<td>3148</td>
<td>7</td>
</tr>
<tr>
<td>2014</td>
<td>3943</td>
<td>7</td>
</tr>
</tbody>
</table>

Between 2009 and 2014, the number of hospitals reporting on this measure increased each year, increasing from 10 to 46 hospitals overall. The **median time to first ECG** for directly admitted patients who arrived by personal vehicle to the hospital ranged from a low of 6 minutes in 2012 to a high of 8 minutes in 2010. The median time for those who arrived by ambulance ranged from a low of 7 minutes in 2009, 2012, and 2013 to a high of 9 minutes in 2014.
HOSPITAL ECG WITHIN 10 MINUTES OF ARRIVAL AMONG TRANSFER PATIENTS

Figure 6 and Table 6 below display the percentage of eligible episodes of care for heart attack in which transfer patients received an ECG within 10 minutes of arriving at the first hospital to which they presented, by mode of arrival to the first hospital and year. Episodes of care in which a patient received an ECG prior to arriving at the hospital were excluded.

Figure 6. Hospital ECG within 10 minutes of first hospital arrival among transfer patients by mode of arrival to first hospital and year

Table 6. Hospital ECG within 10 minutes of first hospital arrival among transfer patients by mode of arrival to first hospital and year

| Year | Personal vehicle | | | | | Ambulance |
|------|------------------|---|---|---|---|---|---|
|      | Cases with ECG | Cases with ECG | % of cases with ECG | Cases with ECG | Cases with ECG | % of cases with ECG |
|      | at STEMI referral hospital (n) | within 10 minutes of arrival at STEMI referral hospital (n) | within 10 minutes of arrival at STEMI referral hospital (n) | at STEMI referral hospital (n) | within 10 minutes of arrival at STEMI referral hospital (n) | within 10 minutes of arrival at STEMI referral hospital (n) |
| 2009 | 269 | 207 | 77.0 | 78 | 59 | 75.6 |
| 2010 | 550 | 363 | 66.0 | 178 | 121 | 67.0 |
| 2011 | 912 | 603 | 66.1 | 257 | 152 | 59.1 |
| 2012 | 1078 | 679 | 63.0 | 278 | 153 | 55.0 |
| 2013 | 1639 | 1090 | 66.5 | 325 | 193 | 59.4 |
| 2014 | 1581 | 1086 | 68.7 | 233 | 146 | 62.7 |

Between 2009 and 2014, the number of hospitals reporting on this measure increased each year, increasing from 5 to 44 hospitals overall. Among patients who arrived at a STEMI referral hospital by a personal vehicle the percent of patients who received an ECG within 10 minutes of arrival at the STEMI referral hospital before being transferred to a STEMI receiving hospital ranged from a low of 63.0% in 2012 to a high of 77.0% in 2009. Among patients who arrived at the STEMI referral hospital by ambulance, the percent of patients who received an ECG within 10 minutes of arrival ranged from a low of 55.0% in 2012 to a high of 75.6% in 2009.

There is opportunity for improvement in this vital component of care. Implementing an appropriate protocol within the hospital ED can lead to more efficient care and improved times on performance of ECG.
**HOSPITAL ECG WITHIN 10 MINUTES OF ARRIVAL AMONG DIRECTLY ADMITTED PATIENTS**

Figure 7 and Table 7 below display the percentage of eligible episodes of care for heart attack in which directly admitted patients received an ECG within 10 minutes of arriving at the hospital, by mode of arrival to the hospital and year. Episodes of care in which a patient received an ECG prior to arriving at the hospital were excluded.

**Figure 7.** Hospital ECG within 10 minutes of arrival among directly admitted patients by mode of arrival to hospital and year.

**Table 7.** Hospital ECG within 10 minutes of arrival among directly admitted patients by mode of arrival to hospital and year.

<table>
<thead>
<tr>
<th>Year</th>
<th>Mode of arrival to first hospital</th>
<th>Personal vehicle</th>
<th>Ambulance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases with ECG at STEMI receiving hospital (n)</td>
<td>Cases with ECG within 10 minutes of arrival at STEMI receiving hospital (n)</td>
<td>% of cases with ECG within 10 minutes of arrival at STEMI receiving hospital</td>
</tr>
<tr>
<td>2009</td>
<td>193</td>
<td>146</td>
<td>75.7</td>
</tr>
<tr>
<td>2010</td>
<td>1094</td>
<td>682</td>
<td>62.3</td>
</tr>
<tr>
<td>2011</td>
<td>2119</td>
<td>1330</td>
<td>62.8</td>
</tr>
<tr>
<td>2012</td>
<td>2707</td>
<td>1791</td>
<td>66.2</td>
</tr>
<tr>
<td>2013</td>
<td>3148</td>
<td>2072</td>
<td>65.8</td>
</tr>
<tr>
<td>2014</td>
<td>3943</td>
<td>2671</td>
<td>67.7</td>
</tr>
</tbody>
</table>

Between 2009 and 2014, the number of hospitals reporting on this measure increased each year, increasing from 10 to 46 hospitals overall. Among directly admitted patients, the percent of patients who received an ECG within 10 minutes of arrival by personal vehicle ranged from a low of 62.3% in 2010 to a high of 75.7% in 2009. The percent of patients who arrived by ambulance and received an ECG within 10 minutes of arrival ranged from a low of 55.3% in 2014 to a high of 69.1% in 2009.
Dwell Time in the Emergency Department of Referral Hospital

The standard of care for time from arrival at first hospital to PCI, including transfer time, is 120 minutes. This transfer process adds another component that must be evaluated as part of the STEMI system of care. The time spent in the referral facility is critical in this transfer process. It is an element that can be improved through streamlined processes and protocols, whereas transport time is more difficult to address due to other factors such as distance to closest receiving hospital.

Figure 8 and Table 8 below display the median time (in minutes) spent awaiting transfer from the STEMI referral hospital to the STEMI receiving hospital for PCI among eligible episodes of care for STEMI heart attack, by mode of arrival to the STEMI referral hospital.

Figure 8. Median time spent in the emergency department (ED) of the STEMI referral hospital among transfer patients by mode of arrival to first hospital.

Table 8. Median time spent in the ED of the STEMI referral hospital among transfer patients.

<table>
<thead>
<tr>
<th>Patient Type</th>
<th>Mode of arrival to first hospital</th>
<th>Personal vehicle</th>
<th>Ambulance</th>
<th>Reporting hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STEMI cases (n)</td>
<td>Median minutes</td>
<td>STEMI cases (n)</td>
<td>Median minutes</td>
</tr>
<tr>
<td>Transfer from other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hospital</td>
<td>55</td>
<td>44.0</td>
<td>18</td>
<td>47.5</td>
</tr>
</tbody>
</table>

The median time spent awaiting transfer from the STEMI referral hospital to the STEMI receiving hospital for PCI was 44 minutes among those who arrived by personal vehicle and 47.5 minutes among those who arrived by ambulance. For referral hospitals, there should be appropriate protocols set in place for identifying a STEMI patient and transferring and transporting them to a receiving hospital. Implementing such a protocol requires rapid performance and interpretation of ECG and communication to the receiving hospital for activation of its catheterization lab.
**Dwell Time in the Emergency Department of Receiving Hospital Among Transfer Patients**

*Figure 9* and *Table 9* below display the median time (in minutes) spent waiting in the ED of the STEMI receiving hospital among transfer patients with eligible episodes of care for STEMI heart attack, by mode of arrival to first hospital and year.

*Figure 9.* Median time spent in the ED of the STEMI receiving hospital among transfer patients by mode of arrival to first hospital and year

*Table 9.* Median time spent in the ED of the STEMI receiving hospital among transfer patients by mode of arrival to first hospital and year

<table>
<thead>
<tr>
<th>Year</th>
<th>Personal vehicle</th>
<th>Ambulance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STEMI cases (n)</td>
<td>Median minutes</td>
</tr>
<tr>
<td>2009</td>
<td>20</td>
<td>22.5</td>
</tr>
<tr>
<td>2010</td>
<td>43</td>
<td>24</td>
</tr>
<tr>
<td>2011</td>
<td>102</td>
<td>26</td>
</tr>
<tr>
<td>2012</td>
<td>111</td>
<td>38</td>
</tr>
<tr>
<td>2013</td>
<td>129</td>
<td>43</td>
</tr>
<tr>
<td>2014</td>
<td>133</td>
<td>36</td>
</tr>
</tbody>
</table>

Between 2009 and 2014, the number of hospitals reporting on this measure increased each year, increasing from 2 to 26 hospitals overall. Among patients who arrived at a STEMI referral hospital by personal vehicle and were then transferred to a STEMI receiving hospital, the *median ED dwell time* at the STEMI receiving hospital ranged from a low of 22.5 minutes in 2009 to a high of 43 minutes in 2013. Among patients who arrived at a STEMI referral hospital by ambulance and were then transferred to a STEMI receiving hospital, the median ED dwell time at the STEMI receiving hospital ranged from a low of 29 minutes in 2009 to a high of 69.5 minutes in 2012.

There is opportunity for improvement of communication and placement of protocols between STEMI receiving and referral hospitals, in order to reduce dwell time in the ED of the STEMI receiving hospital.
**Dwell Time in the Emergency Department of Receiving Hospital Among Directly Admitted Patients**

**Figure 10** and **Table 10** below display the median time (in minutes) spent waiting in the ED of STEMI receiving hospital among directly admitted patients with eligible episodes of care for STEMI heart attack, by mode of arrival to hospital and year.

**Figure 10.** Median time spent in the ED of the STEMI receiving hospital among directly admitted patients by mode of arrival to hospital and year

![Graph showing median time spent in ED by mode of arrival to hospital and year](image)

**Table 10.** Median time spent in the ED of the STEMI receiving hospital among directly admitted patients by mode of arrival to hospital and year

<table>
<thead>
<tr>
<th>Year</th>
<th>Personal Vehicle</th>
<th>Ambulance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STEMI Cases (n)</td>
<td>Median minutes</td>
</tr>
<tr>
<td>2009</td>
<td>57</td>
<td>38</td>
</tr>
<tr>
<td>2010</td>
<td>259</td>
<td>48</td>
</tr>
<tr>
<td>2011</td>
<td>463</td>
<td>47</td>
</tr>
<tr>
<td>2012</td>
<td>563</td>
<td>45</td>
</tr>
<tr>
<td>2013</td>
<td>669</td>
<td>45</td>
</tr>
<tr>
<td>2014</td>
<td>774</td>
<td>43</td>
</tr>
</tbody>
</table>

Between 2009 and 2014, the number of hospitals reporting on this measure increased each year, increasing from 8 to 44 hospitals overall. Among directly admitted patients who arrived at a STEMI receiving hospital by personal vehicle, the median **ED dwell time** ranged from a low of 38 minutes in 2009 to a high of 48 minutes in 2010. Among directly admitted patients who arrived at a STEMI receiving hospital by ambulance, the median ED dwell time ranged from a low of 33 minutes in 2011, 2012, and 2014 to a high of 35 minutes in 2009 and 2010.
FIRST DOOR TO NEEDLE TIME

Fibrinolysis, or use of a clot-dissolving drug to restore blood flow, can be used by hospitals that are not PCI-capable and cannot transfer a patient to receive PCI within the recommended time or for patients ineligible for PCI. Fibrinolytic therapy, when the primary reperfusion strategy, should be administered within 30 minutes of hospital arrival.7

Figure 11 and Table 11 below display the median time (in minutes) elapsed from arrival at first hospital to receipt of fibrinolytic therapy as primary reperfusion treatment among eligible episodes of care for STEMI heart attack, by mode of arrival to first hospital. The patients included in this measure were later transferred to another hospital. The measure reflects median time from arrival at the first hospital to receipt of fibrinolytic therapy as primary reperfusion treatment at the first hospital. It is important to note the number of eligible patients for this measure was less than 100.

Figure 11. Median time from first hospital arrival to primary fibrinolysis among transfer patients by mode of arrival to first hospital

<table>
<thead>
<tr>
<th>Patient Type</th>
<th>Mode of arrival to first hospital</th>
<th>Reporting hospitals (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Personal vehicle</td>
<td>Ambulance</td>
</tr>
<tr>
<td></td>
<td>Cases receiving fibrinolysis at STEMI referral hospital (n)</td>
<td>Median minutes</td>
</tr>
<tr>
<td>Transfer from other hospital</td>
<td>60</td>
<td>37.0</td>
</tr>
</tbody>
</table>

Among patients who arrived at the first hospital by personal vehicle, the median time to fibrinolytic therapy was 37 minutes from first hospital arrival, compared to a median time of 35 minutes to fibrinolytic therapy for those arriving by ambulance.
DOOR TO NEEDLE TIME WITHIN 30 MINUTES AMONG TRANSFER PATIENTS

Figure 12 and Table 12 below display the percentage of eligible patients receiving primary fibrinolysis within 30 minutes, by mode of arrival to first hospital. The patients included in this measure were later transferred to another hospital. The measure reflects the percent of patients who received fibrinolytic therapy as the primary reperfusion strategy within 30 minutes from arrival at the first hospital. It is important to note the number of eligible patients for this measure was less than 100.

Figure 12. Fibrinolysis within 30 minutes of hospital arrival among transfer patients by mode of arrival to first hospital

Table 12. Fibrinolysis within 30 minutes of hospital arrival among transfer patients by mode of arrival to first hospital

<table>
<thead>
<tr>
<th>Patient Type</th>
<th>Personal vehicle</th>
<th>Ambulance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases receiving fibrinolysis within 30 minutes of arrival at STEMI referral hospital (n)</td>
<td>Cases receiving fibrinolysis within 30 minutes of arrival at STEMI referral hospital (n)</td>
</tr>
<tr>
<td>Transfer from other hospital</td>
<td>60</td>
<td>20</td>
</tr>
</tbody>
</table>

Among patients who arrived at the first hospital by personal vehicle, **33.3%** received fibrinolytic therapy within 30 minutes of arrival. Among patients who arrived at the first hospital by ambulance, **36.4%** received fibrinolytic therapy within 30 minutes of arrival.
DOOR TO BALLOON TIME FOR DIRECTLY ADMITTED PATIENTS

PCI is the preferred reperfusion strategy for STEMI patients. The standard of care for time from hospital arrival to PCI or device activation, commonly referred to as door to balloon time, is 90 minutes. Figure 13 and Table 13 below display the median time (in minutes) elapsed from arrival at a STEMI receiving hospital to primary PCI among eligible episodes of care for STEMI heart attack, by mode of arrival and year. This measure is significant because it encompasses all the previous steps that are required for care of STEMI patients from arrival at the hospital, time in ED, arrival in the catheterization lab, and device activation.

Figure 13. Median time from hospital arrival to primary PCI among directly admitted patients by mode of arrival and year

<table>
<thead>
<tr>
<th>Year</th>
<th>Mode of arrival to hospital</th>
<th>Personal vehicle</th>
<th>Ambulance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases receiving primary PCI at hospital (n)</td>
<td>Median minutes</td>
<td>Cases receiving primary PCI at hospital (n)</td>
</tr>
<tr>
<td>2009</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2010</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2011</td>
<td>278</td>
<td>66</td>
<td>277</td>
</tr>
<tr>
<td>2012</td>
<td>393</td>
<td>68</td>
<td>382</td>
</tr>
<tr>
<td>2013</td>
<td>503</td>
<td>68</td>
<td>615</td>
</tr>
<tr>
<td>2014</td>
<td>574</td>
<td>66</td>
<td>638</td>
</tr>
</tbody>
</table>

-- No data available

There were no hospitals that reported on this measure in 2009 or 2010. From 2011 to 2014, the number of hospitals reporting on this measure increased each year, increasing from 26 to 44 hospitals overall. Among patients who arrived at a STEMI receiving hospital by personal vehicle, the median time from hospital arrival to primary PCI ranged from a low of 66 minutes in 2011 and 2014 to a high of 68 minutes in 2012 and 2013. Among patients who arrived at a STEMI receiving hospital by ambulance, the median time from hospital arrival to primary PCI ranged from a low of 52 minutes in 2012 and 2014 to a high of 54 minutes in 2011. Patients who arrived by ambulance had a lower median time to PCI than those who arrived by personal vehicle. In order to further improve the median time to PCI, hospitals can evaluate the protocol for activation of the catheterization lab and aim to have catheterization lab staff arrive within 30 minutes of the activation call.
**DOOR TO BALLOON TIME WITHIN 90 MINUTES FOR DIRECTLY ADMITTED PATIENTS**

*Figure 14 and Table 14* below displays the percentage of eligible episodes of care for STEMI heart attack and patients who received primary PCI within 90 minutes of direct presentation to a STEMI receiving hospital, by mode of arrival and year.

*Figure 14.* Primary PCI within 90 minutes of hospital arrival among directly admitted patients by mode of arrival and year

---

**Table 14.** Primary PCI within 90 minutes of hospital arrival among directly admitted patients by mode of arrival and year

<table>
<thead>
<tr>
<th>Year</th>
<th>Mode of arrival to hospital</th>
<th>Cases receiving primary PCI at hospital</th>
<th>% of cases receiving primary PCI within 90 minutes of hospital arrival</th>
<th>Cases receiving primary PCI at hospital</th>
<th>% of cases receiving primary PCI within 90 minutes of hospital arrival</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Personal vehicle</td>
<td>(n)</td>
<td>(n)</td>
<td>(n)</td>
<td>(n)</td>
</tr>
<tr>
<td>2009</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2010</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2011</td>
<td>278</td>
<td>249</td>
<td>89.6</td>
<td>277</td>
<td>271</td>
</tr>
<tr>
<td>2012</td>
<td>393</td>
<td>353</td>
<td>89.8</td>
<td>382</td>
<td>370</td>
</tr>
<tr>
<td>2013</td>
<td>503</td>
<td>449</td>
<td>89.3</td>
<td>615</td>
<td>606</td>
</tr>
<tr>
<td>2014</td>
<td>574</td>
<td>531</td>
<td>92.5</td>
<td>638</td>
<td>620</td>
</tr>
</tbody>
</table>

---

There were no hospitals that reported on this measure in 2009 or 2010. From 2011 to 2014, the number of hospitals reporting on this measure increased each year, increasing from 26 to 44 hospitals overall. Among patients who directly presented to a STEMI receiving hospital by personal vehicle, the percent who received primary PCI within 90 minutes ranged from a low of 89.6% in 2011 to a high of 92.5% in 2014. Among patients who directly presented to a STEMI receiving hospital by ambulance, the percent who received primary PCI within 90 minutes ranged from a low of 97.2% in 2014 to a high of 98.5% in 2013. A higher percent of patients who arrived by ambulance received primary PCI within 90 minutes of hospital arrival than those who arrived by personal vehicle.
FIRST DOOR TO BALLOON TIME FOR TRANSFER PATIENTS

STEMI heart attack patients who arrive at a STEMI referral hospital and are eligible for and in need of PCI must be transferred to a STEMI receiving hospital to receive appropriate care and treatment. The standard of care for time from arrival at first hospital to PCI, including transfer time, is 120 minutes. Figure 15 and Table 15 below display the median time (in minutes) elapsed from arrival at a STEMI referral hospital to receipt of primary PCI at a STEMI receiving hospital among eligible episodes of care for STEMI heart attack, by mode of arrival to the STEMI referral hospital.

Figure 15. Median time from first hospital arrival to primary PCI for transfer patients by mode of arrival to first hospital and year

Table 15. Median time from first hospital arrival to primary PCI for transfer patients by mode of arrival to first hospital and year

<table>
<thead>
<tr>
<th>Year</th>
<th>Mode of arrival to first hospital</th>
<th>Cases receiving primary PCI at STEMI receiving hospital (n)</th>
<th>Median minutes</th>
<th>Cases receiving primary PCI at STEMI receiving hospital (n)</th>
<th>Median minutes</th>
<th>Reporting hospitals (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>Personal vehicle</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2010</td>
<td>Personal vehicle</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2011</td>
<td>Personal vehicle</td>
<td>174</td>
<td>99</td>
<td>81</td>
<td>69</td>
<td>17</td>
</tr>
<tr>
<td>2012</td>
<td>Personal vehicle</td>
<td>201</td>
<td>99</td>
<td>96</td>
<td>73.5</td>
<td>20</td>
</tr>
<tr>
<td>2013</td>
<td>Personal vehicle</td>
<td>319</td>
<td>93</td>
<td>109</td>
<td>71</td>
<td>26</td>
</tr>
<tr>
<td>2014</td>
<td>Personal vehicle</td>
<td>303</td>
<td>97</td>
<td>62</td>
<td>93.5</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Ambulance</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Ambulance</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Ambulance</td>
<td>201</td>
<td>99</td>
<td>96</td>
<td>73.5</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Ambulance</td>
<td>319</td>
<td>93</td>
<td>109</td>
<td>71</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Ambulance</td>
<td>303</td>
<td>97</td>
<td>62</td>
<td>93.5</td>
<td>32</td>
</tr>
</tbody>
</table>

-- No data available

There were no hospitals that reported on this measure in 2009 or 2010. From 2011 to 2014, the number of hospitals reporting on this measure increased each year, increasing from 17 to 32 hospitals overall. Among patients who arrived at the STEMI referral hospital by personal vehicle, the median time from arrival at the referral hospital to primary PCI at the STEMI receiving hospital ranged from a low of 93 minutes in 2013 to a high of 99 minutes in 2011 and 2012. Among patients who arrived at a STEMI referral hospital by ambulance, the median time from arrival at the referral hospital to primary PCI at the STEMI receiving hospital ranged from a low of 69 minutes in 2011 to a high of 93.5 minutes in 2014. Patients who arrived at a STEMI referral hospital by ambulance had a lower median time to primary PCI than those who arrived at the referral hospital by personal vehicle.
FIRST DOOR TO BALLOON TIME WITHIN 120 MINUTES FOR TRANSFER PATIENTS

Figure 16 and Table 16 below display the percentage of eligible episodes of care for STEMI heart attack patients who received primary PCI at a STEMI receiving hospital within 120 minutes of arriving at a STEMI referral hospital, by mode of arrival to the STEMI referral hospital and year.

Figure 16. Primary PCI within 120 minutes of first hospital arrival among transfer patients by mode of arrival to first hospital and year

Table 16. Primary PCI within 120 minutes of first hospital arrival among transfer patients by mode of arrival to first hospital and year

<table>
<thead>
<tr>
<th>Year</th>
<th>Personal Vehicle</th>
<th></th>
<th></th>
<th></th>
<th>Ambulance</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases receiving primary PCI at STEMI receiving hospital</td>
<td>Cases receiving primary PCI within 120 minutes of first hospital arrival</td>
<td>% of cases receiving PCI within 120 minutes of first hospital arrival</td>
<td>Cases receiving primary PCI at STEMI receiving hospital</td>
<td>Cases receiving primary PCI within 120 minutes of first hospital arrival</td>
<td>% of cases receiving PCI within 120 minutes of first hospital arrival</td>
<td>Reporting hospitals (n)</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>174</td>
<td>117</td>
<td>67.2</td>
<td>81</td>
<td>66</td>
<td>81.5</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>201</td>
<td>137</td>
<td>68.2</td>
<td>96</td>
<td>77</td>
<td>80.2</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>319</td>
<td>230</td>
<td>72.1</td>
<td>109</td>
<td>97</td>
<td>89.0</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>303</td>
<td>222</td>
<td>73.3</td>
<td>62</td>
<td>48</td>
<td>77.4</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

-- No data available

There were no hospitals that reported on this measure in 2009 or 2010. From 2011 to 2014, the number of hospitals reporting on this measure increased each year, increasing from 17 to 32 hospitals overall. Among patients who arrived at a STEMI referral hospital by personal vehicle, the percent who received primary PCI at a STEMI receiving hospital within 120 minutes of arrival to the STEMI referral hospital ranged from a low of 67.2% in 2011 to a high of 73.3% in 2014. Among patients who arrived at a STEMI referral hospital by ambulance, the percent who received primary PCI at a STEMI receiving hospital within 120 minutes of arrival to the STEMI
referral hospital ranged from a low of 77.4% in 2014 to a high of 89.0% in 2013. A higher percentage of patients who arrived at a STEMI referral hospital by ambulance received primary PCI within 120 minutes of arrival than those who arrived at the referral hospital by personal vehicle.
Glossary

*First hospital* refers to a facility where a patient is seen initially.

*STEMI referral hospital* refers to a facility where a patient is seen initially and from which the patient is transferred to a STEMI receiving facility. All STEMI referral hospitals are considered *first hospitals*.

*STEMI receiving hospital* refers to a facility to which a patient is transferred after being initially seen at a non-PCI-capable hospital or STEMI referral hospital.

Table 1 (pg.6)


Table 2 (pg.7)

Data Sources: Texas Hospital Inpatient Discharge Public Use Data File, 2008-12. Texas Department of State Health Services, Center for Health Statistics, Austin, Texas; and County-Level Population Data, 2008-12. Texas Department of State Health Services, Center for Health Statistics, Austin, Texas.

Hospitalization rates were based on hospital records for which acute myocardial infarction was coded as the principal diagnosis, using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes 410.00-410.01, 410.10-410.11, 410.20-410.21, 410.30-410.31, 410.40-410.41, 410.50-410.51, 410.60-410.61, 410.70-410.71, 410.80-410.81, 410.90-410.91, a classification defined in the Specifications Manual for National Hospital Inpatient Quality Measures; exclude records for HIV and drug/alcohol use patients and non-residents hospitalized in-state; and were generated using the 2000 Projected U.S. Standard Population for age-adjustment and the following age-adjustment groups: 0-4, 5-9, 10-14, 15-34, 35-64, 65+.

Figure 1 (pg.7)

Data Sources: County-Level Mortality Data, 2008-12. Texas Department of State Health Services, Center for Health Statistics, Austin, Texas; and County-Level Population Data, 2008-12. Texas Department of State Health Services, Center for Health Statistics, Austin, Texas.

Mortality rates were based on death records for which heart attack was coded as the underlying cause of death, using International Classification of Diseases, Tenth Revision (ICD-10) codes I21-I22; and generated using the 2000 U.S. Standard Population for age-adjustment and the following age-adjustment groups: 0, 1-4, 5-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74,75+.

Figure 2 (pg. 8)


**PRE-HOSPITAL ECG WITHIN 10 MINUTES OF FIRST MEDICAL CONTACT** (pgs. 10-11)

Definition

Time to pre-hospital ECG was estimated by measuring the time elapsed from first medical contact (when the patient was first evaluated by either emergency medical services or another healthcare provider prior to arrival
at the hospital) to receipt of first ECG among patients arriving at the hospital by ambulance and receiving their first ECG prior to arrival at the hospital.

Population excludes patients:
- <18 years old
- Arriving at STEMI receiving hospital via personal vehicle, mobile ICU, or air
- Received as transfer from STEMI referral hospital to STEMI receiving hospital
- Receiving first ECG after arrival at STEMI receiving hospital
- Receiving first ECG>24 hours after first medical contact
- With incomplete records—i.e., records with missing data for any variable used to define the population

TIME FROM HOSPITAL ARRIVAL TO FIRST ECG AMONG TRANSFER PATIENTS (pgs. 11-12)

Definition
Time to ECG was estimated by measuring the time elapsed from arrival at a STEMI referral hospital to receipt of first ECG. Thus, for episodes of care involving patients received as transfers at the STEMI receiving hospital, the date and time of arrival at the STEMI referral hospital, as documented by the STEMI receiving hospital, was used to clock time to ECG.

Population excludes patients:
- <18 years old
- Arriving at STEMI referral hospital via mobile ICU or air
- Directly admitted to STEMI receiving hospital
- Receiving first ECG before arrival at STEMI referral hospital, e.g., while in transit in an ambulance
- Receiving first ECG>24 hours after arrival at STEMI referral hospital
- With incomplete records—i.e., records with missing data for any variable used to define the population

TIME FROM HOSPITAL ARRIVAL TO FIRST ECG AMONG DIRECTLY ADMITTED PATIENTS (pg. 12)

Definition
Time to ECG was estimated by measuring the time elapsed from arrival at the STEMI receiving hospital to receipt of first ECG.

Population excludes patients:
- <18 years old
- Arriving at STEMI receiving hospital via mobile ICU or air
- Received as transfer from STEMI referral hospital to STEMI receiving hospital
- Receiving first ECG before arrival at STEMI receiving hospital, e.g., while in transit in an ambulance
- Receiving first ECG>24 hours after arrival at STEMI receiving hospital
- With incomplete records—i.e., records with missing data for any variable used to define the population

HOSPITAL ECG WITHIN 10 MINUTES OF ARRIVAL AMONG TRANSFER PATIENTS (pg. 13)

Definition
Time to ECG was estimated by measuring the time elapsed from arrival at the STEMI referral hospital to receipt of first ECG. Thus, for episodes of care involving patients received as transfers at a STEMI receiving hospital, the date and time of arrival at the transferring hospital, as documented by the STEMI receiving hospital, was used to clock time to ECG.

Population excludes patients:
- <18 years old
- Arriving at STEMI referral hospital via mobile ICU or air
- Directly admitted to STEMI receiving hospital
- Receiving first ECG before arrival at STEMI referral hospital, e.g., while in transit in an ambulance
- Receiving first ECG>24 hours after arrival at STEMI referral hospital
- With incomplete records—i.e., records with missing data for any variable used to define the population

**HOSPITAL ECG WITHIN 10 MINUTES OF ARRIVAL AMONG DIRECTLY ADMITTED PATIENTS** (pg. 14)

**Definition**
Time to ECG was estimated by measuring the time elapsed from arrival at the STEMI receiving hospital to receipt of first ECG.

**Population excludes patients:**
- <18 years old
- Arriving at STEMI receiving hospital via mobile ICU or air
- Received as transfer from STEMI referral hospital to STEMI receiving hospital
- Receiving first ECG before arrival at STEMI receiving hospital, e.g., while in transit in an ambulance
- Receiving first ECG>24 hours after arrival at STEMI receiving hospital
- With incomplete records—i.e., records with missing data for any variable used to define the population

**Dwell Time in the Emergency Department of Referral Hospital** (pg. 15)

**Definition**
Dwell time in the emergency department was estimated by measuring the time elapsed from arrival at the STEMI referral hospital to discharge at the STEMI referral hospital.

**Population excludes patients:**
- <18 years old
- Diagnosed with non-STEMI heart attack
- Arriving at STEMI referral hospital via mobile ICU or air
- Directly admitted to STEMI receiving hospital
- Not first evaluated in the emergency department of STEMI referral hospital
- Not discharged and transferred to another hospital for PCI
- Transferred >24 hours after arrival at STEMI referral hospital
- With incomplete records—i.e., records with missing data for any variable used to define the population

**Dwell Time in the Emergency Department of Receiving Hospital Among Transfer Patients** (pg. 16)

**Definition**
Time spent in the emergency department was estimated by measuring the time elapsed from arrival at the STEMI receiving hospital to transfer out of the emergency department of the STEMI receiving hospital. Thus, for episodes of care involving patients received as transfers at the STEMI receiving hospital, the time elapsed reflects wait time at the subsequent hospital and not at the STEMI referral hospital.

**Population excludes patients:**
- <18 years old
- Diagnosed with non-STEMI heart attack
- Diagnosed with STEMI heart attack on subsequent ECG
• Arriving at STEMI referral hospital via mobile ICU or air
• Directly admitted to STEMI receiving hospital
• Not first evaluated in the emergency department of STEMI receiving hospital
• Spending >24 hours in the emergency department of STEMI receiving hospital
• With incomplete records—i.e., records with missing data for any variable used to define the population

Dwell Time in the Emergency Department of Receiving Hospital Among Directly Admitted Patients (pg. 17)

Definition
Time spent in the emergency department was estimated by measuring the time elapsed from arrival at the STEMI receiving hospital to transfer out of the emergency department of the STEMI receiving hospital.

Population excludes patients:
• <18 years old
• Diagnosed with non-STEMI heart attack
• Diagnosed with STEMI heart attack on subsequent ECG
• Arriving at STEMI receiving hospital via mobile ICU or air
• Received as transfer from STEMI referral hospital to STEMI receiving hospital
• Not first evaluated in the emergency department of STEMI receiving hospital
• Spending >24 hours in the emergency department of STEMI receiving hospital
• With incomplete records—i.e., records with missing data for any variable used to define the population

First Door to Needle Time (pg. 18)

Definition
Door to needle time was estimated by measuring the time elapsed from arrival at the STEMI referral hospital to receipt of fibrinolytic therapy at the STEMI referral hospital. For episodes of care involving patients received as transfers at the STEMI receiving hospital, the date and time of arrival at the STEMI referral hospital, as documented by the STEMI receiving hospital, was used to clock door to needle time.

Population excludes patients:
• <18 years old
• Diagnosed with non-STEMI heart attack
• Diagnosed with STEMI heart attack on subsequent ECG
• Arriving at STEMI referral hospital via mobile ICU or air
• Directly admitted to STEMI receiving hospital
• Receiving percutaneous coronary intervention for reperfusion therapy
• With a non-system reason for delay of fibrinolysis
• Receiving fibrinolysis >6 hours after arrival at STEMI referral hospital
• With incomplete records—i.e., records with missing data for any variable used to define the population

Door to Needle Time Within 30 Minutes Among Transfer Patients (pg. 19)

Definition
Door to needle time was estimated by measuring the time elapsed from arrival at the STEMI referral hospital to receipt of fibrinolytic therapy at the STEMI referral hospital. For episodes of care involving patients received as transfers at the STEMI receiving hospital, the date and time of arrival at the STEMI referral hospital, as documented by the STEMI receiving hospital, was used to clock door to needle time.
Population excludes patients:
- <18 years old
- Diagnosed with non-STEMI heart attack
- Diagnosed with STEMI heart attack on subsequent ECG
- Arriving at STEMI referral hospital via mobile ICU or air
- Directly admitted to STEMI receiving hospital
- Receiving percutaneous coronary intervention for reperfusion therapy
- With a non-system reason for delay of fibrinolysis
- Receiving fibrinolysis >6 hours after arrival at STEMI referral hospital
- With incomplete records—i.e., records with missing data for any variable used to define the population

DOOR TO BALLOON TIME FOR DIRECTLY ADMITTED PATIENTS (pg. 20)

Definition
Door to balloon time was estimated by measuring the time elapsed from arrival at the hospital to receipt of primary percutaneous coronary intervention.

Population excludes patients:
- <18 years old
- Diagnosed with non-STEMI heart attack
- Diagnosed with STEMI heart attack on subsequent ECG
- Arriving at STEMI receiving hospital via mobile ICU or air
- Received as transfer from STEMI referral hospital to STEMI receiving hospital
- Not receiving percutaneous coronary intervention as primary reperfusion therapy
- With a non-system reason for delay of percutaneous coronary intervention
- Receiving percutaneous coronary intervention >24 hours after arrival at STEMI receiving hospital
- With incomplete records—i.e., records with missing data for any variable used to define the population

DOOR TO BALLOON TIME WITHIN 90 MINUTES FOR DIRECTLY ADMITTED PATIENTS (pg. 21)

Definition
Door to balloon time was estimated by measuring the time elapsed from arrival at the STEMI receiving hospital to receipt of primary percutaneous coronary intervention.

Population excludes patients:
- <18 years old
- Diagnosed with non-STEMI heart attack
- Diagnosed with STEMI heart attack on subsequent ECG
- Arriving at STEMI receiving hospital via mobile ICU or air
- Received as transfer from STEMI referral hospital to STEMI receiving hospital
- Not receiving percutaneous coronary intervention as primary reperfusion therapy
- With a non-system reason for delay of percutaneous coronary intervention
- Receiving percutaneous coronary intervention >24 hours after hospital arrival at STEMI receiving hospital
- With incomplete records—i.e., records with missing data for any variable used to define the population

FIRST DOOR TO BALLOON TIME FOR TRANSFER PATIENTS (pg. 22)
Definition
Time from first door to balloon was estimated by measuring the time elapsed from arrival at the STEMI referral hospital to receipt of primary percutaneous coronary intervention at the STEMI receiving hospital. For episodes of care involving patients received as transfers at the STEMI receiving hospital, the date and time of arrival at the STEMI referral hospital, as documented by the STEMI receiving hospital, was used to clock first door to balloon time.

Population excludes patients:
- <18 years old
- Diagnosed with non-STEMI heart attack
- Diagnosed with STEMI heart attack on subsequent ECG
- Arriving at STEMI referral hospital via mobile ICU or air
- Directly admitted to STEMI receiving hospital
- Not receiving percutaneous coronary intervention as primary reperfusion therapy
- With a non-system reason for delay of percutaneous coronary intervention
- Receiving percutaneous coronary intervention >24 hours after arrival at STEMI referral hospital
- With incomplete records—i.e., records with missing data for any variable used to define the population

FIRST DOOR TO BALLOON TIME WITHIN 120 MINUTES FOR TRANSFER PATIENTS (pgs. 23-24)

Definition
Time from first door to balloon was estimated by measuring the time elapsed from arrival at the STEMI referral hospital to receipt of primary percutaneous coronary intervention at the STEMI receiving hospital. For episodes of care involving patients received as transfers at the STEMI receiving hospital, the date and time of arrival at the STEMI referral hospital, as documented by the STEMI receiving hospital, was used to clock first door to balloon time.

Population excludes patients:
- <18 years old
- Diagnosed with non-STEMI heart attack
- Diagnosed with STEMI heart attack on subsequent ECG
- Arriving at STEMI referral hospital via mobile ICU or air
- Directly admitted to STEMI receiving hospital
- Not receiving percutaneous coronary intervention as primary reperfusion therapy
- With a non-system reason for delay of percutaneous coronary intervention
- Receiving percutaneous coronary intervention >24 hours after arrival at STEMI referral hospital
- With incomplete records—i.e., records with missing data for any variable used to define the population
REFERENCES


